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Keynote Biography

Michael MANTON was Chief of the Bureau of Meteorology Research Centre in Australia from 1984 until his retirement in 2006, and he now has a part-time position as Professor in the School of Mathematical Sciences at Monash University.

For twelve years he was a member of the Joint Scientific Committee for the World Climate Research Programme (WCRP), and he was chair of the Atmospheric Observation Panel for Climate of the Global Climate Observing System (GCOS) for a decade. For six years, he was a member of the START Steering Committee. He is currently chair of the Scientific Steering Committee for Monsoon Asia Integrated Region Study (MAIRS). He is also a member of the Science Advisory Panel for CLIMsystems in New Zealand. He is chair of the Committee for International Organisations of the International Council of Academies of Engineering and Technological Sciences (CAETS).

In Australia, he has been a member of the Antarctic Science Advisory Committee, and he was chair of the Peer Review Committee for the National Environment Protection Measure for Ambient Air Quality. He has been chair of the National Committee for Earth System Science. Currently he is a member of the Board of the Australia Korea Foundation, and he is Senior Advisory, International Engagement to the Australian Academy of Technological Sciences and Engineering (ATSE).

FU Congbin was born on October 14, 1939 in Shanghai,China.Member of Chinese Academy of Sciences (CAS), Professor, College of Atmospheric Science, Nanjing University, and Institute of Atmospheric Physics (IAP), CAS, He graduates from Graduate School of Chinese Academy of Science, Beijing, China in 1967 and receives the honorable Doctor Degree from Gotesborg University of Sweden in 2007.

Prof. Fu has long been engaged in the studies on climate variability and dynamics, including air-sea interaction, air-land interaction, and climate -ecosystem interaction on global and regional scales with particularly the modeling and diagnosis of the variations of monsoon system and its response and feedback to earth system dynamics. He has published about 140 scientific papers, 6 books and more than 10 chapters in co-authored books.

He involved in a number of international scientific organizations.Hewas member of Executive Board of International Council for Science (ICSU), chair of Scientific Steering Committee, Monsoon Asia Integrated Regional Study (MAIRS) of Earth Science System Partnership (ESSP), Member of SSC of Analysis, Modeling and Integration of Earth System (AMIES) of IGBP, IPPT member of CEOP/WCRP, Member of Asia and Australia Monsoon Panel (AAM) of CLIVAR of WCRP, and president of Pacific Science Association.

WU Guoxiong graduated from the Department of Meteorology of Nanjing Institute of Meteorology in 1966, received his doctorate in 1983 at London University Imperial College and worked as a visiting scientist at European Center for Medium-Range Forecasts from 1983 to 1984. He returned to China and worked at the Institute of Atmospheric Physics, Chinese Academy of Sciences in 1985 and was elected the Academician of Chinese Academy of Sciences in 1997. He worked as a Senior Visiting research Professor at the Geophysical Fluid Dynamics Laboratory, Princeton University, U.S.A. from 1989 to 1991. He was the director of State Key Laboratory of Numerical Modelling of Atmospheric Sciences and Geophysical Fluid Dynamics (LASG) during 1993-2000. He is mainly engaged in weather dynamics, climate dynamics and atmospheric general circulation.

He is mainly engaged in weather dynamics, climate dynamics and atmospheric general circulation. He developed the extended Ertel PV-theory to the theory of "slantwise vorticity development"(SVD). By using this theory, he revealed the mechanism on the formation and development of torrential rain. He also extended quasi-geostrophic non-acceleration theorem to primitive equation non-acceleration theorem. He is closely involved in studies on the effects of the Tibetan Plateau on atmospheric general circulation, weather and climate, on the formation and variation of the subtropical anticyclones, and on the dynamics of the Asian monsoon. He has published more than 200 papers on domestic and international academic journals.

He is now the chief editor of "Advances in Atmospheric Sciences", and editor of the international journals "Climate dynamics", the Officer of the Joint Science Committee (JSC) of the World Climate Research Program (WCRP), and the President of International Association of Meteorology and Atmospheric Sciences (IAMAS).

WANG Bin is Professor at the Department of Meteorology at University of Hawaii at Manoa. He was elected Fellow of American Meteorological Society and elected Fellow of American geophysical Union for seminal contributions to the advancement of scientific understanding of the dynamics and predictability of monsoon and tropical climate. His publications have been cited more than 18,000 times, with an h-index of 76 and 62 papers having more than 100 citations each (Google Scholar). Bin Wang is a world leading meteorologist specializing in Climate and Atmospheric Dynamics and one of the most influential scientists in monsoon research worldwide.

Shaw Chen LIU has been a Distinguished Research Fellow and the Director of Research Center for Environmental Changes in the Academia Sinica, Taipei, China since 1999. Prof. Liu has had a distinguished career in the Aeronomy Laboratory of USA NOAA Environmental Research Laboratory, a world famous lab for atmospheric chemistry, for about 20 years (1978-1996). At Aeronomy Lab he first served as a research physicist, and was promoted to the Chief of Teoretical Aeronomy Program in 1980. In 1996 he was appointed as an endowed chair professor at the Georgia Institute of Technology and the Directorof Air Resources and Engineering Center.

Prof. Liu was elected as an Academician of Academia Sinica in 2012. He was elected a Fellow of the American Geophysical Union in 1994. He is also a Fellow of the Chinese Meteorological Society. Prof. Liu served as Editor-in-Chief of the Journal of Geophysical Research-Atmospheres (JGR) from 1988 to 1991. In addition, he served as a co-chair of the IGBP/IGAC Scientific Steering Committee from 2003 to 2005.

Prof. Liu's major research interest is in atmospheric chemistry, air pollution, climate change, and biogeochemistry.

Toshio KOIKE received the Bachelor, Master, and Doctor of Engineering, in 1980, 1982, and 1985, respectively, from the University of Tokyo, Japan. He was at the University of Tokyo, as a research associate in 1985 and a lecturer from 1986 to 1987, and at the Nagaoka University of Technology, Japan as an associate professor from 1988 to 1999 and a professor in 1999. In 1999, he joined the Department of Civil Engineering, the University of Tokyo, where he presently holds the position of Professor. One of the university faculty-liaised organizations, called Earth Observation Data Integration & Fusion Research Initiative (EDITORIA) has inaugurated in the University of Tokyo since 2006, and he was the first Executive Director, EDITORIA for four years after the foundation. He is also working as Advisor to the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT).

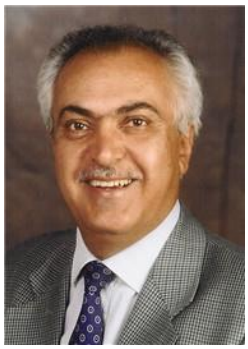
His research interest includes the water cycle and climate sciences and their applications to water resources management, which can be classified into the following three components, establishment of

satellite remote sensing, development of the data integration and information fusion system, and development of the hydrological down-scaling methods including satellite-based data assimilation. Aside from his scientific contributions to water cycle and climate sciences and water resources management, he has been leading the international water cycle science projects and the inter-governmental science and technology cooperation.

He implemented the Coordinated Enhanced Observing Period (CEOP), which was an element of World Climate Research Programme (WCRP) initiated by Global Energy and Water Cycle Experiment (GEWEX) as Lead Scientist. To give some more breakthroughs in his global data integration activities, he has initiated the project, Data Integration Analysis System (DIAS) supported by the Japanese government, through MEXT in 2006, and he has been leading it domestically and internationally since then. With his much passion for solving the water problems in the Asian region by utilizing the cutting-edge science and technologies, hehas lead the Asian Water Cycle Initiative (AWCI) and the African Water Cycle Coordination Initiative (AfWCCI) contributing to the Global Earth Observation System of Systems (GEOSS) under the framework of GEO.

Some of the prominent awards he has won recently include the following: "Award for Contribution to the IPCC NOBEL Peace Prize" from WMO and UNEP in 2008, "Einstein Lecturer Award"in 2009 from Chinese Academy of Sciences, China, and "Japan Water Award -International Contribution" in 2010.

FU Bojie is Professor at the State key Lab. of Urban and Regional Ecology, Research Centre for Eco-Environmental Sciences, Chinese Academy of Sciences. He is an Academician of Chinese Academy of Sciences and Fellow of TWAS. His research areas are landscape ecology and ecosystem services. He service as the Vice President of International Association for Ecology and Vice Chairman of International Long-term Ecological Research Network. He has published more than 300 scientific papers and 9 books, about 160 papers published in the international journals. His prizes include China National Natural Science Prize and Award of Distinguished Service from the International Association of Landscape Ecology.



Soroosh SOROOSHIAN, is a Distinguished Professor of Civil and Environmental Engineering and Earth System Science Departments and director of the Center for Hydrometeorology & Remote Sensing (CHRS) in the Henry Samueli School of Engineering (HSSoE) at UCIrvine. Prior to 2003 he was a Regents Professor at the University of Arizona for 20 years was the founding director of the $35 million-funded NSF STC Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA). His area of expertise is Hydrometeorology, water resources systems, climate studies and application of remote sensing to earth science problems with special focus on the hydrologic cycle and water resources issues of arid and semi-arid zones. Heal so consults on problems related to surface hydrology and urban flooding. He is a member of the U.S. National Academy of Engineering (NAE); Member of the International Academy of Astronautics (IAA); Member, The World Academy of Sciences (TWAS).

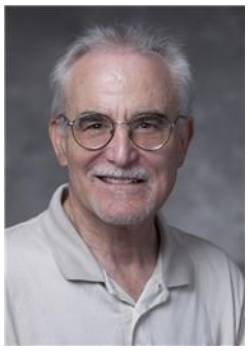
He is also a Fellow, American Association for the Advancement of Science (AAAS) and serves as a Member-at-Large, Section on Atmospheric & Hydrospheric Sciences; Fellow, American Geophysical Union (AGU); Fellow, American Meteorological Society (AMS); Fellow, International Water Resources Association (IWRA); Member, Joint Scientific Committee (JSC) of the World Climate Research Programme (WCRP); Past Chair, Science Steering Group (SSG) of Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Programme (WCRP); U.S. Member of the Hydrology Commission for WMO; Emeritus member of UCAR Board of Trustees and NOAA Science Advisory Board; Past-President of AGU's Hydrology Section; member of five editorial boards and former editor of AGU's Water Resources Research. He has served onnumerous advisory committees, including those of ASA, NOAA, DOE, USDA, NSF, EPA, and UNESCO.

Among his numerous honors are: AGU Robert E. Horton Medalist, 2013; Eagleson lectureship, Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI), 2012; Recipient of the 4th Prince Sultan Bin Abdulaziz International Prize for Water Resources Management & Protection, 2010; elected Associate Fellow of TWAS, the Academy of Sciences for developing countries; named an honorary Professor at Beijing Normal University, China 2010; named the Walter Orr Roberts Lecturer, American Meteorological Society (AMS), 2009; recipient of AMS Robert E. Horton Memorial Lectureship, 2006; recipient of the NASA Distinguished Public Service Medal in 2005 and the William Nordberg Memorial Lecture at the NASA Goddard Space Flight Center in 2004.

CHEN Zhongyuan, Professor, State Key Laboratory of Estuarine and Coastal Research/Department of Geography, East China Normal University, received Ph.D. degree from Department of Geography, East China Normal University, Shanghai, China, 1985-1988. His major research interest is to examine the sediment source to sink processes in river-delta system. To analyze sediment transport, and deposition affected by climate change, sea-level fluctuation and subsidence, etc. Impact of large-scale dams on hydro-geomorphological and sedimentological processes of basin-estuary scale is also the major focus. Geoarchaeological evidences on basin-delta-coast are closely incorporated into the interest, including Neolithic site migration, early agricultural civilization (rice cultivation), in relation to delta formation. Practical field of the river-delta study relates to land-use, freshwater resources and ecological health. Major study area involved includes the Yangtze and Nile, and the megadeltas of Asia.

Ho-Ching LEE is a professor of international relations and director of the STS (Science Technology and Society) program at National Central University, Chung-Li, Taiwan.

Prior to her appointment in 2009, she was at Chung-Yuan Christian University. With Outstanding teaching/research awards in 2005, 2009 and 2011, Lee teaches courses on global environmental governance, humans and the environment, environment, energy and the public policy, environmental diplomacy and Sustainable Taiwan. Her work focuses on the environmental dimensions of international relations and law. Over the years, she has been among the few social scientists in Taiwan taking part in climate change and sustainable development projects. She is now involved in an interdisciplinary research project on Climate Change Adaptation Technology (Tai-CCAT) as well as an international research initiative - COMPON (Comparing Climate Change Policy Networks) as case investigator for Taiwan.Additionally, since 2007 she has been bringing graduate students to COPs (Conference of the Parties to UN Framework Convention on Climate Change) to follow up on climate change negotiations.



James F. REYNOLDS, Distinguished Professor, State Administration Program of Foreign Experts, School of Life Sciences, Lanzhou University, Lanzhou, CHINA *and* Professor of Environmental Studies and Policy, Nicholas School of the Environment, Duke University, Durham, NC USA.

His research focuses on the functioning of dryland ecosystems and the livelihood systems of their human residents. This work is linked to global environmental change through climate, biodiversity loss, human dimensions, and land use change. The long-term goal is to develop a quantitative understanding of dryland degradation in the context of the balance between natural and social systems, and through collaborations with socio-economic researchers, to address questions of direct relevance to human societies in these systems. We developed the Drylands Development Paradigm (http:// dx.doi.org/10.1126/science.1131634) to help navigate the inherent complexity of desertification and dryland development, and to identify and synthesize those factors important to research, management, and policy communities.

PENG Xizhe is currently a Professor of Population and Development at Fudan University and is the director of the Center for Population and Development Policy Studies. Dr. Peng received his Msc. and Ph.D. degrees in Population Studies from London School of Economics and Political Sciences in 1983 and 1988 respectively. His research activities covered a wide range of population-related issues, including population dynamics and policy in China, relationship between population and environment, gender studies etc. He served as advisor to various Chinese government agencies, and is a leading member of academic Associations of in the fields of population and development. He is the author (or editor) for more than 18 books and 150 journal articles including "China's Demographic History and Future Challenges" published in *Science* 333, 581 -587 (2011).

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Rodel D. LASCO has over 30 years of experience in natural resources and environmental research, conservation, education and development at the national and international level. His work has focused on issues related to natural resources conservation, climate change and land degradation. Since 1999, he is a lead author of the IPCC, the 2007 co-winner of the Nobel Peace Prize. He is also a member of the National Academy of Science and Technology (NAST) in the Philippines.

He is the Philippines Coordinator of the World Agroforestry Centre (ICRAF) since April 2004, a center devoted to promoting "tree on farms". Concurrently, he is the Scientific Director of the OML Center, a private foundation whose mission is to promote research on climate adaptation and disasters risk reduction. He is an affiliate professor at the University of the Philippines at Los Banos.

He is a multi-awarded scientist with over 80 technical publications in national and international journals dealing with the various aspects of natural resources conservation and environmental management. He pioneered research in the Philippines on climate change adaptation in the natural resources sector, the role of tropical forests in climate change/global warming, and the policy implications of the Kyoto Protocol. He also spearheaded the Philippines sub-global component of the global Millennium Ecosystems Assessment which is designed to assess the role of ecosystems and their biodiversity in providing services for human well-being.

ZHU Tong, Dean of College of Envrironmental Sciences and Engineering, Peking University2000–present, Chair Professor of the Cheung Kong Program1999–present, Professor of Environmental Science, Center for Environmental Sciencies/College of Environmental Sciences/College of Environmental Sciences and Engineering, Peking University1993–1999, Postdoc and Research Scientist, Agriculture Canada, CLBRR, ECORC1991–1992, Postdoc, Center for Atmospheric Chemistry, York University, Canada. His main research categories focus on Transport and chemical transformation of pollutants in the atmosphere; Health effects of air pollutants; Urban air pollution control.

DU Xiangwan, specialized in applied nuclear physics and laser technology.

Prof. Du Xiangwan is Vice-President of the CAE (2002-). Born on 29 Apr.1938 in Henan Province, China, graduated from Moscow Engineering Physics Institute of the Soviet Union in 1964. He is a research fellow of applied nuclear physics and laser technology, Senior Scientific Advisor of China Academy of Engineering Physics; he was elected Member of the CAE in 1997 and Vice-President of the CAE since Jun, 2002. He was elected foreign member of Russia Academy of Engineering Science in 2006.

Mr. Du Xiangwan was in charge of systematic research on diagnostic theory of nuclear tests and neutron physics of nuclear weapon; served as a chief scientist of laser expert team of 863 program, he led his team working out strategies and plans for power laser development and achieved significant findings in areas of physics principles and key technologies; due to the integrated tests and solving various of technical and engineering problems, several new types of power laser technologies have reached the World level. Thanks to his outstanding scientific achievements, he was honored with one top prize, one first prize and two second prizes of the National Award for Science and Technology Progress.

Mr. Du has participated in the consulting work on china's energy development strategy, Now, he is the deputy head, national energy expert advisory committee.

ZHANG Shiqiu, Professor of College of Environmental Sciences and Engineering, Director of the Institute of Environment and Economy (IoEE) at Peking University (PKU, China). She has been teaching on environmental economics and environmental management, and has been conducting various research projects related to environment and development issues which covers Environmental and Resources Economics, Environmental Policy, and Environmental Management. She is member of Scientific Advisory Panel for UNEP Climate and Clean Air Coalition to Reduce Short Lived Climate Pollutants (CCAC), the Senior expert member of UNEP Technology and Economic Assessment Panel for implementing Montreal Protocol, Co-Chair of the Task force for Replenishment of the Multilateral Fund of Montreal Protocol. She is a Board of Directors of East Asian Association on Environment and Resource Economics (EAAERE).

Tetsuzo YASUNARI is Director-General of Research Institute for Humanity and Nature. He received his D.Sc. in Meteorology & Climatology at Kyoto University in 1981. He is a distinguished scientist in the fields of meteorology, climatology, and climate systems studies. He served as a member of the Joint Scientific Committee of WCRP. He has been working as SSC member of the ESSP/MAIRS (Monsoon Asia Integrated Regional Studies), now serving as vice-chairman. He is a council member of the Science Council of Japan, and chairman of the joint Japan national committee for IGBP, WCRP and DIVERSITAS. He has been elected a member of the first Science Committee for Future Earth, and a chairman of Future Earth committee under Science Council of Japan. He has published about 200 scientific papers and books.

Akio TAKEMOTO is Director of the Secretariat of the Asia-Pacific Network for Global Change Research (APN). From July 2010 to July 2011, he was Project Researcher at the Integrated Research System for Sustainability Science (IR3S), the University of Tokyo. From April 2010 to Jun 2010, Dr. Takemoto served as Director of the Groundwater Office as well as the International Cooperation Office at the Ministry of the Environment, Japan (MOEJ) after serving as Deputy Division Director for international affairs and environmental impact assessment (August 2003 − March 2010). He served as the first and second Secretary of the Permanent Delegation of Japan to the OECD based in Paris (August 2000 – August 2003). Dr. Takemoto began his career on Environment Administration (Environment Agency and Ministry of the Environment, Japan) in April 1992. He obtained a Doctorate of Engineering (Ibaraki University) Degree in 2010 and Master's Degree of Science (Hokkaido University) in 1992. His main research field is sustainable development in developing countries, including climate change adaptation and mitigation.

Keynote Abstracts

Asian Monsoon Rainfall: Decadal Variability and Future Changes

WANG Bin Department of Meteorology and IPRC University of Hawaii, Honolulu Hawaii, 96825 USA

Rainfall is indispensable to life and civilization. How much Asian monsoon rainfall will increase due to global warming has been intensely debated and changes in the spatial distribution of rainfall are highly uncertain. Prediction of monsoon changes in the coming decades is important for infrastructure planning and sustainable economic development and a challenging science issue. Such forecasts require knowledge of the effect on climate not only from man-made greenhouse gasesbut also from huge natural climate swings. This presentation discusses physical processes determining interannual and decadal variability of the Asian summer monsoon rainfall and its future change.

During the recent three decades of prominent global warming of about 0.4^{o}C since the late 1970s, the total amount of global precipitation has no significant trend. but a coherent decadal change of precipitation and circulation emerges in the entirety of the northern Hemisphere summer monsoon (NHSM) system. Surprisingly, the NHSM as well as the Hadley and Walker circulations have all shown substantial intensification, with a striking increase of NHSM rainfall by 9.5% per degree of global warming. The intensification is primarily attributed to a mega-El Niño/ Southern Oscillation (a leading mode of interannual-to-interdecadal variation of global sea surface temperature) and the Atlantic Multidecadal Oscillation, and further influenced by hemispherical asymmetric global warming. Analysis of 140-y observations reveals that the fluctuations of the total NHSM land rainfall as well as its regional components (Asian, northern African, and North American) could be predicted if climate models can faithfully predict the mega-ENSO and ADMO.

The future changes of Asian- Australian monsoon (AAM) system by the end of the 21st century are projected by 20 climate models that participated in phase 5 of the Coupled Model Intercomparison Project (CMIP5). The results suggest: (1) The total AAM precipitation will increase by 4.5 %/K, mainly due to the increases in Indian summer monsoon (5.0 %/K) and East Asian summer monsoon (6.4 %/K) rainfall. (2) The ‘‘warm land-cool ocean’’ favors the entire AAM precipitation increase by generation of an east-west asymmetry in the sea level pressure. But the "warm Northern Hemisphere-cool Southern Hemisphere" favors the ASM but reduces the Australian summer monsoon rainfall. (3) The low-level tropical AAM circulation will weaken by 2.3 %/K due to atmospheric stabilization that overrides the effect of increasing moisture convergence. Different from the CMIP3 analysis, the EA subtropical summer monsoon circulation will increase by 4.4 %/K. (4) The Asian monsoon domain over the land area will expand by about 10 %. (5) The spatial structures of the leading mode of interannual variation of AAM precipitation will not change appreciably but the ENSO-AAM relationship will be significantly enhanced.

Is Extreme Typhoon Precipitation Increasing with Global Warming?

Shaw Chen LIU Research Center for Environmental ChangesAcademia Sinica, Taipei
Chein-Jung SHIU

Significant increases in precipitation intensity, as a result of increases of heavy precipitation and/or decreases of light precipitation have been reported over widespread regions of the globe. The increase in precipitation intensityhas been attributed to global warming. Trenberth et al. [2003] hypothesized that the precipitation intensity should increase at about the same rate as atmospheric moisture which increases at about 7% K-1 according to the Clausius-Clapeyron equation. They argued that the increase in heavy rainfall could even exceed the 7% K-1 because additional latent heat released from the increased water vapor could invigorate the storms. An invigorated storm could remove moisture by more than 7% K-1 from the atmosphere. Heavy precipitation in typhoons also has been observed to increase significantly. In this work, we discuss the relative contributions to the observed increase in heavy precipitation in typhoons from various processes, including global warming, the translational speed of typhoon, the frequency of typhoon, and the intensity of typhoon.

Water Cycle Integrator (WCI) towards Supporting to Integrated Human Security

Toshio KOIKE University of Tokyo

To achieve integrated human security, including the security of water, food, energy, health and ecosystem services, nations firstly need to share comprehensive and accurate data and information, secondly prepare various measures to prepare for threats and disasters in advance of their occurrence, then provide society with timely support and sound decision making, and finally establish transboundary safety networks towards a resilient society. We need data integration infrastructure which enables scientists, practitioners, decision-makers, citizens and other stakeholders to work together toward end-to-end cooperation. To promote effective multi-sectoral, interdisciplinary collaboration based on coordinated and integrated efforts, we are now developing a "Water Cycle Integrator (WCI)", which integrates Earth observations, models, data and information management systems and education systems. WCI sets up "work benches" by which partners can share data, information and applications in an interoperable way, exchange knowledge and experiences, deepen mutual understanding and work together effectively to ultimately respond to issues of both mitigation and adaptation. WCI enhances the coordination of efforts to strengthen individual, institutional and infrastructure capacities, especially for effective interdisciplinary coordination and integration.

Ecosystem Services and Ecological Security

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Ecosystem Services are the benefits people obtain from ecosystems. The ecosystem services of 60% are degradation in the world. The one of major challenges facing the world's people are meeting the needs of people today and in the future, and sustaining atmosphere, water, soil and biological products which provided by ecosystems. This paper is linkage ecosystem structure, processes and services, including biogeochemical cycling, water regulation, soil conservation and food production. The Loess plateau of China, an area suffered from severe soil erosion in the world was taken as the study area. The changes of ecosystem services were assessed and trade off were analysed. The changes in four key ecosystem services including water regulation, soil conservation, carbon sequestration, and grain production are assessed due to the Chinese government's implementation of the Grain to Green Program (GTGP). We found that significant conversions of farmland to woodland and grassland have resulted in enhanced soil conservation and carbon sequestration. However the water yield of region is decrease and the climate becoming warmer and drier. The total grain production increased in spite of a significant decline in farmland acreage, resulting in improved overall socioeconomic conditions in the region. These seemingly contradictory relations have been attributed to the strong socioeconomic incentives embedded in the ecological rehabilitation policy. Although some positive results of the policy have been achieved over the last decade, large uncertainty remains regarding long-term policy effects on the sustainability of ecological rehabilitation performance and ecosystem service enhancement. To reduce such uncertainty, an adaptive management approach to regional ecological rehabilitation policy should be adopted, with a focus on the dynamic interactions between people and their environments in a changing world. Our study also calls for paradigm shifts for restoration ecology and ecosystem service science.

Informing Climate Change Adaptation Decision Making: the Case of TaiCCAT

Ho-Ching LEE GruduateInstitute of Construction Engineering and ManagementNational Central University, Taiwan

Keywords: Adaptation, climate change, vulnerability assessment, exposure, knowledge platform

Climate is indeedchanging due to human emissions of greenhouse gases. Suchchanges in

climatewillaffect all sectors of society and the environment at all scales, ranging from the global to the national and local. There is an urgentneed to developstrategies and policy responses to addressthisclimate-changed society. At the same time, decision-makers, civil society actors and otherinterestedcitizensneed to beable to accessreliable science-based information to helpthemrespond to the risks of climatechangeimpacts and assessopportunities for adaptation.

As most of climatechange research initiativesare more focused on naturalsciences, it is almostimpossible to understand the earth system withoutaddressinghumans as influencing the planet and as an essentialdriving force in shaping the future of Planet Earth. Thus, a major new step has beentaken in the development of science – going from disciplinary to interdisciplinary, from onesector to cross-sectoral, and from naturalsciences to social sciences and the humanities.

The National Science Council of Taiwan has initiated the Taiwan integrated research program on Climate Change Adaptation Technology (TaiCCAT). Three workinggroups on exposure, vulnerability and adaptation were set up to advanceclimate adaptation research in supporting adaptive policy-making. This paperexamineskeyobstaclesTaiCCATfaces, highlighting the importance of the trans-disciplinary approach under the framework of scientificassessment, knowledge platforms and demonstration projects as deliverables. System dynamicswereused to frame the information flows among the approaches. In addition, adaptation pathways in guiding adaptation decision makingareoutlined in the notion of data (D), information (I) and knowledge (K) transformation towardswisdom (W). In the end, thesesystematicpathwayscontribute to integratingclimatechangeinto action, and thus the integrated approach of TaiCCATmaybelearned by othercountriesthatarehighlyexposed to climateextremes, like Taiwan.

Crime and Punishment: Can Integrated, Trans-disciplinary Studies Provide "Magical Roadmaps" for Sustainable Development?

James F. REYNOLDS Environmental Studies and Policy, Nicholas School of the Environment, Duke University, USA
School of Life Sciences, Lanzhou University, Lanzhou, CHINA

Distinguished Professor, State Administration Program of Foreign Experts, School of Life Sciences, Lanzhou University, Lanzhou, CHINA and Professor of Environmental Studies and Policy, Nicholas School of the Environment, Duke University, Durham, NC USA

Throughout all of the monsoon Asia region, change is the norm: urbanization, land use (and degradation), shifting cultural traditions, climate change, globalization and economic development, and so on. All of these changes are uncertain, each moving in assorted directions [+/-], and at variable rates and magnitudes. In spite of this extraordinary complexity, I argue that scientists enthusiastically champion the belief (implicitly, due to our perceived obligations to society? As well as our egos?) that" magical roadmaps" are waiting to be discovered and that policy-makers should follow these roadmaps (once they are "discovered" of course), and that this will lead to sustainable development (the oft-used euphemism for "the provision of key ecosystem services, e.g., food and water security, and human well-being"). Can scientists really provide sustainability roadmaps given the aforementioned complexity? If it IS possible, it will only happen via highly integrated, trans-disciplinary studies. Hence, it is crucial to query if our current paradigms are satisfactory. In this talk I review the pursuit of magical roadmaps, the potentials and limitations of paradigms for trans-disciplinary studies, and outline what I think are some of the strategic challenges we face for monsoon Asia. It is worth noting that in his introductory social-environmental-economics book, Crime and Punishment, the famous Russian ecologist Fyodor Dostoyevsky wrote: "It takes something more than intelligence to act intelligently."

Climate Change in Asia: Implications of The IPCC AR5 Report

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The IPCC AR5 Working Group 2 will be released on March 2014. This presentation will provide an overview of the contents of the report for the Asian continent. Among the possible conclusions of the report are as follows (tentative and to be finalized when the report is out): warming trends and increasing temperature extremes have been observed across most of the continent over the past century; water scarcity will be a major challenge for most of Asia due to increased water demand and lack of good management; food production and food security in the continent will vary by region with many regions to experience a decline in productivity; terrestrial systems in many parts of Asia have responded to recent climate change with shifts in the phenologies, growth rates, and the distributions of plant species, and permafrost degradation, and the projected changes in climate during the 21st century will increase these impact; climate change will increase stress in coastal and marine systems in Asia; and extreme climate events will have an increasing impact on human health, security, livelihoods, and poverty, with the type and magnitude of impact varying across the continent. In addition, multiple stresses caused by rapid urbanization, industrialization and economic development will be compounded by climate change. As a result, the sustainable development capabilities of most Asian developing countries will be at risk.

Air Pollution in China: Scientific and Public Policy Challenges

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Keywords: PM2.5, Health, Effects, Megacities, Metrology, Source, Urbanization

Many cities in China are experiencing serious air pollution, the effects of air pollutants on human health and environments have caused series public concern. Governments at different levels are initiating a large variety of air pollution controlling measures with the hope to reduce air pollution level within a short period. If these controlling measures implemented successfully, I could lead to one of the largest air pollution reductions in a short time in human history. However, given the complexity in air pollution formation, its sources, health effects, and choice of public policy, there are tremendous challenges in scientific research and public policy on air pollution control on China. The presentation will discuss these challenges from three aspects:

Risk: how to estimate the risks to human health and ecology effects of air pollution, and especially multi pollutants? How to establish exposure-response for risk assessment? Do the size and chemical speciation of particle have different health effects?

Reason: Reason: Where does the air pollutant come from? Is air pollution getting worse? How emission sources, meteorology and climate circulation, and chemical transformation interaction to form large scale air pollution in China?

Response: How to control/protect from air pollution effectively and efficiently? Is there any accountability in the public policy for air pollution control in China?

Energy Revolution for Sustainable Future

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Keywords: Energy Revolution Sustainable Future Global Change

1) As fossil fuels have helped human to get rid of dependence on agricultural civilization and embark on industrial civilization but also have brought about serious environmental problems and climate change, the earth is calling for human to move on from industrial civilization to ecological civilization to reach a sustainable future, where the basis is a new "energy revolution". 2) A macroscopic quantitative analysis

of China's environmental capacity and climate capacity shows that China is in an urgent need to change the extensive mode of development and promote an energy revolution. 3) At present and in the next few decades, fossil fuels will remain one of the leading energies in China's energy mix. So, efficient and clean use of fossil fuels is important. But this is not an energy revolution which is the only fundamental solution. Unconventional gases including shale gas play a role in mitigation of environmental problems and climate change, but slogans like "revolution of shale gas" or "era of shale gas" is not appropriate to China because proportion of natural gas in primary energy structure in the country can be increased to a maximum of twenty percent. 4) The Chinese energy structure's transition from a stage dominated by fossil fuels to a stage of multiple components and then to a stage dominated by non-fossil fuels is the inevitable direction, and renewables and nuclear energy will contribute to this transition. 5) In renewables, proportion of non-water renewables will gradually increase. Improvement of their market competitiveness (economical efficiency) relies on technological innovation. Renewables will be the mainstay energy source for the earth in future. 6) Despite the impact of the Fukushima nuclear disaster, the world, including China, will not give up nuclear energy development. Safe, steady and large-scale development of nuclear power is a rational choice of China. Transition from nuclear fission power plant to nuclear fusion power plant is the inevitable direction. Nuclear energy will be a sustainable energy source and another mainstay energy source of the earth in future. 7) China needs to enhance energy security consciousness, vigorously promote energy saving and change the energy supply and demand pattern, transforming "meet a too-fast-growing demand with an extensive supply" to "meet a reasonable demand with a rational supply". 8) All countries need to work together to address global environmental problems and climate change. Energy revolution is the foundation for a sustainable future. With a wide room for international cooperation, win-win cooperation is the only way of overcoming these challenges.

Oral

Session Number: **R1-01**

Session Title: **Integrated Study of Asian Water Cycle under GEOSS/AWCI**

Time: **13:30-16:50, April 8, 2014**

Location: **Conference Room No.1, 2nd Floor, Friendship Palace**

Convener: **Prof. Toshio KOIKE, Dr. WANG Lei**

Speakers:

Toshio KOIKE (University of Tokyo, Japan): AWCI session introduction

Jun MATSUMOTO (Tokyo Metropolitan University, Japan): MAHASRI, AMY, MAIRS and Future Earth

Deg-Hyo BAE (Sejong University, Republic of Korea): Climate Change Impact Assessment on Water Resources over Asia Region Including GEOSS/AWCI Basins

Ghulam RASUL (Pakistan Meteorological Department, Pakistan): Addressing Water Cycle Issues of Indus Basin with Focus on Drought and its Implications to Crop Production

So Im MONICHOTH (Department of Meteorology, Cambodia): Development of the "Water-Climate-Agriculture Workbench" in Cambodia

Mohamed RASMY (University of Tokyo, Japan): A Combined Downscaling Approach for Assessing Future Fate of Water Resources in the Tone River Basin, Japan

Md. Mizanur RAHMAN (SAARC Meteorological Research Centre, Bangladesh): Simulation of Seasonal Monsoon Rainfall over the SAARC Region (including Bangladesh) by Dynamical Downscaling Using WRF Model

Maheswor SHRESTHA (University of Tokyo, Japan): Development of an Energy Balance Based Snow and Glaciermelt Runoff Model and Its Application in the Hydrological Modeling in the Hindukush, Karakarom and Himalaya (HKH) Regions

Peter LAWFORD (University of Tokyo, Japan): Hydrological Model, Tooling, and Methodology Codevelopment

MAHASRI, AMY, MAIRS and Future Earth

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Keywords: Monsoon heavy rainfall multi-scale interaction

MAHASRI has been conducted under GHP/GEWEX/WCRP aiming at establishing hydro-meteorological prediction system, particularly up to seasonal time-scale, through better scientific understanding of Asian monsoon variability from 2006-2015. MAHASRI has been closely collaborating with AMY 2007-2012 which is a coordinated observation and modeling effort under WCRP. It aims at improving Asian monsoon prediction through coordinated efforts to advance our understandings of complex interactions between the earth's land surface, ocean, atmosphere, hydrosphere, cryosphere and biosphere including human activities. MAIRS has been contributed to AMY activities by providing their observation data.

In the years 2008-2010, the Intensive Observing Period (IOP) of AMY and MAHASRI is coordinated in close collaborations with JAMSTEC, The University of Tokyo, Kyoto University, Nagoya University, University of Tsukuba, IAP, SCSIO, CMA, NTU, NCU, Pukyong National University, VNHMS, PAGASA, BPPT, TMD, SMRC, BMD, IMD in Asia, and University of Maryland, Iowa State University and NASA, USA. AMY in-situ observation data will be archived and open to worldwide research community through the Data Integration & Analysis System (DIAS) in the University of Tokyo, Japan. These observation data have been input for the AMY Reanalysis conducted by the Meteorological Research Institute, Japan and the reanalysis data are readily available for the global research community.

Through MAHASRI and AMY activities, multi-scale interactions among diurnal cycle, intra-seasonal variability and inter-annual variability have been investigated in the Indonesian Maritime Continent and Indochina Peninsular. Important role of disturbances in the western Pacific and South China Sea on the occurrences of heavy rainfall in Vietnam, South China and Malaysia have been revealed.

Future Earth that will develop the knowledge for responding effectively to the risks and opportunities of global environmental change and for supporting transformation towards global sustainability in the coming decades is under planning in the International Council for Science (ICSU). It will provide a good opportunity for our future research collaboration for developing Asian monsoon research community.

Climate Change Impact Assessment on Water Resources over Asia Region including GEOSS/AWCI Basins

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Keywords: Climate change Hydrology Trend analysis GCM Asia region

Asia monsoon plays an important role on global water circulation and provides substantial precipitation and water resources to the peoples living within the region. It provides several benefits like power generation, but also causes serious flood and drought disasters. Of course, there are many reasons for these water-related problems, but the current climate change makes them much more complicated and difficult to manage. Thus, the prediction of future climate trend could be the key point affecting further development of Asian region. This study attempts to analyze the historical climate and hydrology with future climate change impact over Asia as a whole and in the eighteen individual basins, one selected from each of the countries that participate in the Asian Water Cycle Initiative (AWCI). The Mann-Kendall test was employed for past trend analyses. The analysis showed an increasing trend for average temperature and a decreasing trend for average precipitation and runoff over Asia during the past 30 years (1977–2006). To analyze future climate change impacts, three Global Circulation Models (GCMs), i.e., CGCM3_T47, CGCM2_3_2 and CM4 were selected using selection criteria based on probabilistic uncertainty analysis, correlation coefficient and RMSE. The future projections showed increase in average temperature, precipitation and runoff over Asia during all future periods of 2020s, 2050s and 2080s. By 2080s, the average temperature, precipitation and runoff over Asia were projected to increase by 3.7°C, 10.7% and 11.1%, respectively. More detailed results and future recommendations for the climate change impact studies over Asia region will be delivered in the presentation.

Acknowledgement

This study was funded by the Ministry of Construction and Transportation for Climate Change Adaptation Research Center for Water Resources. Also, this study was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No.2011-0030040)

Addressing Water Cycle Issues of Indus Basin with Focus on Drought and its Implications to Crop Production

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Keywords: Water Cycle Indus Basin Drought Crop Production

The Indus emerges from western lake of Tibet in China and runs through mighty mountain ranges of Himalayas, Karakoram and Hidukush at an elevation of more than 3000m and thus this region is known as Upper Indus Basin (UIB). The UIB is predominantly a glacierized basin supplemented with seasonal replenishment of snow which sustain the river flows through their melt water in summer. The Indus descends to lower elevations at the foothills of Himalayas where the South Asian Summer Monsoon contributes a lot to the flow of the River Indus. Climate Change has been affecting the winter and summer precipitation patterns on one hand and at the other hand the accelerated melting of glaciers coupled with that has posed the serious challenges to the sustainable water supply. During the first decade of 21st century, Pakistan has experienced history's worst drought (1998-2002) and flood (2010) which inflicted loss to the national economy at a scale of trillions of dollars and disrupted the socio-economic structure. Water is the key element for food security but frequent floods and drought at sowing and critical stages of crop development have increased the risks for sustainable agriculture production to feed the increasing population. Too much water and too less water has become the core issue in water resource management and governance. Under the Asian Water Cycle Initiative (AWCI), a comprehensive start has been taken to address the issues of water cycle In the Indus Basin using in-situ hydrometeorological observations, satellite data and downscaled output of Global Climate Models (GCMs). A Water-Energy Budget (WEB) based Distributed Hydrological Model (DHM) incorporating snow/glacier melt contribution has been validate in Hunza, a glacierized sub-basin of the Indus. The results have been highly encouraging as the extreme water cycle variability triggered by precipitation and snow/glacier melt was well captured. The application of WEB-DHM is now further extended to the rainfed plateau (Potohar Region) habitat of more than 5 million people which contributes about 15% to the national wheat production. This region is the recipient of substantial winter and summer precipitation generating heavy runoffs due to varied topography leaving little to be absorbed by the soil. Precipitation gradient runs high (foothills of the Himalayas) to low from north to south and east to west. Drought is the major issue of this plateau and summer monsoon precipitation is known for its temporal and spatial variability. Monsoon season matches with maize growing season which is highly sensitive to deficit and surplus of water putting the crop production at risk if water availability does not tally the optimal limits. Modeling activity initiated to address the water cycle variability in Soan Basin is intended to support the stakeholders for sustainable crop production.

Development of the "Water-Climate-Agriculture Workbench" in Cambodia

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The entire country of Cambodia depends on agriculture for its economy and most of the agricultural lands are rain-fed the agriculture is the base of Cambodia economy, agricultural output value takes up about 42% of it GDP. On the other hand, it is well-known that climate change increases the water cycle variability. Since most farmers rely only on their own (non-science-based) experience, they would not adjust to changing rainfall and degraded water resources under climate change, so food security in the region would be seriously threatened. Under this condition, irrigation master plans are being considered in order to achieve the government rectangular strategy phase II and the (NSDP 2009-2013) Ministry of Water Resources and Meteorology MOWRAM plans to full fill following the objectives increase irrigated area of 1% annually equivalent to 25,000 ha over the existing potential irrigated land of 1,120,246 ha by doing rehabilitation of existing irrigation infrastructures and construction of new systems within the area where there is water source potential that could supply irrigation water for double cropping. This study aims to contribute to the design of agricultural management including irrigation plan quantitatively and scientifically through the development of "Water-Climate-Agriculture Workbench".

For this purpose, we have developed an integrated model which dynamically couples a distributed hydrological model (WEB-DHM), a rice growth model (SIMRIW-rainfed), and an irrigation model (original one developed by the authors), targeting the granary of Cambodia. This model runs on a real-time basis and the results are opened to the Cambodian government via website.

This work is pioneering in that it links water, climate, and agriculture which is studied by different academic sectors, i.e., hydrologists, climatologists, and agronomists, respectively. Since water cycle affects or is affected by various other sectors, this kind of interdisciplinary work is highly important to solve the water-related problem.

A Combined Downscaling Approach for Assessing Future Fate of Water Resources in the Tone River Basin, Japan

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Keywords: Dynamical downscaling statistical bias correction combined downscaling method precipitation

The climate change is inevitable and adversely impacting on a range of natural and socio-economic systems. Coupled Ocean-Atmosphere General Circulation Models (CGCMs) are the fundamental tools to acquire science-based information on future trend of precipitation associated with climate change. Due to computational constrains, CGCMs are unable to resolve important sub-grid scale features such as topography and clouds. As a result, the biases in CGCMs outputs are larger than climate change signals, could possibly be misinterpreted in climate change impacts studies at a basin scale.

A promising approach to incorporate the effects of sub-grid features and to obtain high-resolution information on future changes in precipitation is the Dynamical Downscaling (DD), which exploits Regional Climate Models (RCMs) and high-resolution datasets to simulate finer-scale features consistent with larger scale phenomena prescribed from parent GCMs. However, DD still contains biases inherited from parent CGCM as well as shortcomings from RCM itself. It was found that DD outputs were strongly influenced by parent CGCM bias, which is the largest obstacle for DD of climate change. In fact, DD does not modify the larger-scale processes derived from CGCMs. Rather it adds regional/local details in response to regional/local scale forcing (e.g., topography) and thus certain CGCM systematic biases cannot be removed simply by increasing resolutions.

Recently, the use of long-term reanalysis (based on real world data) products was recommended to overcome the aforementioned issues of CGCM biases in climate change researches (e.g. Pseudo Global Warming Down-Scaling (PGW-DS)). PGW-DS is the same as the conventional DD but past model boundary conditions are obtained using reanalysis datasets and the future model boundary conditions are obtained by adding the monthly mean differences between the future and the past climates simulated by the selected GCMs from Coupled Model Inter-comparison Project phase-3 (CMIP3) to reanalysis data. However, reanalysis data should not be fully equated with "reality" because of biases in observations and models used. Moreover, RCMs can also be a source of additional bias, depending on physics schemes and parameterizations.

Till now Statistical Bias correction (SBC), which utilizes the observed data was considered as an alternative to DD. Merging DD results with SBC is a newly emerging approach to produce value added climate dataset and to obtain reliable scientific information on future trend of precipitation associated with climate change. This method would reduce the computational burden of so-called super-high-resolution simulations and improve the biases in RCMs by utilizing long-term observations, while maintaining the effect of finer scale features (e.g. orography) and spatial/temporal continuity simulated by RCMs. Having realized the merits of a combined method, this study investigates the nature of biases in the downscaled precipitation obtained from a long-term high-resolution historical RCM simulations, and associated hydrological responses over the Tone river basin in Japan and finds out an appropriate SBC method (comparing with CGCM) to account for the biases prior to evaluating the impacts of climate change. The proposed method will be applied to PGW-DS to obtain reliable information of future changes of water resources in the basin.

Simulation of Seasonal Monsoon Rainfall over the SAARC Region (Including Bangladesh) by Dynamical Downscaling Using WRF Model

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Keywords: Monsoon rainfall TRMM GPCP CMAP

Simulation of the seasonal monsoon rainfall during June-July-August (JJA) is carried out for five years (2006-2010) using WRF-ARW model over the SAARC region including Bangladesh. The NCEP/ FNL analysis data is utilized as initial and lateral boundary conditions (LBCs) at six hours intervals. The model is run for 50 km horizontal resolution and 27 vertical sigma levels. 12 separated boxes are selected representing different geographical characteristics over the eight countries (Afghanistan, Bangladesh, Pakistan, India, Nepal, Bhutan, Sri Lanka and Maldives) for studying the monsoon rainfall. Observed rainfall of TRMM, GPCP, and CMAP are used for verifications of the simulated monsoon rainfall.

Results show that in general the large scale seasonal distributions of rainfall observed by different sources are simulated fairly well by the model. However, a closer look at the time series of the simulated rainfall over smaller regions represented by different boxes over the SAARC region indicate that the model values are generally underestimated over Afghanistan, Pakistan and northwestern parts of India

and overestimated in the central parts of India, Western Ghat mountains, Nepal, Bhutan, Bangladesh, Sri Lanka and Maldives. A statistical analysis based on Standard Deviation (SD) and correlation coefficient has performed for comparisons between the simulated and observed monsoon rainfall over the SAARC regions.

Development of an Energy Balance Based Snow and Glaciermelt Runoff Model and Its Application in the Hydrological Modeling in the Hindukush, Karakarom and Himalaya (HKH) Regions

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Keywords: Snow and glaciermelt HKH region MODIS snow cover WEB-DHM-S distributed hydrological model

The multilayer energy balance based snow and glaciermelt runoff model has been developed and integrated to the distributed biosphere hydrological model for better representation of water and energy budget components improving the understanding of cold region hydrological processes. The integrated model (WEB-DHM-S) is applicable in small to large river basins with diverse landscapes such as land surface with different vegetation, bare soil, seasonal snow, clean glacier, and debris covered glaciers. This study aims in the development of WEB-DHM-S model in two meso-scale river basins; Narayani basin in Nepal Himalaya (32000 km2) and Hunza basin (13000 km2) in Pakistan Karakoram and one mega-scale river basin, Upper Indus basin (207300 km2) in Hindukush Karkoram and Himalaya (HKH) region. Global Land Data Assimilation System (GLDAS) atmospheric data along with APHRODITE precipitation and observed air temperature data have been used as model forcing. The simulations were performed at at hourly time scale at 1km spatial resolution for the years 2002 and 2003. Model results for discharge simulation showed good agreement with the observed one with Nash efficiency at 0.90 in Hunza, 0.80 in Narayani basin and 0.80 in Upper Indus basin repsectively. The pixel by pixel analysis between Moderate Resolution Imaging Spectroradiometer (MODIS) derived snow cover area and the simulated one showed that the model is very likely (85%on average) to correctly predict snow cover if the MODIS snow-cover product depicts snow in the basins of HKH region.

Hydrological Model, Tooling, and Methodology Co-development

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Keywords: Hydrological model workflow enhancement model coupling

Beyond model development, supporting software tools and related computing environment are of strong importance to the effective and efficient translation of climate data into socioeconomically relevant information. The consideration of model development, integration, and application through a holistic strategy can reap rewards of increased productivity and greater transparency.

A strategy is outlined and implemented for the achievement of these goals through effectual model, tooling and methodology co-development.

The goal of this development effort is the creation and enhancement of a modelling environment which can promote such productivity increases across a broad spectrum of tasks from incorporation of new physics schemes to workflow management and research to operational transitioning in a synergistic fashion.

In particular, a software framework was developed to support hydrological modelling tasks and to clarify linkages both internal and external to the model. This has allowed for the identification of a variety of improvement areas within the base model and is expected to decrease simulation time. The process for incorporating new submodels for specific physics schemes has been streamlined and the support for integrating additional climatological and economic models has been enhanced to improve accuracy and applicability in a wider range of hydrological basins. Finally, improved tooling support allows for faster and clearer specification of scenarios, allowing explicit documentation for improved replicability in future studies.

Sample cases in an ungauged and in a well observed basin were analyzed for improved hydrological simulation results.

Session Number: **R1-05**

Session Title: **Linking Terrestrial Processes to Coastal Ecosystem Services in East and Southeast Asia: Understanding the Socioeconomic Drivers and Consequences**

Time: **13:30-16:50, April 8, 2014**

Location: **Conference Room No.2, 2nd Floor, Friendship Palace**

Convener: **QI Jiaguo, Ho Long Phi,Charlie NAVANUGRAHA**

Speakers:

Robert Jan STEVENSON (Michigan State University, USA): Relating Algal Blooms in the Nearshore Zone Determined by Satellite Remote Sensing to Rivers, Nutrient Loading, Watershed Land Use, and Storm Events

Apisom INTRALAWAN (Mae Fah Luang University, Thailand): Land Use Land Cover Change and the Impacts on Ecosystem Services: A Case Study of Inle Lake, Myanmar

Vu Ngoc UT (Can Tho University, Vietnam): Water Quality and Biodiversity of Aquatic Resources in Different Ecosystems in the Mekong Delta, Vietnam

YUE Wenze (Zhejiang University, China): Environmental Consequences of Rapid Urbanization in Zhejiang Province, East China

ZHU Weining (Zhejiang University, China): Water Quality and Aquatic Environment in Estuarine Regions Indicated by Colored Dissolved Organic Matter

Sarawut JAMRUSSRI (Electricity Generating Authority of Thailand, Thailand): Optimal Rajjaprabha Reservoir Operation Using Telemetering System

WU Jiaping (Zhejiang University, China): Spatio-temporal Distribution of Ecological Attributes of Qiantang River Watershed over the Past 20 Years

QI Jiaguo (Michigan State University, USA): Group Discussion on Future Research Priorities and Initiatives in Linking Terrestrial Processes to Marine Ecosystems

Relating Algal Blooms in the Nearshore Zone Determined by Satellite Remote Sensing to Rivers, Nutrient Loading, Watershed Land Use, and Storm Events

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Keywords: Climate Extreme Event Water Quality Algal Bloom

The overarching goal of our project was to identify watersheds for restoration that will reduce risk of algal blooms in the coastal zones of the Great Lakes. We hypothesized that we could relate algal biomass in the coastal zone of the Great Lakes, nutrient concentrations, watershed land use, and storm events with algal biomass determined using MODIS and Landsat remote sensing images and models of nutrient loads from watersheds based on land use and hydrology. Our models of chlorophyll a based on remote sensing images (RS inferred chl a) and nutrient loading in coastal zones were validated with measured chlorophyll concentrations in the Great Lakes and nutrients in rivers. RS-inferred chl a was related to nutrient loading from rivers, which was dependent upon recent storm events and land use in watersheds. RS-inferred chl a was more related to nutrient loads during the week preceding measurement of chl a than other periods before or during chl measurement. This lag time is presumably related to algal growth following nutrient loading, and was non-linearly related to nutrient loading. Our results indicate that these tools will improve understanding of land use effects on algal blooms in coastal zones of the Great Lakes and will help identify priority watersheds for restoration.

Land Use Land Cover Change and the Impacts on Ecosystem Services: A Case Study of Inle Lake, Myanmar

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Keywords: Land Use Land Cover Change Ecosystem Services

This paper examines the land use land cover change and their impacts on ecosystem services over the 20 year period. It is a case study of Inle Lake, Southern Shan State, Myanmar covering the area of 485.42 km2. Landsat images (1990 TM, 2010 ETM) were rectified and registered in Universal Transverse Mercator (UTM) zone 47 N. Broad classification (level 1) was carried out to classify the images into 4 categories: agriculture land, forest land, scrub grass and water body.

For the past 20 years (1990-2010), the most notable land cover change is forest and agricultural area. The forest area had been substantively reduced from 398.04 km2 (82 %) to 63.10 km2 (13%). On the other hand, agriculture area was vastly expanded from 9.71 km2 (2%) to 271.84 km2 (56%). The estimation of the tradeoffs, using value transfer technique based on Chinese context adjusted by Xie et al., reveals that the change in the value of ecosystem service flows has a net decline (measured in dollars) of roughly $US 36.85 million per year, from $US 70.16 million in 1990 to $US 33.31 million in 2010.

Acknowledging the ecosystem service trade-offs, policy makers must balance the increasing economic activities with ecological integrity relative to various choices. This is to ensure the continuity of the flow of various "non-marketed" ecosystem services the rural communities rely upon. Quantifying ecosystem values into economic terms, albeit imperfect, can serve as policy discussion starting points and be very useful for achieving sustainability when such tradeoffs are considered.

Water Quality and Biodiversity of Aquatic Resources in Different Ecosystems in the Mekong Delta, Vietnam

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Keywords: Water quality algae fish biodiversity global change

In order to evaluate the status of aquatic resources and its vulnerability to overexploitation and global climate change in different ecosystems in the Mekong Delta, Vietnam, some studies on these aspects have been conducted. A study on fish biodiversity in Hau River, the largest branch of Mekong River running through Vietnam in the Mekong Delta, was implemented to investigate the water quality, fish diversity, plankton and benthic community. Other study was conducted in Phu Quoc Island where seahorses (Hippocampus spp.) have been considered vulnerable to overfishing to investigate their composition and abundance to serve as base for protection, management and conservation of the resource. Another study was implemented in the mangrove ecosystem in Ca Mau, the cape of Vietnam to investigate the water quality and diversity of shellfish. Details will be illustrated in the full paper with results of number of fish, phytoplankton, zooplankton and benthos species in the Hau River. Similarly, number species of seahorse and their abundance throughout the year will also be presented. The composition of shellfish including crustacean and mollusk will also be given in details. In addition to biodiversity status, water quality in different ecosystem will also be discussed in detail with variation among ecosystems and seasons.

Environmental Consequences of Rapid Urbanization in Zhejiang Province, East China

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Keywords: Urbanization urban heat island

Since reforms carried out in the late 1970s, China has experienced unprecedented rates of urban growth. Remote sensing data and surface observational data are used to investigate the urbanization process and related environmental consequences, focusing on extreme heat events and air pollution, in Zhejiang Province (ZJP), east China. Examination of satellite-measured nighttime light data indicates rapid urbanization in ZJP, initially forming three urban clusters. With rapid urban sprawl, a large amount of cultivated land and natural vegetation has been replaced with building land, causing significant urban heat island (UHI) effect. During extreme heat events in summer, the UHI effect significantly exacerbates nocturnal heat stress in highly urbanized areas. Taking a long-term view, urbanization also causes additional hot days and hot degree days in urban areas. Urbanization also imposes a heavy burden on local and regional air quality in ZJP. Degraded visibility and an increase in haze days are observed at most stations, especially in the three urban clusters. The results show that urbanization has led to serious environmental problems not only on the city scale but also on the regional scale in ZJP. Maintaining a balance between the continuing process of urbanization and environmental sustainability is a major issue facing the local government.

Water Quality and Aquatic Environment in Estuarine Regions Indicated by Colored Dissolved Organic Matter

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Keywords: Water quality CDOM

As an important ocean color component, colored dissolved organic matter (CDOM) is able to indicate water quality as well as many other environmental functions and implications. We assessed the concentration, distribution and dynamic of CDOM in estuarine regions of 10 global major rivers across five continents, based on a newly proposed algorithm QAA-CDOM and hundreds of hyperspectral satellite imagery of EO-1 Hyperion within a period of 2001-2011. According to our results, in general,

CDOM in these regions was quite complex. CDOM concentrations range from 0.02 to 7.2 m-1 and its spatial distribution patterns showed many plumes dispersing from source areas (e.g. adjacent terrestrial vegetated areas) along the direction of flow. Seasonal variations in CDOM levels are also evident (i.e. 0.5–4.0 m −1) as illustrated by the January, April, August and October images of the Volga River. Other environmental factors, such as land use and land cover, temperature, precipitation, river flow and typhoon also have impacts on CDOM spatial-temporal variations. Some evidences also demonstrated that human activities, such as navigation and agriculture/fertilization, fishery may also change CDOM concentrations and distributions and hence influence water quality.

Optimal Rajjaprabha Reservoir Operation Using Telemetering System

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Keywords: Rajjaprabha Dam Telemetering System Tapi and Phum Duang River

Rajjaprabha Dam located in southern Thailand and operated by Electricity Generating Authority of Thailand (EGAT) is used for multiple purposes such as irrigation demand, municipal water supply, shrimp farming, salinity control and electricity generation. Unfortunately, there are not any automatic rainfall and runoff collection in this basin to monitor amount of water release suitable for various demands, therefore Rajjaprabha Dam is sometimes in conflict with water users living along the river. Moreover, in rainy season, there are flooding cause a problem to Rajjaprabha Reservoir operation because there is no information in the field to directly report to operators in time and help operators operate easily and effectively.

To solve these problems, EGAT designed and installed the telemetering system which consists of 17 stations (3 stations upper dam and 14 stations lower dam) for flood forecasting and warning in order to increase the efficiency of Rajjaprabha Reservoir operation especially flood relief. Furthermore, the telemetering system is installed together with the development of the Reservoir Operation Model in order to forecast the water volume based on the real-time of the telemetering system. The telemetering system comprised of three main modules. Frist, the NAM model, a rainfall-runoff model, used for runoff estimation.Second, the MIKE11-HD model, a hydrodynamic model, used for flood routing investigation. Last, the database system for data storage and data management to facilitate model application. NAM model was used to simulate hydrograph at four stations located along two main streams Tapi and Phum Duang River and on theirs tributaries. MIKE11-HD was used to route flood hydrograph along the Tapi and Phum Duang River. Flood hydrograph of ungauged catchments were estimated using NAM model, then were input into MIKE11-HD.

After calibration and verification model, the telemering system of Rajjaprabha Dam has been proved effective in accurately simulating flood hydrograph along Tapi and Phum Duang River and can be applied for flood mitigation purpose in flood risk areas such as the city of Surat Thani. Thus, the telemetering system provides the information to operate the Rajjaprabha Reservoir operation effectively and reduces conflict between EGAT and riparian stake holders who live in the downstream area especially irrigation and shrimp farming.

An Integrated Soci-Ecological Framework Linking Terrestrial Processes to Marine Ecosystems

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Keywords: Coastal Ecosystems Land Use Change Socio-ecological modeling Policy and management

At the interface between land and ocean there exist continuous material exchanges where the terrestrial ecosystems discharge nutrients into oceans to provide food sources for oceanic organisms but also causes red tides that are detrimental to fisheries. As climate change continues and human alteration of terrestrial ecosystems intensifies, ecological impacts on river deltas and fisheries have become a major environmental concern. The proposed presentation is to highlight an integrated socio-ecological framework that quantitatively examine how recent changes in land use, including rural restructuring of towns, villages, and farmlands, affect nutrient transport from terrestrial ecosystems to deltas in Asia. Examples from case studies in Mekong River and Qiantang River watersheds will be presented.

Session Number: **R2-01**

Session Title: **Observation of the Aridity Effect of Asia Dust**

Time: **13:30-16:50, April 8, 2014**

Location: **Conference Room No.3, 2nd Floor, Friendship Palace**

Convener: **HUANG Jianping**

Speakers:

Tamio TAKAMURA (Center for Environmental Remote Sensing, Japan): Cloud Observation in the SKYNET

HU Yongxiang (NASA Langley Research Center, United States): A Study of the Impact of Dust on Ice Nucleation and Cold Rain Process Using CALIPSO/CloudSat Observations

HUANG Jianping(Lanzhou University, China): An Overview of the Aridity Effect of Asia Dust

HUANG Zhongwei(Lanzhou University, China): Heterogeneous Structure of Dusty Cloud Detection from Raman Lidar and CALIPSO Measurements

BI Jianrong (Lanzhou University, China): Field Experiment of Dust Aerosol and Its Shortwave Radiative Effect over Northwest China during the Spring of 2012

Kenji KAI (Graduate School of Environmental Studies, Nagoya University, Japan): Ceilometer Observation of Dust Profile and Flux in the Gobi Desert, Mongolia: Asian Dust and Environmental Regime Shift

QIAN Yun (PNNL, United States): A Review of China Aerosol-climate Study

CHEN Siyu (Lanzhou University, China): Regional Modeling of Dust Mass Balance and Its Climatic Impact over East Asia Using WRF-Chem

WANG Guoyin (Lanzhou University, China): Observation of Land-atmosphere Interaction over Semi-arid Regions

LI Jiming (Lanzhou University, China): Geographical Distributions and Seasonal Variations of Various Cloud Types Based on Active and Passive Satellite Datasets

Cloud Observation in the SKYNET

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Cloud plays one of the most important roles in the global radiation budget. Also aerosols can give contribution to it through cloud formation. Several sites of SKYNET have tried to estimate cloud parameters using some instruments, as well as aerosol parameters. Present targets for clouds are focusing on estimating a cloud optical depth (*COD*) and an effective radius (r_{eff}) by using a combination of liquid water path (*LWP*) and a downward solar radiation. When the *LWP* can be observed by a microwave radiometer, the *COD* is consequently determined by a linear relationship between them under an assumption of r_{eff}. The most appropriate set of *COD* and r_{eff} can be retrieved iteratively so as to reconstruct the downward solar radiation observed simultaneously by a pyranometer. This is advantageous for radiation budget study.

SKYNET operates also a sky radiometer with cloud channels (POM-02), which can give simultaneously cloud parameters. Both results are compared and discussed for validation.

A Study of the Impact of Dust on Ice Nucleation and Cold Rain Process Using CALIPSO/CloudSat Observations

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Keywords: Dust water cycle

Ice nucleation plays an important role in cold rain process (or "Bergeron process"). Ice crystals grow at the expense of supercooled water cloud droplets in mixed phased cloud system because the saturation vapor pressure of ice is lower than that of water. The rapid growth of the ice crystals triggers cold rain process. Dusts from arid regions are one of the most important sources of ice nuclei and can play very important role in the cold rain process.

About a century ago, Bergerson observed that supercooled liquid water clouds only appear at the upwind side of a hilltop and realized that vegetation canopy acted similar to ice nuclei and consumed most water vapor. Bergerson further suggested the importance ice nucleation in cold rain process based on that, and the theory has been supported by experimental and model studies.
Collocated remote sensing instruments on A-train satellites can provide the aerosol, water vapor, cloud

and precipitation measurements to assess the impact of dust on the cold rain process on a global scale. E.g., lidar measurements of CALIPSO satellite can provide accurate identification of supercooled liquid water clouds and dusts around and above these clouds. It also provides accurate cloud and dust layer height information for proper assessment of super-saturation. We will present the basic physics concept of the theory, satellite measurement approach to study the Bergeron process, and preliminary results of global statistics of supercooled liquid water clouds, cold rain, and their correlation with the presence of dust aerosols based on the A-train observations and model outputs.

An Overview of the Aridity Effect of Asia Dust

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Keywords: Asia dust Aridity effect

Dust aerosols play an important role in global climate by scattering and absorbing solar and terrestrial radiation, thereby influencing the radiation balance in the atmosphere [Huang et al., 2006a, 2006b, 2009]. Asian dust often originates from the Taklimakan and Gobi deserts in late winter and spring. This dust is transported long distances by the prevailing westerlies, passing over northeastern Asia and the Pacific Ocean, and reaching North America [Huang et al., 2008b]. Dust aerosols can also be transported to the Tibetan Plateau by topographic lifting [Huang et al., 2007]. During transport, dust aerosols not only reduce local air quality, affect human health and attached by the bacilli, but also act as ice nuclei (IN) and condensation nuclei (CCN) of clouds, thus changing the radiative properties of clouds, ice water paths, precipitation, and cloud lifetimes. Furthermore, dust aerosols can act as nutrients for marine biological organisms and modulate the ocean–atmosphere carbon cycle when transported and deposited over the oceans.

To improve understanding and capture the direct evident of the impact of dust aerosol on semi-arid climate over Loess Plateau, the Semi-Arid Climate & Environment Observatory of Lanzhou University (SACOL) and Lidar network has been established since 2005 [Huang et al. 2008a]. In addition, extensive studies concerning Asian dust and anthropogenic aerosols were conducted during field experiments [Huang et al., 2008b]. Those ground and satellite Lidar measurements suggest that dust are always present in the atmosphere over dust source regions and form dust plumes in upper-layers of troposphere. These dust plumes often become entrained in westerlies and flow out from the continent to the open sea near Korea and Japan, and can impact the atmospheric hydrological and radiative budgets along the way. The effect of this mixed dust-pollution plume on Pacific cloud systems and the associated radiative forcing constitute an outstanding problem for understanding climate change [Huang et al., 2007, 2008b].

Huang' group [Huang et al., 2006b, 2010] have studied the dust aerosols' semi-direct effect on cloud water path over East Asia. They found that the water path of dust-contaminated clouds is considerably smaller than that of dust-free clouds. The mean ice water path (IWP) and liquid water path (LWP) of dusty clouds are less than their dust-free counterparts by 23.7% and 49.8%, respectively. The long-term statistical relationship derived from International Satellite Cloud Climatology Project (ISCCP) data also confirms that there is a significant negative correlation between dust storm index and ISCCP cloud water path. Those studies show some evidence of the semi-direct effect of Asian dust aerosols on cloud properties. Both local anthropogenic dust aerosols and natural dust aerosols transported into a region can significantly reduce the water cloud particle size, optical depth and LWP. These results suggest that dust aerosols warm clouds, increase the evaporation of cloud droplets and further reduce the cloud water path. The semi-direct effect may be the dominating factor in dust aerosol-cloud interactions over arid and semi-arid regions in East Asia and may contribute to the reduction of precipitation via a significantly different mechanism than that observed in Africa [Huang et al., 2010].

Cloud droplets form on CCN and reduce the water vapor saturation barrier necessary for droplets to form. Higher aerosol concentrations result in more cloud-droplet embryos competing for available water vapor. Changes in the number and size distribution of cloud droplets create thermodynamic and microphysical feedbacks that have the potential to change cloud evolution and properties. A significant feature of dust-cloud-precipitation interactions over arid and semi-arid areas is that it creates a positive feedback loop. The feedback loop begins with a decrease in rainfall and a resulting deficit in soil moisture. This leads to an increase in the occurrence of dust storms. Consequently, dust aerosols in the atmosphere warm clouds, increase the evaporation of cloud droplets and further reduce the cloud water path (the semi-direct effect). This decreases the low cloud cover and water vapor amount, leading to less rainfall. The occurrence of dust storms would then increase, which could lead to even less rainfall.

The consequences of human activities, such as overcultivation and overgrazing, include drastic reductions in vegetative cover and soil destabilization. Loss of vegetative cover makes the predominantly sandy soils vulnerable to wind and water erosion. Another aspect of human influence on dust activity is land desertification due to water diversion to farmland. The consequences of diminished vegetation cover on dust storms may exacerbate the effects of drought, thus leading to a further decline in vegetation cover. This aggravates a general climatic trend toward increasing aridity and may initiate local climatic change.

However, if dust aerosols are transported to wet regions (e.g., East Asia and Pacific regions) and suspended in the atmosphere, they serve as a source of IN which can enhance ice formation by droplet nucleation, and intensify precipitation. Dust aerosol effects and associated feedbacks that modulate cloud properties, rain formation and cloud lifetimes is still the subject of much debate. Some studies

claim that the effects are fairly strong while others suggest that the system is well buffered.

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Heterogeneous Structure of Dusty Cloud Detection from Raman Lidar and CALIPSO Measurements

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Keywords: Dust aerosol CALIPSO Raman lidar

Dust aerosols are of particular interest due to its significant impact on the Earth-atmosphere system. Many investigates strongly suggested that dust particles, during their long distances transport, physically and chemically interact with other aerosols and gases in the atmosphere. According to Tobo et al. (2009 and 2010), Asian dust particles can convert into aqueous droplets under remote marine atmospheric conditions because a deliquescent layer on the particle surfaces could be formed by elevated concentrations of HCl within the boundary layer. It seems that water vapor emitted from the sea acts as essential constituent controlling the modification of the particles through reactions on the dust particle surface.

In this study, a dust event originated from the Gobi desert in March 2009 is investigated based on ground-based polarization Raman lidar, space-borne lidar, surface in-situ measurements and HYPSLIT backward analysis. Our Raman lidar observations involve measuring backscattering, polarization, and Raman scatterings of aerosols and water vapor. The results showed that Asian dust could be long range transported from the Gobi desert to Taiwan Island, crossing through the eastern of China and Taiwan Strait. We can clearly see the heterogeneous structure of dusty cloud due to modification of dust particles and dust-cloud interaction. Observational evidence was found the possibility that the particles of the lower dust layer largely modified during the long-range transport. So the ability of polluted dust aerosols acting as cloud condensation nuclei (CCN) would be enhanced greatly, consequently convert into water cloud under the moist atmospheric condition. Thus, they may have an impact that cannot be ignored on precipitation, such as suppress or enhance rainfall. In future, we will further study interaction of dust-cloud from measurements of multi-wavelength polarization Raman lidar due to its unique technique advantage, especially combing with observation of advanced microwave cloud Radar.

Field Experiment of Dust Aerosol and Its Shortwave Radiative Effect over Northwest China during the Spring of 2012

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Keywords: Dust aerosols aerosol optical properties regional climate effect field campaign

Arid and semi-arid areas account for about 30% of the earth surface. Changes in climate and climate variability will likely have a significant impact on these regions. Gobi and desert region over northwest China is one of primary dust aerosol sources in East Asia. To improve our understanding of the impact of dust aerosol on climate, an intensive field experiment has been conducted by Semi-Arid Climate & Environment Observatory of Lanzhou University (SACOL) in Dunhuang (40.49 N/94.95 E, 1061m ASL) over northwestern China from April 1th to June 30th, 2012. A suite of active and passive ground-based remote sensing instruments are deployed in the field experiment, such as Micro-Pulse Lidar (MPL), Cimel sun photometer (CE318), Prede sky radiometer (POM-01), grating spectroradiometer (MS-700) and Multi-Filter Rotating Shadowband Radiometer (MFRSR). We can retrieve aerosol optical depth, Ångström exponent, volume size distribution, single scattering albedo, and asymmetry factor from these ground-based measurements. Furthermore, aerosol optical properties can be inter-compared and validated for each other. Surface radiation quantities estimated from SBDART radiative transfer model can be compared with a dozen of the state-of-the-art ground-based radiometers' observations. The dust aerosol radiative forcing and heating rate in Gobi desert over northwest China are estimated using the SBDART radiative transfer model. This campaign is vital to understand the characteristics and variations of dust aerosols in East Asian so that we can evaluate more accurately the effect of mineral dust aerosols on global and regional climate change in the future.

In this paper, we summarize the primary scientific objectives, the design of field campaign, and major findings.

Ceilometer Observation of Dust Profile and Flux in the Gobi Desert, Mongolia: Asian Dust and Environmental Regime Shift

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Keywords: Asian Dust Ceilometer Environmental Regime Shift

Dust has an important role both in a climate and ecosystem. The Gobi Desert, distributed in Mongolia and China, is one of the great sources of the Asian dust. Grasslands are mainly distributed in the north of the Gobi Desert. The Mongolian grassland that has a rich ecosystem with wild animals and plants is a barrier to prevent the desertification. The first purpose of this study is to observe the dust profile and flux in the Gobi Desert. The second purpose is to discuss an interaction between the grassland and the desert.

We installed a ceilometer (Vaisala CL51) at Dalanzadgad Observatory (43.6N, 104.4E, 1470 AGL) in the Gobi Desert as part of a cooperative research on the Asian dust between Institute of Meteorology, Hydrology and Environment (IMHE), Mongolia and Nagoya University in May 2013. We employed the ceilometer for a long-term monitoring the dust profile and flux in the Gobi Desert. The ceilometer uses a simple LIDAR technology with a pulsed diode laser (wavelength of 910 nm). Beforehand, we determined a calibration constant of the ceilometer by a comparison of the ceilometer with the lidar and skyradiometer in March 2013 in Tsukuba, Japan.

A continues observation from March to October in 2014 shows that dust storms five-times occurred in May and June. The dust was not lifted up to the height of long-range transport (LRT) in 2014 in the Gobi Desert near Dalanzadgad. Attenuated backscatter coefficients and concentration of PM10 were small in July and August.

A case study of a dust event during 22−23 May 2013 was conducted. The dust event was caused by the passage of a cold front in central Mongolia. The dust layer extended up to a height of 1.0 km from 16:30 to 22:30 LST on 22 May. The concentrations of PM10 and PM2.5 at 22:00 reached 119 and 76 μg/m3, respectively. The wind speed was reached 10 m/s at 23:00 LST. Part of the dust was systematically lifted up along the cold front of the low pressure system. This dust reached the height of LRT.

Finally, a newly-revised Core-to-Core Program (Asia-Africa Science Platforms) of the Japan Society for the Promotion of Science (JSPS) is briefly introduced. The title and period of the project are:

Collaborative Research between Mongolia, China and Japan on Outbreaks of Asian Dust and Environmental Regime Shift from April 2013 to March 2016

Core institutes are Nagoya University, National Institute of Environmental Studies, Rakuno Gakuen University, IMHE (Mongolia), Lanzhou University, and Xinjiang Institute of Ecology and Geography, CAS, China. The purpose of the project is to build up a science platform for the collaborative research between Mongolia, China and Japan on outbreaks of Asian dust and environmental regime shift though staff and student exchange.

A Review of China Aerosol-climate Study

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Keywords: Aerosol climate

Because of rapid increase of population and human activities, pollutant and dust emission has increased dramatically in China for the last several decades. The increased air pollution and dust have produced a fog-like haze in China that reflected/absorbed radiation from the sun and resulted in reduced visibility/clearness, less sunshine duration, solar radiation and evaporation, reduced warming trend, decreased wind speed, decreased light rain in China, etc. Long-term observational data reveal that both the frequency and amount of light rain have decreased in eastern China for 1956-2005 with extremely high spatial coherency. Solid ground observations show that total solar radiation reduced more than 10 W m-2 in past 50 years over China, which has an important implication for East Asian monsoon because the reduction of solar radiation over land (not ocean) will change the thermal contrast between land an ocean. The presence of light-absorbing aerosols (e.g. black carbon, dust) in snow can reduce the snow albedo and accelerate melting of snow and glacier in Northern China and Tibetan Plateau. In addition the snow-impurities will affect the Asian monsoon by changing the snow albedo over Tibetan Plateau. Meanwhile, large scale of urbanization in China have generated several super mega-city clusters, which not only has changed the land-atmosphere interaction and PBL structure by imposing an Urban Heat Island (UHI) effect, but also has modified the cloud microphysical properties and precipitation efficiency through emitting more aerosol particles which can potentially act as CCN over urban areas. In my talk I will review the research progress and what we learned from both modeling and observations in above subjects, and discuss the remaining issues and future direction.

Regional Modeling of Dust Mass Balance and Its Climatic Impact over East Asia Using WRF-Chem

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Keywords: Dust aerosol WRF-Chem model East Asia Dust radiative forcing

The Weather Research and Forecasting model with Chemistry (WRF-Chem) is used to investigate the seasonal and inter-annual variations of mineral dust over East Asia during 2007-2011, with a focus on the dust mass balance and its direct radiative forcing. A variety of in-situ measurements and satellite observations have been used to evaluate the simulation results. Generally, WRF-Chem reasonably reproduces not only the column variability but also the vertical profile and size distribution of mineral dust over and near the dust source regions. In addition, the dust lifecycle and processes that control the seasonal and spatial variations of dust mass balance are investigated over seven sub-regions of desert dust sources (Taklimakan Desert (TD) and Gobi Desert (GD)), the Tibetan Plateau (TP), Northern China, Southern China, the ocean outflow region, and Korea-Japan. Over the two major dust source regions of East Asia (TD and GD), transport and dry deposition are the two dominant sinks with contributing of ~25% and ~36%, respectively. Dust direct radiative forcing in a surface cooling of up to -14 and -10 W m-2, atmospheric warming of up to 9 and 2 W m-2, and TOA (Top of atmospheric) cooling of -5 and -8 W m-2, respectively. Dust transported from the TD is the dominant dust source over the TP with a peak in summer. Over the identified outflow regions (the ocean outflow region, and Korea-Japan), maximum dust column concentration in spring is contributed by transport. Dry and wet depositions are comparable dominant sinks, but wet deposition is larger than dry deposition over the Korea-Japan region, particularly in spring (70% versus 30%). The ability of WRF-Chem to capture the measured features of dust optical and radiative properties and dust mass balance over East Asian provides confidence for future investigation of East Asia dust impact on regional or global climate.

Over the Tibetan Plateau, dust modifies the atmospheric heating profiles and cloud properties, leading to a decrease of snowfall and hence snow coverage on the ground. These results are from a reduction of surface albedo and increased surface temperature, further accelerating snowmelt. This impact is smallest in summer, when the snow coverage is relative low. Over the East China-Korea-Japan regions, dust modifies the atmospheric heating profiles and cloud properties. Dust induces significant changes in the magnitudes and diurnal variations of surface temperature. Cloud liquid water content is also significantly impacted, as reflected in changes of cloud forcing at the top of the atmosphere (TOA) with a maximum in summer. The dust impacts on spatial distribution of precipitation and wind circulation are also investigated, showing distinct seasonality of dust impact on the regional climate over East Asia.

Observation of Land-atmosphere Interaction over Semi-arid Regions

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Keywords: Arid and semi-arid area Land-atmosphere interaction

Investigating the physical and biochemical processes between the land surface and the atmosphere interactions, and exploring the mechanism and strategy of the land-atmosphere interactions over the arid and semi-arid areas, will significantly improve the prediction of the regional climate models, protect its fragile ecological environment, and reduce the negative impact on human activities. In this paper, the long-term characteristic of energy budget, hydrological cycle, the CO2 flux exchange, as well as the effect of precipitation on land-atmosphere interactions in different climate background and years, were investigated by using the continuous observation data from the Semi-arid Climate and Environment Observatory of Lanzhou University (SACOL), and Xinglong mountain cropland (XM).

It was found that the 6-yr-average annual precipitation was 428.2 mm at SACOL, more than the 50-year climatic average 370.2 mm, but had large inter-annual variability, and approximately 80% of the precipitation occurred during the growing season (May to October). The annual potential evaporation and actual evapotranspiration were 780~1020 mm, 280~490 mm, respectively. Total precipitation, precipitation intensity, and its spatial and temporal distribution will change the characteristics of soil moisture. Meanwhile, the energy partitioning and ecological environment of this region will be affected. However the increasing total annual precipitation cannot always decrease the impact of drought on the semi-arid areas.

With the temperatures raised and soil moisture increased during Julian day 180~306, plant growth reached its peak, the rate of carbon absorption was also higher than the first half year, but when it started is mainly dependent on the distribution of precipitation and soil moisture. In the case of year, which was much less precipitation and higher potential evaporation, as well as soil moisture cannot provide sufficient water for evaporation, or precipitation mainly occurred in the first half year, were not conducive to the growing of underlying surface plant. The maximum monthly averaged CO2 flux appeared at SACOL, only when the soil moisture at SACOL reached it maximum during the growing season, with high relationships with inter-annual variability and monthly total amount precipitation.

Geographical Distributions and Seasonal Variations of Various Cloud Types Based on Active and Passive Satellite Datasets

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Keywords: Cloud type By using the vertical detection advantages of active sensors, we analyze and study the global and zonal distributions of different cloud types and their co-occurrence frequency across different seasons by using four years (2007-2010) of data based on the Radar-Lidar cloud classification product from CloudSat, that is 2B-CLDCLASS–Lidar.

The statistical results show that more high clouds, altocumulus, stratocumulus or stratus and cumulus are identified in the Radar-Lidar cloud classification. In particularly, compared to previous results, high clouds and cumulus cloud fractions increased by factors 2.5 and 4-7, respectively. The new findings are in more reasonable agreement with at least one of the other datasets, typically the ISCCP one. In addition, stratocumulus and stratus are the dominant cloud types world-wide, particularly over the ocean. However, the high clouds are mainly concentrated in the tropics and subtropics. We also find some new features, that is, altostratus and altocumulus prevail over the arid/semi-arid land areas of the Northern and Southern Hemispheres, respectively.

The seasonal variations of the multilayered cloud fraction are small, the globally averaged values range from 23% (26%) to 25% (30%) for daytime (nighttime). In multilayered cloud systems, high clouds account for a higher percentage, especially in the tropics. Global statistical results indicate that high cloud, altostratus, altocumulus and cumulus are much more likely to co-exist with other cloud types regardless of day or night, land or ocean. However, stratus/stratocumulus, nimbostratus and convective clouds are much more likely to exhibit individual features. This behavior is particularly true for stratus/stratocumulus over the ocean. In summary, the cloud fractions based on the random overlap assumption are largely underestimated over the vast ocean except in the west-central Pacific Ocean warm pool. Obvious overestimations are mainly occurring over land areas in the tropics and subtropics. We suggest that a linear combination of minimum and random overlap assumptions possible may further improve the predictions of real cloud fraction for those multilayered cloud types (e.g. As+St/Sc and Ac+St/Sc) over the ocean of 40ºS pole-ward. Cloud overlap distribution active satellite dataset.

Session Number: **R4-03**

Session Title: **Sediment Dynamics and Anthropogenic Impacts of River Mouth and Coastal Systems of Marginal Seas**

Time: **13:30-16:50, April 8, 2014**

Location: **Conference Room No.4, 2nd Floor, Friendship Palace**

Convener: **Jan HARFF, TANG Cheng**

Speakers:

WU Jiaxue (Sun Yat-Sen University, China): Sediment Trapping and Escaping Processes from the Yangtze Estuary to the East China Sea

Michal TOMCZAK (Szczecin University, Poland): Depositional Environment at the Northern Continental Margin of the South China Sea during the Last Glacial Cycle and Holocene

TANG Cheng (Yantai Institute of Coastal Zone Research, CAS): Monsoon Controlled Sedimentary Environmental Change in the Beibu Gulf, Northern South China Sea

LI Yanfang (Yantai Institute of Coastal Zone Research, CAS): The Effects of Sea Level Rise and Anthropogenic Reclamation on the Bohai Sea

Alexandra ROMANOVA (Far East Geological Institute Russian Academy of Science Russian): Sedimentation in the Sea of Okhotsk at Present and Past Time (based on Planktonic Foraminifera)

DENG Junjie (Szczecin University, Poland): Anthropogenic Impact on Morphodynamic Evolution of the LINGDING Bay (Pearl River Estuary) from 1970s to 2000s

Andrzej OSADCZUK (Szczecin University, Poland): The Szczecin Lagoon (Odra River Mouth, Baltic Sea) - a Key Area for the Study of Late Holocene Natural and and Anthropogenic Impacts on Sedimentation

Jan Harff (Szczecin University, Poland): Shelf Sediment Systems – Zones of Interference between Terrestrial, Marine and Anthropogenic Impacts

Sediment Trapping and Escaping Processes from the Yangtze Estuary to the East China Sea

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Keywords: Sediment transport Estuarine dynamics Shelf circulation Small-scale processes Yangtze Estuary East China Sea

How fluvial sediments are trapped and escaped from the estuary to the continental shelf is a big problem in marine geology. In past more than 20 years, sediment dispersal from small mountainous rivers into the narrow and steep shelf was found to be induced dominantly by sediment gravity current. In contrast, sediment transportation from large rivers into a wide and flat shelf has received a relatively less attention. Fine-grained sediment derived from the Yangtze River has generated extensive depositional systems on the shelf, and is involved with some critical issues in marine environments and ecology. Sediment trapping and escaping processes from the Yangtze Estuary to the shelf are still an open problem. Three integrated topics are addressed, estuarine turbidity maxima (ETM), sediment dispersal over the subaqueous delta, and long-distance transportation of fluvial-derived sediment along the shelf. Shelf circulation and small-scale processes such as bottom boundary layer flows, stratification and mixing, internal waves, are examined. Main finding are as follows:

The ETM at the leading front of saline intrusion occurred on the seaward side of the river mouth bar, while a secondary high-concentration zone (SHZ) induced by intense mixing appeared on the landward side of the bar. Sediment flocculation settling dominates in the ETM, whereas sediment resuspension predominates in the SHZ. The resuspension and settling in the SHZ are locally equilibrium, and therefore sediment escape is limited. In contrast, the ETM can form a benthic high-concentrated suspension, which moves downslope of the subaqueous delta.

Sediment gravity flows were found to occur off the river mouth in the 2013 flood season, where a thermocline and a halocline both appeared in the river plume. The turbulence microstructural profiler showed that both stratification and shear are stronger in the pycnocline, while viscous dissipation is weaker there. Turbulence mixing is stronger in the surface and bottom layers, and it is weaker in the mid-depth. The echo-sounder images showed that internal waves (IW) appeared on the steeper slope of the subaqueous delta. The IW can overturn the temperature and salinity profiles, forming staircase structures. In the meanwhile, the IW propagation will enhance the bottom stress, resulting in sediment suspension. This IW-supported sediment gravity current is probably a major mechanism of sediment escaping on the subaqueous delta.

Long-distance transportation of the Yangtze-derived sediment on the shelf engenders a large-scale mud deposit belt along the Zhen-Min inner shelf. Various mechanisms for the mud belt formation have been pointed out: coastal drift current, marine fronts, upwelling currents. More direct processes such as bottom current and sediment dispersal, however, have received less attention in the past. The stratified flows over a slope and boundary mixing can trap sediment suspension on the pycnocline for a long time. This trapping mechanism for suspension can transport fine-grained sediments in a long distance along the shelf. This new finding can properly illuminate the contour current and the formation mechanism of the mud deposit belt.

Depositional Environment at the Northern Continental Margin of the South China Sea during the Last Glacial Cycle and Holocene

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Keywords: Depositional environment multi-proxy approach last glacial cycle NW South China Sea

Climate, oceanographic and sea level history during last glacial cycle (LGC) and Holocene at the northwestern continental margin of the South China Sea are investigated within a bilateral Chinese/Polish research project. For that purpose two sediment cores (HDQ2 and 83PC) and single-channel seismic sections were selected to serve as a proxy data source for paleoceanographic and paleoclimatic reconstructions. The sedimentary facies is interpreted by multi-proxy approaches considering micropaleontological, sedimentological and geochemical analyses. According to the radiocarbon (14C) and optically stimulated luminescence (OSL) datings, sediments of shallow water drill core HDQ2 (88.3 m length) cover a time span of ca. 110 kyr BP. Seismic images of the sampling site show a series of reflectors which can be correlated with coarse layers of core HDQ2. These layers are interpreted as transgression / regression horizons. Due to the age model it is possible to correlate these horizons with the general sea level dynamics within the SCS as it is displayed in relative sea level excursions for the MIS 5 to 2 from the Sunda Shelf (Hanebuth et al. 2011). Core 83PC (8.6 m length) retrieved from the continental slope from water of depth 1917 m provide constant record and calm environment. Therefore, we decided to use this core as a source for data proxy for environmental reconstructions. According to δ18O and paleomagnetic analysis, a good age model which indicate age of this core to ca. 130 kyr was elaborated. This model will help to correlate the paleoenvironmental data

with core HDQ2. Alkenones, δ18O, the Ca/Mg ratio, and micropaleontological proxies will be used for paleo-SST curves and monsoon variability reconstructions in research area. δ15N and δ13C will serve as indicators for nutrient supply to the marine environment. Diatomological analysis as essential tool for paleoenvironmental reconstructions will outlines the environmental evolution and interrelations between their parameters during the LGC.

Reference:
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Monsoon Controlled Sedimentary Environmental Change in the Beibu Gulf, Northern South China Sea

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Keywords: Monsoon Beibu gulf sedimentary environment

3 cores (371800, 371820, 371840) collected in 2009 in the Beibu Gulf survey together with Geophysical sub-bottom profiles. Grain size analysis together with MSCL core measurements have been done in the lab, the results showed that 371800 and 371840 cores in the similar pattern, the sediment is composed most of silt with little sand. A clear variance can been seen 2 meters below the sea bottom which may indicate storm evidences during the sedimentary history. The variation of the grain size both in the lateral and vertical may be caused by the intense seasonal monsoon influence, particularly the typhoon impact. The core 371820 is close to the west coast of Hainan Island, with high sand content in the upper core, may be caused by the strong coastal current. A sediment transport pathway from the shelf to the deep basin can be found in the seismic profiles and grain size analysis, which indicate the special sedimentary environment in this region.

The Effects of Sea Level Rise and Anthropogenic Reclamation on the Bohai Sea

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Keywords: Sea level rise reclamation

Since the emergence of concerns about human-induced global warming in the 1980s, sea-level rise (SLR) and its impacts on the coastal areas have attracted considerable concern. It has been suggested in recent papers that SLR may have significant and unexpected effects on the tidal dynamics of the shelves. Recently large amount of reclamation carried out by authorities around the Bohai Sea which is a semi-closed gulf with shallow water, has reached new heights as a consequence of significant economic expansion in the coastal areas, which could change coastlines. Both SLR and reclamation could influence tidal dynamics, however, the response of the tidal amplitudes varied significantly between the studies.

As tidal motion is one of the major dynamical processes in the Bohai Sea, we are concerned that what affects both SLR and reclamation has on the tidal dynamics. Numerical study shows different tidal patterns due to SLR and changed coastlines. SLR could move the amphidromic points towards deep water. Reclamation could induce a redistribution of the extra tidal energy also change the tidal range and phase, move the amphidromic points. Both SLR and reclamation can result in rise of tidal amplitude towards shelf which may enhance the coastal hazards such as storm surge. Identifying the processes which control the responses of coastal sea tides not only increase our knowledge about tidal systems, but also aids predictions of how shelf sea systems will respond to future climate change and anthropogenic activities.

Sedimentation in the Sea of Okhotsk at Present and Past Time (based on Planktonic Foraminifera)

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Keywords: Sedimentation climate change

It is well known fact that sea ice anomalies in high latitude areas of Russia impact on the summer monsoon circulation and precipitation over East Asia (Ohshima, 2007; Guo et al, 2013). Far East seas are very sensitive to climate changes not only at present time, but also in the past. Planktonic organisms that live in the upper column are very sensitive to such changes and due to the hard shell can be used as

proxy for reconstruction of paleoclimate changes and processes of sedimentation. We create database of planktonic foraminifera in modern sediments that is used as model for past-climate reconstruction. Database includes information about taxonomy, ecological preference of foraminifera and also information about certain patterns of foraminifera preservation that are different in certain parts of the ocean floor. Comprehensive data analysis of modern foraminiferal assemblages provides us to distinguish 5 biogeographical provinces of planktonic foraminifera. These provinces were a initial model for paleoclimate reconstruction. Based on data from 4 cores we distinguished certain criteria for planktonic foraminifera in Okhotsk sea that can help another scientists to use this group of organisms as proxy for past climate reconstruction in high latitude areas. Our study reveals new information about climate changes and processes of sedimentation in the Okhotsk Sea during last 100 000 years using planktonic foraminifera that is very poorly investigated in this region. We distinguished 5 long and 11 short term periods of climate oscillations that are connected with sea-ice cover, nutrient supply and influence of Pacific waters. The data fixed abrupt climate change between Marine Isotope stage 1 and 2 that also influenced on processes of sedimentation. We proved our results by correlation with another data from Okhotsk Sea sediments and also with data from terrestrial sediments of the close area.

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Anthropogenic Impact on Morphodynamic Evolution of the LINGDING Bay (Pearl River Estuary) from 1970s to 2000s

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Keywords: Anthropogenic impact morphodynamic evolution; LINGDING Bay; future projection

The past reconstruction and thus the future projection of the coastal environment are of major societal concern for the coastal area around LINGDING Bay. This area is one of most urbanized areas of China. Due to anthropogenic activities as for instance land claiming, damming of river water, sand extraction, the river mouths' natural position within the ternal system of influencing factors (wave / tide / river) is increasingly changing. On a basis of the nautical charts of the years 1974, 1988, 1998 and 2006, the decadal morphological changes of the tidal shoal area and tidal channel were quantified by using the method of Geographical Information System. Meanwhile, the anthropogenic activities such as land reclamation were compared. The two-dimensional hydrodynamic numerical model was employed to investigate the hydrodynamic responses on the boundary condition changes of coastline and bathymetry.

The numerical simulations were conducted individually in the representative half tidal cycle (flooding season) of each decade mentioned above. The measured tidal gauge data was used as the hydrographic boundary driving forces of the numerical simulations. The results indicate the LINGDING Bay has been shrinking due to the great amount of continuous sediment supply from the Pearl River, but this shrinking process slowed down at the beginning of 21st century. This shrinking is followed by the expanding of the water area shallower than 2m and the decrease of the water area deeper than 5m. The land reclamation activities have been identified as the key factor determining the coastline change of LINGDING Bay from 1970s to 2000s. The considerable land reclamation activities have shown significant impact on the flow dynamics particularly in front of river mouth (or so-call "gate" at the Pearl River Delta). The shrinking of the LINGDING Bay has also caused the decreases of the tidal prism that may have reduced tidal influences. Due to the anthropogenic influences, the future projection of the LINGDING Bay cannot use the simple historical linear extrapolation. The implications of the climate change such as sediment accommodation space emerged by continuous and accelerated rise of sea level as is demonstrated by IPCC reports have to be taken into account.

The Szczecin Lagoon (Odra River mouth, Baltic Sea) - a Key Area for the Study of Late Holocene Natural and Anthropogenic Impacts on Sedimentation

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Keywords: River mouth sediment geochemistry Szczecin Lagoon Odra River

The Odra River Mouth System (including Swina Gate and Szczecin Lagoon) serves as a counterpart to coastal systems in the Bohai Sea (including Yellow River mouth) – a semi-enclosed shallow water body connected east to the Yellow Sea through the narrow strait, to study the reaction of highly sensitive coasts during the Late Holocene to climate change and anthropogenic stress. Such a comparison of coastal systems is underway within the frame of the Chinese-Polish research project "Coastal environmental change and bio-diversity response during the last century in the Laizhou Bay, Bohai Sea, and the Swina River Gate, Baltic Sea - A Comparative study". The main difference between these areas lies in the fact that the Baltic Sea is the sea without tides. This causes that the effects of coastal processes are not masked as much as in the case of tidal sea coasts.

The Odra is a border river between Poland and Germany (Central Europe) which flows into the Baltic Sea. The Odra mouth is not estuary sensu stricto (Osadczuk et al. 2007). A key element of this mouth system is a shallow, lagoonal basin called "Zalew Szczeciński" in Polish and "Stettiner Haff" in German; English equivalent term is Szczecin Lagoon. Szczecin Lagoon water flow into the Baltic Sea by three relatively long and narrow strait.

The natural depth of the Szczecin Lagoon does not exceed 8.5 meters, and approximately 96% of the bottom surface has a depth of less than 6 meters. The depth of less than 2 meters comprises slightly over 25% of the bottom surface. In the bottom of the lagoon narrow shipping channel, with a depth of 11 meters, was incised in the second half of the nineteenth century.

The average salinity of the Szczecin Lagoon ranges between 0.6 and 0.9 PSU and changes seasonally. The lagoon is strongly affected by anthropogenic impacts from industry, shipping and agriculture. A serious problem in the lagoon is the large nutrient load which in turn results in eutrophication.

There are significant differences in sedimentary conditions between the eastern (Polish) and western (German) part of the lagoon. Sedimentation in south-western area of the Polish part of lagoon is closely connected with the inflow of suspended and dissolved substances carried by the Odra River. Its feature is a high proportion of organic matter and trace metals in sediments. In the north-eastern area of the Polish part of lagoon, we observe a stronger influence of sea water. Sediments are characterized by low content of organic matter, calcium carbonate and trace metals, and a high content of sulphur and magnesium. German part of the lagoon is characterized by relative stability of sedimentary processes, as a result of a balance between the impacts of marine and fresh waters. In this area the sediments have a high proportion of calcium carbonate derived from high primary production (500-700 g C m2yr-1) (Lampe 1998).

There are four granulometric types of sediment: silts, sandy silts, silty sands, sands. Silty sediments contain significant proportion of organic matter. In fact, they are muds similar to gyttja (mainly algal gyttja). The principal components of the muddy sediments are: quartz pelite, amorphous organic matter (up to 12% Corg) and biogenic remains (crushed shells of molluscs, ostracods and diatoms) (Osadczuk 2004).

Muddy sediments are contaminated, mainly by nutrients (particularly phosphates), heavy metals (Cd, Zn, Hg, Cu, Pb) and Polycyclic Aromatic Hydrocarbons (PAHs). However, chemical analyses have revealed that concentrations of heavy metals in lagoonal sediments in total do not exceed permissible values. The only mercury and zinc show dangerously high levels in some parts of the lagoon bottom. The measurements have revealed 55 samples with concentrations of Hg higher than 1 mg•kg-1, and 6 samples with concentrations of Zn higher than 1000 mg•kg-1 (out of a total of 606 analyses)(Witkowski et al 2009).

Thus, we can conclude that surface sediments are minimally contaminated with PAH's (Polycyclic Aromatic Hydrocarbons) and PCB's (Polychlorinated Biphenyls), but are significantly contaminated by organic compounds of tin (Sn). All analyses revealed concentrations of tributyltin (TBT) above the threshold value.

Sequential extraction of heavy metals was performed in order to determine their bioavailability: a 6-step sequential extraction procedure was applied to determine phases of Cd, Pb, Cu, Zn, Cr, Ni according to procedure of Calmano & Förstner (1982) (modified of Tessier et al. 1979). Results of sequential extraction show that heavy metals are bounded rather to moderately mobile forms: Zn & Cd are bounded to easily & moderately reducible phases; Pb& Cu are bounded to moderately reducible or residual phase; Ni & Cr are bounded mainly to residual phase, but also to moderately or easily reducible phases. It shows that heavy metals don't occur in easy mobile forms. Therefore its bioavailability is not high.

Relatively low degree of sediment contamination indicates that Szczecin lagoon is rather a transit than retention (sedimentary) basin for pollutants. It corresponds to results of nutrient content in sediments, reported earlier by Lampe (1999).

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Shelf Sediment Systems – Zones of Interference between Terrestrial, Marine and Anthropogenic Impacts

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Keywords: Shelf sediment systems modelling

Shelf systems - including river mouths - form complex and highly fragile transition zones from terrestrial to marine environments. Regarding the transit of particulate matter fluviatile, cross-shore and long-shore transport forces interfere where rivers discharge their load to the sea. Fluviatile processes are controlled by the environment of the drainage basins. Here, in addition to natural environments anthropogenic activities, as for instance, damming of river water, play an increasing role. The fate of the discharged load that has reached the river mouth depends on the marine wave climate and tidal environment. The pathway along the coast to receiving shelf basins -the depositional sinks - is steered by lateral transport, whereby atmospheric circulation is considered one of the main driving force. For Asian marginal seas the monsoon systems and their seasonal variation have to be taken into consideration in particlar. Correspondingly, sediments deposited within shelf basins can serve as valuable proxy-records of terrestrial and marine environments when setting up source-to-sink models. Complex models based on the concept of sequence stratigraphy can be used to generate scenarios of the paleo-morphogenetic development as well as future projection. In these models the impact factors, sea level change, neotectonics, sediment supply, hydrographic dynamics, and anthropogenic activities have to be weighted according to the setting of the source-to-sink system under investigation. Case studies of the Yellow River and the Pearl River mouth systems, as well as the Beibu Gulf are demonstrated regarding backstripping to reconstruct paleo-topographies and forward models to generate future scenarios. Comparative studies with the tide-less Baltic Sea help to separate signals of global atmospheric circulation pattern within the Holocene sedimentary records. Time series analyses support hypotheses of tele-connected atmospheric circulation pattern of the Northern Atlantic and tropical Asian Seas. The study shall contribute to the elaboration of effective management strategies for environmentally and economically important river mouth systems.

Session Number: **R1-02**

Session Title: **Progress in Land Surface Modeling in Eastern Eurasia, and Their Future Perspective**

Time: **13:30-15:00, April 8, 2014**

Location: **Conference Room No.5, 2nd Floor, Friendship Palace**

Convener: **Jun ASANUMA, YANG Kun**

Speakers:

Jun ASANUMA (U. Tsukuba): A Summary of Asian Dryland Model Intercomparison Project (ADMIP)

YANG Kun (ITPR, CAS): Field Experiments and Satellite Data Assimilation for Regional Soil Moisture Estimation

Atul JAIN (U. Ilinois): Implementation of Prognostic Leaf Area Index in a Land Surface Model to Improve Water, Energy and Carbon Fluxes

Kaoru TACHIIRI (JAMSTEC): Dispersion among Vegetation Model Outputs for Asian Drylands

Jinkyu HONG (Yonsei, U): Evaluation of Terrestrial Carbon Cycle from CarbonTracker-Asia over Eastern Eurasian Forest

A Summary of Asian Dryland Model Intercomparison Project (ADMIP)

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Keywords: Arid climate land surface model terrestrial ecosystem model soil moisture evaporation

Asian Dryland Model Intercomparison Project (ADMIP) aims to inter-compare numerous landsurface process models, which are subprograms of climate models to reproduce water, energy and vegetation processes at landsurface. The data needed to drive the models were collected, archived and used to drive land surface models (LSMs), and terrestrial ecosystem models (TEMs). The outputs of these models were subject to mutual comparison to shed light into differences between the models caused by different schemes and different modeling approaches. While all of the models selected in this project are among the most elaborated, the results revealed by this project suggested that skills of current climate models to reproduce water and ecosystem processes are still under its developing stage at Asian dryland. More data and more elaboration on the testing of the models are needed. The current effort is following the similar efforts in Europe, Australia and America, but one of the first in Asia. The driving data and the model outputs archived by this project will surely serve as a basis for future works, as will do with the researchers community build in this project.

Field Experiments and Satellite Data Assimilation for Regional Soil Moisture Estimation

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Keywords: Soil moisture data assimilation microwave satellite

Soil moisture plays a key role in the land-atmosphere interactions but its estimation is a major challenge in land surface modeling and satellite remote sensing. In this talk, the following two efforts in this field will be presented.

1. We established a multi-scale soil moisture network on the Tibetan Plateau that may serve to validate regional soil moisture products. The experimental area is characterized by low biomass, large soil moisture dynamic range and typical freeze-thaw cycle. The network consists of 56 stations and measure soil moisture and temperature at three spatial scales (1.0, 0.3, 0.1 degree). All data have been calibrated according to measured soil texture and soil organic matters. A new spatial upscaling method was developed to obtain the regional mean soil moisture truth from the point measurements. The accuracy of current major soil moisture products retrieved from AMSR-E for this region is presented.

2. We developed a dual-pass land data assimilation system. The essential idea of the system is to calibrate a land data assimilation system before a normal data assimilation. The calibration is based on satellite data rather than in situ data. Through this way, we may alleviate the impact of uncertainties in determining the error covariance of both observation operator and model operation, as it is always tough to determine the covariance. The performance of the data assimilation system will be presented through applications with Mongolian and Tibetan Plateau soil moisture measuring networks.

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Implementation of Prognostic Leaf Area Index in a Land Surface Model to Improve Water, Energy and Carbon Fluxes

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Keywords: Phenology Water and Energy Fluxes

In land surface models, phenology and leaf area index (LAI) regularly alters land surface boundary conditions by changing surface albedo, roughness, and surface water and energy fluxes. Therefore, they are the key variables for accurate estimation of seasonal variations of terrestrial ecosystem processes, such as photosynthesis and respiration, as well as land-atmosphere exchange of energy, water and carbon fluxes. In the modeling studies, LAI is prescribed through the use of satellite-based data, while the model accounts for prognostic phenology scheme leading to inconsistency between phonological stages and LAI seasonality. We implement prognostic LAI based on the leaf carbon content and environmental factors in a land surface model, the Integrated Science Assessment Model (ISAM) aimed at calculating continuous LAI consistent with the plant phonological development stages. We perform two model experiments, one with prognostic LAI and other with satellite-based LAI and compare our model results for land-atmosphere water, energy and carbon assimilation fluxes with site measurements. We investigate the advantages of using prognostic LAI for better estimation of the seasonal variation in water, energy and carbon assimilation fluxes. Our analysis reveals that better understanding of the environmental controls on phenology results in a better representation and implementation of phenology and LAI in a land surface model and hence improves the model results for land-atmosphere water, energy and carbon assimilation fluxes.

Dispersion among Vegetation Model Outputs for Asian Drylands

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Keywords: Dryland model intercomparison terrestrial ecosystem models

Among the 18 participants of the Asian Drylands Model Intercomparison Project (ADMIP), 7 models provided at least some vegetation-related variables, and they are compared with observation, including remote sensing, data at grassland in Kherlenbayan-Ulaan in Mongolia and Tongyu in China. The results show the following issues. First, due to relatively high temperature and little precipitation, the modeled vegetation production reduced in 2006-2009, although such reduction was not significant in the observation data, by which it is indicated that models are too sensitive to dry stress. Second, the difference in outputs between the models with different photosynthesis formulation is not clear, except a model with a significantly simple formulation. Third, the models which do not consider the transpiration or with sparse vegetation had good representability in soil moisture, by which it is indicated that generally models overestimate the transpiration. Finally, difference in how to spin-up can influence soil carbon (and then soil respiration and Net Ecosystem Exchange), which may not be vital for instantaneous vegetation activity, but important for carbon budget.

Evaluation of Terrestrial Carbon Cycle from CarbonTracker-Asia over Eastern Eurasian Forest

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Keywords: CarbonTracker-Asia Eastern Eurasian Forest Carbon Cycle

CarbonTracker-Asia is a synthetic tool to keep track of carbon uptake and release at the Earth surface by combining data assimilation, in-situ observation, and atmospheric model. Because of its ability to monitor and to diagnose natural and anthropogenic spatiotemporal distribution of sources and sinks of carbon dioxide, it enables us to better understand the carbon cycle and its interaction with the climate system. These systems also support decision making aimed at limiting anthropogenic emission of greenhouse gases for sustainable societies. Terrestrial ecosystems play an important role both in controlling carbon cycle through photosynthesis and respiration. Therefore, better representation of the terrestrial ecosystem can reduce uncertainties of the global carbon cycle from the CarbonTracker-Asia. In this presentation, we briefly discuss carbon uptake from the CarbonTracker-Asia in Eastern Eurasian forest.

Session Number: **R2-02**

Session Title: **Integrated Study on Eco-hydrological Processes in Inland River Basins**

Time: **15:20-16:50, April 8, 2014**

Location: **Conference Room No.5, 2nd Floor, Friendship Palace**

Convener: **LI Xin, YANG Dawen,Soroosh SOROOSHIAN**

Speakers:

DENG Xiangzheng (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China): Exploring the Intersectoral Water Relationships Based on Environmentally Extended Input Output Tables in Heihe River Basin

LI Xin (Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, China): Hydrological Cycle in the Heihe River Basin and Its Implication for Water Resource Management in Inland River Basins

GAO Bing (China University of Geosciences (Beijing), China): Development of a Model Structure for Distributed Eco-hydrological Simulation in the Upper Heihe River Basin

ZHENG Yi (Peking University, China): Assessing the Uncertainty in Integrated Surface Water-groundwater Modelling: the Experience from an Inland River Basin in China

Yam Prasad DHITAL (Kathmandu University, Nepal): Hydroclimatological Changes in the Bagmati River Basin, Nepal

WANG Xufeng (Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, China): Gross Primary Production (GPP) Estimation Based on Remote Sensing Data in Heihe River Basin

Exploring the Intersectoral Water Relationships Based on Environmentally Extended Input Output Tables in Heihe River Basin

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We propose a new approach to compile an environmental extended input output tables as as to explore the intersectoral water relationships by using RAS-algorithm with Partial-Survey adjustment at county level, and non-parameter methodology as a supplement to missing data interpolation. According to administrative structure in China, provincial level is parallel to state level in other countries, and a county is subordinate to its province. We introduced water consumption caused by cultivation in the primary sector, and water usage in other sectors into a environmentally extended input-output matrix for the case study area, Shandan County of Heihe river basin. Evidence of our empirical analysis shows our environmentally extended input output tables are capable of more efficiently describing economy structure than multiplied by a simple weighed coefficient to its provincial level input output table. Moreover, water resource is actually important to local economy structure of the case studied Shandan County. Thus, water scarcity would be a constraint of sustainable development, especially, such as Shandan County located at a far rural area within Hehei river basin.

Hydrological Cycle in the Heihe River Basin and Its Implication for Water Resource Management in Inland River Basins

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Keywords: Water balance Heihe River Basin Arid region Water resource management Sustainability

Inland river basinstake about 11.4% of the land area of the world and most of them are distributed over arid regions. Understanding the hydrological cycle of inland river basin is important for water resource management in water scarcity regions. Our research focused on illustrating hydrological cycle of a typical inland river basin in China, the Heihe River Basin (HRB). First, water balance in upper, middle

and lower reaches of the HRB was conceptualized by analyzing dominant hydrological processes in different parts of the river basin. Then, GBHM-SHAW and GWSiB models were used in upper reaches and middle-lower reaches respectively, to study the water cycle in the HRB.

The results show that the hydrological cycle in HRB has some distinctive characteristics. In upper reaches, mountainous area generates almost all of the runoff for the whole river basin. High-elevation zones have much larger runoff/precipitation ratio. And snow melting and glacier runoff provide stable water resource for oases downstream. Forest area contributes almost no runoff but it smoothes runoff and reduces floods by storing water in soil and releasing it out slowly. In the middle reaches, river water and groundwater, recharged by runoff from mountainous area, is the water resource to support the agriculture and nurture the riparian ecosystem. Precipitation, approximately 150 mm in average, is only a supplement to agriculture use but sufficient to sustain desert vegetation. Water resources are redistributed by very developed and extensive irrigation system. In the extremely arid lower reaches, water availability has a great impact on the evolution of natural ecosystem and vice versa the landscape change reshapes the hydrological cycle. After the water resource reallocation project implemented in 2000, the water delivered to lower reaches has increased by 36%. Of all the available water resource, about 10% is used to sustain a terminal lake and other water bodies, 20% is used for irrigation to support very rapidly increased farmlands, 40-50% is used to nurture the natural oasis, and other water is lost due to evaporation.

The feature of hydrological cycle in the HRB is very typical for inland river basins in China's arid region. In this region, air temperature is rising and precipitation is most likely to increase. Accelerating glacier retreat will also produce more water. However, water demand increases more rapidly due to quickly developing economy and growing population. Therefore, how to turn our understanding of hydrological cycle in this environmental fragile region into more rational water resource management is a grand challenge.

Development of a Model Structure for Distributed Eco-hydrological Simulation in the Upper Heihe River Basin

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Keywords: Distributed eco-hydrologcal simulation the Heihe River basin hillslope parameterization

Accuracy simulation of the interaction of the catchment hydrological processes and the ecological processes is the key issue in development of land surface hydrological model in inland basins. This study proposed a new model structure for distributed eco-hydrological modeling in the upper Heihe River basin. A 1-km gridded system is used to spatially discretize the study area. The streamflow pathway is described by the river networks of the sub-catchment and the "hillslope-valley" systems in the flow-intervals of the river sections. The topography similar hillslope within each grid is considered as the basin unit for eco-hydrological simulation. A Horton-Strahler ordering system is used to describe the river routing sequence. The hillslope is parameterization using high resolution GIS data. A number of complex hydrological and ecological processes are simulated in the hillslpope through a number of physical equations. A simple test shows that the eco-hydrological processes are sensitive of the hillslope parameterizations such as slope aspect and slope shapes. The long term hydrological cycles of the Heihe River basin is simulated by the model and the performance of the model is evaluated using observation records. The results also show that the water balance characteristics are different from vegetation types. This highlights the importance of coupling the vegetation dynamics into the catchment hydrological simulation in the future.

Assessing the Uncertainty in Integrated Surface Water-groundwater Modeling: the Experience from an Inland River Basin in China

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Keywords: Surface water-groundwater interaction integrated modeling uncertainty analysis Heihe River Basin GSFLOW Probabilistic Collocation Method

Systematic uncertainty analysis (UA) has rarely been conducted for integrated modeling of surface water-groundwater (SW-GW) systems, which is subject to significant uncertainty, especially at a large basin scale. The main objective of this study was to explore an innovative framework in which a systematic UA can be effectively and efficiently performed for integrated SW-GW models of large river basins, and to illuminate how process understanding, model calibration, data collection and management can benefit from such a systematic UA. The framework is based on the computationally efficient Probabilistic Collocation Method (PCM) linked with a complex simulation model. The

applicability and advantages of the framework were evaluated and validated through an integrated SW-GW model based on the GSFLOW code for Zhangye Basin, northwest China. Zhangye Basin is in the middle Heihe River Basin, the second largest inland river basin in China. It has the typical climate and water resources issues in arid and semiarid regions. The hydrological cycle in this basin is highly impact by human actitities such as surface water diversion, groundwater pumping and irrigation. The study results show that the framework for systematic UA allows for a holistic assessement of all relevant uncertainties under complex SW-GW interactions, providing detailed spatial and temporal infomration about these uncertainties and yielding valuable insights into the hydrological processes, model structure, data deficit, and potential effectiveness of managmement. Overall, this study confirms that a systematic UA should play a critical role in integareted SW-GW modeling of large river basins, especially those with signifcant human impacts, and the PCM-based approach is a promising option to fulfill this role.

Hydroclimatological Changes in the Bagmati River Basin, Nepal

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Keywords: Bagmati River Basin hydroclimatological change

Study on hydroclimatological changes in the mountainous river basins has attracted great interest in recent years. Changes in temperature, precipitation and river discharge pattern could be considered as indicators of hydroclimatological changes of the river basins. In this study, the temperatures (maximum and minimum), precipitation, and discharge data from 1980 to 2009 were used to detect the hydroclimatological changes in the Bagmati River Basin, Nepal. Simple linear regression and Mann-Kendall test statistic were used to examine the significant trend of temperature, precipitation, and discharge. Increasing trend of temperature was found in all seasons, although the change rate was different in different seasons for both minimum and maximum temperatures. However, stronger warming trend was found in maximum temperature in comparison to the minimum in the whole basin. Both precipitation and discharge trend were increasing in the pre-monsoon season, but decreasing in the post-monsoon season. The significant trend of precipitation could not be observed in winter, although discharge trend was decreasing. Furthermore, the intensity of peak discharge was increasing, though there was not an obvious change in the intensity of maximum precipitation events. It is expected that all these changes have effects on agriculture, hydropower plant, and natural biodiversity in the mountainous river basin of Nepal.

Gross Primary Production (GPP) Estimation Based on Remote Sensing Data in Heihe River Basin

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Keywords: Light use efficiency model Gross Primary Production Heihe River Basin

Gross Primary Production (GPP) is an important variable in carbon cycle, it indicates carbon amount entering into ecosystem from atmosphere. In recent year, with the climate changing carbon cycle of inland river basin in cold and arid region is changing greatly. The objective of this study is to discuss how the environmental change impact on GPP changes in Heihe River Basin. Based on remote sensing data and Light Use Efficiency model (LUE-model), regional GPP can be easily estimated. In this study, we use the in-situ observed carbon flux data to calibrate LUE-model based on Monte Carlo Markov Chain (MCMC) method. Using the calibrated parameters, MODIS data, and meteorological data as inputs of LUE model, GPP in Heihe River Basin was estimated from year 2000. The GPP change trends for different ecosystems were analyzed. The possible reasons for the GPP change trends were also discussed.

Session Number: **R2-03**

Session Title: **Land Cover and Land Use Change in the High Asia under Climate Change and Regional Development**

Time: **13:30-15:00, April 8, 2014**

Location: **Conference Room No.2, 1st Floor, Building No.8**

Convener: **ZHANG Yili**

Speakers:

HUANG Chong (Institute of Geographic Sciences and Natural Resources Research (IGSNRR), Chinese Academy of Sciences (CAS), China): Assessment of Grassland Dynamics in the Mongolia Plateau Using Remote Sensing and Climate Data from 1982 to 2012

LI Shicheng (IGSNRR, CAS): Spatially Explicit Reconstruction of Cropland and Forest Cover in China over the Past 300 Years

YANG Jiuchun (Northeast Institute of Geography and Agroecology, CAS, China): Dynamic Changes of Farming-pastoral Ecotone in Northeast China under the Background of Global Warming over the Past Century

XU Erqi (IGSNRR, CAS): Spatially-explicit Sensitivity Analysis for Land Suitability Evaluation

GAO Jungang (IGSNRR, CAS): Land Cover Change and Its Relationship with Climate Change in Koshi River Basin of the Central Himalaya

BAI Wanqi (IGSNRR, CAS): Adaptation of Tibetan Nomadism to Climate Change in the Source Region of the Yellow River

Assessment of Grassland Dynamics in the Mongolia Plateau Using Remote Sensing and Climate Data from 1982 to 2012

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Keywords: the Mongolia Plateau NDVI Grassland Dynamics

The grassland ecosystem in the Mongolian Plateau (MP) plays an important ecological role for North China or even the Northeast Asia. In this study, the pattern and dynamics of grassland in the MP were investigated using the NOAA/AVHRR 10-day maximum NDVI composite data of 1982-1999 and MODIS 16-day maximum NDVI data of 2000-2012. A conversion model was built up for harmonizing the two different types of data to get a time series of 30a normalized NDVI data. Based on time series analysis methods, the slope of the fitted line of NDVI from 1982 to 2012 for each grid cell was calculated, which is set as the indicator of the intensity of vegetation changes. Then the correlation analysis was implemented to explore the response of grassland to climate variation. The results showed that spatial distribution of NDVI was in agreement with the general climate pattern in the Mongolian Plateau. However, the inter-annual dynamics of grassland NDVI showed different characterization according to the elevation, vegetation cover and climate condition in the dry MP.

Spatially Explicit Reconstruction of Cropland and Forest Cover in China over the Past 300 Years

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Keywords: Historical land cover land suitability model for cultivation spatially explicit reconstruction China

Spatially explicit reconstruction of land cover is important to assess the impact of human activities on climate change. The Center for Sustainability and the Global Environment (SAGE) created a global cropland data set for the period AD 1700-1992 with a 0.5° grid resolution using a ‘hindcast modeling’ technique. The History Database of the Global Environment (HYDE) was obtained too using historical population density maps as a proxy, which is the effort of Netherlands Environmental Assessment

Agency. The historical maps of cropland and pasture in HYDE3.1 cover past 12000-year period with a 5-min grid resolution.

In this study, firstly, we collected and reconstructed crop and forest area of China over the past 300 years at provincial level. And then assimilated and linked them together. Secondly, to spatially allocate the provincial cropland into spatial explicit grid cells, we designed a land suitability model for cultivation by quantifying the effects of altitude, slope and climate factors on cultivation. The satellite-based modern crop distribution extent and potential vegetation data were also used in provincial area allocating process. Besides, by reconstructing the crop and forest cover in 2000 via our approach and comparing it with satellite-based crop and forest cover in 2000, we validated the rationality of our model quantitatively. Furthermore, the county level historical literature-based crop and forest cover data of Northeast China are available, as a case, the county-level differences of our dataset with this data were calculated to assess the accuracy of reconstruction results at regional scale.

The reconstruction results show that cropland area show a rapid growing tendency and increased 74.52 million ha over past 300 years. While the forest area decreased from 1700-1949 and increased from 1949-2000 and 77.82 million ha forest area decreased on the whole. The 10-km crop and forest cover datasets of China indicated that cropland expanded and forest shrinked obviously in Si-Chuan Basin and Northeast China in 18 and 19 century. And during 20 century, the agricultural frontier expanded northeastward obviously while forest expanded in South China. The comparison results with satellite-based data in 2000 indicate that the method we designed can allocate provincial area into 10-km grids well. And county level comparison results show that the data we reconstructed are close to historical literature-based data.

Our reconstructed results can be used within global climate models to study the impact of land use and land cover change on climate over the past several centuries.

Dynamic Changes of Farming-pastoral Ecotone in Northeast China under the Background of Global Warming over the Past Century

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Keywords: Land use and land cover change farming-pastoral ecotone the past century

Climate change has become a hot point arousing great attention from the international community. From

the IPCC reports, we can know the global average temperature in the past 100 years has increased by 0.6±0.2℃ while the average temperature in China has gone up by 0.5-0.8℃, which would have tremendous effects on economical or social environment, especially in the ecological fragile zone.

Farming-pasturage ecotone is a transitional belt which is characterized by ecological vulnerability, poverty and multi-ethnic groups, and it is also the natural barrier for ecological security.The farming-pastoral ecotone in Northeast China is located in the transitional zone between the semi-humid agriculture area and the arid/semiarid pastoral area. It is a sensitive region of terrestrial ecosystems which is more vulnerable to global change and human disturbance, which is alarmingly comparable to the Sahara region in northern Africa. High-intensity human activities, such as excessive reclamation, grazing, excavation, abandonment, have generated enormous negative environmental impacts in the region, especially the destruction of natural vegetation that has constantly drained the service functions of the local ecosystems. Therefore, large areas of grassland have been converted into cropland due to climate warming, increased population and food demand, etc., causing the location and boundary in farming-pastoral ecotone of Northeast China changing continually, and the land use and land cover in the ecotone changing quickly. With the encroachment of cropland in traditional pastoral zones, the picture of resilient and balanced rangeland ecology has turned upside down. So how farming-pastoral ecotone pattern in Northeast China changes and the related issues are becoming increasing and significative topics.

Besides, most of the researches about farming-pastoral ecotone of Northeast China have been limited to the past 50 years by far. However, a relatively long time-scale is essential to understand long-term human-environment interactions and to clarify the characteristics and mechanism of land use and land cover change response to climate change, i.e., spanning decades up to a century. Based on our research program—Digital rebuilding of LUCC spatial-temporal distribution in the past century in Northeast China by making use of many sources of data such as IM, MSS images, physical environmental background maps including terrain, climate, geology, soil and vegetation as well as socioeconomic statistical data, there is a possibility for me to carry out the related studies.

The purpose of this study is to elucidate the impact of climate change and human activities on the pattern changes to the farming-pastoral ecotone of Northeast China over the past century. In particular, I attempt (1) to reveal the spatial and temporal dynamics of the climate and land use boundaries in the farming-pastoral ecotone of Northeast China; (2) to quantify the contribution of climate warming to farming-pastoral ecotone pattern in Northeast China, especially to reclamation and abandonment activities; and (3) to clarify how the relative potential of agricultural production change as a result of the pattern changes of the transitional belt, and then impact on population carrying capacity and population mobility.

Spatially-explicit Sensitivity Analysis for Land Suitability Evaluation

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Keywords: Land suitability evaluation Spatially explicit analysis Earth mover's distance

Effective use of arable land to meet the growing demand for food requires rational land use management and planning. Land suitability evaluation (LSE) is an important step in this planning. The robustness of the LSE results should be evaluated for the effective implementation in land-use planning. Until now, sensitivity analysis has received only minimal attention especially lacks an insight into the spatial dimensions.

We proposed a new framework that incorporates the spatial configuration information for sensitivity analysis, which combines the land suitability evaluation and the sensitivity analysis.

The framework couples spatial visualization and summary indicators, which include a traditional metric (i.e., the mean of the absolute change rate, MACR) and a novel spatially explicit metric (the Earth Mover's Distance, EMD). The weights of evaluation criteria were assumed as the only source of uncertainty and the newly reclaimed region of Yili in China was studied as the representative area.

The result indicates that the LSE is robust according to the MACR, but local areas are relatively sensitive through the spatial visualization. Based on this framework, the MACR summarizes the information in the numerical value variations, whereas the EMD incorporates new information from the spatial variations for sensitivity analysis. All of these validate the effectiveness of this framework and demonstrate that it can provide a spatially explicit approach for the effective implementation of land use planning for the LSE.

Land Cover Change and Its Relationship with Climate Change in Koshi River Basin of the Central Himalaya

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Keywords: Koshi River Baisn Climate change Land cover change NDVI Himalayas

Land use and land cover change (LUCC) plays an important role in global environment change and sustainable development. Koshi River Basin (KRB), located at southern Tibetan Plateau, is a sensitive area to global environmental change. In this study, based on the technologies of modern Remote Sensing (RS), Geographic Information Systems (GIS) and Global Positioning System (GPS), land cover dataset of KRB in 1992 and 2010 was produced using the theory and methods of geography, spatial information and climatology along with the observation data from field investigation and weather station. According to long-term climate record and the land cover dataset, LUCC and the relationship between LUCC and climate change were analyzed. Future land cover patterns were simulated at different climate change scenarios.

(1) Characteristic of soil cover pattern at different scales

There was a significant difference between land cover types in southern and northern KRB in 2010. The unique land cover pattern was caused by topography, climate and human disturbance in this region. Alpine grassland is the main vegetation cover in northern KRB, while forest and crop land are the main vegetation cover in southern KRB in Himalaya. Central KRB was formed by high mountain, where was mainly distributed by sparsely vegetated land, bare land, glacier and snow cover land. Data with high and low resolution showed that the land cover with smaller area, scattered characteristics and being sensitive to altitude gradient could not get reflected (e.g. forest grassland, bush grassland, etc.) in the process of up-scaling. Some land cover types have significant preference to distribute on different slopes or aspect in the KRB. The data with high and low resolution showed a similar rule that it was more favorable to grow forest on the northwestern, southwestern, western and northern aspect, and bush land on southwestern and southern aspect. It demonstrated a different rule that it was more favorable to grow grassland on the southern and southeastern aspect in high resolution data and on the northeastern and southwestern aspect in low resolution data. The other land cover types showed similar rules in different resolution data. In the case of slope, all land cover types showed a consistent rule in different resolutions data. Forest was mainly distributed on the slope of 16-40°, and it was 18-36° for bush land and bush grassland, 4-16° for alpine grassland and sparsely vegetated land, and 16-36° for cultivated land. The obvious vertical zonality was observed in main land cover types in the KRB. As altitude increases, order of the main land cover types were forest land, bush land, grassland, sparsely vegetated land, bare land and glacier/snow cover land. The longitude has no significant effect on land cover types, while the latitude has a slight effect. However, both of the two types of zonality were significantly affected by altitude gradient. That is to say, KRB was a typical region in the vertical zonaltiy for land cover types. Land cover changes from 1992-2010 showed that glacier and snow cover in the central high altitude region receded, the river, glacier lake and wetland cover increased, alpine grassland in northern KRB continuously degenerated, forest land was gradually transformed to cultivated land in southern low altitude region, especially in the broad-leaved evergreen forests region.

(2) Relationship between long-term serials vegetation cover changes and climate changes

Our study showed that NDVI increased in 1982-1994, suddenly decreased in 1994-2000, and then continuously increased in 2000-2011 in the KRB. Climate change was one of the main driving forces in this process. In addition, turn point of NDVI change was appeared in 1994, which was ahead of the turn point of 1997 in Eurasia. Main effects of temperature and precipitation on NDVI change in the KRB in 1982-2009 varied with the time and space.

Adaptation of Tibetan Nomadism to Climate Change in the Source Region of the Yellow River

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Keywords: Climate change adaptation Tibetan nomadism the source region of the Yellow River

The widespread pasturing area in the world is one of the regions suffering most from modern climate change,where traditional nomadism that has lasted for thousands of years is facing unprecedented challenge. Whether and how the nomadic culture can adapt to modern climate change is an important issue with scientific and practical implications.

Based on family questionnaire, meteorological and statistical data, remote sensing and field survey, a case study of Darlag county in the source region of the Yellow River has been conducted to understand the process of alpine grassland degradation and the behaviors of Tibetan nomads' response and adaptation to climate warming. The results show that there was an increase of 0.29℃/10a on average in annual temperature during 1956~2009 in Darlag county, which indicated more obvious warming effect than that in the Tibetan plateau and the whole country. With the impacts of climate warming and grazing, 29.39% grassland degraded between 1970S～2000. For dealing with the consequences of grassland degradation, local nomads have taken various adaptive measures in livestock production, such as earlier moving from summer pasture to winter pasture, making fence for pasture, adjusting the amount and structure of livestock, increasing the amount and ratio of livestock for sale, supplementing fodder in winter, planting grasses, etc., and simultaneously changes in lifestyle and ideology have also happened correspondingly. This demonstrates that the Tibetan nomadism essentially possess the nature and mechanism of adaptation to climate change, and is capable of adjusting production and living to a certain extent actively or passively. Therefore, with adaptive modification Tibetan nomadism will prove to be an important adaptation mode of climate change in the source region of the Yellow River.

Session Number: **R3-04**

Session Title: **Mountain Land User / Cover Change under Economic Development and Climate Changes**

Time: **15:20-16:50, April 8, 2014**

Location: **Conference Room No.2, 1st Floor, Building No.8**

Convener: **WANG Juanle**

Speakers:

LU Chunyan (Northeast Institute of Geography and Agroecology, CAS, China): Improvement and Degradation of Natural Ecosystem in China-Russia Border from 1990 to 2013

Davaadorj DAVAASUREN (Department of Geography, National University of Mongolia, Mongolia): Impact of Climate Change and Human Activity in Soil Moisture Dynamics on Alluvial Soils on Tuul River Valley

LI Junli (Xinjiang Institute of Ecology and Geography, CAS, China): Mapping Seasonal Variations of Alpine Lakes in Xinjiang during 1990-2013

CAO Xiaoming (Institute of Desertification Studies, Chinese Academy of Forestry, China): Study of the Spatio-temporal Changes of Drought in the Mongolian Plateau in 30 Years Based on TVDI

YU Hao (Northeast Institute of Geography and Agroecology, CAS, China): Dynamic Changes of Forest Landscape in the Changbai Mountain and Its Driving Forces since 1990's

WANG Juanle (Institute of Geographic Sciences and Natural Resources Research, CAS, China): Study on Grassland Degradation in Mongolia from 1990 to 2010

Improvement and Degradation of Natural Ecosystem in China-Russia Border from 1990 to 2013

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Keywords: Land cover/use change Natural ecosystem Climate change Economic development China and Russia border

Natural ecosystem is of importance on biodiversity and sustainable development. However, during recent decades, a lot of natural ecosystems have faced with variety of threat in the context of increasing human pressures, development needs and global climate change. Monitoring the change of natural ecosystems is indispensable for providing more reliable and sound information for the government and managers making protection policies and measures. China and Russia are ones the most countries in Monsoon Asia with different economic development level, the former is developing, and the latter developed. In order to research the change of natural ecosystem in mountain areas under economic development and climate change in the two countries, we chose one study area (latitude in this area ranges from N43°28′ to N45°01′ and longitude from E130°39′ to E131°34′) in China-Russia border.

Using remote sensing image data (Landsat TM/OLS image, 30 m resolution) and object-oriented classification, we obtained the land cover/use results in 1990 and 2013. The land cover categories in the study area include natural wetland, constructed wetland, woodland, grassland, cropland, built-up Area, and barren land. In addition, through the spatial analysis and calculation of landscape metrics, we got the change trend of different land cover/use types. At last, the climate change and economic development were considered into analyzing the change reason of land cover.

It was found that (1) In China, the forest increased from 6,899.56 km2 in 1990 to 6,928.93 km2 in 2013; the grassland increased from 171.76 km2 to 204.61 km2, the natural wetland increased from 336.72 km2 to 337.22 km2, the constructed wetland increased from 2.46 km2 to 2.69 km2, the built-up area increased from 110.51 km2 to 127.80 km2, the cropland decreased from 707.18 km2 to 629.80 km2, and the barren land decreased from 2.91 to 0.07, in corresponding year., at an average change rate of 1.28 km2/year, 1.43 km2/year, 0.02 km2/year, 0.01 km2/year, 0.75 km2/year, 3.36 km2/year, and 0.12 km2/year, respectively. (2) In Russia, the forest increased from 4309.58 km2 in 1990 to 4530.66 km2 in 2013, the grassland increased from 1182.58 km2 to 1294.58 km2, the natural wetland decreased from 148.90 km2 to 46.66 km2, the built-up area increased from 171.50 km2 to 172.31 km2, the cropland decreased from 880.72 km2 to 649.56 km2, in corresponding year., at an average change rate of 9.61

km2/year, 4.87 km2/year, 4.44 km2/year, 0.04 km2/year, and 10.05 km2/year, respectively. (3) For all natural ecosystems, both China and Russia, they were all improved. They increased from 7408.05 km2 in 1990 to 7470.77 km2 in 2013 in China, with growth rate of 2.73 km^2/year. In Russia, they increased from 5641.05 km2 to 5871.90 km2 at an average change rate of 10.04 km^2/year. (4) From the calculation of landscape metrics, it can be inferred that the landscape of wetland became better in China. However, the wetland landscape became worse during the period 1990-2013. For forest and grassland, they were both improved in China and Russia. (5) Through Climate changes occurred over the study period, it has not played important influence on the change of natural ecosystem. (6) The economic development did not impose a negative impact on sustainability development of natural ecosystem, and government funding support paly a positive role on conservation of natural ecosystem, especially in China.

According to the results, the natural ecosystem conservation and economic development have balanced in China and Russia border. Additionally, the climate change had not imposed a critical influence on the change of natural ecosystem.

Impact of Climate Change and Human Activity in Soil Moisture Dynamics on Alluvial Soils on Tuul River Valley

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Keywords: Soil moisture Land use change

Global warming impacts the water cycle not only by changing regional precipitation levels and temporal variability, but also by affecting water flows and soil moisture dynamics. Soil moisture is a key component of the hydrological cycle, controlling the partitioning of precipitation between runoff, evapotranspiration and deep infiltration (Daly and Porporato, 2005). Soil moisture serves a critical role in shaping the ecosystem response to the physical environment.

Last several years, climate changing which the soil humid level, river level downing, plants cover getting small. In Tuul river valley, including Ulaanbaatar city, the researchers have already been observed of average annual temperature increased by 1.3-1.6 OC and annual precipitation has decreasing 40-80mm, respectively. During the 2006-2008, we have been studied the soil humid in Alluvial meadow soil and Alluvial-derno soil on the Tuul river over Ulaanbaatar city. Most rivers have full cold in winter season in Mongolia. Therefore soil humid measure doing in summer at the between in May and October. Floodplain soil formatting in wet condition. Therefore alluvial soil has different nutrient, humid,

temperature that other soil. Then alluvial soil moisture has been indicated soil moisture dynamics at more clear.

The objective of this study were: (i) to determine the variations and dynamics soil moisture before and after precipitation events and (ii) to quantify relationships of soil moisture trends with land use and soil types on river valley. The study area was chosen because it is characterized by intensive land use in urban area and predominantly soil cover indicated by human activity.

We hypothesized that soil cover become dried by the decreasing precipitation and human activities. Through the following investigation, we provided a more direct assessment of the role of the soil moisture dynamics during the raining seasons.

The soil moisture surveys were carried out during 2006 to 2008 by means of the gravimetric method and Time Domain Reflectrometry (TDR) method, with no measurement during the very cold winter season, when soil is very wet. We focused the research on the driest periods of the year, when the changes of soil water are more dynamic.

Measurements of the soil moisture content were done from April 01th, 2006 to October 15th 2007. During this period 10th sampling was done was 52 sampling days. During the following year from April 1th to October 10th 130 days completed. Within each plot, TDR and scale method probe was located at 0-50cm depth.

As expected, soil moisture trend was measured with the surface layer of 0-50 cm on the each measurement site. Alluvial derno soil moisture showed a different trend during the years 2006 to 2007.

From April 1th to October 15th of 2006 the average soil moisture content 28.5%, mean while it reached 34.6% during the summer season (Figure.2). As shown in figure.2 show that the soil moisture was in 2006, average soil moisture has ranged 20-40% (mass content) at April to July, 2006. During the precipitation time, soil moisture has reduced 5-20% (mass content) at the August to October, 2006. The soil moisture trend was induced by the frozen melting and precipitation variations. This was due to the 2006 rainfall and thunderstorms which accounted 233mm of rainfall collected during studied period.

During 2007, from April 4th to November 5th, soil moisture trend shows the expected yearly trends. This year was the drier period compared last 40 years data. During the warm months, the precipitation has 157 mm at 2007 and air temperature have 35-40OC at 2m high from soil and surface temperature has 36-42oC during the measurement time.

The mean annual soil moisture 8.9%, meanwhile during the summer sampling period the soil moisture

was only 17.1% in top soil layer. The Figure.3 has shown, soil moisture content was very low in soil layers.

Soil moisture is very small, and in the depth 20-50 cm humidity haven't fluctuated, only humidity have 0.5-2% (mass content).

Our result provided direct field evidence that soil type and land use are effect to dynamic and variations in the soil moisture due to several reasons. First, the study area has under the intensive land use. Especially, the constructions are affected by the decrease the vegetation cover, change the soil properties and melting the frozen soil in study area. Second, change the climate parameters in study area. The researchers noted by annual air temperature has increased 1.3-1.6OC, and annual precipitation has decreased 40-80mm on the Ulaanbaatar city (Davaadorj. D, Enkhtuya. B; 2006).Third, to change the soil properties in the study area. There are some fact has change the soil properties, including house construction, car road and decreased river level. The human activities directly affected to change the soil properties. Also precipitation has been decreased, it is lead to soil become dried during the several years, the figure.4 has showed that soil moisture trends at 2007 and 2008. After the soil dried at 2008, water penetration has actively in study area. The alluvial soil can't save the water from precipitation, most of water came melting and ground water.

Mapping Seasonal Variations of Alpine Lakes in Xinjiang during 1990-2013

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Keywords: Seasonal variations alpine lakes

Glacial lakes in the alpine regions remain sensitive to climatic change and fluctuate with temperature and precipitation variations. Study shows that glaciers in alpine regions of Xinjiang have retreated dramatically, leading to the expansion of the existing glacial lakes and the emergence of many new glacier lakes. The existence of these lakes increases the possibility of outburst flood during the ice melting season, which can bring a disaster to the downstream area. Mapping alpine lakes and monitoring their changes would improve our understanding of regional climate change and glacier-related hazards. Glacial lakes in Central Asia are mainly located at the Tienshan Mountains, the Altai Mountains and Kunlun Mountains with average elevation more than 1500 meters. Most of these lakes are supplied with the glaciers and snowmelt water during the summer seasons. However, due to the restricted access, the characteristics of these lake changes remain unknown. Satellite remote

sensing provides an efficient and objective tool to analyse the status and variations of glacial lakes. The increased availability of remote sensing sensors with appropriate spatial and temporal resolutions, broad coverage makes lake investigations more feasible and cost-effective. The paper intends to analyse the alpine lake changes in with Landsat TM/ETM+ imagery and lake level observations. And the Kanas Lake, the Bosten Lake, the Tianchi Lake, the Chaiwopu Lake, the Sailumu Lake and the Ayakum Lake are selected to analyse the seasonal characteristics of lake variations. And the precipitation and temperature data are also used to find the relations between alpine lakes and region climate change. Over 500 Landsat imagery were used to map lake areal changes. The result shows that seasonal variations of the glacial lakes in the Altain Mountain remain stable, while the Tianshan Mountain have experienced greate changes in the last two decades. The alpine lakes in the Kunlun Mountain is have experienced expansion changes since 1990. The reasons of these lake changes need further research.

Study of the Spatio-temporal Changes of Drought in the Mongolian Plateau in 30 Years Based on TVDI

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Keywords: Drought monitor the Monglian Plateau Ts-NDVI space TVDI

The vegetation degradation, drought and other environmental issues in the Mongolian Plateau have been as the hot spot in the study of the climate change and the ecological environment changes in Northeast Asia. Based on the NOAA AVHRR NDVI-PathFinder 10d remote sensing data of 1981-1999 and MODIS vegetation index and the surface temperature 16d data of 2000-2012, the study inverted Temperature and Drought Vegetation Index (TVDI) by the Ts-NDVI general space, their spatio-temporal distribution and changes were studied. The main results are: 1) the results of accuracy verification showed that, TVDI could reflect the trends of soil moisture condition, and could be used as the drought evaluation index; 2) there were about 51.51% of the whole area suffering drought, and it was severe in some years; 3) in the period of 1981 – 2012, the drought became more serious in the Mongolian Plateau; 4) in the whole growing season, the drought alleviates from April to August, and increased in September and October; 5) There is close relation between soil moisture and vegetation cover, Land use. Bare land, construction area and grassland were dominated by drought, the drought in construction area and grassland were followed. Forest and shrubland were dominated by moisture, but shrubland was drier than that in grassland.

Dynamic Changes of Forest Landscape in the Changbai Mountain and Its Driving Forces since 1990's

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Keywords: Dynamics Change Driving forces Changbai Mountain

Forest is the largest carbon pool in the terrestrial ecosystem, and plays an important role in the carbon balance under global change. Monitoring the changes of forest landscape is one of the top priorities for the protection of ecosystems. This paper is based on theories of landscape ecology and supported by Geographical Information Systems (GIS) and Remote Sensing Technology. Landscape indexes are used to investigate the landscape pattern and dynamic changes of forest in the Changbai Mountains based on the satellite imagery data of Landsat (TM) in 1990, 2000, 2010, and potential driving forces from natural and social factors in the two decades are examined. Furthermore, the land cover in 2020 is predicted utilizing the Markov model. All those studies are hopeful for contributing to regional sustainable development and usage of forest resource. The research outline and the conclusions are as following:

(1) Landsat thematic mapper (TM) images were classified using the Ecognition software to extract the land cover of the study region in 1990, 2000 and 2010. The land cover is extracted more effectively by taking into account auxiliary information such as the digital elevation model (DEM), multi-temporal imageries, expertise and historical data. All the images well pass the classification accuracy tests implemented by sampling verification. The classification accuracy for the three epochs are respectively 88.79%, 89.91% and 88.39%.

(2) The landscape pattern variations in the Changbai mountains region are interpreted by means of landscape index from 1990 to 2010. Further understand the relationship of mutual conversion between forests and other types feature by developing transition matrix, the dynamic models and center of gravity model. The result demonstrated that the overall loss area of forests is 344.85 km2 during the 20 years, implying an annual deforestation rate is 17.24 km2. In two decades, the most obviously conversion is the transformation from forest to cropland, there are 476.83 km2 land transformed from forests to cropland, it occupies 24.2% of the forest area in 2010. Reverse conversion from cropland to forests occupies 2% of the forests area, and the variable quantity is 264.60km2. Forests center of gravity offset to the northeast region.

(3) The driving forces are relate to the dynamic variations of forests in the Changbai mountains region which are unveiled from both aspects of natural and social factors. There is a negative correlation between the population and the area of forests. Meanwhile, forests are affected by terrain, leading to a vertical distribution. The variations of forests at high altitude are less significant. The combined effects of the reserve boundary and the population distribution cause minor variations of forests within the 15 km distance of natural reserve, and at a distance of 30-45 km, the variations of forests get maximum.

Study on Grassland Degradation in Mongolia from 1990 to 2010

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Keywords: Grassland degradation land cover change Mongolia climate change driving force

Grassland ecosystem is fragile and subject to climate change and human activities. What is the influence of climate change for grassland in the last two decades? How about the grassland degradation caused by the human activities, especially after the political and ecosystem revolution after 1992 in Mongolia? Facing to these problems, the paper will analyze the grassland change from 1990 to 2010 based on two kinds of basic data. One is the grassland distribution map in 1990 and 2010, which was derived from land cover interpretation based on TM images. Another one is the series NDVI datasets of MODIS data products month by month from 1990 to 2010. The paper will discuss the grassland change, trends and driving forces in Mongolia.

Session Number: **R2-04**

Session Title: **Assessing Variability of Grassland Degradations and Carbon Sinks in Response to Climate Change and Human Activities in Long Term**

Time: **13:30-16:50, April 8, 2014**

Location: **Conference Room No.3, 1st Floor, Building No.8**

Convener: **LI Jianlong, QI Jiaguo**

Speakers:

Tsolmon RENCHIN (National University of Mongolia): Monitoring Summer Time Pasture Productivity in the Central Part of Mongolia

Muhammad IJAZ (Quaid-i-Azam University Campus): Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Grasslands in Pakistan response to past Climate Change

ZOU Xinglong (The University of Sydney): Changes of Afforestation and Carbon Storage in Sydney City

GANG Chengcheng (Nanjing University): Assessing the Temporal and Spatial Dynamic of Grasslands NPP in Response to Climate Change in China, North America, Europe and Australia in 1981-2010

CHEN Yizhao (Nanjing University): Grassland Productivity and Carbon Sequestration in Temperate Eurasian Steppe: A Grassland Ecosystem Biogeochemical Model Development, Evaluation and Simulation

WANG Zhaoqi (Nanjing University): Application of Normalized Difference Impervious Index (NDII) to Extract Urban Impervious Surface Feature Based on Landsat TM Image

LI Jianlong (Nanjing University): The Main Advances of Assessing Spatiotemporal Variability of NPP and Carbon Sink of Global Grassland Ecosystem in Response to Climate Change

Monitoring Summer Time Pasture Productivity in the Central Part of Mongolia

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Keywords: Pasture degradation productivity

Development of farm land, mining industry, changes in traditional livestock husbandry, and overgrazing, specially around settlement areas and water issues causes pasture land degradation in Mongolia. To calculate and estimate productivity of pasture land is important.

The productivity of summer-time pasture available to herders controls the optimal number of grazing animals in the warm season as well as the amount of the fodder resources to be harvested for the following cold season. The combination of accurate estimation of pasture resources, soil moisture and a good understanding of current pasture utilization leads to compiling better information about the pasture/fodder resources in the central part of Mongolia. In an attempt to develop a procedure for rapidly producing maps that depict summer time pasture amount distribution with frequent observing satellite data, we linked ground pasture amount and MODIS vegetation index (VI). For the estimation soil moisture in Mongolia we used Remotely Sensed data. The moisture index was derived from CRU (Climate Research Unit) data and calculated to indicate climate derived water availability and distinguish between precipitation and potential evapotranspiration. The relationships among ground pasture amount, vegetation index and soil moisture show different results in different pasture cover types.

Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Grasslands in Pakistan response to past Climate Change

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The rangeland/grassland resources of Pakistan consist of 9 classes/zones: (i) Alpine Pastures, (ii) Trans-Himalayan grazing lands, (iii) Himalayan Forest grazing lands, (iv) Pothohar Plateau grazing lands, (v) Thal Desert grazing lands, (vi) Dera Ghazi Khan grazing rangelands, (vii) Cholistan Desert ranges, (viii) Tharparkar Dessert ranges and (ix) Kohistan ranges. Of these, three sites are proposed to be selected, based on the availability of climatic data, differences in climatic conditions, e.g. of temperature, and precipitation for the APN Project " Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Grassland Ecosystems in response to Climate Change in 1911-2011", with China as the Lead Country and Professor and Dean, Dr. Jianlong Li as the Project Leader . These are: i) Himalyan Forest grazing lands, ecologically divided into moist temperate and subtropical, include grazing lands of Siran, Kaghan, Neelam and Jhelum valleys, ii) Pothohar Plateau, ecologically located in subtropical semi-arid to sub-humid, includes Islamabad, Rawalpindi, Chakwal, Jhelum and Attock districts, and iii) Dera Ghazi

Khan Rangelands, ecologically tropical plain, lie between the Sulaiman Range and the Indus River over an area of 0.5 million hectares. The general climatic regime of D.G. Khan Tract is typical of very arid sub mountainous, sub tropical area. The Comprehensive Sequential Classification System (CSCS)' will be used to get the total grassland areas and spatiotemporal distributions of different grassland types in the participating countries. The relative roles of climate changes and human activities in grassland degradation and dissertation of different grassland types will be quantified using CASA (Carnegie Ames Stanford Approach), CENTURY, LPA and PPR models.

Investigation of the Carbon Storage Variation in the Urban District of Sydney Based on Remote Sensing Techniques

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Keywords: Remote sensing urban forest carbon storage

In the case of urbanization, the loss of prime forest is a significant issue. Thus, as one of the major factors controlling greenhouse gas (GHG) emissions, improved urban forest carbon storage to fractionally compensate for the lost pristine forest, is becoming more important to mitigating against climate change. By reviewing from past studies, many previous researches were focused on investigating the relationship between urban land use patterns change and carbon emissions, especially emissions from urban forests. However, recent technological innovations in the field of remote sensing can be further integrated with designed-based methods involving ground surveys, to elucidate urban carbon storage and other ecosystem services provided by urban forests. In this study, remote sensing technology was applied to classify the Landsat images obtained for 1991, 2001 and 2011, in order to determine the extent and distribution of urban forests among other land use/land cover (LULC) types. As the result, the proportion of urban coverage of the total study area increased from 24.7 % in 1991 to 44.6% in 2011, which is indicative of significant urbanization during the twenty year period. By using the field sampling data, urban forest within the study area was quantified using an urban forest-effect model; the model was also applied to the classified images to elucidate urban forest variation. The related urban forest ecosystem services, such as carbon storage/sequestration, air pollutant removal ability, were estimated using the regression equations in the model. The model revealed that the total number of tree within North-West Sydney region was estimated to be approximately 2.3 million. These urban forests potentially store about 1.3 mt C in various forms such as biomass and soil. Additionally, urban forests in the study area can potentially remove about 44,600 tons of pollutants (mainly GHGs) annually equivalent to a saving of about $AUD 409 million every year. Thus the results reveal the spatial-temporal variation of urban vegetation during the last twenty year period; and showcase the importance and potential role of urban vegetation in preserving carbon storage and reducing greenhouse gas emissions into atmosphere.

Assessing the Temporal and Spatial Dynamic of Grasslands NPP in Response to Climate Change in China, North America, Europe and Australia in 1981-2010

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Keywords: Grassland ecosystems Climate change Closed shrublands NPP spatiotemporal dynamics Quantitatively assessment

Grassland is one of the world's largest biomes, accounting for nearly 25% of the world's land surface. As such grassland has contributed significantly to food security by providing feeds for ruminants as sources of meat and milk for human consumption. The grassland ecosystems also play a key role in balancing the global atmospheric greenhouse gases, particularly through the processes of carbon storage and sequestration. Even though the grassland ecosystems have long been modified by climate change, there is hardly any research that have been focused on how grassland ecosystems responded to climate change. However, as many studies on grassland ecosystems in these regions were carried at the local and subcatchment scales, it would be scientifically prudent to study the spatiotemporal dynamics of grasslands in response to climate change and variability at the regional scale. This study is mainly focused on the grassland resources in China, North America, Europe and Australia, which share similar climate patterns and grassland communities. Most importantly, grassland ecosystems are widely distributed in these four regions, providing vast lands of well-developed farming and grazing systems. In this study, grasslands NPP and its spatiotemporal variation in China, North America, Europe and Australia were assessed and compared using a synthetic model. Subsequently, correlations between NPP of each grassland type and climate factors were also evaluated to reveal the nature of the responses of grassland ecosystems to climate change from 1981 to 2010. The results showed that all mean annual temperature (MAT) increased during the 30-year period, and a decreasing trend in mean annual precipitation (MAP) was only observed in North America. The maximum grasslands NPP of 4225.30 ± 215.43 Tg DW yr−1 was found in North America, which has the largest area of grassland ecosystems. However, the minimum grasslands NPP of about 928.95 ± 24.68 Tg DW yr−1 occurred in Europe which is the region with the least area of grasslands among the four regions. With regards to the grasslands NPP variations, an increasing trend was found for China and Australia, whereas, a decreasing trend occurred in the case of Europe and North America during the study period. Additionally, grasslands NPP was significantly positive correlated with the MAP in these four regions, especially in arid and semi-arid parts of each region. However, there is notable differences of the correlations between grasslands NPP and MAT, as each grassland type in Europe showed positive correlations with MAT, while negative correlations for all of the grassland types in Australia. In conclusion, climate change played a significant role in explaining the spatiotemporal patters and variations of the grasslands NPP in these four regions with overall negative in North America but positive in China and Australia.

Grassland Productivity and Carbon Sequestration in Temperate Eurasian Steppe: A Grassland Ecosystem Biogeochemical Model Development, Evaluation and Simulation

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Keywords: Terrestrial biogeochemical modelling regional carbon sequestration Temperate Eurasian Steppe

The temperate natural and semi-natural grasslands of northern Eurasia (further in the text – Temperate Eurasian Steppe belt, TES) are one of the largest terrestrial biomes, which play a significant role in the global terrestrial carbon cycle. However, despite of the importance of TES and great international efforts to investigate this biome, some gaps remain which still should be addressed. One of the existing research gaps is related to carbon sequestration at the scale of the whole TES biome as well as comparison of its estimates among separate TES grassland regions and sub-regions. The second research gap is an absence in existed sophisticated land biosphere models for TES of comprehensive description of all terrestrial processes including biogeochemical cycle and biotic/abiotic disturbances. –These two gaps were addressed by the grassland ecosystem simulation system (GESS Ver. 1.0) model which includes biogeochemical cycle and disturbance effects. The model uses an improved daily time-step version boreal ecosystem productivity simulator (BEPS) with biome-specified update of parameters including spatial-distributed temperature sensitivity of soil respiration (soil Q10), leaf maximum carboxylation rate (Vc, max), a carbon allocation module, and model parameters specifically modified for simulation of grasslands. It also incorporated graze and fire modules to account for main grassland disturbances. Model results were validated using a multi-source data set that include eddy covariance (EC) and field biomass observations from recently published studies. Validation results showed high accuracy of model simulations and good suitability of GESS for applications in grasslands. Model results showed that during the period of 1999 – 2008, TES was acting as a weak carbon sink, about 9g C m-2 yr-1 for the whole region. However, a tendency of changing this sink into a weak carbon source was recognized due to the ongoing desiccation of climate, especially in the KS region. We found that, generally, NPP had a significant positive correlation with annual growing season precipitation (AGSP) ($P<0.01$), and only under high annual growth season temperature (HAGST), its precipitation (AGSP) correlates with NPP notably with R2 exceeded 0.5. For net ecosystem productivity (NEP), the relationship with AGSP was weaker, but statistically significant positive correlation still existed under each annual growth season temperature (AGST) ($P<0.01$). In this study we applied graze model only for MS while the fire module was applied for both regions. The direct loss of vegetation productivity from both grazing and fire somewhat increased during the study decade. This work provided insight into the carbon sequestration and its external driving factors in two major parts of TES by simulating and analyzing its variations during the past decade.

Application of Normalized Difference Impervious Index (NDII) to Extract Urban Impervious Surface Feature Based on Landsat TM Image

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Keywords: Normalized difference impervious index (NDII) impervious surface urbanization threshold thermal infrared band

The ecology of urban environments has been deteriorating due to population growth and increasing urbanization level, with significant effects on human health. The impervious surface is an important indicator of urban ecological environment change, therefore quickly and accurately estimating impervious surface area is essential to monitoring urban area change dynamics, human activity and its effects on urban environmental quality. However, few methods applied in estimating urban impervious surface are capable of providing results quickly and accurately. The shadow of mountain, tree and large buildings in the satellite image greatly affected the extraction accuracy, prohibitive costs and the timing of data acquisition restrict the use of high spatial resolution image. As a result, higher resolution data does not necessarily lead to more accurate estimates. Traditional supervised classification and linear spectral mixture analysis method is time-consuming and labour intensive. Furthermore, regression analysis method may have universal application as multi-source data is utilized. This study proposed a new index named normalized difference impervious index (NDII) based on Landsat TM image, utilized the visible (red, green and blue) and thermal bands. The index was used to extract the impervious surface area of Nanjing city, Jiangsu province, China. Using modified normalized difference water index to mask the water from the raw image. This paper hypothesized that the result of strict supervised classification is the true value of surface feature in order to verify the accuracy of NDII. We used the SVM method of supervised classification divide raw image into impervious surface and non-impervious surface. Supervised classifications were conducted a total of five times. The average pixel numbers for impervious and non-impervious surface were 1298834 and 3057447 respectively. The threshold of the impervious surface determines the extractive accuracy. We assume that the impervious surface generated from NDII contains two parts, impervious surface and non- impervious surface, therefore peaks and troughs for the two parts in an image must exist from which we can find the threshold at the intersection of two land feature troughs. The results show that the combination of red and thermal band extract resulted in a total of 1339747 impervious surface pixels numbers, with producer's accuracy of 86.93%, user's accuracy of 84.61%, the total accuracy of 94.35% and a Kappa coefficient of 0.80 higher than any other band combination. This method can rapidly extract urban impervious surface area with promising accuracy and is not affected by shadows in the extractive process.

The Main Advances of Assessing Spatiotemporal Variability of NPP and Carbon Sink of Global Grassland Ecosystem in Response to Climate Change

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Keywords: Climate change comprehensive sequential classification system (CSCS) global grassland ecosystems net primary production (NPP)

To assess the variations of distribution, extent and NPP of global natural vegetation in response to climate change in the period 1911-2000, and to provide a feasible method for global change research in regions where historical data collected/observed were difficult to be obtained. In this research, variations of spatiotemporal distributions of global potential natural vegetation (PNV) from 1911 to 2000 were analyzed with the comprehensive sequential classification system (CSCS), and net primary production (NPP) of different ecosystems was evaluated with the Synthetic model, to determine the effect of climate change on the terrestrial ecosystems. The results showed that consistently rising global temperature and altered precipitation patterns had exerted strongly influenced on spatiotemporal distribution and productivities of terrestrial ecosystems, especially in the mid/high latitude. Ecosystems in temperate zones expanded and the areas of global deserts decreased as a consequence of climate variations. The mostly decreased vegetation was cold desert (18.79%), while the maximum increase (10.31%) was recorded on savanna. In addition, the area of tundra & alpine steppe reduced significantly (5.43%), and were forced to head northward due to significant ascending temperature in mid-and high latitude. In accordance, the global terrestrial ecosystems productivities increased by 2.09%, most of which was attributed to savanna (6.04%), tropical forest (0.99%) and temperate forest (5.49%), whereas the most NPP losses was found on cold desert (27.33%). NPP increase also presented latitudinal distribution, tropical zone, NPP of which amounted to more than a half of total NPP, was estimated to be the maximum increase with 1.32%, and followed by NPP in North Temperate Zone with 3.55%. At global scale, NPP showed a significant positive correlation with precipitation in comparison to mean annual temperature and biological temperature.

Session Number: **R5-01, R6-01**

Session Title: **Adapting to Climate Change: Social Research and Local Actions**

Time: **13:30-18:00, April 9, 2014, 270 mins**

Location: **Conference Room No.1, 2nd Floor, Friendship Palace**

Convener: **LEE Ho-ching, WANG Xiaoyi**

Speakers:

YANG Tingshuo (Jishou University): Chinese Thinking to Tackle Climate Change

Mohan RAKESH (Oxfam Hong Kong): Adapting to Climate Change: Actions from Small Holder Farmers' Perspective

WANG Xiaoyi (Institute of Sociology, Chinese Academy of Social Sciences): Social Adaptation: Shifting between Pastoralism and Farming

YIN Yanting (Institute of Grassland Research, Chinese Academy of Agricultural Sciences): Herders' Short-term and Long-term Adaptive Behavior to Climate Change

ZHAO Huiyan (Northwest A&F University): Investigation and Analysis about the Adaptation

CHANG Ching-Cheng (Institute of Economics, Academia Sinica Taiwan, China): An Integrated Assessment of Flood Mitigation Plan under Climate Change: the Case of Jiang-Chun River Basin in Taiwan

GUAN Xiaodan (Lanzhou University): Impact of Population Growth on Regional Snow Cover and Land-surface Temperature over Mid-latitude Areas of East Asia

ZHANG Yali (Soil and fertilizer institute, A&F Academy, Qinghai University): Effects of Chemical Fertilizer and Straw return on Soil Fertility and Spring Wheat Quality

Walaiporn LAOSUKSRI (China Agricultural University): Climate Change Adaptation by Local Forestry Community in Central Thailand

JIN Leshan (China Agricultural University): Adaptation to Climate Change: Community-Based Adaptation Planning in Siziwang, IMAR

ZHANG Qian (Institute of Sociology, Chinese Academy of Social Sciences): Poverty Trap and Elite Capture: Wealth Polarization of Pastoral Areas in Inner Mongolia under Climate Change

CHIANG Yi-Chang (Department & Graduate Institute of Architecture and Urban Design, Chinese Culture University, Taiwan): Framing Urban-rural Relationships in a Changing Climate – A Case Study of Taiwan

LUO Kanglong (Jishou University): Glutinous Rice Varieties' Specialization and Ecological Environmental Adaptation

SHI Xiangying (Shanshui Conservation Center): Reducing Drought Risk by Improving Access to Freshwater and Forest Conservation: Case Study in Yunnan, China since 2010

Chinese Thinking to Tackle Climate Change

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Keywords: Diversity national culture adapt endowments

Climate variability, has almost become the world's most attention nowadays, environmental issues are also the most big headache. Different natural risks in different regions thus bringing facing, it is the world's taut nerves. However, in turn, the system in the course of life on Earth billions of years to run, the emergence of climate change but the dictates its own laws of nature, and even if after the emergence of human society, this phenomenon is still not in human behavior will, and normal human society can continue to the present, which is not all destroyed. This shows that after the human society, in the course of life on Earth systems interact, creating a unique human society - culture, life on Earth to deal with the risk of system operation brought. Specific to the southeast coast of China in terms of monsoon region, where a large number of ancient earning our nation and in the continuation and development of generation, creating a long history of national culture.These national culture, and the local ecosystem has already reached a coevolutionary relationship, which historically has actually experienced a similar climate change content, with a dynamic response to climate change endowments. Although with the changing times, the national culture to contemporary society has also undergone a corresponding change, but once restored their traditional cultural content, in time to start their cultural adaptation mechanism, then the response to climate change present monsoon region southeast coast of China, also become rule-based, evidence-based, and it is also able to obtain low-cost treatment effectiveness.

Adapting to Climate Change: Actions from Small Holder Farmers' Perspective

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Keywords: Agriculture small holder farmer

With nearly 80 per cent of the population living in the rural areas with as much as 66 per cent of population engaged in or dependent on agriculture – rain fed primarily; agriculture remains a prime source of livelihood to the majority of people contributing 33 per cent to the national GDP. However, agriculture is largely subsistence in nature. Any change in the pattern of weather affects agriculture severely. The traditional calendar and agriculture plan is no more practical with growing uncertainties caused by weather induced disasters – increasing months of drought, high rainfall in short period, increased frequency of flood etc..

Yet, investment in agriculture is lower - less than 5 per cent of the total budget for agriculture sector. Weak policy provisions and poor service delivery mechanisms make it more vulnerable. As a consequence, agriculture is not seen as a profitable venture and there is a growing trend of male migration in search of livelihood, adding responsibility of agriculture to the women.

Now, more women are getting engaged in agriculture and they comprise almost 60 per cent of agriculture labour force. In many cases they are farm managers, yet not recognized as farmers. Women do not have access to quality input, extension services, credit, market, women friendly tools and technology. The recent agriculture census has identified only 19 per cent of the lead farmer as women; this statistics manifests how women are not seen as producers, farmers or agricultural professionals. The paradoxical fact is that only 9 per cent of women in Nepal are land owners.

Disaster is another challenge faced by agriculture sector and Nepal is vulnerable to multiple natural disasters, many of which are predicted to intensify due to climate change. The mountain and hilly areas are vulnerable to earthquakes and localised landslides, floods and debris flows. In turn, the lowland areas are vulnerable to widespread and prolonged flooding and water stagnation. The farming community in these areas are the most vulnerable as they are completely dependent on nature for agriculture works and have the least capacity to cope up and protect their agriculture from disasters.

The scenario has resulted in growing food insecurity in Nepal, with about 16% of the people being severely food insecure (EIU, 2012) and 33 districts falling under food deficit category. This situation is reflected in 2012 Global Food Security Index also, where Nepal ranked 79th out of 105 countries.

Under such a critical scenario, there is no choice than investing more in agriculture sector to secure food for all. Need to strengthen adaptive capacity of small holder farmers and making their agriculture resilient to weather induced disasters. And for most of them, adaptation will mean having food for family for more number of months from their agriculture field. And if adaptation is linked to securing food for the small holder farmers it has to broaden itself from a science to a complete development package that reduces social exclusion, enhances equity to ensure access to land, inputs and services, increases productivity that can feed the family, protects their crops and build resilience, and to sustain it… there is need for favorable policies and responsive governance.

Perhaps it requires a comprehensive approach to mitigate different challenges i.e. Challenges related to production; challenges in making agriculture resilient to weather induced disasters; prevailing inequity in land holding; the social challenge – accepting women as farmer and women's ownership over land and other productive resources; and lack of favorable policies and supportive governance mechanism in an integrated manner.

Social Adaptation: Shifting between Pastoralism and Farming

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Keywords: Social pastoralism adaptation

Social Adaptation is the changing of social system to cope with the external changes. This paper would describe the changing of land use in an agro-pastoral village in past century to adapt the climate change. There were three shifts in the last century, the major mode of land use in the village were rain-fed farming. As the farmland degraded due to the over cultivation, the pastoralism developed to compensate the loss in farming. When both of farmland and grassland degraded, irrigation farming and store-feeding replaced the rain-fed faming and herding.

The findings of the research were: 1) the adaptation strategy was formed in the interaction of climate change, policy and technology. 2) the adaptation could weak the local capacity to adapt climate change. 3) social adaptation was needed to enhance the capacity of local action.

Herders' Short-term and Long-term Adaptive Behavior to Climate Change

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Keywords: Herders climate change mental stocking rate bounded rationality northern China

Two surveys were conducted to explore the herders' short-term and long-term adaptive behavior to climate change in 2010 and 2012 in the rangeland regions of northern China. Results showed that herders' response to climate change mainly focused on the grassland- livestock interface. Herders' adaptive behavior was characterized as passive but not active. The behavior mainly included short-term and long-term adaptive behavior. In the short term, 84.04% of respondents held that drought was the key climate factor impacting their livestock management practices; The main adaptive measures was selling livestock, buying forage, taking otor, taking a part-time job outside and captive breeding, and buying forage was considered as the first measure against drought or snowstorm; Selling livestock cheaply and taking otor were second importantly when herders encountered a drought; captive breeding was considered as a second choice against snowstorm. However, less herders choose to take part-time job against natural disasters. In the long term, herders' adaptive behavior focused on the balance between grass and animals. Their behavior, such as lambing, the lease of grassland, selling livestock and buying

forage was characterized by bounded rationality, and was guided by mental stocking rate, which told herders how to adjust their livestock management practices. The flock structure changed significantly and small livestock increased dramatically; The lambing time was advanced by about 25 days; The selling time was also advanced and most lambs were sold in the same year, and the breeding time was shortened to 150-180 days by approximately 600 days; More forage was bought and the reserved forage per sheep was increased.

Investigation and Analysis about the Adaptation

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Keywords: The ability to adapt to climate change Adaptation; Mitigation Vulnerability Rural women

There are 2 strategies to cope with climate change(mitigating and adaptation) , the international community (including China) have made achievements significantly on mitigating strategy, but the adaptation strategies and actions generally are inadequate attention, especially the lack of research and action in rural community adaptation. In view of this, seven villages in climate vulnerable areas in province of Shaanxi were selected using PRA (participatory rural assessment) for vulnerability research, and the policy and system of climate change of government in Shaanxi provincial were survey and interview during 2012-2013. The impacts of climate change on rural livelihoods and communities were estimated, and the ability of adaptation were evaluated, challenges to deal with climate change and solutions to these challenges in the local and provincial government was analyzed, the vulnerability of the villages by causal various relationship was analyzed too, so that the theoretical basis and case will be provided for China's adaptation to climate change strategy.

Research results show that, the trend of climate changes in Shaanxi Province are the same as those generally expected in Northern China. While impacts are clear, farmers are already adapting. Households are diversifying income sources as the climate becomes more variable. Household adaptation decisions however, are shaped by institutional support systems. Developing an enabling environment for adaptation requires institutional support in five main areas: 1. Access to appropriate climate and weather information. 2. Improved disaster management. 3. Increasing water access. 4. To improved agricultural support systems. 5. Building resilience. Shaanxi Province has prioritized climate change as a key governance issue, providing a potential avenue to address these five adaptation needs

for rural households. These needs are included within current mandates of departments, policy documents and programs. Implementation of these mandates, however, is currently not reaching the most vulnerable populations with the greatest needs. Given the high concentrations of climate vulnerability in rural households, and that key policy areas for adaptation are agriculture, water resources and disaster management, it is clear that adaptation strategies should be more focused on rural communities while recognizing that their input is essential to creating effective policy interventions.

An Integrated Assessment of Flood Mitigation Plan under Climate Change: the Case of Jiang-Chun River Basin in Taiwan

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Keywords: Integrated assessment model Cost benefit analysis Flood losses Climate change fully probabilistic model

The economic losses caused by natural hazards amounted approximately 3% of GDP annually in Taiwan. Climate change is expected to bring more frequent and intense weather conditions in Taiwan, causing increased damage to human lives and civilian properties in the long term. With the heightening threat imposed by climate change, a growing body of literature has examined risk reduction, environment management and climate change adaptation. To structure a full-scale study of risk management on climate disasters, this study introduces a fully probabilistic modeling technique into the flood loss assessment and cost-benefit analysis of flood control projects, using Jiang-Chun River Basin Integrated Flood Control Plan in Tainan County as an example. Computer simulated flood hazard maps were used in conjunction with the GIS-based census data and land uses information for the flood risk exposure analysis. The estimation of direct flood damages to residential and commercial buildings were based on the depth-damage functions established by previous surveys on the disaster areas. Furthermore, an aggregate loss exceedance probability curve was presented for a complete assessment on annual overall losses. The overall objective is to provide a comprehensive decision making model for public policy makers that contain the uncertain aspect of climate change and a balanced standpoint of resource allocation.

The Jiang-Chun River Basin comprises Guantian, Siaying, Yanshuei, Madou, Sigang, Jiali, Syuejia, Beimen and Jiangjyun townships with a size of 159.8 square kilometers. Due to the winding and narrow watercourses of Jiang-Chun River, floodwater are unable to be carried away within the usual drainage channel. So the basin area is frequently flooded which threaten cause huge damages to local residents and their economic activities. The simulation is conducted under three IPCC GHG emission scenarios

(A2, A1B and B1) with three GCM models (CGCM2.3.2, CM2.1, and ECHAM5) that are reported by the IPCC AR4. The Geographic Information System (GIS) is used to identify the populations, business and assets that potentially are affected by floodwater within the flooded area. The stage-loss curve which relates flood losses to flood depth is used to calculate flood loss per GIS unit. The results show that in the worst scenario climate change can bring almost twice as much the current flood losses into the region, with three climate change models predicting respectively annual average increases of 12%, 30% and 41% in flood losses by years of 2025, 2055 and 2080. Among the three models, the CGCM2.3.2 model predicts the largest flood losses. In coping with the flooding risk, we also estimate the cost and potential benefit constructing a flood detention reservoir on the river basin to retain future floods. The results suggest that the flood detention reservoir with a height of 1 meter built on vacant land is the most cost-effective adaptation strategy, which can reduce 10% of economic losses in the flooding area. The results of such benefit-cost analysis can be used as a decision-making guideline to prioritize alternative measures and to allocate appropriate funding for various public agencies.

Impact of Population Growth on Regional Snow Cover and Land-surface Temperature over Mid-latitude Areas of East Asia

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Keywords: Warming human activities

The impact of population growth on regional snow cover fraction and land-surface temperature over Eastern Asia was analyzed using data of the past 10 years from the population grid dataset, MODerate Resolution Imaging Spectroadiometer (MODIS) snow cover fraction product and Climate Research Unit (CRU) temperature dataset. The results showed the population growth over Eastern Asia drylands (regions with precipitation less than 600 mm/year) had a relatively significant (at 99% confidence level) warming effect compared to that over Asian semi-wet and wet regions through reducing snow cover fraction. The snow cover fraction in population growth area was much lower than that in the non-growth area. These results suggested that population growth led to decrease of snow cover fraction, which would cause the rise of surface albedo and increase local temperature in further—the so-called snow-albedo feedback effect. The snow cover reduction may be caused by the black carbon deposited in snow, which was mainly emitted by fuels for winter residential heating. The field measurements confirmed higher density of black carbon in higher population density area. Therefore, the adjusted temperature increased faster in population-growth area as a result of higher density of black carbon.

Effects of Chemical Fertilizer and Straw Return on Soil Fertility and Spring Wheat Quality

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Keywords: Long term field experiment straw return soil quality

A long-term field experiment was conducted for 19 years under the condition of wheat-wheat continuous rotation on castanozems soil in Hehuang irrigation region of Qinghai province to investigate the effect of chemical fertilizer and wheat straw return on soil fertility and quality of grain. The result showed that: Compared with N,P chemical fertilization, the control treatment , in potash addition fertilization and / or straw return treatments, soil bulk density decreased by 1.2%～7.1%, soil water content increased by 4.7%～13.5%. >0.25mm water-stable aggregate of soil increased and stability of soil aggregate improved. Regard to improving soil physical properties, straw return was superior to chemical N, P, K fertilization. Light fraction of soil organic mater, soil total organic mater, soil N,P,K contents increased as well, especially soil available K content increased sharply, it even reached 279.5mg/kg in the NPK+100%ST treatment which was 2.6 times than the control treatment. The yield of spring wheat was highest in the chemical N, P, K fertilization treatment, combination of straw and chemical fertilizer also increased the yield. On base of N, P fertilization, straw return and or potash addition except for the NPK+100%ST treatment improved protein content of wheat seed and had no negative effect on grain quality. Conclusions: suitable amount of potash and or straw application with chemical N,P fertilization based can improve soil fertility and spring wheat yield and quality, and half amount of straw return can replace potash application in local agricultural practice.

Climate Change Adaptation by Local Forestry Community in Central Thailand

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Keywords: Community Forestry Climate Change Adaptation Limestone ecosystem

Climate Change in the context of rural agricultural villagers is the non-reasonable, uncontrollable, and unpredictable natural extreme weather. The perception, including inadequate knowledge and low priority, resulted to passive mobilization on the mitigation and adaptation to the climate change. However, the research found that actually the adaptation has been simultaneously conducted especially in the agricultural sector. In the study area, Baan Lam Nam Kaew community forestry in Lopburi Province and

its surrounding community livelihoods in the central region of Thailand, the changes in raining pattern, droughts, long time delayed rain, and higher temperature have been evidenced of extreme weather. From the field household survey and interviews, the villagers adjust their cultivating time, rotate field crops to relax the soil, try new seedlings that tolerant to the droughts, and manage the water resources, and implement community forestry and wildlife rehabilitation project. The latter two adaptive local initiatives have significantly improved ecosystem services and reduced droughts. The research found that technical knowledge and financial support from outside has brought up the village attention on forest conservation. The village cooperation and identity have been strengthened through the community forestry project, which has been extended to other cooperative projects such as natural resources management, poverty alleviation, environmental conservation including climate change, and so on.

Adaptation to Climate Change: Community-based Adaptation Planning in Siziwang, IMAR

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Keywords: Community based adaptation planned adaptation

Agriculture is one of the main industries targeted in China's climate change policies. China's strategy of adaptation to climate change, especially in agriculture sector, is to integrate adaptation into the sector polices, such as environmental policy, agricultural policy, water policy and disaster management policy. These planned adaptation policies get more attentions in recent years, but much less attentions are placed on the effectiveness of these policies on livelihoods of farmers or herders. In fact, farmers and herders have already acted in the context of climate change and taken a series of adaptation measures based on their own capitals and communities. It is important to understand the community-based adaptation (CBA) strategies and approaches when making any planned adaptation policies. CBA could reinforce government policies or dismantle it, and vice versa. This study is to identify the community based adaptation strategies, measures and its diversity and conditionality, and try to link it with the government planned adaptation in order to reinforce each other in combating the climate change.

The field survey was done in Gachas (village) and Sumus (township) of Siziwang Banner (county), Inner Mongolian Autonomous Region (IMAR). Participatory tools such as PRA (participatory rural assessment) was used in Gachas and interviews with government officials had also been done in IMAR, Wulanchabu Municipality, and Siziwang Banner. Questionnaires were used to evaluate both the herders' perceptions of climate change and their view of government policies. Here are the results of the survey.

Herders' perception of climate change is varied. Their perception of change in air temperature was more in accord with scientific meterological data than that of precipitation. Their perception of change in frequency of sand-storm was very different from the meterological monitoring records. Most herders reported impressive impacts of draughts, such as lowering of water table, hindered grass growth, increase of animal diseases, and uncontrolled rodents. More households were vulnerable to draught than to other extreme events such as snowstorm, extreme cold and heat wave.

Herder households had autonomously taken many adaptation measures. About 22 adaptation measures had been reported by the herders in the survey. Those which were adopted by more than half respondents were i) store more feed/forage; ii) build warm shed; iii) reduce livestock; iv) cooperate in vaccinations; v) don't let next generations become herders; vi) credit loans; vii) reduce consumption expenditures.

The study showed that different groups of herders had different portfolios of measures to take. To adapt to draught, for example, large-holder herders were more likely to adopt "store more forage", "move herds far and rotate grazing", "savings", "credit loan", and "reduce consumption expenditures" while the small-holder herders were unlikely to adopt "move herds far and rotate grazing", "credit loan". The option of "go outside for a job" was more likely adopted by small-holder herders in case of an extreme climate events. Adaptation options were diverse. Herders chose a set of them based on their own livelihood capitals and community conditions.

The adaptation options were assessed with the method of MCA (multi-criteria assessment). The criteria include the measures' effectiveness, economic benefits, flexibility, no-regret, no-adverse-impacts, government support, fit with development policy, and widespread relevance. The finally selected options for further analysis were i) store more forage/feed; ii) build warm shed; iii) reduce livestock; iv) use new breeds; and v) go outside for a job (see ICRAF report).

The government policies were reviewed on the levels of autonomous region, municipality, and banner. Most of the policies reviewed were that of sectors of environment, agriculture, water, and disaster management. These policies were assessed, with FAO methodology, of their relevance with combating climate change. For example, "does it contribute to increase herder households' physical resilience, economic resilience, social resilience?" It was showed that "subsidy to build warm shed" and "subsidy to build silage pit"were most relevant to combating climate change positively, while "subsidy to buy machines for animal husbandry" was not relevant to adaptation and even negatively relevant to mitigation of climate change.

Government policies had also been appraised by the herders. Among the 24 individual policies, 13 of them were recognized as effective by more than half of herder respondents (n=102). There were 6

policies which were recognized as effective by less than one third respondents. The "effective policies" recognized by most herders were i) education; ii) weather forecast; iii) dig well against draught; iv) credit loan support; v) agricultural insurance subsidy; vi) strengthen public service; vii) subsidy to build ward shed for livestock; viii) subsidy to build silage pit. These policies could build herders' capacity to adapt to the climate change. Some other policies such as weather modification was also hailed.

It was further explored in the study on how to link the community based adaptation measures with the government policies.

Poverty Trap and Elite Capture: Wealth Polarization of Pastoral Areas in Inner Mongolia under Climate Change

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Keywords: Pastoral poverty natural disasters

Many case studies have proved that vulnerability to climate change could induce poverty trap. But it is only one side of wealth redistribution caused by climate change. In fact, adaptation process to climate change has redefined 'winner' and 'loser' and their gap. It is critical to understand this process as a whole to find ways to eliminate poverty. Taking a village in Hulun Buir Grassland in Inner Mongolia as an example, based on metrological data and field investigation, this article presents that poverty trap and elite capture have expanded polarization between the rich and the poor. By using their economic and social capitals, the rich households captured more projects to increase their ability to combat natural disasters. However, the poor households lost their livestock because they could not afford forage and infrastructure repair. Compared these two kinds of households, it explained that why government project subsidies cannot achieve the goal of poverty elimination. Only by strengthening herders' ability to deal with natural disasters can we protect herders from falling into poverty trap and reduce rich-poor gap.

Framing Urban-rural Relationships in a Changing Climate – A Case Study of Taiwan

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Keywords: Catchment climate knowledge urban-rural relationship

A reservoir plan of a city region of Taiwan on exploiting land in rural areas to cope with potential climate-induced city drought was protested by the rural residents due to change in the rural environment they have lived with regarding water for both drought and flood reasons. It is argued that the local knowledge of the rural is key for sustainable catchment management, however faced with extra water demand of the city in a changing climate. This case raises a concern that climate-induced environmental change of city region is expecting new urban-rural relationships highlighting stakeholder engagement and needs an integrated approach to comprehensively assess water risk. It is of concern that a catchment-based approach to managing the water environment through the urban-rural linkage looks at activities and issues in the catchment as a whole across levels, sectors and actors. In this background, we use Google Earth as multi-layer platform to demonstrate interdisciplinary key information on both climate impacts and adaptive capacity of the city region; while hotspots throughout observation and projection are identified, stakeholders' awareness, ability and actions are analyzed via community-based interviews coupled with questionnaires. This multi-layer approach contributes to informing policymaker on both climate challenges and opportunities. We concluded that the approach plays a scientific role in advancing climate change adaptation from risk perception perspectives where transnational learning and action are needed.

Glutinous Rice Varieties' Specialization and Ecological Environmental Adaptation

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Keywords: The Dong Community Specialization; Glutinous rice varieties; Ecological adaptation

During the fieldwork in Huanggang 黄冈 village, Liping 黎平 County, we systematically identified and recorded 13 glutinous rice varieties in the state of dimension and application and 11 other glutinous rice varieties planted sporadically. However, they were very limited parts of glutinous rice varieties Dong people once possessed. Moreover, they were real significant quintessence of Dong traditional farming which revived after extinction. Dong region is wide and its ecological system is diverse. Limited rice varieties are unsatisfied with the need of ingenious cultivation. In history, like current Huanggang village, almost each Dong village had dozens of glutinous rice varieties in order to ensure a harmonious steady continuation of rice, fishes, and ducks, and have efficient adaptation of disaster prevention. To some extent, it was to remedy adverse factors of rice transplanting under the specific ecological background. During that age, in the whole Dong district, excluding those reduplicating names, perhaps there were

hundreds of glutinous rice varieties. Subsequently, during a social process of "planting indica rice instead of glutinous rice" (Ch. 糯改籼) and later "growing hybrid rice instead of indica rice"(Ch. 籼改杂) which were compelled to carry out by the central government, in Pingba 平坝 area, especially the Dong villages along the traffic lines and close to the key cities, most traditional glutinous rice varieties were extinct. Their extinction is a loss of immaterial traditional cultural inheritance which is difficult to be rotrieve. Therefore, 24 extant rare glutinous rice varieties in Huanggang village become very precious. In the last 50 years, scientific and technological, economic, and political movements on "growing indica rice instead of glutinous rice" and later "planting hybrid rice instead of indica rice" were compelled to carry out in the Dong areas. Villagers paid an arduous and disastrous price during that period of time. However, Dong people in Huanggang village still reserved various glutinous rice varieties. Since 1990s, especially in this century these glutinous rice varieties have acquired an opportunity of development. Not only has Huangang village been a place reserving to grow glutinous rice but also has become a production base of green agriculture. This paper shows that these glutinous rice varieties are a result that for a long time Dong people have adapted to natural environments such as water temperature, sunlight, fertility of soil, land and so on. However, this culture adapting to the nature has reached a coupling relationship between culture and environment. Once this coupling relationship establishes, its sustaining ability will be acquired and its life will not be broken off by a sort of external strength's intervention. That is cultural life and cultural strategy.

Reducing Drought Risk by Improving Access to Freshwater and Forest Conservation: Case Study in Yunnan, China since 2010

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Keywords: Water security Drought Climate Change adaptation Mountainous area

China's rural villages are suffering from climate change and associated extreme weather. The lack of adaptation measures exposes rural villages to the negative impact of these changes and it is believed that ecosystem based adaptation is one of the best solution for the rural community to adapt the extreme weather (IUCN, 2009).

In the spring of year 2010, the mountainous areas of Southwest China were hit by extreme drought and millions of people suffered. With plenty working experience in Yunnan, we find that the surrounding area of the primary forest and nature reserve were less affected. Some scholars also find irreplaceable role of

primary forests in mitigating the effects of rainfall anomaly events, and the importance of protecting primary forests in enhancing the capacity of this region in coping with rainfall anomaly events (Qi, 2012).

To alleviate the impact by drought, Shanshui Conservation Center has launched "Protect the forests for drought risk reduction" initiative. Shanshui has helped 7 drought-stricken communities located near nature reserves set up a facility to divert water from local forests to the local communities. Shanshui also helped the local communities reach agreements with local nature reserve authorities to protect the forest-watershed system.

Through the initiative, an ecosystem-based approach for natural disaster risk reduction was introduced to policy makers. More than 4,000 villagers in 5 different areas have benefited directly from this initiative, which has maintained their drinking and irrigation water. This approach is both highly cost-effective and suitable for the local communities over the long term.

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Time: **13:30-16:50, April 9, 2014**

13:30-15:00, April10, 2014

Location: **Conference Room No.2, 2nd Floor, Friendship Palace on April 9**

Conference Room No.5, 2nd Floor, Friendship Palace on April 10

Convener: **WANG Shuyu, R. KRISHNAN**

Speakers:

Krishnan RAGHAVAN (Indian Institute of Tropical Meteorology, Pune, India): High Resolution Simulation of the South Asian Monsoon Using a Variable Resolution Global Climate Model

GAO Xuejie (National Climate Center, CMA, China): Performances of RegCM4.4 over CORDEX-EA (phase 2) Region

WANG Shuyu (Nanjing University, China)

Juneng LIEW (Universiti Kebangsaan Malaysia): Sensitivy of Surface Climate over the CORDEX-SEA Regions to Different Physical Parameterizations in RegCM4

TANG Jianping (Nanjing University): An Assessment of Upper-Level Variables from Several Reanalysis Datasets over China

Valerio LUCARINI (Institute of Meteorology, University of Hamburg): Hydrological Cycle over South and Southeast Asian River Basins as Simulated by PCMDI/CMIP3 Experiments

Gibies GEORGE (Indian Institute of Tropical Meteorology): Relative Importance of Indian Ocean and Pacific Ocean Dynamics on Indian Summer Monsoon Simulation in NCEP CFSv2 Model

Balram AMBADE (National Institute of Technology (NIT) Jamshedpur-831014, Jharkhand, INDIA): Chemical Composition of Sub Micron Aerosol in Industrial Site and Remote Site of India

Amir M. YADGHAR (University of Tehran, Iran): Climate Change Model: CEQUEAU Hydrological and Water Temperature Model

Mohammad Mahmudul ISLAM (Sylhet Agricultural University): Impacts of Monsoon Anomalies in the Haor Region of Bangladesh: Threats and Responses

High Resolution Simulation of the South Asian Monsoon Using a Variable Resolution Global Climate Model

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Keywords: High resolution variable-grid model South Asian Monsoon Moist Convective Processes Scale Interaction

This study examines the feasibility of using a variable resolution global general circulation model (GCM), with telescopic zooming and enhanced resolution (~ 35 km) over South Asia, to better understand regional aspects of the South Asian monsoon rainfall distribution and the interactions between monsoon circulation and precipitation. For this purpose, two sets of ten member realizations are produced with and without zooming using the LMDZ (Laboratoire Meteorologie Dynamique and Z stands for zoom) GCM. The simulations without zoom correspond to a uniform 1o x 1o grid with the same total number of grid points as in the zoom version. So the grid of the zoomed simulations is finer inside the region of interest but coarser outside. The use of these finer and coarser resolution ensemble members allows us to examine the impact of resolution on the overall quality of the simulated regional monsoon fields. It is found that the monsoon simulation with high-resolution zooming greatly improves the representation of the southwesterly monsoon flow and the heavy precipitation along the narrow orography of the Western Ghats, the northeastern mountain slopes and northern Bay of Bengal (BOB). A realistic Monsoon Trough (MT) is also noticed in the zoomed simulation, together with remarkable improvements in representing the associated precipitation and circulation features, as well as the large-scale organization of meso-scale convective systems over the MT region. Additionally, a more reasonable simulation of the monsoon synoptic disturbances (lows and disturbances) along the MT is noted in the high-resolution zoomed simulation. On the other hand, the no-zoom versionhas limitations in capturing the depressions and their movement, so that the MT zone is relatively dry in this case. Overall, the results from this work demonstrate the usefulness of the high-resolution variable resolution LMDZ model in realistically capturing the interactions among the monsoon large-scale dynamics, the synoptic systems and the meso-scale convective systems, which are essential elements of the South Asian monsoon system. This talk will also briefly discuss results of the LMDZ high-resolution simulations pertaining to climate change over the South Asian monsoon region.

Performances of RegCM4.4 over CORDEX-EA (phase 2) Region

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Keywords: Regional climate model East Asia

Twenty years simulation of regional climate over CORDEX (phase 2)-EA (East Asia) region has been conducted at a grid spacing of 25km by the latest version of the Abdus Salam International Centre for Theoretical Physics (ICTP) regional climate model RegCM4.4, for the period 1990−2010. The model is driven by the re-analysis data of ERA-interim. For the model physics, instead of the traditional Grell and Biosphere-Atmosphere Transfer Scheme (BATS) options, convective precipitation is represented using the scheme of Emanuel, and surface processes are carried out with the Community Land Model (CLM) version 3.5, respectively. The simulated seasonal mean precipitation and surface temperature in December-Janduary-Febuary (DJF) and June-July-August (JJA) are compared against observation to assess the model performances over the region. Results show that the model can in general reproduce the observed spatial pattern and amount well although the traditional warm-bias in the in high latitudes in the cold season, as well as the underestimation of precipitation in both cold and warm seasons in southern China still exist. Climate change simulations of driven by CMIP5 (Coupled Model Intercomparison Project Phase 5) models under the emission scenarios of RCPs (Representative Concentration Pathways) will be conducted in the future based on the model version under the CORDEX phase two frame.

Sensitivy of Surface Climate over the CORDEX-SEA Regions to Different Physical Parameterizations in RegCM4

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Keywords: CORDEX Southeast Asia RegCM4 Climate downscaling

CORDEX Southeast Asia (CORDEX-SEA) is a new component of World Climate Research Programme's (WCRP) Coordinated Regional Climate Downscaling Experiments (CORDEX). The proposed downscaling region covers 80°E-145°E; 15°S-40°N, covering the larger SEA regions identified as one of the more vulnerable regions to the impacts of climate change due to high population living in countries with high exposure to climate-related hazards and with low adaptive capabilities. This study examined the sensitivity of the surface climate simulations over this CORDEX domain to different combinations of cumulus parameterizations and ocean fluxes treatment in the 4th version of Regional Climate Model system (RegCM4) developed by International Centre for Theoretical Physics (ICTP). A total of eighteen 21-years (1989-2009) simulations at 36 km were conducted using the ECMWF Interim product as lateral boundary conditions. The quality of the simulated surface climate of each of the experiments were compared to gridded observation datasets. For the comparison of rainfall simulations, multiple observational gridded datasets which include the Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation of Water Resources (APHRODITE), Climate Research Unit (CRU), Global Precipitation Climatological Centre (GPCC) and Tropical Rainfall Measuring Mission (TRMM) were used in order to account for the uncertainties in the observation. The inter observational product variations are generally larger over the east coast of IndoChina Peninsular and the equatorial regions due to small rainfall amount in the APHRODITE dataset over the regions. The simulation of rainfall is more sensitive to the cumulus parameterization but less so to the ocean flux treatment. Mixing of cumulus treatment with Grell scheme over the land and Emanuel scheme over the ocean appears to produce the best rainfall climatology simulation. Nevertheless, regions over the northern IndoChina generally showing larger rainfall biases with higher sensitivity to different physical options. On the other hand, the equatorial regions, where rainfall biases are generally smaller, is less sensitivity to physical parameterization options. Surface temperature climatology was compared with APHRODITE gridded temperature dataset. Initial result shows that all the simulations are too cold over the Tibetan plateau and Indochina, especially during the boreal winter. During the boreal summer, the simulated temperature tend to be smaller. Nevertheless, the seasonal cycles of regional mean are well captured. Over some areas, modeled temperature anomalies are opposite to those of the observed in all of the simulation experiment. In addition, the choice of the ocean flux treatment can affect the model's temperature biases remarkably. This highlight the need to carefully choose the appropriate configuration for RegCM4, particularly for the SEA region, for subsequent climate projections downscaling.

An Assessment of Upper-Level Variables from Several Reanalysis Datasets over China

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Keywords: Reanalysis datasets; sounding observations; high-altitude variables; reliability

The upper-level variables extracted from the National Centers for Environment Prediction (NCEP)-National Centers for Atmospheric Research (NCAR) reanalysis-1, the NCEP-Department of Energy (DOE) renalysis-2, the NCEP-Climate Forecast System Reanalysis (CFSR), the 25 year Japanese Meteorological Agency (JRA-25) reanalysis, the European Centre for Medium-Range Weather Forecast (ECMWF) Interim Reanalysis (ERA-Interim) and the Modern-Era Retrospective analysis for Research and Applications (MERRA) reanalysis products are evaluated with the Integrated Global Radiosonde Archive (IGRA) global sounding observations over China. It is found that the mean values of geopotential height and temperature in each reanalysis dataset are consistent with the observations, but the wind fields, especially the meridional wind, are not. Besides, the reanalysis products do a bad job in revealing the inter-annual variation of meridional wind.The results of empirical orthogonal function (EOF) analysis imply that all reanalysis datasets exhibit better performance in depicting the temporal and spatial distributions of geopotential height and temperature than other variables, especially the wind fields；MERRA performs specific humidity better than other reanalysis products. Generally, NCEP/NCAR, NCEP/DOE and NCEP/CFSR products are not as good as JRA-25, ERA-Interim and MERRA.

Hydrological Cycle over South and Southeast Asian River Basins as Simulated by PCMDI/CMIP3 Experiments

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Keywords: Hydrological Cycle Climate Models

We investigate how CMIP3 climate models describe the hydrological cycle over four major South and Southeast Asian river basins (Indus, Ganges, Brahmaputra and Mekong) for the XX, XXI, and XXII

centuries. For the XX century, models' simulated water balance and total runoff quantities are neither consistent with the observed mean river discharges nor among the models. Most of the models underestimate the water balance for the Ganges, Brahmaputra and Mekong basin and overestimate it for the Indus basin. The only modest inter-model agreement is found for the Indus basin in terms of precipitation, evaporation and the strength of the hydrological cycle and for the Brahmaputra basin in terms of evaporation. While some models show inconsistencies for the Indus and the Ganges basins, most of the models seem to conserve water at the river basin scale up to a good degree of approximation. Models agree on a negative change of the water balance for Indus and a positive change in the strength of the hydrological cycle, whereas for Brahmaputra, Mekong and Ganges, most of the models project a positive change in both quantities. Most of the models foresee an increase in the inter-annual variability of the water balance for the Ganges and Mekong basins which is consistent with the projected changes in the Monsoon precipitation. CMIP3 GCMs show a varying degree of skill in simulating the basic characteristics of the monsoonal precipitation regimes of the Ganges, Brahmaputra and Mekong basins, while the representation of the monsoon over the Indus basin is poor in most cases. For this basin, instead, a satisfactory representation of the western mid-latitude precipitation regime is instead observed. Similarly, most of the models exhibit a satisfactory agreement for the basin-integrated runoff in winter and spring, while the spread is large for the runoff during the monsoon season. For future climate scenarios, winter (spring) P − E decreases over all four (Indus and Ganges) basins due to decrease in precipitation associated with the western mid-latitude disturbances. Consequently, the spring (winter) runoff drops (rises) for the Indus and Ganges basins. Such changes indicate a shift from rather glacial and nival to more pluvial runoff regimes, particularly for the Indus basin.

Relative Importance of Indian Ocean and Pacific Ocean Dynamics on Indian Summer Monsoon Simulation in NCEP CFSv2 Model

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Keywords: Indian Summer Monsoon South Asian Monsoon Coupled Model CFSv2 Ocean dynamics ENSO IOD Hadley cell Walker cell Teleconnection

The ElNino Southern Oscillations (ENSO) in the Pacific Ocean and Indian Ocean Dipole (IOD) in the Indian ocean are the two most dominant modes of climate variability driven by the ocean dynamics.

These two forcing factors not only drive the interannual variability of the Indian summer monsoon rainfall (ISMR), but also act as a bridge which connects the two ocean basins through the atmospheric teleconnection. The role of ocean dynamics in the seasonal prediction of the ISMR is a topic of discussion for a long time. The present study investigates the relative role of the Indian Ocean and Pacific Ocean dynamics on the ISMR using a set of coupled sensitivity experiments with CFSv2. The analysis reveals that there are some misrepresentations in the Indian Ocean dynamics in the CFSv2 model, which can lead to the Summer Monsoon dry bias over the Indian land region. The Indian Ocean dynamics in CFSv2 act as a damping force of the monsoon circulation and hence causes the dry bias. Noise from the Indian Ocean dynamics are responsible for some of the failed forecasts (e.g: 1982, 1990, 1992, 1996) where the right signal from the Pacific Ocean is contaminated by the Indian Ocean dynamics. In this study, we hypothesized a mechanism based on Walker and Hadley circulation through which the ocean dynamics impact the ISMR. In an optimistic point of view we can improve the seasonal prediction skill of ISMR in CFSv2 by improving the Indian Ocean dynamic representation in the model.

Chemical Composition of Sub Micron Aerosol in Industrial Site and Remote Site of India

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Keywords: Air pollution India correlation matrix

In India, aerosol particles damage the health of hundreds of millions of people. Migration from the country side to megacities increases emissions and exposure to particles. Some countries have started to limit emissions based on particulate mass, but this may increase particle number concentrations. In this study we discuss some earlier measurements carried out in the industrial and remote site to compare results from ten-week measurement campaigns concerning the particle number size distribution and PM1 mass concentrations in industrial site of Raipur, India and remote site of thankurbandha, India . Our results show that submicron particle concentrations are high in both places. The common PM1 concentration was 139µg/m3 in Raipur and 32 µg/m3 in Thakurbandha. Statistical multivariate analysis and

Correlation matrix analyses were performed for factor identification and consequent source apportionment. Contour profiles demonstrate spatial variation of elemental compositions indicating possible source contribution along with meteorological influences.

Climate Change Model: CEQUEAU Hydrological and Water Temperature Model

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Keywords: Climate change Modeling Water resource Deterministic hydrological model

Climate change models aim to improve the understanding of Earth's climate by focusing on scientific analysis of the governing sets of processes that describe the climate over different conditions; evaluate strong methods to obtain higher spatial resolution for projections of climate change; and detect uncertainties in climate predications by real simulating. Watersheds and water resources modeling is one of the important parts of climate change models. The decision making process related to water allocation and ecological flow determination in rivers often requires the assessment of several hydro-meteorological scenarios at different spatial and temporal scales. Deterministic hydrological models are often one of the main tools that provide synthetic flow time series associated with different scenarios, from which sound decisions can be made. One such model, CEQUEAU is a semi-distributed model that it can account for spatial heterogeneity in land use and can simulate flows anywhere along the river network without requiring all the inputs associated with a fully distributed model. It also has a thermal model. Water temperature is being increasingly studied and considered by authorities. The simulation of a North American river (St-Marguerite) and hydrological-water temperature modeling will be presented. Upcoming model development, including the inclusion of different evaporation algorithms and statistical tools to assist in calibrations will also be discussed.

Impacts of Monsoon Anomalies in the Haor Region of Bangladesh: Threats and Responses

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Keywords: Haor Monsoon Anomalis

Haor is a saucer-shaped shallow depression that lies between the natural levees of a river including rivulets and seasonally flooded cultivated plains, and thus forming a mosaic of wetland habitats. Collectively termed as Haor basin, this landscape covers an area of approximately 24,500 km2 that are dispersed in the five districts of north-east Bangladesh. Monsoon floods predominately shape this haor basin ecosystem by providing habitat for rich biodiversity, replenishing ground water sources and supplying water for irrigation of rice varieties that are cultivated once in year in the basin. Thus

monsoon flood-influenced haor basin serves as centrepiece of the economy and livelihoods of the millions of haor dwellers. Using case study approach this study explores the monsoon anomalies in natural system of hoar basin of Sylhet region with respective impacts in the human system. The study will further assess to what extend the response from human system and governing system influencing the well-being of hoar dwellers with possible remedial measures for policy implication. The result shows that haor basin in Sylhet region is facing a number of events resulting from monsoon anomalies for example, changes in water flow and rainfall, incidence of flash floods. Reduced flow of monsoon water causes the reduced availability of alluvium and irrigation water that negatively affect the agricultural and fisheries production-the two main labour absorbing sectors in the basin. On the other hand, flash flood washes away crops, followed by large scale erosion of homestead lands. This ecological changes couple with decline in natural productivity and biodiversity of haor due to a number of reasons such as change in agricultural practice, over-exploitation of aquatic resources, and conservation of wetlands to brickfields and aquaculture ponds. Already burden with widespread human development poverty and income poverty, such changes have profound negative impacts on haor dwellers such as seasonal food insecurity during monsoon period. As a result, wide scale outmigration is reported in the study areas as a seasonal coping strategy. Response from governing systems is far from adequate as the development issues of the haor basin is overlooked in the policy arenas, largely due to its inaccessibility from urban center. Finally, the study submits that for increasing resilience of the haor dwellers against changing situation in haor basin, interventions are required in several veins at different scales in the natural, human, and governing system of haor basin. Ensuring sustainable use of natural resources and attaining self sufficiency in food production of haor basin should be the priority.

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Session Title: **Water Security and Future Dryland in Central Asia**

Time: **13:30-16:50, April 9, 2014**

Location: **Conference Room No.3, 2nd Floor, Friendship Palace**

Convener: **QI Jiaguo, Termirbek BOBUCHOV, Chuluun TOGTOKH, Dennis OJIMA**

Speakers:

Temirbek BOBUSHEV (American University-Central Asia, Kyrgyzstan): Natural Constrains and Prospects for Sustainable Agricultural Production in Central Asia

Tsolmon RENCHIN (National University of Mongolia): Water Quality Condition in Mongolia

Atul JAIN (University of Illinois, United States): Implications of Growing Biofuel Crops on Hydrological Cycle

Surajit MURASINGH (National Institute of Technology, Rourkela, India): Remote Sensing Technique for Groundwater Assessment in a Hilly Forested Sub-watershed, India

LI Changbin (Lanzhou University, China): Spatial-temporal Characteristics of Alpine Snow and Ice Melt under a Background of Regional Climate Change-a Case Study in Northwest China

Selenge MUNKHBAYAR (National University of Mongolia): Land Cover Change Mapping in Some Mining Areas of Mongolia

CHEN Jiquan (University of Toledo, United States): Coupled Human and Natural Systems on Mongolia Plateau

QI Jiaguo (Michigan State University, USA): Societal Roles in Grassland Ecosystem Services in Inner Mongolia

Dennis OJIMA (Colorado State University, USA): Resilience and Vulnerability on the Mongolian Plateau: Social – ecological Framing of Climate Adaptation Strategy Development for Sustaining the Mongolian Pastoral Systems

Chuluun TOGTOKH (National University of Mongolia): Future Drylands in Asia: Linking Science and Development Policy for Sustainability

Natural Constrains and Prospects for Sustainable Agricultural Production in Central Asia

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Keywords: Sustainable agriculture development constrains

Climate change is one of the biggest environmental and political problems of the present century, significantly affecting the development of the agricultural sector of the economy. In this sense, agricultural production should contribute to climate change mitigation to reduce and minimize greenhouse gas emissions and at the same time ensure the production of high quality food and renewable raw materials. Sustainable agriculture requires new efforts in research, development, and implementation of strategies for the development of different countries and territories. I must say, that sustainable agriculture has different meanings to different people. For some, this means continued use of existing agricultural practices, for others the focus is on the ecological integrity of other problems. In general, the problem of sustainable agriculture aims to study ways to reduce agricultural impacts through the use of renewable and recycled resources.

To overcome such situations, efficient and sustainable development of agriculture must include the concept of management. However, despite the evidence of the development of agriculture, there are some constrains in developing countries, which oppose the adoption of the concept of sustainable agriculture.

The main restriction, apparently, (1) is the lack of economic incentives in the government policy to support farmers. Decline in the quality or condition of the soil, unfortunately, are not financial incentives for small farmers to adopt sustainable farming practices.

Other constraint (2) is the lack of awareness of the concept of sustainable development, not only at the farmers' level, but also at a higher level in society.

Third main limitation (3) is that not one system, for example, in agricultural production, starts up if it is not institutionalized.

The fourth restriction (4) is due to the need to create a database on resources for the successful development of agricultural production.

Thus, sustainable development of agriculture involves: (1) study of the causes of instability, (2) the availability of sufficient information resource base of targeted actions that will contribute to sustainability, and (3) the possibility of using the resource base for sustainability assessment. Unfortunately, in many developing countries, these three conditions are not identified and investigated.

Water Quality Condition in Mongolia

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Keywords: Water quality water management

Mongolia has one of the fastest growing economies. As it becomes a more developed and modern country it becomes even more important to explore the effects of its development on the health of its people. A major concern involved with its development is its water quality. A study by Nriagu et al. (2012) showed there were metals including arsenic and uranium that exceeded the standard levels as determined by the World Health Organization (WHO).

The Capital city Ulaanbaatar in Mongolia has a big concern of water quality on the Tuul river. The Capital city is expected to keep growing rapidly and the general consensus is that the current water resources are insufficient for future UB. According to the "Master Plan of Ulaanbaatar for 2020" the municipal water demand alone will reach 314,000 m3/day by 2020 and the city may start to face water shortage crisis from 2010. There are several studies on river and lakes in Mongolia. We need research on the water quality of the lakes and rivers.

It becomes more important that perspective on water quality are not only voiced but decision makers encouraged to explore viable solutions to this growing concern In order to make solution it is best way to do research on actual water availability and provide recommendations for sustainable water management and increased water use efficiency through rehabilitation, new systems and public awareness to reduce consumption.

Implications of Growing Biofuel Crops on Hydrological Cycle

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Keywords: Energy crops hydrology ISAM

Biomass crops are being included as a large-scale option for providing fuel with low greenhouse gas emissions in some scenarios. The potential impacts of bioenergy crops on hydrological cycles at shorter and longer scales and its impact on regional climate change need to be better understood to judge the merits of biomass crops. In this talk we address potential impacts of land use changes associated with bioenergy crops on the directly altered surface energy and water balance using a coupled biophysical, physiological and biogeochemical modeling system. We study the impacts of changes agriculture lands (crops and pastures) and herbaceous biomes (grasses and shrubs) to two perennial grasses (Miscanthus and Switchgrass). Our preliminary results suggest that changing agriculture and herbaceous lands increase evapotranspiration because of the deeper roots and longer growing season of the perennial grasses. This increase in water input to the atmosphere means more water available for local and regional precipitation, and also dramatically affects the surface energy balance, resulting in less sensible and longwave heating of the atmosphere. This may also cause cooling of the surface air temperature, leading to an increase in precipitation.

Remote Sensing Technique for Groundwater Assessment in a hilly Forested sub watershed, India

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Keywords: Groundwater; Remote Sensing Electrical Resistivity surveys; ArcGIS; Sub watershed

Despite sufficient rainfall, large part of India suffers from water scarcity. Ground water occurs in weathered or semi-weathered/fractured layers in hard-rock areas whose thickness varies, in general, from 5m to 20m. Satellite images are increasingly used in groundwater exploration because of their utility in identifying various ground features, which may serve as either direct or indirect indicators of presence of groundwater, a fast; cost-effective and economical way of locating and exploration is to study and analyze remote sensing data. Integration of remote sensing data and the geographical

information system (GIS) for the exploration of groundwater resources has become a breakthrough in the field of groundwater research, which assists in assessing, monitoring, and conserving groundwater resources. In the present work, remote sensing techniques have been used to explore the groundwater availability in a typical Mine area of India. Various maps (i.e., base map, DEM, drainage density, contour, land use, lineament density, and groundwater prospect zones) were prepared. The result help in finding suitable site, for the analysis different maps were put together for making thematic layers. This thematic layer was then used for statistically analysis to find out lineament, fractured zone, soil moisture etc; which indicate the available of groundwater. The groundwater prospect zones (GPZ) which was developed with the help of remote sensing data and the geographical information system (GIS) were further tested and validated. It has been observed that the outcome obtained from remote sensing technique provide suitable locations for ground water available sites. Further, the Resistivity meters tests support in locating the depth at which the groundwater is available at all the sites found suitable for groundwater exploration using remote sensing. The resistivity meter tests indicate the availability of ground water at 45 m and 83 m depths at two sites of observation. This substantiates the applicability of remote sensing technique for groundwater exploration.

Spatial-temporal Characteristics of Alpine Snow and Ice Melt under a Background of Regional Climate Change-a Case Study in Northwest China

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Keywords: Spatial-temporal characteristics snow and ice melt streamflow separation MLRE climate change

The variation of regional climate change has a very important influence on alpine snow and ice melt (SIM). The increase of the air temperature has caused redistribution and variation of the mid-latitude mountain snow cover at watershed scales in the northern hemisphere in the past decades. For a better understanding of inland alpine SIM hydrology, the Recursive Digital Filter (RDF) and Isotopic Hydrogeochemical Method (IHM) were coupled to separate the monthly SIM from eight selected alpine rivers in the upper reaches of Heir River Basin in Northwest China. A multiple linear regression

expression (MLRE) between the separated SIMs and the geographically corrected air temperature and precipitation was fitted and tested for the predictive accuracy, resulted in satisfactory values of NSE for both calibration and validation. The MLRE was implemented to discover the alpine SIM characteristics under a background of regional climate change and suggested a monthly average temperature range of -4.7°C to 5.6°C, responding to the higher probability of a SIM triggered flood. Annual trend test since 1981 to 2010 resulted in increasing amplitudes of 0.60℃/10a and 24.54 mm/10a for air temperature and precipitation. The SIM grew up at an increasing rate of 0.48 mm/10a overall. The maximum variation of SIM occurred in the altitudinal zone between 3900 m to 4700 m in the upper west part of the study area, with the maximum increasing amplitude of 0.69 mm/10a, reflecting a distinct spatial pattern of snow and ice melt in the alpine area under a background of climate change.

Land Cover Change Mapping in Some Minnig Areas of Mongolia

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Keywords: Mining land degradation socioeconomic

Nowadays, massive mining activities are developing in Mongolia. There are possible environmental impacts of such large scale mineral development. Objective of this research is determination of land cover change in mining activity area. The study area is selected by Tavan tolgoi Co'Ltd coal activity Company. There are 3 different mining companies working on coal. They've started to work since 2008. We used Landsat TM data (September 2006 and 2013) statistical data. We determined from this research, mining area is highly increasing from 2009 to 2013 and decreasing livestock number. It is important to make environmental and social impact assessment in the study area.

Coupled Human and Natural Systems on Mongolia Plateau

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Keywords: Mongolia Plateau NEESPI

The Mongolian Plateau, including Inner Mongolia (IM) of China and Mongolia (MG), is a climatic change "hotspot" and a region of 2.62 million km2 with rapid ecological and socioeconomic changes. The Plateau has increasingly received worldwide attention due its rapid biophysical and socioeconomic changes. Building upon our intensive previous research on the Plateau, we bring together many active researchers who have rich experience on the Plateau to understand the divergent courses of action and progressions following the coupled natural and human concept. Our objective is to examine and model the interactive changes of the natural system and human system as well as the feedbacks in time and space for the Plateau in recent decades. We hypothesize that while climate change produced uneven pressures among ecosystems and societies in time and space on the Plateau, the socioeconomic changes and their disparities among the administrative units further escalated the complex causal relationships among the elements of the human and natural systems. We further hypothesize that the human influences on the systems exceeded those of the biophysical changes but the significance varies in time, location, and ecological setting. The five major underlying processes for the natural systems include the changes in water fluxes, radiation, soil heat flux, primary production, and carbon loss, while the five processes for the human systems are economic growth, population growth, urbanization, technology advancement, and lifestyle change. The system functions and changes are examined by the life expectancy index, income index, education index, net primary production, evapotranspiration, and ecosystem carbon loss. More importantly, we place major focus on the relationships between these functions, such as the productivity vs. income index. Land cover and land use change will be used as the mediator processes to connect the human and natural systems. The progressive changes of the causes and consequences are measured and examined by various levels through three tasks: 1) modeling household behaviors and surrounding ecosystems, 2) divergent progressions for Mongolian systems from past to future; and 3) understanding the vulnerability and future adaptation strategies toward a sustainable Plateau. The multiple dimensions of examining the systems are integrated together systemically, holistically, and across disciplines. Lessons learned from past 10 years from our research are synthesized in this presentation.

Societal Roles in Grassland Ecosystem Services in Inner Mongolia

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Keywords: Ggrassland ecosystems Societal roles Inner Mongolia

It has been documented that large-scale land degradation occurred in the Inner Mongolian grassland ecosystems resulting from enhanced human activities and regional climate change. Ecological, environmental and societal consequences of grassland degradation have been widely reported but practical solutions to restore the grassland ecosystem services are lacking. Among many reasons, the societal role in developing and mainstreaming strategies for ecological and environmental restoration has not been incorporated, due in part to the lack of co-design and co-implementation. In this paper, the role of multiple stakeholders including private agencies is discussed using examples from case-studies in Inner Mongolia, China. These case studies demonstrate that the societal role in ecological and environmental restoration of grassland ecosystems is essential and lack of local participation may lead to ineffective policies.

Resileince and Vulnerability on the Mongolian Plateau: Social – ecological Framing of Climate Adaptation Strategy Development for Sustaining Mongolian Pastoral Systems

Dennis OJIMA
Chuluun TOGTOHYN
Katherine GALVIN
Kelly HOPPING

Management of our natural resources in a sustainable manner is a growing challenge due to the complex nature of changing driving forces on and dynamics in social-ecological systems. Climate and land use changes are affecting the physical and socio-economic components of the world around us, thereby affecting the water supply, habitat for wildlife, consumption patterns of different sectors of society, and other aspects of social-ecological systems. Management decisions are being developed in ways that call for meeting multiple, sometimes competing, goals and trade-offs across sectors and policy interests ranging from ranching to conservation to economic development and the use of a suite of natural resources, both renewable and non-renewable. How we discern and reconcile different social-ecological controlling variables of commodities or services exchanged within different system components are not well understood. In addition, how decisions on choices of trade-offs are not well formulated to evaluate feedback in the social ecological systems. Yet, society needs to address these issues to meet these challenges and to engage in a more informed dialogue in order to formulate options and strategies that will manage changes occurring to our natural resources and affecting social-ecological systems. This paper will present a social ecological approach to evaluate vulnerability and response strategies to meet management needs under the influence of multiple changes.

Linking Science and Development Policy: Regional, National and Local Sustainability

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Science Director of the Institute for Sustainable Development, National University of Mongolia

Keywords: How to co-design "Future Earth: Research for Global Sustainability" program with global, regional and national policy frameworks?

This paper shares some applications of science for interlinked global, national and local sustainable development policy. Innovative adaptation system for dryland pastoral systems to reduce risks to drought and zud is demonstrated with the video (8 min).

Mongolia has followed the Kuznets curve, degrading environment (air, water, land and biodiversity), and also increasing poverty and income disparity during transition to the market economy and democracy over 20 years. The Government of Mongolia has made a noble decision to reverse this trend, development green development strategy for transformation towards green civilization. Green development concept of Mongolia incorporated governance and culture in addition to economic, social and environmental dimensions in order to incorporate local context. Mongolia as an open country is embedded on the Earth social-ecological system. Climate compatible development, green economy, equity, natural-cultural integrity and smart governance are keyaspects of this holistic concept.

However, success of these polices will depend on regional and global sustinability framework such as post 15 sustainable development agenda and regional initiatives. Our northeast Asia is rich with innovative policies such as Ecological Civilization in China, Green Growth in Korea, Low Carbon Development Partnership in Japan, Green Bridge in Kazakhstan in addition to global Parthnership for Action in Green Economy (PAGE) by UNEP. For example, Mongolia’s future economic development will depend on the regional renessaince or China’s green development, according the World Econonic Forum.

We have to focus on tackling of systemic global risks the most likely for next decade such as increasing greenhouse gas emission and increasing income disparity in order to channel national efforts towards global sustainability. It can be done if the Global Sustainability Index, consisted of carbon productivity and equity, is accepted along with as SDGs in the post-15 development agenda. The SI adoption will be paradigm shift relative HDI, integrating social-ecological resilience and incentives of low carbon, resource efficient, just and equitable development for all countries.

Session Number: **R5-02, R6-02**

Session Title: **Climate Change Adaptation and Social Resilience in Himalayan Region**

Time: **13:30-15:00, April 9, 2014**

15:20-16:50, April 10, 2014

Location: **Conference Room No.4, 2nd Floor, Friendship Palace in April 9**

Conference Room No.5, 2nd Floor, Friendship Palace in April10

Convener: **Lance HEATH, YAN Jianzhong**

Speakers:

Lance HEATH (Climate Change Institute Australian National University): Working towards Improving Resilience and Adaptive Capacity to Climate Change in the Hindu Kush-Himalayan (HKH) Region

WEI Jie (Institute of Atmospheric Physics): Interannual and Interdecadal Variability of Drought in Nepal

Prem Sagar CHAPAGAIN (Tribhuvan University): Climate Change, Water Scarcity and Local Adaptation Strategies: A Case Study from Panchkhal Valley, Nepal

Ali SHAUKAT (Institute of Atmospheric Physics): Future Climatic and Hydrological Changes over Upper Indus Basin of Himalayan Region Pakistan

QI Wei (Institute of Geographic Sciences and Natural Resources Research, CAS): Climate Change between the Southern and the Northern Region of Mt. Qomolangma (Everest) Region since 1971

Terry Chan (Monash Sustainability Institute Monash University)

Interannual and Interdecadal Variability of Drought in Nepal

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Keywords: Drought Nepal interdecadal variability

In this paper, by using the observational data, the drought index such as percent of precipitation anomaly, Palmer drought severity index and standardized precipitation index, are used to quantify the drought intensity in Nepal. Analysis shows that the winter drought is characterized by remarkable interdecadal variability, together with the interannual variability over the region, with the abrupt change occurring mostly in the beginning of this century, when drought happens frequently.. Meteorological diagnosis using atmospheric reanalysis reveals that the drought is a manifestation of an anomaly of atmospheric circulation. The drought is largely affected by the Arctic Oscillation and its decadal variability. It's found that the interannual drought is the intensified stationary wave train over the Eurasia continent. Much part of Nepal is controlled by high pressure ridge. Such atmospheric circulation anomalies are highly stable.

Climate Change, Water Scarcity and Local Adaptation Strategies: A Case Study from Panchkhal Valley, Nepal

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Keywords: Climate change, water scarcity, water sources, water demand and supply, adaptation, well, deep boring, rainwater, livelihood

Climate data of 30 years shows increasing temperature and decreasing rainfall in the study area. This has resulted a massive water shortage mainly due to drying off the natural water sources on which local people depended for drinking, livestock, irrigation water. About 60 percent such sources have dried off and the volume of water has decreased in the remaining ones. The average supply of water for household purposes is less than 50 percent of the total demand. Water demand has not only increased because of population growth but also largely due to the commercialization of agriculture. Being just 30 Km east from Kathmandu, the study area has completely transformed from traditional to commercial vegetables production within last 20-30 years.

Local people have adopted several measures to water scarcity. Among them the most notables are digging shallow and deep tube well, rainwater harvesting, construction of ditches on river bed for irrigation and changing irrigation system, crop insurance, and buying drinking water that supplied by taker from nearby river. However, due to the construction of a few deep boring, the water level of shallow

well has decreased on which majority of household depend for their water demand that poses another threatened to the people.

Future Climatic and Hydrological Changes over Upper Indus Basin of Himalayan Region Pakistan

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Keywords: Regional Climate Models (RCMs), RegCM (REGional Climate Model) Hydrological Models, University of British Columbia (UBC) Hydrological Model, calibration and validation

Climate change is a major concern for the mountainous river basins which is influenced by glacier melting. This study presents the Climatic and Hydrological changes over Upper Indus Basin (UIB) for the baseline period (2001-2010), future one (2041-2050) and future two (2071-2080) under emissions scenarios of RCP45 and RCP85 using REGional Climate Model (RegCM) and University of British Columbia (UBC) Hydrological Model. The output of RegCM downscaled from two GCMs of CMIP5, is first bias-corrected and then used as input to UBC model. For calibration and validation the sensitivity of different parameters is analyzed for UBC model. The model control run (2001-2010) underestimate the temperature and overestimate the precipitation when compared with observe station data. The quantitative analyses suggest that RegCM output needs bias correction being used for hydrological impact studies. The future projection scenario of RegCM show increasing trend of temperature and precipitation by 1.6oC and 14% for 2041-2050 and 4.2oC and 23% for 2071-2080 respectively. The future runoff is highly variable and increase in summer is 40% for 2041-2050 and 65% for 2071-2080 by providing the changes of temperature and precipitation to hydrological model as input. The increasing trend is higher during 2041-2050 while relatively low in 2071-2080. The possible reason may be that glaciers are melting faster and reducing in size which contributes to inflow more during first half decade of the century. In last half decade of the century, as the size of the glacier decreased, it shows little contribution to inflow increasing trend. RCP85 show higher increase with RCP45 in summer for the projected inflow of 2071-2080. Overall, the percentage increased in runoff is more in winter than summer while the highest inflow was observed in summer monsoon (rainy days) which will increase the risk of flooding. Due to more inflow in the river and positive trends in precipitation, water availability will be more in 2100 century and will sustain the water demands of the region. However, new reservoirs may be constructed to combat the water storage issues and most variable climatic and hydrological changes (e.g. flooding) in the future.

Climate Change between the Southern and the Northern Region of Mt. Qomolangma (Everest) Region since 1971

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Narendra R. KHANAL	Central Department of Geography, Tribhuvan University	

Keywords: Climate change Mt. Qomolangma region Mann-Kendall analysis Koshi River Nepal

Mt. Qomolangma has become the most sensitive area because of its unique physiographic conditions, matchless height and fragile environment. However, only a few scholars have studied the climate change conditions on this region. While understanding the climate changing trend is essential to develop strategies for climate change adaptation. This research focuses on the analysis of temperature and precipitation change between 1971 and 2009 on the basis of related data from China and Nepal weather stations. The stations are located in China on the northern hillside of Mt. Qomolangma and Nepal on the southern hillside of Mt. Qomolangma. And then the examination of the similarities and differences when comparison between the northern region and the southern region. The results showed that: (1) between 1971 and 2009, the annual mean temperature in the sohthern area was 20.0℃, the rising rate of annual mean temperature was 0.25℃/10a, and the temperature increases were highly influenced by the maximum temperature in southern region. On the other hand, the temperature increases on the northern slope of Mt. Qomolangma region were highly influenced by the minimum temperature. (2) Precipitation had an asymmetric distribution; between 1971 and 2009, the annual precipitation was 1729.01 mm in southern region. (3) The influence of altitude on climate warming was not clear in the southern region, whereas the trend of climate warming was obvious on the northern slope of Mt. Qomolangma. The annual mean precipitation in the southern region was much higher than that of the northern slope of the Mt. Qomolangma region. This shows the barrier effect of the Himalayas as a whole and Mt. Qomolangma in particular. There is no doubt that this research could provide the scientific foundation for climate change prediction, water resource allocation, agricultural production management and ecological protection in this region.

This paper has been published in Chinese and revised partially.

Session Number: **R4-04**

Session Title: **Climate Change and Social-economic Transformation**

Time: **15:20-16:50, April 9, 2014**

15:20-16:50, April 10, 2014

Location: **Conference Room No.4, 2nd Floor, Friendship Palace in April 9**

Conference Room No.5, 2nd Floor, Friendship Palace in April 10

Convener: **YAN Jianzhong, Giovanna GIOLI**

Speakers:

YAN Jianzhong (Southwest University, China): Labor Migration and Land Use Change of Farmers in the Upper Dadu River Watershed, Tibetan China

Giovanna GIOLI (University of Hamburg, Germany): Migration as a Livelihood Diversification Strategy in the Context of Climatic and Environmental Change in the Upper Indus Basin

Firdos KHAN (Institute of Statistics, Austria): The Role of the Lndus River for the Economy of Pakistan under IPCC Climate Change Scenario, the Present and Future

LIU Wei (IIASA, Austria): Natural Disasters and Socio-ecological Transitions – The Case of Wolong Nature Reserve, China and Its Implications for Climate Change Adaptation of Mountain

Narendra Raj KHANAL (Central Department of Geography, Tribhuvan University, Nepal): Climate Change and Socio-economic Vulnerability: A Case Study of Poiqu/Bhotekoshi/Sunkoshi Watershed

ZHAO Zhilong (Institute of Geographic Sciences and Natural Resources Research, CAS): Drought Disaster Risk Analysis of Tibetan Plateau

Labor Migration and Land Use Change of Farmers in the Upper Dadu River Watershed, Tibetan China

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Keywords: Livelihood strategy land use change

Since 1980, China has been undergoing a process of rapid emigration of labor from rural to urban centers combined with a rising opportunity cost of farming labor. This trend has caused the marginalization of agricultural land, while China's sown area of crops and agricultural output keeps increasing. In the context of small-scale agriculture in China, the question of how labor emigration affects land-use change and agricultural output is lacking in research so far. This paper intends to provide an in-depth perspective about the connection between farmers' livelihood strategy and land use. Using stratified random sampling, participatory rural appraisal (PRA) methods, and land plot surveys, we first propose hypotheses and then make investigations into 274 households and 1405 land plots in four typical villages in Jinchuan County in the upper reaches of the Dadu River in Sichuan province, southern China. We classified rural households into pure-agriculture households and non-agriculture households according to whether they have non-farm livelihood activities or not, and then we made a subdivision of non-pure agriculture households based on the proportion of non-farm income accounting for total household income. We also analyze labor emigration, land circulation, changes in labor intensity and capital intensity, and agricultural output growth since 1980. Research results verify the hypothesis that differentiations in livelihood strategies exist among farmers in this area. Firstly, the continuous emigration of labor in the typical areas has generated the problem of agricultural labor shortage, resulting in the abandonment of a small amount of land. However, since rural households in the typical areas have different livelihood strategies, land transfers among them have slowed down the marginal trend of arable land to a certain extent. Non-agriculture households rent out the most arable land, and agriculture-dependent households rent in the most. Secondly, emigration of labor results in decreased labor intensity; land use generally changes to the extensive form and multiple cropping index decreases. The most significant change is that the mode of double cropping of 'corn-wheat' changes to the mode of single cropping of corn. Thirdly, the trend of capital and technology substitution for labor is quite distinct and mainly manifested in the rapid growth of the production-increasing labor-saving inputs. Now there is a decline in labor intensity, but an increase in the proportion of the aging and female workforce. Also, the inputs for increasing production and saving labor have all increased, and more chemical fertilizers are used but less farmyard fertilizers. The level of mechanization has improved. The capital and technology substitution for the labor of agriculture-dependent households is the most significant. Finally, the transfer of arable land, and the substitution of capital and technology for labor, has caused the extensive use of land owing to labor emigration and contributed to the steady growth of grain output in the research area over the past 30 years. This implies that labor emigration has little impact on local agricultural output.

From the results and highlights mentioned above, we give a better explanation of the land-use change in varied types of rural households, and provide an important empirical case for micro-level land-use change in this southern region of China.

Migration as a Livelihood Diversification Strategy in the Context of Climatic and Environmental Change in the Upper Indus Basi

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Keywords: Migration, Remittances, Climate Change, Adaptation, Indus Karakoram

Migration in the context of environmental and climatic change is increasingly understood as a possible positive adaptation strategy rather than as a last resort option (Warner et al 2012; Banerjee et al 2012).

Especially in resource-dependent and poverty-stricken communities, migration can be an important livelihood diversification strategy for reducing vulnerability to different sources of (environmental) stress. Many studies (e. g. Adger et al. 2002; Tacoli 2009; Banerjee et al 2013) show that labour migration may increase the adaptive capacity via remittances, with significant consequences for the household's living conditions, social security, education and health care. Often, remittance provides a safety net for the recipient household in times of environmental hazard (Savage and Harvey 2007; World Bank 2009, Tacoli 2009; Gioli et al 2013; World Bank 2009; Tacoli 2009).

There is a knowledge gap regarding migration in mountain regions, and the upper Indus basin (UIB) is a white spot in terms of available data and information. The UIB lies within the Hindu-Kush, Karakoram and Himalayan mountains where climate change is already impacting the glacial regime, with important consequences on the environment and on local livelihoods. The communities of the UIB are highly dependent on ecological goods and services and are adapting in various ways to climatic and environmental stressors. Though not a new phenomenon, labour migration has emerged as a key livelihood strategy and as a core response to environmental pressure to be adopted both as an ex ante and ex post adaptive strategy.

In this contribution, we will present some key results of a study recently conducted in the Hindu-Kush/Karakoram region of Pakistan and we will try to assess under which circumstances migration can be a positive adaptation strategy to environmental pressure.

The Role of the Indus River for the Economy of Pakistan under IPCC Climate Change Scenario, the Present and Future

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Keywords: Agriculture, Climate Change, Energy, Hydropower, Hydrological Model, Regional Climate Model, Tarbela Reservoir, Inflow, Evaporation, Upper Indus Basin.

In the fast changing and increasingly uncertain world, most business leaders now recognize the importance of water for financial success, long-term and sustainable growth. The elements in the cluster of Energy-Food-Water are interlinked with one another and among them water plays a crucial role for the existence of the other two parts. This nexus is the central environmental issue around the globe generally, and is of particular importance in the developing countries. In countries like Pakistan, agriculture contributes 23 percent to the Gross Domestic Product (GDP). The Indus River contributes 44 percent of the available water to irrigation of crops and the ecosystem, and currently produces 5,112 Megawatt (MW) electricity, with a potential to produce 38, 602 MW electricity. This paper is an attempt to investigate the role of the Indus River for the economy of Pakistan via energy and agriculture, in present and future, under A2 and B2 emission scenarios. In the first part of the paper, we focus on the importance of the Indus River for the economy of Pakistan in terms of agricultural production and hydropower generation. The second part of the paper is related to the availability of water in the Indus River under climate change scenarios. Toward this end, we make use of the wide-spread technique of one way coupling by incorporating the regional climate model PRECIS (Providing Regional Climate for Impact Studies) and the hydrological model UBCWM (University of British Columbia Watershed Model). The climate change is investigated first and it is found that climate change is increasingly taking place in the area. The results show that the Indus River contributes 80 percent of the total hydropower generation in Pakistan. Further, we investigate whether sufficient water will be available in the Indus River under climate change scenario, which will be crucial for the economy of Pakistan in future. The analyses show that availability of water will be sufficient in future under A2 and B2 climate change scenarios, with few exceptions in which there will be scarcity of water. However, by proper management and optimum utilization of the available water, the scarcity of water can be minimized considerably.

Natural Disasters and Socio-ecological Transitions – The Case of Wolong Nature Reserve, China and Its Implications for Climate Change Adaptation of Mountain Communities

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Keywords: Disaster resilience Socio-ecological transition Climate change Mountain Adaptation Livelihood

Transitions in complex socio-ecological systems are intermediate phases between two successive and more stable periods or states and involve various societal, ecological, and biophysical changes that are often non-linear and inter-related. Understanding transitions is challenging but important for guiding and shaping socio-ecological systems for achieving environmental sustainability and improving human well-being. Natural disasters, especially those low-probability, high-consequence ones with diverse indirect consequences, can significantly alter the transition trajectories of socio-ecological systems and jeopardize their long-term sustainability. There have been very few empirical studies on this important topic, mainly due to the lack of long-term pre-disaster information and data.

Wolong Nature Reserve for Giant Pandas in Sichuan, China is home for ~5000 local residents, mostly Tibetan and Qiang ethnic minorities. With an elevation range from 1150 to 6250 m above sea level, Wolong is characterized by a high-relief topography with heavy rainfall in summers due to East Asia Monsoon. A long-term research on human-nature relationships in Wolong has been conducted since the late 1990s, during which the Reserve experienced a decade featured by a series of major transitions in land use, economic structure, and energy consumption, mainly due to the implementation of a series of environmental and economic policies. A mega-disaster, the 7.9 Mw Wenchuan earthquakes, struck the boundary of the Reserve on May 12 in 2008, caused massive damages, and resulted in intensive recurrent flush flood, debris flow and landslides in the following years. We take a special look on detailed household survey data (income, expenditure, energy consumption, and land use activities, etc.) over a nine-year period before as well as one and several years after the earthquake. About 200 households from six villages were interviewed and a series of focus group discussions with key stakeholders were also conducted. This unique dataset is used to investigate the question of how pre-earthquake heterogeneity within communities and across different scales affects their coping strategies and recovery trajectories after the earthquake. We also consider the local ecological and socio-economic context and structure them into various types of capitals using the sustainable livelihood approach.

Under the future climatic situations, many mountain communities in Asia and other continents face similar dilemma like Wolong's in simultaneously meeting multiple goals in biodiversity conservation, socioeconomic development and poverty reduction, and disaster reduction and preparation with limited resources. Our long-term and transdisciplinary research in Wolong not only has direct implications for

building disaster resilience and support sustainability transitions in mountain regions of developing countries, but also increases our general understanding of the complexity of socio-ecological systems, such as non-linearity and path-dependent characteristic.

Climate Change and Socio-economic Vulnerability: A Case Study of Poiqu/Bhotekoshi/Sunkoshi Watershed

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Keywords: Flash floods Climate change Poiqu/Bhotekoshi/Sunkoshi watershed Risk Vulnerability

Flash floods such as glacial lake outburst flood, landslide dam outburst flood, directly associated with high intensity precipitation resulting loss of life and properties are common in high mountain areas. The frequency and magnitude of such flood disasters are likely to increase in the context of climate change. This paper attempts to assess socio-economic vulnerability due to climate change in Poiqu/Bhotekoshi/Sunkoshi watershed. Poiqu-Bhotekoshi is a transboundary river. It originates from the Tibet Autonomous Region (TAR) of China and runs across the high mountain region into the Koshi River. The altitude of the watershed declines from over 8000 m asl to about 649 m asl with a total area of about 3,393 km2 and population of 202,862. Socio-economic and infrastructure development is taking place in this watershed as a result of increasing socio-economic linkage between China and Nepal. The economic activity of the local people is based mainly on agriculture and other economic activities in the watershed include the generation of revenue from international trade, tourism and supply of hydroelectricity.

The estimated value at flash flood risk in the watershed downstream from the Friendship Bridge exceeds USD 224 million (only in Nepal side). Livelihood vulnerability assessment shows that communities located in the Bhotekoshi, Balephi, and Sunkoshi sub-watersheds are exposed to a relatively high flood risk. Those in the northernmost part, in the Balephi sub-watershed, are relatively more sensitive to flood risk since they live in remote areas with limited access to service infrastructure such as health care, communications, and markets and are subject to severe food shortages. These more susceptible communities also have a lower adaptive capacity in terms of levels of literacy and diversification of household income. Although the adaptive capacity of communities located in accessible valleys is relatively higher, their degree of exposure to flash flooding is very high and the existing adaptive capacity is not adequate to cope. The overall livelihood vulnerability is relatively high in the poorly accessible northern parts of the Balephi and Bhotekoshi watersheds. Preparedness planning and its adoption are necessary in all the communities located within the watershed in order to reduce the prevailing risk.

Drought Disaster Risk Analysis of Tibetan Plateau

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Keywords: Tibetan Plateau drought disaster risk historical data

With the global climate change, the aridification of Tibetan Plateau is becoming more and more obvious. Based on the 1951~2010 meteorological disaster statistical data and the vulnerability data of bearing body in 2010, and with the GIS technology and the natural disaster risk analysis model, this study comprehensively analyzed the spatial distribution of drought disaster risk factors for agricultural and pastoral areas within the Tibetan Plateau, and then used natural crack method to make drought disaster risk zoning. The results showed:1. The area with drought disaster risk of above medium level (0.24-1.00) is 103.26×104 km2,accounting for 63% of the total agricultural and pastoral areas；2. The area of highest value (0.44-1.00) center of drought disaster risk is 9.63×104 km2, and the area of Tibetan Autonomous Region, Qinghai Province and Gansu Province account for 20%, 77％ and 3% of the total highest value center area each respectively； 3. The area of lowest value (0.00-0.15) center of drought disaster risk is 54.49×104 km2, and the area of Tibetan Autonomous Region, Qinghai Province, Yunnan Province, Sichuan Province, Gansu Province and Xinjiang Uygur Autonomous Region account for 52%, 6%, 1%, 35%, 1% and 5% respectively of the total lowest value center area each. So the situation of drought disaster for agricultural and pastoral areas within the Tibetan Plateau is severe. This paper has been published in Chinese and revised partially.

Session Number: **R3-05**

Session Title: **Water, Energy and Food Security in Asia**

Time: **13:30-15:00, April 9, 2014**

Location: **Conference Room No.5, 2nd Floor, Friendship Palace**

Convener: **Makoto TANIGUCHI**

Speakers:

Makoto TANIGUCHI (Research Institute for Humanity and Nature): Water-energy-food Nexus in Asia Pacific

SONG Xianfang (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences): Coupling Mechanism and Evaluation System between Groundwater, Environment and Social Economy in North China Plain

CHEN Jianyao (Sun Yatsen University): Overview on Water-energy-environment-food Maze in China: Water Availability for Sustainable Energy Policy: A Case Study on India

Bijon MITRA (Institute for Global Environmental Strategies): Water Availability for Sustainable Energy Policy: A Case Study on India

Water-Energy-Food Nexus in Asia Pacific

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Keywords: Water-energy-food nexus Asia Pacific

Increases in demand of resources, such as water, energy, and food for human-beings and societies, cause increased levels of tradeoffs and conflicts among these resources and stakeholders under the climate and social changes. Policy development and resource management require careful consideration between nature and society, because these resources are inter-connected as nexus. Ecosystem serves and various risks depend on natural conditions such as geology, geomorphology, and hydro-meteorological as well as social situations in the Asia Pacific region. Therefore the different type of water-energy-food nexus for the sustainable society may be existing in Asia Pacific region. Themes for this study include conflicts and tradeoffs between geothermal power generation and the hot spring business (water-energy nexus), water uses on land vs environmental flow from land to the ocean for coastal ecosystem (water-food (fishery resources) nexus), and resource development vs water use and contamination (water-energy nexus), and others. This study integrates interdisciplinary and transdisciplinary research with co-design/co-production and science in society. Horizontal integration with different issues and sectors, and vertical integration from local, national, regional to global scale are also targeted.

Coupling Mechanism and Evaluation System between Groundwater, Environment and Social Economy in North China Plain

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Keywords: Groundwater Social Economy

1. The Research Objective

The overall objectives of this project are as follows: First is to understand evolution of the groundwater regime and groundwater resources to environmental changes. Second is to investigate the feedback mechanism between the ecological system and the groundwater system. Third is to analyze the interaction among groundwater exploitation, environmental changes, and economic development. Last is to establish an assessment system and evaluation methods for groundwater resources carrying capacity.

2. The Research methods

First is to recognize the evolution of groundwater-environment-economy system based on

multi-information complemented by field observation and environmental isotope method. Second is to develop an integrated simulation system to model the groundwater-environment-economic process at watershed scale using GIS and remote sensing technique. Third is to propose the evaluation system of groundwater carrying capacity in the North China Plain in terms of system dynamics and optimal allocation theories, which is used to achieve the efficient use of water resources.

3. Progress in research

The statistics including groundwater level data, city population, GDP, industrial and agricultural development in recent 50 years were collected in the North China Plain. Field experiments of crop water consumption, soil water distribution and its relation to water table were carried out in three representative sites (Gaocheng, Hengshui and Cangzhou). Seawater intrusion at Qinhuangdao, and land subsidence at Tanggu, Tianjin areas were surveyed.

Agricultural irrigation quota in the region was determined basing on variation of agricultural water and effective irrigated area. The results showed that irrigation quota was significantly different in piedmont plain and coastal plain. Wetland as one of the main ecosystems in this region, its evolution and relationship with groundwater were also clarified.

The variable relationship between socio-economic growth and groundwater in the last fifty years was investigated. This relationship was significant different between typical regions, and groundwater had great supporting effect for mining and petroleum industries.The environmental geological problems (such as seawater intrusion, land subsidence and soil salinization) caused by groundwater exploitation and economic development were systemically investigated. The studies in the area of Bohai bay based on in-situ monitoring, water sampling and analysis of water chemistry and isotope indicated that deep groundwater quality was deteriorated by seawater intrusion more and more evidently. Field investigation showed that serious soil salinization was obvious in Cangzhou, coastal areas of Tangshan, as well as Xingtai and Hengshui in the North China Plain.

Based on the system dynamics theory, the evaluation index system and assessment model of groundwater carrying capacity were established in terms of the interactions between groundwater and national economy, which have been applied in the typical city group such as Beijing-Tianjin-Tangshan region. The relationship between groundwater exploitation and social economic development as well as precipitation and surface water in the Beijing-Tianjin-Tangshan region was studied. The results indicated that the decline of groundwater level was caused by the combined effects of natural condition changes (such as regional drought climate) and human activities. The stage of groundwater exploitation was greatly consistent with that of social economic development. The distribution of groundwater resources had significant effects on industrial and agricultural layout and population distribution, whereas the development of industry and agriculture obviously relied on groundwater exploitation.

Overview on Water-energy-environment-food Maze in China

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Keywords: Overview water-energy-environment-food

Water-energy-environment-food nexus is a complicated system in China with huge population and relevant demands for water, energy and food supply. The demand driven development in the past 30 years now faces the shortage of these supplies and the deterioration in environment. The comprehensive approach is necessary to integrate all these four aspects in order to find a solution for sustainable development though the linkage/nexus among them is a kind of maze. Data of meteorological series, agricultural yield, field observations in several monitoring experimental stations, and environmental survey were collected and relevant papers were critically reviewed to have a preliminary picture of the maze in China. Population-Resource-Environment-Development (PRED) strategy was proposed to assess water and land allocation policy in a case study along the middle water transfer zone from the Yangtze River to North China.

Water Availability for Sustainable Energy Policy: A Case Study on India

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Keywords: Water availability Energy security Thermal power plant

Over a period of time, due to rapid population growth, the introduction of complex industrial processes and rapid agricultural growth, both water and energy have become exhaustible resources in Asia. Water and energy are inherently inter-dependent and insecurity of each of the individual resources is also aggravated when they are considered together, which would challenge sustainable development in the region.

Understanding this fundamental principle of interdependence, we have tried to investigate the scientific relationship between these two resources in the context of electricity generation and subsequently the long-term consequence of water constraints. There are ample studies available where the relationship of energy use in water extraction, distribution and consumption has been investigated. But the upper cycle of the relationship, where water is an essential input factor for energy generation, has hardly been investigated in a scientific manner in the Asia region. Understanding the requirements of such an

important assessment, we conducted a case study in India, to demonstrate the impacts of water scarcity on long-term energy supplies until 2050.

To meet the objectives of this study we depended on several tools such as a literature review, power plant survey, stakeholder consultation, and water adjusted MESSAGE model, an energy system model. We relied on available literature for analysing the state of water resources in India. Power plant survey was conducted to estimate water use intensity of different types of power plants. We used MESSAGE model to obtain an integrated assessment output.

In India where per capita water availability has dipped below the alarming threshold of water stress (below 1700 m3), water intensive thermal power plants form the backbone of national power supply by contributing almost 60% of electricity generation in India. Geographically about 75% of existing thermal power plants (TPPs) are set up in either water scarce or water stressed regions. This instigates exclusive need of water for electricity generation that will intensify conflicts among sectors of water use. On the other hand, trend of intensifying water scarcity may put the operational continuity of power plants in jeopardy. To minimize potential damage, India's Ministry of Environment and Forests (MoEF) banned the construction of TPPs with open loop wet (OLW) cooling systems in June 1999. We have therefore estimated two different water demands based on both the pre-1999 and post-1999 regulatory situation. It indicates that if India were to continue pre-1999 open loop wet cooling system, the country would require a maximum of 227 billion cubic meters (BCM) of water per year just for thermal power generation by 2050 which would be 20% of the total utilisable water in the country by that time. However, with post-1999 policy intervention water for energy could reduce to around 85 BCM per year by 2050.

Under water constrained conditions, the energy system model behaves conservatively and deploys technologies which need less or no fresh water. As a matter of fact, sea water cooling in gas TPPs becomes predominant in this case. It has been observed that unless there are alternative technologies available to mitigate the impact of water scarcity for electricity generation, the system also fails to meet the required energy demand. As a matter of fact, water availability is absolutely critical to maintain the balance of energy supply and demand in the market.

Session Number: **R1-04**

Session Title: **Soil Moisture Observation & Modeling and Its Climatology**

Time: **15:20-16:50, April 9, 2014**

Location: **Conference Room No.5, 2nd Floor, Friendship Palace**

Convener: **WEN Jun, ZHAN Xiwu**

Speakers:

ZHAN Xiwu (NOAA-NESDIS): Evaluation of Satellite Soil Moisture Data Products from NOAA-NESDIS SMOP Servations, Land Surface Model Simulations Against in Situ Measurements

WANG Lei (Chengdu University of Information Technology): Study of Surface Dry and Wet Conditions in Southwest

SANG Yan-Fang (IGSNRR/CAS): Discussion on Trend Identification of Hydrological Time Series

QIN Jun (ITPR/CAS): Reducing Uncertainties in Validating Satellite-Based Soil Moisture by Appropriate Spatial Upscaling

ZHANG Tangtang (CAREERI/CAS): Spatiotemporal Variations of Soil Moisture from AMSR_E Dataset over Source Area of the Yellow River

WEN Jun (CAREERI/CAS): An Introduction to the Soil Moisture Observation Networks in the Tibetan Plateau

Evaliation of Satellite Soil Moisture Data Products from NOAA-NESDIS SMOPServations, Land Surface Model Simulations Against in Situ Measurements

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Keywords: Satellite soil moisture validation

Satellite soil moisture data products have been generated since more than a decade ago. However, none of these satellite soil moisture data products has been used operationally in numerical weather prediction models because of their accuracy or reliability issues. A climatologically consistent and qualitatively reliable global soil moisture product for NCEP Global Forecast System (GFS) has been generated from NOAA-NESDIS Soil Moisture Product System (SMOPS) recently. SMOPS scales the soil moisture data products from Soil Moisture Ocean Salinity (SMOS) satellite of European Space Agency, Advanced Scatterometer (ASCAT) on EUMETSAT's Metop-A and Metop-B satellites, and WindSat of Naval Research Lab to the climatology of the Noah land surface model of GFS, and merges them to a blended global soil moisture data product for use in NCEP GFS. This presentation will describe the architecture of SMOPS and evaluation of the SMOPS global soil moisture data products against other satellite soil moisture products, land surface model simulations and in situ measurements for significant time periods. Science for satellite soil moisture data product validation and applications will be discussed.

Study of Surface Dry and Wet Conditions in Southwest

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Keywords: Dry and wet conditions Southwest

Using the monthly measurements during 1961 to 2011 of 113 meteorological stations in Southwest China, the potential evapotranspiration and aridity index were calculated with the Penman-Monteith

model and then the characteristics of spatial-temporal change of surface dry and wet conditions in Southwest China in recent 50 years are discussed. The results show that the dry and wet conditions in Southwest China are spatially uneven with a characteristic named "humid east and arid west" while they are moist as a whole. The climate dry and wet conditions tend to be hotter and drier in this area in recent 50 years and are growing more serious in the last 12 years. The climate dry and wet condition of summer is the moistest in four seasons while it is the driest in winter. There are two time points where the climate dry and wet conditions changed abruptly in Southwest China in the past 50 years. One is around 1992 when it tends to be moist and the other is around 2002 when it becomes dryer instead of moister. Precipitation plays a dominant role in the climate dry and wet conditions of Southwest China region meanwhile the factors such as sunshine duration and relative humidity also have a significant impact on them.

Discussion on Trend Identification of Hydrological Time Series

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Keywords: Trend identification Empirical Mode Decomposition

Trend identification is a substantial issue in hydrology and climate variability studies, but it is also a difficult task due to the confusing concept of trend and disadvantages of methods. In this paper, an improved definition of trend is given as: "a trend is the deterministic component in the analyzed data and corresponds to the biggest temporal scale on the condition of giving the concerned temporal scale". It emphasizes the intrinsic and deterministic properties of trend, can clearly distinguish trend from periodicities, and points out the prerequisite of the concerned temporal scale only by giving which the trend has its specific meaning. After that, the performances between the Mann-Kendall (MK) test and the Empirical Mode Decomposition (EMD) method, which are use commonly for trend identification of series, are investigated. Analyses of both synthetic and observed series indicate the better performances of EMD compared with the MK test. The results show that pre-whitening cannot really improve trend identification when using the MK test, and even would cause wrong results. It can be due to the good correlation of series' trend, so pre-whitening would also weaken trend's magnitude sometimes. Series' periodic components greatly influence the trend identification of series, especially when the analyzed series has big periodicities. Accurate trend identification results cannot be obtained if the magnitude of the analyzed series is small, because the trend would be submerged by other components of series too

badly to identify trend. However, the EMD method can eliminate the influences of periodic components and trends' magnitude, so it has more effective power for trend identification. In conclusion, it is suggested that trend of time series can be directly identified by the MK test but need not do pre-whitening; moreover, the influences of periodic components and trends' magnitude should be carefully considered for trend identification. Comparatively, the EMD method is not impacted by the above unfavorable factors, and it can adaptively determine the specific shape of the nonlinear and nonstationary trend of series, so the EMD method can be an effective alternative for trend identification of hydrological time series.

Reducing Uncertainties in Validating Satellite-based Soil Moisture by Appropriate Spatial Upscaling

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Keywords: Satellite soil moisture upscaling validation

Soil moisture is a key factor in energy and water cycles. Many satellite missions have been exclusively planned and implemented for retrieving soil moisture globally. Due to the limited spatial representativeness of a single moisture sensor, a network of sensors needs to be deployed and simultaneously an upscaling procedure is also required to convert these point-scale station moistures into upscaled ones in order to validate satellite moisture products on a grid scale comparable to a satellite footprint. However, such a procedure itself introduces uncertainties into the upscaled moistures and thus the choice of an appropriate upscaling algorithm benefits more objective validation. In this study, four mainstream upscaling strategies are investigated and evaluated according to their stability for validation of the moisture estimated by assimilating microwave signals over the Tibetan Plateau and the Mongolian Plateau. It is found that the performance of the model-based upscaling strategy is the most unstable because model simulations are fraught with uncertainties despite its sensible notion. The block kriging upscaling method performs no worse than the simple averaging strategy; the former may generate more representative upscaled moistures if the range of the semivariogram is comparable to the extent of a satellite footprint. An advanced upscaling algorithm with the aid of high-resolution satellite thermal infrared data is the most stable compared to the other three ones.

Spatiotemporal Variations of Soil Moisture from AMSR_E Data Set over Source Area of the Yellow River

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Keywords: Soil moisture spatiotemporal variation AMSR_E source area of the Yellow River

In this study, the observation data of soil moisture was used to evaluate the accuracy of three AMSR_E soil moisture products from NASA, JAXA and VUA-NASA in Maqu, Source Area of the Yellow River (SARA). The results show that the correlation coefficient of AMSR_E soil moisture products from NASA and ground observation is 0.7 at the wetland, and 0.9 at the grassland, the product can describe the real trend of wet or dry condition of the Source Area of the Yellow River; and the absolute error of AMSR_E soil moisture products from VUA-NASA and ground observation is 0.07 at wetland, and 0.08 at the grassland, the products can describe the real wet or dry condition of the Source Area of the Yellow River. And then, the AMSR_E soil moisture products from VUA-NASA (Jun in 2002-Oct in 2011) were used to analysis the spatiotemporal variations of soil moisture over the Source Area of the Yellow River.

An Introduction to the Soil Moisture Observation Networks in the Tibetan Plateau

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Keywords: Soil moisture the Tibet plateau, observation network

Soil moisture has great impacts to the climate change and ecology system in the Tibetan Plateau, the determination of soil moisture from ground measurements, satellite remote sensing and numerical simulation are largely demanded. In this paper, the basic information about the three soil moisture observation networks, the Mau Soil Moisture Network in the eastern regime of the Tibetan Plateau, the Naqu Soil Moisture Observation Network in the central Tibetan Plateau, and the Ali Soil Moisture Network in the western Tibetan plateau, are introduced separately, their potential application and future enhancement are perfected.

Session Number: **R4-01**

Session Title: **Ecosystems & Human Health**

Time: **13:30-15:00, April 9, 2014**

Location: **Conference Room No.2, 1st Floor, Building No.8**

Convener: **Hein MALLEE**

Speakers:

Hein MALLEE (Research Institute for Humanity and Nature, Kyoto): Introduction to Session

FANG Jing (Kunming Medical University): Using Ecosystem Approach to Reduce Pesticide Use in Agricultural Production in Yuanmou County, Yunnan Province, China

WANG Libin (China Agricultural University): Impacts of Poultry Production Clusters on Livelihoods, Environment and Human Health in Asia

Jennifer HOLDAWAY (Social Science Research Council): Migration, Environment and Health in China

Mohd. Nordin HASAN (ICSU Regional Office for Asia and the Pacific): Urban Pollution and Human Health in Asia

Ecosystems and Human Health

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Keywords: Ecohealth GEC & health

People's health depends in many crucial ways on the wider ecosystems of which they are part. Ecosystems around the world, in fact, the entire planetary ecosystem, are affected fundamentally by the interrelated processes of population growth economic development, industrialization, urbanization, and globalization. The interlinkages among development, globalization, global environmental change and human health increasingly give rise to health problems that are either global in scale or influenced by worldwide change processes. For example, the combination of wildlife habitat change, rapidly developing poultry industries (due to greater wealth and dietary changes) in densely populated areas, trade in poultry and related products, and increased human mobility has made pandemic threats of zoonotic origin considerably more likely. The potential health impacts of climate change mediated by changes in food availability, extreme weather events and shifting disease vector distributions are also becoming increasingly clear. In many ways, health can be regarded as an indispensable element of sustainable development.

This session brings together a number of speakers to present cases of the linkages among development, global environmental change and human health in order to explore how future global environmental change research can incorporate human health dimensions even more closely.

Using Ecosystem Approach to Reduce Pesticide Use in Agricultural Production in Yuanmou County, Yunnan Province, China

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Keywords: EcoHealth agricultural intensification pesticide using human health

Background: agricultural intensification has been taking place in China since 1960s that has greatly improved food security and nutrition. However, intensified agricultural production also pose critical

problems for ecosystems and health that include, but not limited to, biodiversity loss, excessive pesticide and chemical fertilizer use, nutrient runoff, excessive water usage, and (re)emergence and spread of infectious diseases. Among others, pesticide use and its implication for health has increasingly become a concern of researchers and the general public. Yuanmou County, Yunnan Province, China is a winter-seasonal vegetable production base in China where large amount of pesticides are used to promote vegetable plantation. Supported by IDRC and as part of the project "Field Building Leadership Initiative, Advancing EcoHealth in Asia", we are undertaking an EcoHealth project in Yuanmou aiming at reducing pesticide use and promoting local sustainable development.

Methodology: EcoHealth is an integrated and holistic action research approach that promotes transdisciplinarity, systems thinking, stakeholder participation and social equity including gender equity in the context of socioeconomic development aiming at sustainable development. In this project, we used a combination of quantitative and qualitative research methods including household questionnaire survey; in-depth interviews of farmers, pesticide sellers, health workers, agricultural extension workers and government officials; and collection and analysis of secondary data.

Findings: the project is still ongoing and the preliminary findings show that large scale vegetable and fruit plantations have rapidly increased in Yuanmou in the last decade due to the increasing of urban financial capital investment; local plantations and smallholder farmers highly rely on pesticides in agricultural production that cause high economic cost and potential health and environment costs; most pesticides used in Yuanmou are so-called low toxic and low residue new generation of pesticides and the old ones are prohibited to use in vegetable plantation; a new professional group: agricultural workers has occurred but little attention was paid to the occupational hygiene of this group; farmers and agricultural workers wear little protection when using pesticides; local health workers have low awareness and capacity in dealing with pesticide related health problems and local agricultural department and pesticide sellers play a key role in the excessive use of pesticide.

Discussion: the excessive use of pesticides in agricultural production in Yuanmou is caused by the complex interaction of different actors with diverse interests and aims that are deeply embedded in the institutional arrangements and agriculture development policy that creates structural incentives. Simply forbidding the use of high toxic pesticides cannot prevent the negative impact of pesticide using on human health and ecosystems.

Conclusions: we need to continue our research in Yuanmou to generate scientific evidences that reveal the impact of pesticide use on human health and the ecosystem. To effectively address the problems of excessive pesticide using need systems thinking and multi-stakeholder participation. In addition to farmers and pesticide dealers, middleman of vegetable trade and consumers should be involved in order to reduce the use of pesticides.

Impacts of Poultry Production Clusters on Livelihoods, Environment and Human Health in Asia

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Keywords: Infectious diseases human health

The poultry industry in Asia is a vital source of livelihood in many rural communities. However, since 2003, the unprecedented Highly-Pathogenic Avian Influenza (HPAI) outbreaks in Asia have stalled the development of the poultry sector and threatened human lives. In response, many Asian countries have promoted the construction of Poultry Production Clusters (PPCs) as a means to drive small commercial producers into higher-productivity and safer poultry value chains. Although there are many initiatives to develop PPCs in Asian countries, there is very limited empirical evidence on the social, economic, human health, and environmental consequences of production clusters and their implications for the control of emergent infectious diseases. Specifically lacking is an eco-health approach to assess this production mode from a multiple disciplinary perspective.

This study assessed the impacts of PPCs on farmers' livelihoods, environment and human health through a trans-disciplinary ecohealth approach in four Asian countries.

We found that though PPC programs are the key strategies in many Asian countries to engage small commercial producers in high value and bio-secure production chains, the poultry farms in clusters do not necessarily have better economic performance than those outside PPCs. Many farmers in PPCs only consider PPCs as an advantage to expand the scale of their poultry operation and improve household income, and they are less concerned about, and have limited capacities, to enhance bio-security and environmental management. We measured the bio-security level of farms in PPCs through a 14-item checklist, and found that it is generally very low across all sample sites. The increased flies, mosquitoes, rats, smells in and around PPCs not only polluted the environment and affected the human health, but also caused social conflicts with the surrounding communities.

The research concluded that a poultry cluster, mainly driven by economic objectives, is not necessarily a superior model for control of infectious diseases and environment management. Good management and collective action for implementing bio-security measures are the keys for small producers in PPCs to address common challenges and pursue health-based animal production practices.

Environment, Health and Migration: Towards a More Integrated Analysis

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Keywords: Health Environment Migration

Many of the health risks faced by rural-urban migrants in China relate to environmental factors, including exposure to occupational hazards, unhealthy living conditions, and environmental pollution. This commentary reviews some of the major trends in recent research on migration, environment and health and discusses some of its limitations and challenges. It argues that while a focus on the health problems facing existing migrants remains important, it is also necessary to consider the interaction between environment, health and migration in the context of long term processes of urbanization, agricultural intensification and industrialization. These processes have generated very particular patterns of migration and also of environmental impacts and health risks, and they will continue to do so as China enters a new period in which rapid urbanization is accompanied by industrial restructuring. Situating analysis within this broader context has the potential to provide the basis for more forward-looking and locally-appropriate health and environmental protection policy.

Session Number: **R5-04**

Session Title: **Urban Spatial Planning, Climate Change Adaptation and Disaster Risk Reduction**

Time: **15:20-16:50, April 9, 2014**

Location: **Conference Room No.2, 1st Floor, Building No.8**

Convener: **LI Yinpeng**

Speakers:

LI Yinpeng (International Global Change Institute, New Zealand): Climate Change and Urban Adaptation: Science and Practice: Exploring the Challenges

Sachiho ADACHI (JAMSTEC, Japan): Moderation of Summertime Heat-Island Phenomena Via Modification of the Urban Form in the Tokyo Metropolitan Area

Vilas NITIVATTANANON (AIT, Thailand): Climate Change Vulnerability and Adaptation in Southeast Asia: Case of Selected Coastal Cities

Vandana TOMAR (Haryana Institute of Public Administration): Assessment of Global Phenomenon and Urban Change Dynamics using Geospatial Strategy

HUANG Mei (Institute of geographical and natural resources research, CAS China): The Integrated Assessments of Eco-environmental Vulnerability and the Climate Risk in China's Megacities

Peter URICH (International Global Change Institute, New Zealand): Towards an Integrated Climate Change Impact Assessment Tool for Urban Policy-Makers (UrbanCLIM)

Climate Change and Urban Adaptation: Science and Practice: Exploring the Challenges

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Keywords: Urban climate change adaptation best practice

The effective collaboration through the development of an adaptation community of practice (CoP) will be critical to achieving 'best practice' in adaptation. The key elements in climate change practice include: (1) Scientist group, including pure and application climatological and meteorological research shall provide the observations, modelling and theory of climate change which are the foundation of climate change adaptation. This group's products include large sets of climate related data, methodologies and tools for that require further analysis for efficient application. (2) Practioners and Facilitator group, including the consultancy firms and individual practitioners, who focus on implementing adaptation projects and translating the climate change information to stakeholder accessible formats including documentation for local governments, and national and international agencies. (3) Government Policy Makers and international agencies group, the funding dispensers and outcome receivers. (4) Gap fillers, or climate change service providers. Because the perceived intellectual distance between scientists, practioners and policy makers there exist a number of gaps between the scientific community and organizations and individuals operating in the practice realm. There is a need for a group of people who can understand and communicate among and between these groups, which should include practical yet scientifically robust data services and practical tool development. The barriers among different groups could be filled through the efforts of a CoP approach.

Moderation of Summertime Heat-Island Phenomena Via Modification of the Urban form in the Tokyo Metropolitan Area

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Keywords: Regional climate model Urban climate Adaptation to Global climate change

Heat-related health issues during the night including heat stroke and sleep disruption, in addition to those during the day, are becoming a significant social issue in the Tokyo metropolitan area (TMA) with

increasing of surface air temperature. In TMA, 16,477 people were hospitalized due to heat stroke between July and September 2010, and 621 people died of heat stroke over the full year. Thus, countermeasures against hot humid summer conditions in the TMA are required.

Moderation of the urban heat island is a potential method to improve uncomfortable summer conditions in urban areas. Moreover, such moderation is expected to become part of an adaptation strategy to global climate change because urban heat-island mitigation should be mostly implemented by local governments.

This study focused on changes in the urban form, although many methods have been proposed to mitigate urban heat-island effects.

Two urban scenarios with the same population as that of the current urban form were used for sensitivity experiments: the dispersed-city and compact-city scenarios. Numerical experiments using the two urban scenarios as well as an experiment using the current urban form were conducted using a regional climate model coupled with a single-layer urban canopy model. The averaged nighttime surface air temperature in TMA increased by about 0.34°C in the dispersed-city scenario and decreased by about 0.1°C in the compact-city scenario. Therefore, the compact-city scenario had significant potential for moderating the mean areal heat-island effect in the entire TMA. Alternatively, in the central part of the TMA, these two urban-form scenarios produced opposite effects on the surface air temperature, i.e., severe thermal conditions worsened further in the compact-city scenario because of the denser population. This result suggests that the compact-city form is not always appropriate for moderation of the urban heat-island effect. This scenario would need to combine with other mitigation strategies, such as the additional greening of urban areas, especially in the central area. This study suggests that it is important to design a plan to adapt to higher urban temperatures, which are likely to ensue from future global warming and the urban heat island, from several perspectives, i.e., designs that take into account not only climatological aspects but also impacts on urban inhabitants.

Climate Change Vulnerability and Adaptation in Southeast Asia: Case of Selected Coastal Cities

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Keywords: Climate adaptation coastal cities Southeast Asia

This presentation covers part of the results from an on-going research for vulnerability and adaptation assessment in urban water management of Indonesia, Vietnam and Thailand from 2011 to 2014. The goal of this project is to enhance local adaptive capacities through learning from the cooperative research results on climate change (CC) impacts in Southeast Asian (SEA) coastal cities. The results of the assessment would also be used to select cities, where climate change risk assessments would be conducted for piloting adaptation actions.

In Phase 1 for investigation, by using rapid vulnerability assessment (RVA) method, the study investigated 5 coastal cities in each of the three countries. The RVA process consisted of review of literature and published reports to identify the cities' climate-related hazards, vulnerable sectors and adaptation-related activities, and primary data collection in the form of unstructured interviews with households and key informants, group discussions, and on site observations to investigate the extent of vulnerability of affected sectors and areas. For Phase 2 which is on-going and aiming at piloting, 2 cities were selected for each of the 3 countries, to conduct risk assessment in water resources under CC and urbanization context at study areas with support tools/techniques.

The results revealed that the cities are found to be susceptible to the following impacts of climate change: coastal and riverine flooding, sea level rise; coastal erosion; degradation of human settlements; degradation of landscape and coastal erosion. Flooding in the coastal communities may not only be brought about by sea level rise but also due land subsidence arising from ground water over extraction. Even though the study areas were urban, the main economic activities that are projected to be significantly affected by CC are related to agriculture and fisheries, as well as tourism in some cities. Lack of access to potable water is also considered to aggravate the effects of climate change to human settlements. Furthermore, groundwater is also threatened by saline intrusion, causing further scarcity on fresh water sources for drinking and livelihood.

The study also concludes that while major cities such as Ho Chi Minh and Bangkok already have substantial studies with regards to CC, smaller and secondary cities have a dearth of information on climate change vulnerabilities. This constraint hampers city planners and managers in providing timely and critical interventions to mitigate the impacts of the CC. By providing a landscape of the existing vulnerability and adaptation in SEA, country and city managers from the region and other regions facing similar vulnerabilities would have an opportunity to assess their overall needs in order to successfully adapt the design and operational practices on urban water-related sectors to CC.

Assessment of Global Phenomenon and Urban Change Dynamics using Geospatial Strategy

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Keywords: Change detection Khat statistic Geospatial techniques Urbanization

Urbanization is a global phenomenon mainly driven by population growth for their livelihood. In developing countries like India, where the population is one-sixth of the world's population, urban sprawl is taking its toll on the natural resources at an alarming pace. So, the term urbanization can represent the level of urban relative to overall population, or it can represent the rate at which the urban proportion is increasing. It has become an engine of change, and the 21thcentury which has become the center of urban transition for human society. In a way urbanization is desirable for human development. Urban population growth and urban-sprawl induced land use changes coupled with industrial development. Remote Sensing and Geographic Information System are now providing new tools for advanced urban growth management. Patterns of sprawl and analysis of spatial and temporal changes could be done cost effectively and efficiently with the help of Geospatial techniques such as Geographic Information System and Remote Sensing. The change in the urban area can easily be seen by comparing the imagery of different years. The present study focuses on the nature and pattern of urban expansion of Ranchi city over its surrounding region during the period from 1990 to 2010. The result of the work shows a rapid growth in built-up from 1990 to 2010. Multi temporal satellite data sets of Ranchi area for 1990, 2004 and 2010 is used to detect land use land cover changes. During the period of 20 years the change in land resources shrinkage and transformation is detected by the use of remote sensing and GIS.

The Integrated Assessments of Eco-environmental Vulnerability and the Climate Risk in China's Megacities

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Keywords: Climate risk eco-environmental vulnerability Delta area

The Yangtze River and Pear River Delta are two major economic zones in China. Many megacities like Shanghai, Guangzhou and Shenzhen located in the two deltas. Based on the remote sensing data and

with the help of geographic information system, an integrated assessment was conducted on the eco-environmental vulnerability of the delta areas. Spatial principal component analysis was used to generate the evaluation indicators,and analytic hierarchy process (AHP) was applied to determine the weights of the evaluation factors. The possible reasons for causing the vulnerability were discussed. The future risks from climate change are also evaluated.

Towards an Integrated Climate Change Impact Assessment Tool for Urban Policy-Makers (UrbanCLIM)

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Keywords: Integrated climate modelling System dynamics Impact assessments Economic models

UrbanCLIM was designed as a decision support system for climate change in urban areas, to enable risk assessment and socio-economic analysis of climate change impact, adaptation and mitigation. Its design enables it to easily extend to other major sectors such as climate related hazards, resilience, water, transport, and health as we work to serve the needs of the UrbanCLIM community of practice.

The UrbanCLIM architecture was designed to provide robust support for three classes of users – Developers, Modellers and Analysts/Policy Makers. Developers are able to reach into the deepest software layers to extend existing, or build new, simulation, modelling and interactive capabilities that integrate seamlessly with (essentially becoming part of) the UrbanCLIM application. Modellers are able to use blocks and connectors, user interaction and model aggregation capabilities to create robust models, and Analysts and Policy Makers use simple and powerful analytical tools that smoothly integrate models and other decision making tools into a decision support engine for formulating practical approaches to real world challenges. System dynamics simulation core, climate change datasets, models and applications, are integrated in one platform. Therefore, the UrbanCLIM core can act as a generic platform for many other areas other than climate change issues by incorporating additional components.

Session Number: **R5-03, R6-03**

Session Title: **Future Northern Asia**

Time: **13:30-16:50, April 10,2014**

Location: **Conference Room No.1, 2nd Floor, Friendship Palace**

Conveners: **Pavel GROISMAN, Shamil MAKSYUTOV,Evgeny GORDOV**

Speakers:

Pavel GROISMAN (UCAR, USA): Transition from Northern Eurasia Earth Science Partnership Initiative (NEESPI) to Future Northern Eurasia

ZHUANG Qianlai (Purdue University, USA): The Role of Northern Eurasia in Changes of Global Land Use and Land Cover and Carbon Cycling in the 21st Century

YUAN Wenping (Beijing Normal University, China): Satellite-Based Analysis of Evapotranspiration and Water Balance in the Grassland Ecosystem of Dryland East Asia

Anastasia PIKALEVA (Main Geophysical Observatory, Russia): Future Climate Changes in the Northern Asia as Inferred from CMIP5 Simulations

Alexander SHIKLOMANOV (University of New Hampshire, USA): Modeling Hydrological Processes Across Northern Eurasia with a New Water Balance Model - Transport from Anthropogenic and Natural Systems

Alexander GELFAN (Inst. Water Problems, Russia): Disastrous Flood of 2013 in the Amur River: Conditions, Estimate of Recurrence, and Simulation Results

Geoffrey HENEBRY (University of South Dakota, USA): Cropland Phenologies and Seasonalities in Kazakhstan, Ukraine, and Southern Russia Observed Using Cooler Earthlight

Iurii POLISHCHUK (Tomsk State University, Russia): Remote Study and Modeling Changes of Thermokarst Lakes in West-Siberian Permafrost under Global Warming

Sergey MARCHENKO (University of Alaska-Fairbanks, USA): Modeling Temporal and Spatial Variability of Permafrost in the Tian Shan Mountains during the Last Millennia

Margarita SYROMYATINA (St. Petersburg State Un8iversity, Russia): The Study of the Tavan Bogd Mountain Massif Glaciers as One Key Element for Western Mongolia Sustainable Development

Tamara BURENINA (RAS Institute of Forest, Russia): Indicating Industrial Atmospheric Pollution at High Latitudes

Elena KUKAVKSKAYA (RAS Institute of Forest, Russia): Effects of Repeated Fires in the Forest Ecosystems of Siberia

Impact of In-Situ Measurement Deficiencies on Quantification of Precipitation and Its Trends over Northern Eurasia

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Keywords: Precipitation changes Northern Eurasia measurement biases

Instead of "ground truth" precipitation, rain gauges at meteorological stations estimate a function of several variables. In addition to precipitation, these variables include temperature, wind, humidity, gauge type, state of the gauge exposure, and observational practices. Their impact and changes hamper our efforts to estimate precipitation changes alone. For example, wind-induced negative biases for snowfall measurements are higher than for other precipitation types and a redistribution of these types during regional warming can cause an artificial increase in measured precipitation. In such conditions, the only way to properly estimate actual climatic changes of precipitation as well as to provide hydrological models with correct input would be a use of precipitation time series that are corrected for all known systematic biases. Methodology of such corrections has been developed and recently implemented for Northern Eurasia for the past 50+ years (up to 2010). With the focus on Russia, we assess differences that emerge when officially reported precipitation across the seasonal cycle is compared to corrected precipitation time series at the same network. It is shown that for the cold season, conclusions about trend patterns over Russia are quite different when all sources of inhomogeneity of precipitation time series are removed, and impact of all factors unrelated to the precipitation process are accounted for. In particular, we do not see statistically significant increases of the cold season precipitation over most of the Russian Federation and in the Asian Arctic it significantly decreases. In the summer season (June-July-August), the Far Eastern Russian Arctic is the only region with a statistically significant regional precipitation decreasing trend. Except for this region, we do not observe significant large-scale systematic changes in summer precipitation totals over the entire Russian Federation since mid -1950s. However, the use of MEASURED in situ data to characterize precipitation changes over Northern Eurasia during the past 60 years shows mostly increases, especially in the cold season, that have been artificial, being induced by changes in observational practice and in two other meteorological variables: near-surface air temperature and wind.

The Role of Northern Eurasia in Changes of Global Land Use and Land Cover and Carbon Cycling in the 21st Century

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Keywords: LCLUC Carbon and Climate

In recent decades, the largest increase of surface air temperature and related climate extremes have occurred in Northern Eurasia. The temperature increase and extreme climates are projected to continue during the 21st century with global climate models. The changing climate will affect biogeography and land cover and biogeochemical cycles in the region, which will, in turn, affect how global land use evolves in the future as humans attempt to mitigate and adapt to future climate change. Regional land-use changes, however, also depend on pressures imposed by the global economy. Feedbacks from future land-use change will further modify regional and global biogeochemistry and climate. This study uses a suite of linked biogeography, biogeochemical, economic, and climate models to explore how climate-induced vegetation shifts in Northern Eurasia influences land-use change and carbon cycling across the globe during the 21st century. We find that, by the end of the 21st century, the vegetation shift due to climate is a more important factor than the climate itself in driving land-use change in Northern Eurasia. While climate policy appears to have little influence on the cumulative release of about 20 Pg C from Northern Eurasia over the 21st century, the redistribution of global land use causes the global terrestrial biosphere to sequester less carbon (43 Pg C) with implementation of a climate policy than without a policy (65 Pg C). The vegetation shift in Northern Eurasia induced from changing climate and global economic growth significantly affects global land use and decreases carbon sink activities at the global scale.

Satellite-Based Analysis of Evapotranspiration and Water Balance in the Grassland Ecosystem of Dryland East Asia

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Keywords: Drought Evapotranspiration

The regression tree approach is used to upscale evapotranspiration (ET) measurements at eddy-covariance (EC) towers to the grassland ecosystems over Dryland East Asia (DEA). The

regression tree model was driven by satellite and meteorology inputs and is trained and validated by measurements from thirteen grassland EC towers. The model explained 82% and 76% of the variations of ET observations in the calibration and validation datasets, respectively. Over the DEA region, the calculated ET ranged from 222.6 to 269.1 mm yr-1 with an average of 245.8 mm yr-1 during the 1982-2009 period. ET had negative trends over 61% of the DEA region, especially at the majority of Mongolia and eastern Inner Mongolia, with decreased precipitation as the dominant environmental variable for ET variation in time and space. Positive trends in ET occurred primarily at the west and south of DEA. The Global Precipitation Climatology Project (GPCP) precipitation dataset was used to analyze the changes in the regional water balance (i.e., precipitation-ET). The precipitation appeared to have --an increasing trend in western DEA and a decreasing trend in the rest area of DEA. Combined with precipitation and ET variations, the water balance showed remarkable decreases over most eastern and northern areas and increase trends in western DEA. As a whole, water balance showed a drying trend over DEA region. The drying trend occurring over the DEA regions can exert profound impacts on a variety of terrestrial ecosystem structures and functions (e.g., vegetation growth).

Future Climate Changes in the Northern Asia as Inferred from CMIP5 Simulations

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Keywords: Climate change modelling

The CMIP5 ensemble simulations are validated against reanalyses and compared with CMIP3 simulations in the northern Asia. It has been shown that the surface air temperature and its seasonal evolution, temperature extremes and temperature-related permafrost characteristics are more realistically simulated in CMIP5 models as compared with that in CMIP3 ensemble. Projected for the mid- and late XXI century changes in the surface air temperature and precipitation, and their extremes as well as elements of the cryosphere (snow cover and permafrost) in the northern Asia are analysed. The IPCC RCP4.5 and RCP8.5 scenarios are used. The analysis of modeling results has shown that future climate of northern Asia is expected to be milder and more humid as compared with that in the recent decades. As winter precipitation rate is expected to increase under global warming the spring snow accumulation will likely increase, as well. This may lead to significant increase in the flood statistics over major river watersheds of Siberia and the Russian Far East. On the other hand, the south-eastern regions and northern China will experience higher temperature extremes in summer. The study has been supported by the Russian Foundation for Basic Research (grant 13-05-00541).

Modeling Hydrological Processes across Northern Eurasia with a New Water Balance Model - Transport from Anthropogenic and Natural Systems (WBM-TrANS)

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Keywords: Climate change Water resources Hydrology River runoff

WBM is a global-scale, gridded model that simulates both the vertical exchange of water between the ground and the atmosphere, and the horizontal transport of water through runoff and stream networks. The recently upgraded WBM-TrANS model, is an extended re-design (to be more feature reach, computationally efficient, manageable, and input data friendly) of the existing water balance and river routing model. The WBM-TrANS operates with sub-pixel land cover types, anthropogenic water use (e.g. irrigation for most of existing crop types), inter-basin water transfer, reservoir operating rules based on dam purpose (e.g. hydropower, water supply, irrigation, etc.), utilization of parallel computing, mixed programming environment (modules can be in various programing languages), etc.

Multiple estimates for gridded runoff, river discharge, irrigation water demand and reservoir regulation have been made across different North Eurasian landscapes using various input data, temporal and spatial resolutions, and computational schemes. The simulated hydrological data were compared with observational data to demonstrate the model uncertainties in various climatic and geographical conditions. Several different potential driving forcings for modeling of historical, contemporary and future hydrological characteristics and their uncertainties were applied, including the new AR 5 IPCC climate RCPs scenarios for future climate projections.

WBM-TrANS incorporates the most comprehensive to date database of Global and Asian glaciers with historical and modeled future ice balances and glacier melt waters contributing to the regional hydrology. In many regions of the Eurasia glaciers are significant contributors to seasonal river discharge, serving as frozen reservoirs of water that supplement runoff during warm and dry periods. Preliminary simulations with WBM-TrANS show that seasonal glacier water in many Asian watersheds comprises 40 % or more of their discharge. Global warming as predicted unambiguously by all climate models is expected to cause accelerated glacier retreat, thus reducing the glacier's storage capacity. As a result, seasonal river discharge may be significantly changed during most water-demanding summer period. Thus, glacier decline due to climate changes may have detrimental societal, ecological and economic impacts in many regions of Eurasia.

Disastrous Flood of 2013 in the Amur River: Conditions, Estimate of Recurrence, and Simulation Results

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Keywords: Flood Amur River recurrence interval model reservoir

The major formation factors of a catastrophic flood in the Amur basin in July-September 2013 have been discussed. The main observed characteristics of flood have been summarized and preliminary estimates of the recurrence of flood peak discharge are given. It has been shown that, considering the deficiency of data on water discharges along the river and the short duration of the available observation series, the estimates of flood hazard on the Amur River obtained by statistical treatment of those data shows considerable uncertainty. For example, the recurrence interval of the extreme discharge of 46000 m3/s, which was measured in the Khabarovsk city in August 2013, varies from 100 to 300 years depending on the probability distribution curve fitting the available discharge observation data. The physically-based semi-distributed model of runoff generation in the Amur River basin has been developed and applied for reproducing the flood of 2013. The model is based on the ECOMAG modelling system and describes processes of snow accumulation and melt, soil freezing and thawing, water infiltration into unfrozen and frozen soil, evapotranspiration, thermal and water regime of soil, overland and subsurface flow. To simulate channel flow a hydrodynamic MIKE-11 model has been coupled with the ECOMAG. The model has been applied for the middle part of the Amur River including two largest left tributaries, Zeya and Bureya Rivers, where large reservoirs are located. The model has been calibrated using streamflow discharges measured in the different gauges of the main river and its tributaries for 10 years (2000-2009). Validation of the model has been carried out for the period of 2010-2013. For the flood of 2013, the Nash and Sutcliffe efficiency criterion of the river stage simulation has been obtained as 0.84-0.94 depending on the streamflow gauge.

Numerical experiments have been carried out to assess the effect of the Zeya reservoir regulation on the middle Amur River stage. It has been shown that in the absence of the reservoir, the water levels within the Blagoveshchensk city (downstream of the Zeya River mouth) would be 0.5-1.5 m higher than the levels measured during the flood of 2013.

Cropland Phenologies and Seasonalities in Kazakhstan, Ukraine, and Southern Russia Observed Using Cooler Earthlight

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Keywords: Passive microwave remote sensing Northern Eurasia

Phenology and seasonality are complementary aspects of ecosystem functioning: phenology deals with timing of biotic phenomena; whereas, seasonality concerns temporal patterns of abiotic variables. In this study, we assessed the seasonal patterns of air temperature retrieved from AMSR-E passive microwave time series from 2003-2010 over 46 cropland locations in Kazakhstan, Ukraine, and southern Russia. The spatial resolution of the dataset was 25 km. The land surface seasonality of growing degree-days was parsimoniously modeled as a convex quadratic (CxQ) function of accumulated growing degree-days (AGDD). Coefficients of determination were generally above 0.94 in Kazakhstan and southern Russia, but several locations in Ukraine and some in Russia exhibited a slight but distinct seasonal bimodality in growing degree-days leading to lower fits, although always above 0.86. This bimodality was associated with growing season precipitation, which was confirmed by weather station data and by other geophysical variables retrieved from the passive microwave data. Vegetation optical depth (VOD), a microwave vegetation index, was also available from the same AMSR-E enhanced land parameter dataset. We modeled VOD at three different microwave frequencies (6.9, 10.65, 18.7 GHz) as CxQ functions of AGDD, yielding high coefficients of determination and phenometrics that could characterize cropland dynamics in our study sites. VOD varied as a function of frequency with higher frequencies yielding higher VODs. The AMSR-E data were also able to capture the effects of the two heat waves that impacted grain production. Although the AMSR-E sensor failed in 2011, the AMSR2 sensor on the Japanese satellite SHIZUKU (GCOM-W1) offers a continuing global record of passive microwave observations.

Remote Study and Modeling Changes of Thermokarst Lakes in West-Siberian Permafrost under Global Warming

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Keywords: Thermokarst lake permafrost Nothern Asia warming

Dynamics of thermokarst processes under global warming was investigated using space images taken in different time. Study of thermokarst changes have been carried out in test parts chosen in permafrost territory of Western Siberia, Russia. Two different trends of thermokarst changes were revealed in Siberian permafrost: growth and decrease of thermokarst lakes areas in continuous and discontinuous zones of permafrost accordingly. Change of continuous permafrost boundary for three last decades is shown in digital map of Siberian permafrost. Forecast of thermokarst lakes areas dynamics is given till 2030 year using geosimulation modeling. Intraseasonal changes of thermokarst lakes areas were studied during warm seasons with using ERS-2. This research was supported by ESA CAT-1 Project ID: 5762 «Cryogenic processes monitoring in Russian permafrost territories using radar data», RFBR Project No. 12-05-90833-mol_rf_nr and Megagrant of Russian Federal Programme Project 14.B25.310001 (BIO-GEO-CLIM).

Modeling Temporal and Spatial Variability of Permafrost in the Tian Shan Mountains during the Last Millennia

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Keywords: Climate oscillations Late Holocene mountain permafrost numerical modeling

During the Late Holocene there were numerous periods of warming and cooling in the Tian Shan Mountains Central Asia. The evolution of air and ground surface temperature changes occurring in Tian Shan at altitudes of 2,500 and 3,300 m a.s.l. for the millennium has been obtained by correlating the data from radiocarbon dates, tree-rings indexes, limnological, archeological and historical data. In the last millennium the most significant periods of cooling occurred during 1150-1350 and 1600-1850.

Ground temperature and permafrost area in the Northern Tian Shan have been subject to repeated fluctuations during the Late Holocene. During the maximum warming the ground temperatures rose by approximately 1.5-2°C. The altitude oscillations of the permafrost lower boundary had amplitude of about 200-300 m. The result of numerical simulation shows that permafrost at an altitude of 2500 m a.s.l. at some locations have developed and completely disappear at least two times during the last millennia.

At the lover boundary of permafrost distribution the soil temperature now are close to 0°C and at some locations the permafrost degradation has already started. Analysis of measured active layer and

permafrost temperature coupled with numerical thermal modeling (permafrost temperature reanalysis) shows that most of the recently thawed permafrost was formed during the Little Ice Age. Since the second part of the nineteenth century, permafrost in the Tian Shan Mountains is experiencing a warming period, which continues up to present. The temperature observations and modeling indicate that in the Tian Shan Mountains more favorable conditions of permafrost occurrences and preservation exist in the coarse blocky material with high porosity where the mean annual temperature are typically 2.5-4.0°C colder than the mean annual air temperature.

The Study of the Tavan Bogd Mountain Massif Glaciers as One Key Element for Western Mongolia Sustainable Development

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Keywords: Glaciers Tavan Bogd mountain massif sustainable development western Mongolia

Tavan Bogd mountain massif located at the junction of the Russian and Mongolian Altai ranges is a modern glaciation center including the largest valley glaciers of the entire Altai region. The glaciers of eastern and south-eastern slopes of the Tavan Bogd mountain massif are concerned with formation of the left headwater of the Khovd River the main river of western Mongolia and its large tributary Tsagan-Gol. According to the Mongolian researches (G. Davaa, D. Oyunbaatar and others, 2010) about 40-60% of the Khovd River run-off consists of melting snow and ice. As the Khovd River plays a critical part in the water supply of the submontane desert steppe plains of western Mongolia it is important to investigate glaciohydroclimatic interconnections and changes.

Today regime and dynamics of glacier systems of the Mongolian part of the massif are mostly underinvestigated. In July-August 2013 we carried out field research together with the Khovd State University in the upper parts of Tsagan-Us and Tsagan-Gol river basins. In order to carry out glacier system regime monitoring and glaciohydroclimatic interconnection modelling we provided glacier geodetic survey, snow-firn survey, remote sensing data field classification and other activities. On the base of field data and remote methods the description of glacier current state and dynamics as well as estimations of the large glacier system morphological characteristics were given (The Potanin, the Alaxandra, the Grane, the Kozlova and the Krylova glaciers). According to the preliminary calculation the areas of the main glaciers substantially have not changed since 1989, while the glacier tongue regression was fixed. Glacioclimatological characteristics for 2013 balance year on the base of equilibrium line monitoring at the end of ablation season were calculated. Ablation-accumulation value

was estimated as 127 g/sm2 under the mean summer temperature on the equilibrium line of 1,1°C. According to the national water body inventory statistics (Ministry of Environment and Tourism, 2007) about 10% of rivers, 13% of the lakes and 7,6% of the ponds in the basin were dried up as a result of unsustainable use of water, desertification and climate change. The economy of this region is based on subsistence agriculture and water resources are mostly used for irrigation and livestock as well as for hydropower stations and mining industry. Water resource utilization is far fewer than available assuming that it is important in sustainable development of such arid and dynamically developing region. Much fresh water is concentrated in glaciers of the Tavan Bogd mountain massif. Glacier-fed Khovd River regime depends largely on glacier regime. During the last several years the assessment of the Mongolian water resources and socio-economic survey including water security particularly in the Khovd river basin were conducted at request of WWF Mongolia Country Office and in the framework of special international project (Integrated water management national assessment report, 2012). But there are still few investigations of monitoring glacier, snow and river regimes in their interconnection including the low land environment. As the Tavan Bogd mountain massif and Khovd River basin is a trans-border region the tendency of integrated international cooperation is appeared. Significantly in the nearest future an increase of livestock, irrigating and other activities associated with transition to market-based economy as well as human population increase are expected that, of cause, will result in water utilization intensification.

Indicating Industrial Atmospheric Pollution at High Latitudes

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Keywords: Precipitation trends snow cover pollution

Norilsk Industrial Region has the highest atmospheric pollution among industrial areas of Siberia. At high latitudes, snow cover best indicates levels of industrial pollution of the environment due to its long persistence and ability to sequester atmospheric pollutants depositing on the underlying surface. During three years (2002-2004) snow cover industrial pollution was on-ground monitored at subarctic latitudes of Krasnoyarsk Region as a part of an interdisciplinary environmental pollution study that covered the area affected by Norilsk Industrial Complex (NIC) activity.

As a result of the study, maps of inter annual variability in spatial distribution of pollutants were obtained. Unfortunately, these maps do not enable to estimate temporal pollution trends. From the covariance of

precipitation with atmospheric pollution we identified in our previous studies and from results of certain studies conducted in California by American researchers it became clear that precipitation chronosequences could be used to estimate industrial pollution dynamics in the area of interest.

The 1955-2009 precipitation data provided by eleven weather stations located in northern areas of Krasnoyarsk Region were analyzed to show that temporal monthly precipitation tended to vary among the stations depending on the distance between any given station and a source of atmospheric pollution. These trends appeared to be most pronounced in winter.

A cluster analysis revealed a ‘background’ and ‘industrial’ precipitation trend types. The ‘background’ type was characteristic of weather stations located beyond the NIC-affected area, whereas those within this area had the ‘industrial’ type of precipitation.

At weather stations located within the NIC-affected area, solid precipitation (snow) exhibited a relatively rapid increase of 3-4 mm/year from the beginning of the observation period to after 1986, and then it decreased fairly rapidly (1.5-3 mm/year) to the end of the observation period. Snow precipitation thus increased from 1955 to 1986 in the NIC-affected area by 100-120 mm. The decrease in precipitated snow, as compared to its maximum in 1986, identified for the next two decades was 30-60 mm.

Interestingly, abnormally high contents of pollutants in snow cover were concentrated around industrial emission sources, although pollution plumes were elongated south-eastward, i.e. in the direction of the prevailing air mass transfer. Abnormally high amounts of precipitated snow were 40-50 km eastward from pollution sources. Such inconsistency between anomalous pollutant content of snow cover and abnormally high solid precipitation occurrences might be caused by some specific atmospheric processes and also by certain characteristics of coalescence, which enhance precipitation formation.

Beyond the highly polluted area, solid precipitation trends were poorly pronounced and were, at some weather stations, in the phase opposite to those in the polluted area.

Our study showed that, under the subarctic climate, precipitation increased where aerosol emission to the atmosphere was high, while beyond the polluted area it tended to slightly decrease. These trends were especially clear in winter, when the most favorite conditions for coalescence occur in aerosol-containing clouds, and they contain little water when they occur beyond the polluted area. The precipitation trends and snow cover pollution data obtained in the NIC-affected area thus show that precipitation changes and snow pollution levels may be considered as indicators of environmental effects of large industrial enterprises.

Effects of Repeated Fires in the Forest Ecosystems of Siberia

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Keywords: Light-coniferous forests fuel loading fire emissions regeneration

The main natural disturbance in the boreal forests of Siberia is wildfire, which modifies the carbon budget and has potentially important climate feedbacks. Every forest formation has its specific fire regime that is characterized by fire type and severity, area burned, fire seasonality, and frequency. Anthropogenic and climatic factors can result in substantial increase of area burned and fire occurrence. Large areas of the southern regions of Siberia were disturbed by repeated fires over the last decades. We have investigated a number of sites in light-coniferous (Scots pine, larch) forests of Siberia and evaluated the impacts of repeated fires on fuel loads, carbon emissions, and tree regeneration. At many areas repeated fires resulted in substantial decrease of carbon stocks, changed the vegetation structure and composition, and lead to soil erosion. At drier sites repeated fires prohibited successful regeneration and resulted in forest conversion to grassland. Understanding current effects of fires on forest ecosystems is important for accurately modeling ecosystem processes and to the future development of sustainable forest management strategies for climate change mitigation. The research was supported by RFBR grant #14-04-92605.

Session Number: **R3-01**

Session Title: **Climate Change and Natural Disasters in Asia**

Time: **13:30-16:50, April 10, 2014**

Location: **Conference Room No.2, 2nd Floor, Friendship Palace**

Convener: **FENG Qiang, Kerry-Ann MORRIS**

Speakers:

FENG Qiang (IRDR China): Analysis of Climate Characteristics of a Sharp turn from Drought to Flood

LEE Ming-An (Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University): Long-Term Variability of Rainfall in Taiwan Possibly Influenced by ENSO and PDO

Kerry-Ann MORRIS (IRDR IPO): The Integrated Research on Disaster Risk (IRDR) Programme: Linking Science to Disaster Risk Management

Basanta PAUDEL (Institute of Geographic Sciences and Natural Resources Research):Seismic Vulnerability Assessment of Buildings in Gis Environment: Dhankuta Municipality, Nepal

ZHANG Xiaoyang (South Dakota State University, USA): Investigation of Drought-Impacts on Crop Yield from Long-Term Satellite Data across Asia

LI Kuo (Institute of Environment and Sustainable Development in Agriculture, CAAS): Analysis of Spatio-temporal Characteristics and Causes of Seasonal Drought from 2009 to 2013 in Yunnan Province, China

CHEN Rong (Institute of Mountain Hazards & Environment, Chinese Academy of Sciences): Risk Analysis and Management of Mountain Hazards Related to the M8.0 Wenchuan Earthquake during the Reconstruction Periods

Moon-Hwan LEE (Sejong University, Korea): Trend Analysis of Climate and Hydrology at Each Climate Zone over Asia Regions

ZHANG Wanchang (Institute of Remote Sensing and Digital Earth, CAS)

LI Guoqing (Institute of Remote Sensing and Digital Earth, CAS): Linking Open Data for Disaster Mitigation Research

WANG Dongming (China Earthquake Disaster Prevention Center): Assessment of Disaster-carrying Capability and Disaster Risk in Urban Place

QIAN Cheng (Institute of Atmospheric Physics, Chinese Academy of Sciences): Multidecadal Variability of North China Aridity and Its Relationship to PDO during 1900-2010

Analysis of Climate Characteristics of a Sharp turn from Drought to Flood

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Keywords: Lanina phenomenon Atmospheric circulation sharp turn from drought to flood monsoon

In the first five months of 2011, the most severe and continuous meteorological drought of the past 6 decades occurred in the middle and lower reaches of Yangtze River. But in the next month, namely June, these regions were suffering from severe flood disasters. Owing to four stages of strong precipitation process, the total precipitation of the year ranked the first among the past 60 years during the same period. It was the first time that such a sharp turn from drought to flood took place since the 1950s. Based on the global reanalysis data provided by NCEP/NCAR and the climate data provided by National Meteorological Information Center, we analyzed the characteristics of atmospheric circulation background, the monsoon circulation and the Lanina phenomenon, and concluded with results as follows: 1)The precipitation in the middle and lower reaches of the Yangtze River was less than the corresponding climatological normals from January to May in 2011, but a sudden surge in June led to the severe flood disasters, a significant turn from drought to flood with such a great strength and an extremely fast speed; 2) Water vapor is the essential condition and monsoon circulation is the important force which transported water vapor to the south of China. Winter monsoon was stronger in northern hemisphere and summer monsoon was weaker in southern hemisphere from January to May in 2011, and the warm and wet air stayed far away from the north, hence a wide range of continuous drought disaster. In early June, the summer monsoon got stronger, whereby more warm and wet air was transported to the north. 3) Lanina events have formed in July 2010 and continued to April 2011, then decreased and ended eventually in the equatorial central and eastern Pacific. With the influence of these events, changes of ocean circulation leading to convection activities weakened apparently in spring of the tropical western Pacific, at the same time the summer monsoon became weaker, thus blocking tropical water vapor was transported to the middle and lower reaches of Yangtze River. While the events ended, the summer monsoon kept strong and tropical water vapor has been carried to the southern of China. 4) Abnormal and continuous high pressure activities appeared in the Europe and central Russia in the spring 2011, while the eastern Russia is in a low-pressure circulation. The atmospheric circulation situation prevented tropical water vapor from going to the southern China. In early June, the circulation was adjusted quickly, which expressed in detail is that the western Pacific subtropical high press extended to the west and then jumped to the north abruptly. Meanwhile, East Asian Trough kept strong and was maintained in the west, for the reason that cold and warm air converged in the middle and lower reaches of Yangtze River. And it is the main reason that caused the sharp turn from drought to flood in those regions.

Long-Term Variability of Rainfall in Taiwan Possibly Influenced by ENSO and PDO

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Keywords: Rainfall Taiwan

This study was part of Taiwan Integrated research program on Climate Change Adaptation Technology (TaiCCAT). We used the long-term 50-years (1960-2009) monthly rainfall gridded data set with produced by the Taiwan Climate Change Projection and Information Platform Project (TCCIP) and the empirical orthogonal functions (EOF) to examines interannual and decadal variability of monthly rainfall in Taiwan and its possible links ENSO and PDO (Pacific Decadal Oscillation). The high resolution gridded data (5km x5km) provided a clearer view of spatial distribution of the monthly rainfall variability in Taiwan. The first three temporal EOF modes explain up to 87% of the total variance. 1st mode (65%) shows the annual peaks of large rainfall in the southwest mountainous area associated with southwest monsoon and typhoon during summertime. In addition, there is no significant trend in the study period. 2nd mode accounted for 16% of the total variance, shows a northeast to southwest out-of-phase distribution, roughly divided by the Central Mountain Range (CMR). This mode reveals the rainfall brought by the northeast monsoon and its interaction with the CMR slope, which become a rain shelter for the southwestern part of the island. The interannual variation of the second mode reveals influence of ENSO events. During the autumn of La Niña years, the amplitude of mode 2 was significantly stronger than in the normal years. However, the anomaly in the summertime doesn't have a similar tendency. The mode 3 (6%) depicts a north-south out-of-phase pattern. There are slowly evolving variations roughly in phase with PDO.

The Integrated Research on Disaster Risk (IRDR) Programme: Linking Science to Disaster Risk Management

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Why is it that, despite the marked growth over recent decades in our knowledge and understanding of natural hazards, losses associated with disasters have risen during the same period at a seemingly exponential rate? The response of the International Council for Science (ICSU), the International Social Science Council (ISSC), and the United Nations International Strategy for Disaster Reduction (UNISDR) to this conundrum has been to create a major new international research programme, Integrated Research on Disaster Risk (IRDR).

IRDR is a decade-long global, trans-disciplinary research programme created to address the major challenges of natural and human-induced environmental hazards. The complexity of the task is such that it requires the full integration of research expertise from the natural, socio-economic, health and engineering sciences as well as policy-making, coupled with an understanding of the role of communications, and public and political responses to reduce the risk.

IRDR is guided by three research objectives:

1. Characterisation of hazards, vulnerability and risk.
2. Understanding decision-making in complex and changing risk contexts.
3. Reducing risk and curbing losses through knowledge-based actions.

IRDR Projects

To meet its research objectives the IRDR established four core projects, comprising working groups of experts from diverse disciplines, to formulate new methods in addressing the shortcomings of current disaster risk research.

1. Assessment of Integrated Research on Disaster Risk (AIRDR):AIRDR will undertake the first systematic and critical global assessment of integrated research on disaster risk. Such a synthesis of perspectives is not easy, but is vital in producing the new understanding of disasters and their impacts and in achieving IRDR's objectives.

2. Disaster Loss Data (DATA):DATA will study issues related to the collection, storage, and dissemination of disaster loss data. Recognising the need for standards or protocols to reduce uncertainty in disaster loss data, DATA intends to establish an overall framework for disaster loss data for all providers, to establish nodes and networks for databases, and to conduct sensitivity testing among databases to ensure some level of comparability.

3. Forensic Investigations of Disasters (FORIN):FORIN will develop, disseminate and implement a radical new approach in disaster research that aims to uncover the root causes of disasters through in-depth investigations that go beyond the typical reports and case studies conducted post-disaster events. Thoroughly analysing cases, including both success stories and failures, will help build an understanding of how natural hazards do—or do not—become disasters.

4. Risk Interpretation and Action (RIA):will focus on the question of how people — both decision-makers and ordinary citizens — make decisions, individually and collectively, in the face of risk. Decision-making under conditions of uncertainty is inadequately described by traditional models of

'rational choice.' Instead, attention needs to be paid to how people's interpretations of risks are shaped by their own experiences, personal feelings and values, cultural beliefs and interpersonal and societal dynamics.

This presentation will describe the work and accomplishments of this major research programme since its official establishment in 2010.

Seismic Vulnerability Assessment of Buildings in Gis Environment: Dhankuta Municipality, Nepal

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Keywords: Seismic vulnerability Earthquake hazard Building characteristics Factors of vulnerability

This study was carried out to assess the Seismic vulnerability of buildings in Dhankuta municipality. It includes estimating probable building damage at different intensities for certain earthquake scenario. This study has three fold objectives. At first, nature and types of buildings were identified based on field survey and then probable buildings damage condition under different earthquake scenarios was assessed based on GIS built different hazard layers. Lastly, factors responsible for increasing risk of building vulnerability was identified based on existing studies. The building information of 4287 both residential and non residential buildings and 7849 separate floor were collected. Among that, 82.79 percent floors are use for residential purposes and 7.86 percent are use for commercial purposes and 9.35 percent are rest for other purpose. Most of these buildings were constructed from stone in mud mix. Around 51.4 percent buildings were built 20 to 50 years ago. The building vulnerability in different earthquake scenario is assumed at different intensities. The assessment of vulnerability of building, building damage matrix, GIS and seismic intensity map were used. To estimate the buildings damage three earthquake scenario i.e. Udayapur, North-Sunsari and South-Sunsari earthquake scenarios were used. It is estimate that if Udayapur earthquake strike the municipality 14.21% of the total buildings will totally collapse the rest 83.33% will be partially damaged. The ward number 7, 6, 1, and 5 have buildings with high vulnerability due to old buildings, building attached and some parameters of construction materials. This study recommends that awareness programme related how to make buildings safe from earthquake by lunched by the responsible agencies such as municipality and other concern organization.

Investigation of Drought-Impacts on Crop Yield from Long-Term Satellite Data across Asia

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Keywords: Climate change Drought impact Crop yield Long-term satellite data

The world faces a persistent increase of food demand while climate change has significant impacts on crop yield. Growing population and rising per-capita consumption will cause the demand for cereals and grains to an annual-average increase of 1.3%. During the twentieth century, agricultural productivity has greatly increased to keep pace with population growth through the advancement of agriculture technology or Green Revolution technologies. Climate change, on the other hand, has strongly negative impacts on crop yield due to temperature increase, particularly, extremely high temperature, and drought stress, particularly, lengthening of drought spells. Thus, severe drought is and will be among the greatest natural disasters across Asia, which leads to immense agricultural loss. For example, Indian suffered from a severe summer drought in 2009 which was one of the worst failures over the last 100 years; China experienced the worst drought in 2010–2011 during past 60 years that affected most of wheat-producing regions and suffered an intense drought episode in 2013 that parched southern regions and left nearly 13 million people without sufficient drinking water. With the increase of future food demand, the diminishing returns from advancements in agricultural technology, and the impacts of climate change on crop yield, global food security has become a great concern. Thus, the monitoring of drought impacts on crop growing conditions is important for the economic development and food security.

Satellite remote sensing has been demonstrated to be an effective tool in monitoring drought impacts and crop health over a national and regional coverage. This study tracks, traces and projects the climate impacts on crop growth across Asia using a long-term daily vegetation index from 1982-2013. The daily enhanced vegetation index (EVI) is derived from the NOAA (National Oceanic and Atmospheric Administration) AVHRR (Advanced Very High Resolution Radiometer, available since 1981) and NASA (National Aeronautics and Space Administration) MODIS (Moderate Resolution Imaging Spectroradiometer, available since 2000) data at a spatial resolution of 0.05 degrees. According to daily EVI, this study simulates the temporal trajectory of crop growth for each individual pixel using piecewise logistic models. The simulated EVI trajectory is then used to detect the drought impacts on crop growth health and yield and to examine the corresponding temporal and spatial patterns during past thirty years. Further, the crop drought stress detected from EVI is associated with precipitation, temperature, and crop yield across the Asia. Finally, the drought impacts on crop yield are evaluated.

Analysis of Spatio-temporal Characteristics and Causes of Seasonal Drought from 2009 to 2013 in Yunnan Province, China

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Keywords: Seasonal Drought Yunnan Province Spatio-temporal Characteristics Cause Analysis Trend

Since 2009, serious seasonal drought disasters have occurred continuously every year in Southwest China, especially in Yunnan Province. Based on this situation, spatio-temporal characteristics of seasonal drought from 2009 to 2013 in Yunnan Province are analyzed to reveal the main causes of seasonal drought and the relationship between drought and climate change. According to the data of average monthly precipitation and temperature from 2009 to 2013 in 8 weather stations of Yunnan Province, the climate characteristics of drought disasters are preliminarily analyzed. The relationship between changes in atmospheric circulation and drought disasters in Yunnan Province is investigated. According to the research, the main causes of drought in Yunnan Province is found. Climate change leads to intensification of Pacific El Niño which destroys the atmospheric structure and causes abnormalities of westerly circulation system. The marine monsoon could not land to make the rain become. In the other hand, the shortage of water retaining is the chief cause of drought disasters in Yunnan Province in the past four years. Based on the analysis of spatio-temporal characteristics of seasonal drought from 2009 to 2013 in Yunnan Province, the trend of seasonal drought in Yunnan Province is forecasted which could provide scientific basis for the prevent and mitigate of drought disasters.

Risk Analysis and Management of Mountain Hazards Related to the M8.0 Wenchuan Earthquake during the Reconstruction Periods

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Keywords: Wenchuan earthquake post-disaster reconstruction mountain hazards risk management autonomous community for disaster prevention

Many new-built housings and infrastructures in Wenchuan quake-affected areas suffered twice or more damage due to mountain hazards occurred in recent years and posed great pressure on the reconstruction. A study is presented to analyze the characteristics of post-earthquake mountain hazards

in Sichuan province and the effects of risk management measures. It is found that the magnitude and frequency of post-earthquake mountain hazards varied in different areas, even in the same kinds of areas heavily affected by earthquake. Mountain hazards activities in Longmenshan town, Pengzhou county were few in the first four years but turn alive and group-occurring in the following years, which is different with most other heavily affected area such as Qushan town, Beichuan county and Longchi town, Dujiangyan county. Early warning monitoring measures combinated with a system named residents' self-mitigating of disaster were proved to be effective measures, as witnessed by the case in Longmenshan town, which are worth to promote in geological disaster prone area during post-disaster reconstruction. Besides, risk management countermeasures are suggested including discrimination and assessment of disaster risk, assumption disaster prevention measures for the reconstruction projects based on risk assessment, strengthenment of monitoring and early warning, and improvement of disaster risk management mechanism to build resilient communities. But there are still some problems in need of further solutions, we will mainly discuss the following questions. (1)How different people interpret risk in different regions of China? (2)How to implement community-based disaster risk reduction in Chinese mountainous regions? (3)What are the challenges to the implementation in post-disaster reconstruction? (4)How to engage public for building resilient communities to reduce disaster impact in different regions? (5)How people's interpretations of risks are shaped by their own experiences, personal feelings and interpersonal and societal dynamics?

Trend Analysis of Climate and Hydrology at Each Climate Zone over Asia Regions

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Keywords: Trend analysis Asia Climate Hydrology Climate change

The wise management of water resources in the Asia regions is an important task, because more than 60% of the world's population is living within the domain. Water resources in some regions are abundant, but water scarcity in many other regions has been a major disaster due to Asia monsoon. The worldwide global warming and climate change impact will deteriorate the water scarcity. To predict the change in water resources, the trend analysis using the long-term observation data will be the most widely used basic method. The purpose of this study is to perform the trend analysis of climate and hydrology using observed and simulated data. For this study, the past climatology (precipitation, max/min/mean temperature, wind speed) data at horizontal grid resolution of 0.5 degree was collected from APHRODITE and VIC model dataset. The VIC model was employed for generation of hydrology data. The non-parametric Mann–Kendall test and regression analysis were used to detect trends in annual

temperature, precipitation and runoff. The trend analysis showed increase in temperature over whole Asia except some regions such as Bangladesh, Thailand and Sri Lanka. The annual precipitation was observed to decrease over Asia as a whole over the 30-year period. Especially significant decreasing trends of annual precipitation (with a 95% confidence level) appeared over the Tibetan Plateau, Indonesia, inland India and southern Far East Russia, while increasing trends were observed over northwest China, north Pakistan, eastern Afghanistan and Korea. The annual runoff over Asia overall also decreased over the same time period. The spatial distribution of runoff trends was similar to that of precipitation trends. The interaction between the results of trend analysis and climate characteristics will be discussed in details in the presentation.

Assessment of Disaster-carrying Capability and Disaster Risk in Urban Place

Wang Dongming
Zang Mingyuan

Natural disaster is an important object of all kinds of risk management, and is widely noted by the fields of disaster reduction and reliefat home and aboard. Over the past 100 years, the number of population grew rapidly, resource is increasing consumed and natural environment is destroyed seriously, what's more, about 20% to 50% population every year in the world is threaten by the natural disaster, such as earthquake, floods, drought, hurricane, storm surge. With the challenge of urbanization, urban cities are faced with increased natural disaster hazard, the vulnerability of disaster-carrying bodies is higher, once the natural disaster happened, the cities will suffer a great loss.

Earthquake usually happens suddenly and is highly interactive. We will never forget the terrible scene of Wenchuan 8.0 Msearthquake now. After the earthquake, the cities are suffered heavy loss both in society and economy, for example,heavy casualties,productivity impairment, and disaster-carrying capability of environmentwent down.Therefore, if we try to know the reasons of losses and find out the factors impacted the losses, we can work better in earthquake prevention and disaster relief.

Previously, the emphasis of many studies and management of disaster was placed on Geophysics.The project takes Wenchuan Earthquake as a typical representative of natural disaster in China,starts from the internal mechanism of disaster bearing body system, the vulnerability of disaster-carrying bodies and the hazards of earthquake are two dimensions of the earthquake risk and analysis the factors of losses in Wenchuan Earthquake.

At first, urban earthquake risk factors are based on vulnerability and hazard. The project collected data

of each province about 4000 years to analysis the earthquake hazard, the percentage of earthquake which has more than 6.0 Ms is the index to assessment the hazard. And then, the index system of urban disaster-carrying bodies' vulnerability is established, which about engineer indexes and non-engineer indexes, the variable fuzzy clustering is used to assess the vulernability.

Then, the research modified the traditional risk matrix method, identified the level classification criteria for the vulnerability of disaster-carrying bodies and the earthquake hazard,then the two variables are input into the risk matrix and got the urban earthquake risk level. Data of some municipalities and provincial capitals are adopted in the case study, the results show that most cities' earthquake risk is in the general level. The cities with low earthquake risk are almost located in the eastern coastal areas, which have advanced economy, and have occurred less destructive earthquakes in the history; But western cities have high vulnerability and backward economy, are regularly shaken by earthquakes, therefore, they have high earthquake risks.

At last, based on DEA-Tobit model, the index system of urban earthquake loss is proposed, and the data of the 10 very heavy disaster areas in Wenchuan Earthquake is chosen as the objects. First, the hazard of earthquake is used as input indexes together with the loss of earthquake is as output indexes, and compute the hazard bearing efficiency of disaster-bearing counties; Then, With the efficiency being the dependent variable in the Tobit model, a regression analysis was taken on the reasons that relief capacity and resist capacity mainly influence the scale of loss. The results show that vulnerability of economic, society and environment and the disaster relief capacity of urban are the key factors of urban earthquake loss.

Linking Open Data for Disaster Research

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More data means more chance to make deep understanding to nature and find new rule of our world. Disaster mitigation depends to multi-disciplinary data study, not only in the phases of emergency response, but also for normal disaster study. Data sharing has been regarded as one of the main ways to take well data management around the world. Lots of effort has been taken to make open accessing to disaster related data resources and more and more data has been opened. To link opened data together and make collaborative study is important method to take future disaster research. CODATA established a task group to identify the scientific method to make such study. This report is based on the research of CODATA task group to present the technical framework and study progress.

Multidecadal Variability of North China Aridity and Its Relationship to PDO during 1900-2010

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Keywords: Drought Multidecadal variability Atmosphere-ocean interaction Pacific decadal oscillation

North China has undergone a severe drying trend since the 1950s, but whether this trend is natural variability or anthropogenic change remains unknown due to the short data length. This study extends the analysis of dry–wet changes in North China to 1900–2010 on the basis of self-calibrated Palmer Drought Severity Index (PDSI) data. The ensemble empirical mode decomposition method is used to detect multidecadal variability. A transition from significant wetting to significant drying is detected around 1959/60. Approximately 70% of the drying trend during 1960–1990 originates from 50–70-yr multidecadal variability related to Pacific decadal oscillation (PDO) phase changes. The PDSI in North China is statistically negatively correlated with the PDO index, particularly at the 50–70-yr timescale, and is also stable during 1900-2010. Composite differences between two positive PDO phases (1922–1945 and 1977–2002) and one negative PDO phase (1946–1976) for summer exhibit an anomalous Pacific–Japan/East Asian–Pacific pattern-like teleconnection, which may develop locally in response to the PDO-associated warm sea surface temperature anomalies in the tropical Indo–Pacific Ocean, and meridionally extends from the tropical western Pacific to North China along the East Asia coast. North China is dominated by an anomalous high pressure system at mid–low levels and an anticyclone at 850 hPa, which are favorable for dry conditions. In addition, a weakened land–sea thermal contrast in East Asia from a negative to positive PDO phase also plays a role in the dry conditions in North China by weakening the East Asian summer monsoon.

Session Number: **R3-02**

Session Title: **Air Quality and Human Health in Megacities of Asia**

Time: **13:30-16:50, April 10, 2014**

Location: **Conference Room No.3, 2nd Floor, Friendship Palace**

Convener: **ZHU Tong**

Speakers:

David PARRISH (NOAA, USA): Air Pollution in Developing Mega-cities: Something Old, Something New

ZHANG Yanjun (Peking University, China): Investigating Difference of Sources and Health Impacts between Northern and Southern China

Salman TARIQ (University of the Punjab, Pakistan): Variability of Aerosol Properties and HYSPLIT Model Estimates for Aerosol Transport Pathways over Lahore

ZHAI Yuhong (Peking University Shenzhen Graduate School, China): Characterization of Submicron Aerosols in an Urban Site in Northern China Using an Aerodyne High-Resolution Aerosol Mass Spectrometer

GE Baozhu (IAP, CAS, China): Nitrogen Dioxide Measurement by Cavity Attenuated Phase Shift Spectroscopy (CAPS) and Implications in Ozone Production Efficiency and Nitrate Formation in Beijing, China

GUAN Tianjia (Peking University, China): Endotoxin Concentrations in Ambient Air Fine Particles in Beijing

ZHENG Mei (Peking University, China): Characteristics of PM2.5 in China and Its Potential Health Impacts

LIN Weiwei (Sun Yat-sen University, China): Impact of Changes in Air Pollution Exposure on Biomarkers of Oxidative Stress in Children Before and During the Beijing Olympics

HAN Yiqun (Peking University, China): The Association between Acute Respiratory Inflammation of Elderly with Diabetes or Prediabetes and Ultrafine Particles in Ambient Air

ZHU Yanhong (Shandong University, China): Size Distribution, Toxicity and Sources of Particulate PAHs under Hazy Conditions during Summer and Winter in the Yellow River Delta National Nature Reserve, China

DU Bohan (Peking University Shenzhen Graduate School): Characterising Seasonal Variation and Spatial Distribution of PM2.5 Species in Ningbo

YAO Lan (Shandong University, China): Perchlorate and Chlorate in PM2.5 in Ji'nan China

Air Pollution in Developing Mega-cities: Something Old, Something New

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Keywords: Air Pollution Mega-city

For nearly six decades major urban areas in the earlier developing countries (e.g., Los Angeles, USA) have struggled to provide acceptable air quality for their inhabitants. Increasingly stringent emission control efforts have been implemented, which have been remarkably effective in reducing ambient pollutant concentrations. Importantly, this progress has been slow, and significant problems do continue. Substantial and growing air pollution issues are also confronting today's rapidly developing mega-cities, both in Asia and in Africa. Lessons learned in the air pollution control efforts in the earlier developing countries can provide useful guidance for similar efforts needed today in developing urban areas, both in responding to current problems and in avoiding some of the more severe problems experienced during earlier urban development. However, new urban areas have their own unique character, which will require fresh examination of old approaches to air pollution control. This talk will review some aspects of the approach to air pollution control that have been found effective, and will point to some issues in the developing urban areas that have not required addressing in the past. It will be suggested that fruitful research approaches will include carefully examining the old approaches, determining how they can be adopted and adapted to new situations, and investigating what new approaches are required. The regional nature of air pollution in East Asia will be a particularly emphasized example of a new situation.

Investigating Difference of Sources and Health Impacts between Northern and Southern China

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Keywords: PM2.5 Health effect

Fine particulate matter, PM2.5, has received great concern and attention all over China ever since those frequent and severe hazes in the fall of 2011. Numerous studies demonstrated that short-term exposure

to PM was associated with increased risk of mortality and morbidity. Recently a study was conducted in sixteen cities (the China Air Pollution and Health Effects Study, CAPES) all over China in order to reveal seasonal and geographical characteristics of acute effects of particulate air pollution. The results suggest that people in southern China might have higher health risks. However, a research conducted by Chen et al. showed that residents of the northern China would have shorter life expectancy than those of the southern part because of more exposure to total suspended particulates (TSP). Therefore, it is important to investigate difference of sources and composition of fine particles in the north and south, which is critical to better understand the health impacts of particulate matter. This study summarizes temporal and spatial characteristics of components and sources of fine particulate matter in China and discusses the relationship between sources and health impacts in the northern and southern China.

Variability of Aerosol Properties and HYSPLIT Model Estimates for Aerosol Transport Pathways over Lahore

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Keywords: AERONET HYSPLIT Lahore

AERONET data from December 2009 to November 2010 have been used to analyze the aerosol properties over Lahore, a megacity located in the central region of Pakistan. The parameters studied includ Aerosol optical thickness (AOT), Angstrom exponent (AE), and single scattering albedo (SSA). ARL's HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) model has been used to compute backward trajectories for the transported dust and materials over Lahore. The highest values of AOT at different wavelengths were observed in October 2010, which have been interpreted due to the presence of aerosol particles from a combination of seasonal biomass burning and vehicular emissions. The average monthly peak value of AE was found to be 1.33 in December 2009 with corresponding AOT value of 0.54 indicating dominance of fine particles. However, the lowest average monthly value of AE was found to be 0.4 in June 2010 with corresponding AOT value of 0.71pointing towards the presence of coarse particles over Lahore. Average monthly SSA values at different wavelengths were lowest in April 2010 and highest in September 2010.

Characterization of Submicron Aerosols in an Urban Site in Northern China Using an Aerodyne High-Resolution Aerosol Mass Spectrometer

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Keywords: Submicron particles aerosol mass spectrometry

Atmospheric particles have significant influence on human health and earth's climate. In recent years, with the rapid economic development and increasing number of vehicles in Northern China, especially Shandong Province and its surrounding area, high level of air pollution becomes a severe issue.

In order to further understand the pollution formation mechanism and pollution characteristics, a campaign was carried out in November 2013 in Qingdao, south of Shandong Province. In this study, an Aerodyne High Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-TOF-AMS) was used to measure the chemical composition and size distribution of non-refractory submicron particulate matter (NR-PM1). According to the results, The NR-PM1 mass concentration varied largely from 1.95 to 125.88 μg m−3, with an average of 30.11 μg m−3. Organic is the most abundant component (averagely accounting for 33.5 % of the total mass) followed by nitrate, sulfate, ammonium, BC, and chloride. The concentration of BC is measured by AE (Magee Scientific Company, Berkeley, California, USA).

Nitrogen Dioxide Measurement by Cavity Attenuated Phase Shift Spectroscopy (CAPS) and Implications in Ozone Production Efficiency and Nitrate Formation in Beijing, China

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Keywords: Cavity Attenuated Phase Shift Spectroscopy (CAPS) NO2 Ozone production efficiency (OPEx) Nitrate Beijing

Nitrogen dioxide (NO2) is a key species in studying photochemical smog and formation mechanisms of nitrate in fine particles. However, the conventional chemiluminescence (CL)-based method often has uncertainties in measuring NO2 because of interferences with other reactive nitrogen species. In this study, an Aerodyne Cavity Attenuated Phase Shift Spectroscopy (CAPS) NO2 monitor that essentially has no interferences with nitrogen-containing species was deployed in Beijing for the first time during August 2012. The CAPS NO2 monitor is highly sensitive with a detection limit (3σ) of 46.6 ppt for 1-minute integration. The NO2 measured by CAPS shows overall agreement with that from CL, yet large differences up to 20% were also observed in the afternoon. Further, the discrepancies of NO2 measurements between CAPS and CL appear to be NOz dependent with larger differences at higher NOz concentrations (e.g. > 14 ppb). As a result, the ozone production efficiency of NOx (OPEx) derived from the correlations of Ox-NOz with the CL NO2 can be overestimated by 19-37% in Beijing. The daily OPEx calculated with the CAPS NO2 ranges from 1.0 to 6.8 ppb/ppb with an average (±1σ) of 2.6 (±1.3) for the entire study. The relatively low OPEx and the relationship between OPEx and NOx suggest that ozone production chemistry is VOC sensitive during summer in Beijing. Two case studies further show that high concentrations of NOx can significantly enhance the formation of nitrate in fine particles in the presence of high O3 and favorable meteorological conditions.

Endotoxin Concentrations in Ambient Air Fine Particles in Beijing

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Keywords: Endotoxin ambient fine particulate matter meteorological factors gaseous pollutants chemical components oxidative potential

Health risk of ambient fine particulate matter is already well known. Although many studies report the chemical constituents of particles, they paid little attention to the biological parts, which may also induce adverse health effects. As an important biological component of particles, endotoxin induces immune responses, inflammation, and probably have synergic effects with other pollutants. However, continuous endotoxin concentration in populated urban area was not reported in previous studies. From March 2012

to 27 February 2013, we collected daily ambient PM2.5 filters in Beijing, China, and measured their endotoxin concentrations. The endotoxin geometric mean was 0.65 EU/m3 (range: 0.10-75.02), and its fraction in PM was 10.25 EU/mg PM2.5 (range: 0.38-1627.29). We found the airborne endotoxin concentrations had seasonal patterns, which were high in spring and winter and low in summer and autumn. Both temperature and relative humidity significantly influenced the airborne endotoxin. Sulfur dioxide and nitrogen oxides were found to correlate with the airborne endotoxin. Positive correlations of endotoxin with Na+, K+, Mg2+, F- and negative correlations with P, Co, Zn, As, Tl were also found. In oxidative potential analysis, endotoxin was found to have positive correlations with ROS but not DTT. This study provides first continuous time series of ambient endotoxin level in Beijing, and characterizes its potential associations with ambient factors

Characteristics of PM2.5 in China and Its Potential Health Impacts

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Keywords: PM2.5 Health effect

In recent years, severe haze episodes are frequently observed in cities of China and the scales of impacted regions and magnitudes of the episodes are so significant that both government and public have shown clear and great concern. As PM2.5 is known as the major player of haze, its sources, formation mechanisms, control strategy and health impacts are recent research focuses. Particle size and chemical composition are two major factors that determine its health impacts, which are closely linked to emission sources of particles though atmospheric processing can change particle size and chemical properties. In this research, characteristics of PM2.5 in China are investigated through comparison with PM2.5 in the U.S. It is clear that PM2.5 in China is characterized by elevated concentration and primary emissions in winter, higher relative contribution from anthropogenic sources for both primary and secondary fine particles, rapid increase of mass concentration within a few hours etc. Potential health impacts due to its distinct chemical and physical properties are discussed. The exposure, measured in particle number and mass concentration, in three traffic-related microenvironments in Beijing are determined and compared. The deposition of fine particles in human upper respiratory tract, tracheobronchial, and pulmonary are estimated using a Multiple-Path Particle Dosimetry model (MPPD).

Impact of Changes in Air Pollution Exposure on Biomarkers of Oxidative Stress in Children Before and during the Beijing Olympics

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Keywords: Air pollution Beijing Olympics black carbon children 8-oxo-7,8-dihydro-2´-deoxyguanosine intervention malondialdehyde

Background: Air pollution is thought to adversely affect health effects via oxidative stress, which causes damage to DNA and lipids. However, it is not known whether exposure to air pollutants causes systemic oxidative stress in children.

Objective: To investigated the association between exposure to air pollution and biomarkers of oxidative stress using a governmental air quality intervention implemented during the 2008 Beijing Olympic Games.

Methods: We studied 36 schoolchildren during five time periods before and during the Olympic Games. Air pollutant concentrations were measured continuously at an air-pollution-monitoring station located 650 m southwest of the elementary school. The oxidative stress biomarkers 8-oxo-7, 8-dihydro-2´-deoxyguanosine (8-oxodG) and malondialdehyde (MDA) were measured from daily urine samples collected during each period. Generalized estimating equations were used to examine the relationship between repeated biomarker measurements and ambient air pollutant levels. Between-pollutant confounding was tested using two-pollutant models. The exposure-response relationship between biomarker levels and air pollution concentrations was investigated.

Results: During the Olympic intervention period, substantial reductions in air pollution (-19 to -72%), urinary 8-oxodG (-37.4%; 95% CI, -53.5– -15.7%), and MDA (-25.3%; 95% CI, -34.3– -15.1%) were found. 8-oxodG was significantly associated with black carbon (BC) concentrations 2 days before sample collection; and with PM2.5 (fine particles with diameter < 2.5 μm) and carbon monoxide concentrations 1 day before sample collection.

Conclusion: A decrease in the levels of oxidative stress biomarkers in the children was strongly associated with a reduction in BC concentration. These findings suggest that exposure to BC leads to systemic oxidative stress in children.

The Association between Acute Respiratory Inflammation of Elderly with Diabetes or Prediabetes and Ultrafine Particles in Ambient Air

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Keywords: Fine particulates size fractions Aitken mode respiratory inflammation cardiometabolic disease elderly population

Background Introduction: Substantial evidence was provided that short-term exposure to ambient pollutants especially PM was associated with acute respiratory inflammation. However, due to unconventional measurement of size distribution, epidemiological studies focusing on the potentially different health effects of detailed size-fractioned particles were very limited. Besides, limited studies reported the susceptibility of people with preexisting cardiometabolic conditions to respiratory system injuries caused by PM.

Scientific Questions: Is there any distinction in the association of acute respiratory inflammation with particles in different size?

Objectives: this panel study carried out in elderly population was aimed to 1) investigate the short-term associations between biomarker of respiratory inflammation and exposure of ambient pollutants, especially focused on the particles in detailed size fractions and modes; 2) explore the potential effect modifiers, such as gender and preexisting cardiometabolic conditions.

Methods: We recruited 62 subjects in an urban area in Shanghai, China to form a panel and conducted 342 repeated measurements of biomarkers and air pollutants. Mixed effect model was used to estimate the association of the fraction of exhaled nitric oxide (FENO) with the moving averages (MA) concentrations (up to 24 hours) of gas pollutants and PM in different size fraction, and the robustness of the association was further evaluated with a two-pollutant model. Effect modification by gender and preexisting cardiometabolic conditions such as obesity, diabetes and hypertension was assessed.

Results: FENO was positively associated with the 18 hour MA concentrations of all pollutants except ozone. Aitken mode (20-90 nm) particles have the most robust association with the increase in FENO. An apparent size-fractioned distinction in the association was observed, with the increase of FENO being 13.8% [95% confidence interval (95%CI), 6.7%-21.5%], 6.1% (95%CI, 0.4%-12.2%), and 2.0% (95%CI, -7.9% to 13.0%) per interquartile range (IQR) increase in 8 hour MA surface concentrations (PSC) of Aitken mode particles, accumulation mode particles (90-560 nm) and nucleation mode particles (<20 nm), respectively. The associations were stronger and more persistent in female and subjects with cardiometabolic conditions.

Conclusions: The association between acute respiratory inflammation and concentration of fine particulates is depending on the size of the particles. Aitken mode particles have the greatest and most robust association. Female and participants with preexisting cardiometabolic diseases might be more vulnerable than others to the adverse effects of fine particulates.

Size Distribution, Toxicity and Sources of Particulate PAHs under Hazy Conditions during Summer and Winter in the Yellow River Delta National Nature Reserve, China

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Keywords: Haze PAHs background site

Regional haze has been one of the most disastrous weather events in recent years in China, and the Bohai Sea region is the most rapid increasing regions in haze frequency. Haze has significant impact on visibility, public health, and on the global climate. Between 1981 and 2005, 71% of the 615 meteorological stations in Mainland China have observed visibility deterioration at a rate of -2.1 km per every 10 years. The Yellow River Delta National Nature Reserve (YRDNNR), which is located in the Bohai Sea region, is a typical littoral wetland ecosystem and rarely influenced by human activities. Therefore, the geographical location of the YRDNNR makes it an ideal location in which to investigate the long-range transport of air pollution from heavily polluted areas to background sites in association with large-scale regional haze. However, most contaminant studies on the YRDNNR have focused on the distributions of nitrogen and phosphorus, and little attention has been paid to organic compound in aerosol, particularly to the occurrence of PAHs on hazy days.

As the world's largest emitter of PAHs, China is suffering from severe PAH contamination from various sources. Chinese PAH emissions accounted for approximately 22% of the total global PAH emissions in 2004. The knowledge about the size distribution of PAHs is essential to estimate their input into ecosystems and into the human respiratory system, to trace their origins and to understand their aging processes; therefore, it is important to study the size distributions of PAHs during hazy days in China. The previous studies on the size distribution of PAHs in China were conducted in several rapidly developed and highly polluted regions; such studies were rarely conducted in background sites.

Therefore, the purpose of this study is to investigate the characteristics, sources and effects on human health of particulate PAHs as part of haze pollution in the YRDNNR, to analyse the potential contribution of PAHs delivered via atmospheric transport to the YRDNNR and to estimate the impact of anthropogenic activities on PAH levels in the YRDNNR. The result showed the average concentrations of particulate PAHs were in the order of haze > normal and winter > summer, and the PAH ratio of hazy days to normal days was 3.24 in the winter and 1.42 in the summer. The dominant individual PAHs—consisting of Fl, Phe, Flu and Pyr for each sampling period—presented higher values on hazy days than on normal days. A bimodal distribution was found for 3-ring PAHs with peaks in hazy days that were higher than those in normal days; 4-6 ring PAHs followed a nearly unimodal distribution in which the highest peaks for both hazy and normal days were in the 1.0-1.8 μm range. A significantly higher TEQ value was found on hazy days compared to normal days. Diagnostic ratios and principal component analyses indicated that the principal source of particulate PAHs were coal combustion and vehicular emissions for both hazy and normal days.

Characterizing Seasonal Variation and Spatial Distribution of PM2.5 Species in Ningbo

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Keywords: Chemical composition spatial distribution seasonal variation PM2. 5

With the acceleration of urbanization and the rapid development of economy, many cities such as Beijing, Shanghai, Guangzhou, Nanjing and Hangzhou suffer from serious air pollution. Ningbo, as the second largest city of Zhejiang Province, mainly develops in port industry, chemical industry and metal manufacturing-based energy. The air quality of Ningbo deteriorates year by year, leading Ningbo to become the key target to be controlled of urban air pollution in Yangtze River Delta. A campaign based on PM2.5 membrane sampling was carried out from winter 2012 to autumn 2013 in Ningbo, aiming to study on the pollution level and chemical characterizes of PM2.5, the influence of meteorological conditions on the forming process of heavy PM2.5 pollution, the spatial and temporal distribution and source apportionment of PM2.5.

Two kinds of sampling instrument, Thermo2300 and TH-16A, were set in five sites. SZ and CX represent urban areas. XS is a background site. ZH and BL are industrial site and port site respectively. The mass concentration was determined by gravimetric method. Then the chemical components of PM2.5 were analyzed. The DRI 2001A was used to measure the Elemental carbon (EC) and Organic carbon (OC).The DionexICS2500 was used to analyze water soluble ions contained in PM2.5. Metal elements were analyzed by inductively coupled plasma mass spectrometry (ICP-MS). These obtained data was under strict quality control and quality assurance. We took use of the clustering results of backward trajectories to estimate the contribution of regional transport to the pollution of PM2.5. And positive matrix factorization (PMF) model was used to analyze specific source of pollution.

In conclusion, the average concentrations of PM2.5 in spring, summer, autumn and winter are 71.0, 30.7, 52.53 and 70.0 μg/m3 respectively. Urban sites have higher PM2.5 concentration than other sites. OM, SO42-, NO3-, NH4+ and EC are the most important five compositions of PM2.5, composing about 70~90% of the total PM2.5 mass concentration; As for winter, the concentration of SO42-, NO3- and NH4+ has no obvious spatial difference; they mainly come from regional transport. But the concentrations of EC and OM in SZ and CX are much higher than these of ZH, BL and XS, so EC and OM mainly come from local emissions. There are 8 kinds of sources of the PM2.5 in the winter of Ningbo. They are steel smelting, mixed dust, biomass burning, secondary nitrate, chlorine-rich source, vehicle emissions, residual oil combustion and secondary sulfate. They account for 5.6%, 3.3%, 3.2%, 28.8%, 6.8%, 22.2%, 0.7% and 29.4% of the total sources respectively. The secondary sulfate, secondary nitrate and vehicle emissions are the main sources, accounting for 80% of the source emissions.

Perchlorate and Chlorate in PM2.5 in Ji'nan China

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Keywords: Perchlorate and chlorate PM2.5 Indoor concentration

Perchlorate and chlorate are new emerging persistent environment pollutants and exist ubiquitously in groundwater, soil and atmosphere. Perchlorate and chlorate are of high water solubility, mobility and stability and have potential health impacts on humans, especially on women and infants. Perchlorate is noticed to restrain the uptake of iodine and disturb thyroid hormone synthesis, interfering with the development of the skeletal system and the central nervous system of infants. In the breast milk of lactating women in perchlorate exposure, perchlorate has been detected and is an important source to infants. One of the known health effects of chlorate is oxidative damage to red blood cells.

Perchlorate pollution in environment results from anthropogenic and natural sources. A wide range of anthropogenic perchlorate source is due to it is used as an ingredient of fireworks, an oxidant in solid rocket propellants, explosives and fertilizer. Natural sources of perchlorate include its presence as an impurity in Chilean nitrate and atmospheric sources. And the atmospheric source of perchlorate has not been well understood. Simonaitis-Heicklen suggested ClO4- a sink for chlorine radicals in the stratosphere: Cl radicals react with O3 to produce ClO3 radicals and continue to react with OH radicals, producing HClO4. Dasgupta et al. reported different steps of atmospheric HClO4 formation. Vasile I. Furaui investigated perchlorate in Arctic Snow and found in stratosphere perchlorate concentration was correlated with the total ozone level, while in troposphere possible perchlorate formation was related to chloride.

Some scholars proposed perchlorate and chlorate intake via atmosphere is not the main way to human exposure. However, perchlorate and chlorate in atmosphere can transfer to water though wet and dry deposition. Srinath Rajagopalan found a very large area in Southern High Plains of Texas, ClO4- concentrations of groundwater are high and these increased concentrations were caused by atmospheric ClO4- deposition and accumulation over thousands of years. Long Ye et al found perchlorate concentrations in groundwater and surface water decrease after rainy season in summer.

So far, some studies reported the occurrence of perchlorate in rice, bottled water, milk, tap water, groundwater, and surface water in China. However, few studies about atmospheric perchlorate and chlorate have been reported in China. Therefore, it is of great significance to investigate atmospheric perchlorate and chlorate contamination level since China is a fireworks production country and setting off fireworks and firecrackers is the tradition of Chinese people to celebrate gala day.

From Jan 12- Feb 4, Feb 9 – 10, 2013, we simultaneously collected indoor and outdoor PM2.5 samples for perchlorate and chlorate measurement in Ji'nan. The objectives of this study are to investigate the atmospheric perchlorate and chlorate concentration, possible formation and indoor concentration of perchlorate and chlorate. The results show fireworks display during New Year has a significant effect on atmospheric and indoor perchlorate concentration. To our knowledge, it is the first investigation of indoor perchlorate and chlorate concentration.

Session Number: **R6-04**

Session Title: **Co-Design, Co-Production and Co-Delivery in Future Earth**

Time: **13:30-15:00, April 10, 2014**

Location: **Conference Room No.4, 2nd Floor, Friendship Palace**

Convener: **AI likun, Hein MALLEE**

Speakers:

AI likun (MAIRS IPO, China): Co-Design and Trans-Disciplinary Study in Global Change Research

Ho-Ching LEE (National Central University, Taiwan / China): Science, Uncertainty and Participatory Process in Environmental Decision Making Process

ZHANG Jianxin (Institute of Psychology, Chinese Academy of Sciences): Climate Change and Psychological Research

FENG Yongfeng (Guangming Daily, China)

SHI Xiangying (Shanshui Conservation, Peking University): What Does Climate Change Mean to People's Llife: Interdisciplinary and Cross-Cutting Data Sharing and Cooperation?

Co-Design and Trans-Disciplinary Study in Global Change Research

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Keywords: Trans-disciplinary study global change

Co-design, co-production and co-delivery of trans-disciplinary research activities are key aspects of Future Earth. Co-design entails articulation of the research challenges and overarching research questions through deliberative dialogue among researchers and relevant stakeholder groups in the formative stages of research. Co-production links the scientific knowledge generating processes with implementation actions by the stakeholders. Dialogue and discussion with stakeholders happens not only in the design stage, but also in revisiting and adjusting the research activity by evaluation of its impact on stakeholders. A major feature of co-production is the assurance of "no surprises" for stakeholders as research results emerge. To transfer the scientific knowledge to broader communities and the public, co-delivery is necessary to promote the outcomes of co-design and co-production.

Climate Change and Psychological Research

ZHANG Jianxin Institute of Psychology, CAS

Keywords: Climate change psychology

Today psychologists dealing with the issues of climate change usually start from answering the following several questions:

1. How do people understand the risks imposed by climate change?
2. What are the human behavioral contributions to climate change and the psychological and contextual drivers of these contributions?
3. What are the psychosocial impacts of climate change?
4. How do people adapt to and cope with the perceived threat and unfolding impacts of climate change?
5. Which psychological barriers limit climate change action?

I’d like to share some of the preliminary answers by psychologists with scientists from other research subjects.

Session Number: **R4-02**

Session Title: **Adaptive Land Use and Water Management in the Pearl River Delta under Climate Change and Sea Level Rise**

Time: **15:20-16:50, April 10, 2014**

Location: **Conference Room No.4, 2nd Floor, Friendship Palace**

Convener: **HUANG Heqing, Saskia WERNERS**

Speakers:

Saskia WERNERS / YAO Mingtian (Wageningen UR, Netherlands): Sectoral Water Use Trends in the Urbanizing Pearl River Delta, China

DENG Jiaquan (The Pearl River Hydraulic Research Institute, China): Salt Tide Intrusion in the Pearl River Estuary: Causes, Effects and Management Approaches

Ronald HUTJEST (Wageningen UR, Netherlands): Impact of Climate Change on Water Resources in the Pearl River Basin

LIU Zhijia (IGSNRR of Chinese Academy of Sciences, China): Complex Interactions among Changes in Built-up Area, GDP, and Demography in the Pearl River Delta

Saskia WERNERS (Wageningen UR, Netherlands): Adaptation Turning Points: Implication of Climate Change for Water Management in the Rhine River Delta, the Netherlands and the Pearl River Delta, China

HUANG Heqing (IGSNRR of Chinese Academy of Sciences, China): Approaches to Coping with the Threats of Floods and Droughts in the Pearl River Delta

Sectoral Water Use Trends in the Urbanizing Pearl River Delta, China

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Keywords: Water use Pearl River Delta

Assessing and managing water use is crucial for supporting sustainable oriented river basin management and regional development. The first consistent and comprehensive assessment of sectoral water use in the Pearl River Delta, China was performed by analysing regional water use data from 2000 to 2010. The regional-scale water use model PRDWUM was developed to explore the possible driving forces underlying water use changes in the domestic, industrial and agricultural sectors. We calculate water intensities from annual socio-economic and water use data. We find that the Pearl River Delta managed to stabilize its absolute water use by dramatic improvements in industrial water use intensities, and early stabilisation of domestic water use intensities. Yet the highly uneven temporal distribution of water usage and water resources can result in water shortage in the delta area. In addition, large differences in sectoral water use exist between the cities in the delta. Looking at water uses intensity, -the water use per unit of GDP in a sector-, we conclude that the industrial water use intensity of individual cities can be as much as 80% above or below delta average. Domestic water use intensity varies by +/- 30% compared to the delta average.

In general the early-developed cities have higher domestic water use intensity. Significantly, for all cities per capita water use is expected to level off at values much below the average values suggested in recent global studies. Therefore, these global assessments may have overestimated future domestic water demand in developing countries. Although scarce and uncertain input data and model limitations lead to a high level of uncertainty the regional water use model is useful in exploring the underlying driving forces of water use changes and can help explore future water use scenarios.

Salt Tide Intrusion in the Pearl River Estuary: Causes, Effects and Management Approaches

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Keywords: Salt tide intrusion Pearl River estuary

Salt tide intrusion in the Pearl River estuary is getting more and more serious in recent years due to global climate change and human activities. The influences of the two factors on the salt tide intrusion are mainly on four aspects. Firstly, the rise of sea level increases the salt content of both ground and surface water in the estuary region and also leads to an upward movement of the interface between salt and fresh water such that the release of runoff from upstream into sea has been blocked. Secondly, an increase in extreme weather events, decline in rainfall, a decrease in runoff from upstream in dry seasons, and the enhancement of tidal dynamics, all contribute to the upward movement of the salt-fresh water interface. Thirdly, surface water evaporation resulted from global warming, water consumption in metropolitan areas, and the time of consumption for water intake in the basin all increase, making the impacts of salt tide intrusion get more and more significant. Finally, the rapid change of riverbed resulted from disordered and highly intensive sand excavations leads to a rapid increase in the tidal prism in the Pearl River estuary, directly enhancing the dynamic movement of tides and aggravating the severe situation of salt tide intrusion.

The salt tide intrusion in dry seasons has already threatened the daily water supply to many cities, typically Zhuhai, Macau, Zhongshan and Jiangmen. This has brought the attention of the office of the State Flood Control and Drought Relief Headquarter and the Ministry of Water Resources. To solve the problem, the water administration body of the basin, i.e., the Pearl River Water Resources Commission launched a program of Emergent Water Dispatch to supplement fresh water and to press salt intrusion before the arrival of Spring Festival in 2005 and 2006. This ensured the safety of drinking water for 15 million people in the Pearl River Delta. Due to the success of the program, it has been continually implemented in dry seasons since then for six years from 2006 to 2013.

Impact of Climate Change on Water Resources in the Pearl River Basin

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Keywords: Climate change water resources Pearl River Basin

Climate change will affect the hydrological regimes of rivers, and has a direct impact on the availability, renewability, and quality of water resources. To better understand the current and future water resources in the Pearl River basin, here we assess the impact of climate change on river discharge, and investigate whether climate change will lead to increasing water availability or scarcity at the catchment scale. The Variable Infiltration Capacity (VIC) model is used for hydrological simulations driven by WATCH (the Integrated Project Water and Global Change) forcing data (1958-2001), WATCH forcing data ERA interim (1979-2001) and ten bias-corrected projected climate scenarios from MPI-ESM-LR, HadGEM2-ES, CNRM-CM5, IPSL-CM5A-LR and EC-EARTH, each forced by RCP4.5 and RCP8.5 emission scenarios respectively(1961-2099). All sub basins except Yujiang basin show a decrease in streamflow from 1961 to 2099. The results also indicate that the wet season will become more wet, and the dry season will become drier over the whole Pearl River basin after 2030. Highly uneven spatial and temporal distribution of water resources may result in water shortages and severe hazards in this region.

Complex Interactions among Changes in Built-up Area, GDP, and Demography in the Pearl River Delta

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Keywords: Pearl River Delta; Built-up area; GDP; Resident population.

The Pearl River Delta (PRD) has experienced rapid economic and social development over the last several decades. Bound by natural and human factors, an interdependent and mutually restrained relationship is shown among changes in built-up area, GDP and demography. By combining satellite imagery based land use change data with GDP and resident population statistics, this study shows that the significant increase in the proportion of built-up area from 0.5% in 1979 up to 10.8% in 2009 is achieved mainly at the cost of a rapid loss in agricultural land. There is a significant linear relationship between resident population and built-up area and when the proportion of built-up area is relatively lower, there is a significant power-function relationship between GDP and built-up area, manifesting the contribution of built-up area's expansion to regional economic growth. However, this power function relationship weakens with an increase in the proportion of built-up area, demonstrating that the regional economic growth will rely more largely on the increase of the production value of unit built-up area other than on the expansion of built-up area.

Adaptation Turning Points: Implication of Climate Change for Water Management in the Rhine River Delta, the Netherlands and the Pearl River Delta, China

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Keywords: Adaptation turning points Pearl River Delta Climate change adaptation Rhine River Delta

Concerned decision makers increasingly pose questions as to whether current management practices are able to cope with climate change and increased climate variability or whether alternative strategies are needed. Climate research has typically focussed on assessing the extent of climate impacts. Yet, at least equally important is the question for how much longer current policies and management are expected to suffice and when adjustments will be required.

In this paper, a methodological approach for identifying the policy implications of climate change is first presented and then applied to water management in the Rhine River Delta, the Netherlands and the Pearl River Delta, China. This approach focuses on the identification of situations where policy objectives and societal preferences are compromised by climate change. We call this situation an 'adaptation turning point'. The assessment of adaptation turning points translates uncertainty about the extent of climate impacts into a time range over which it is likely that specific impacts occur and which can be used to take adaptive action. This paper will discuss the theoretical basis (how to define, identify and quantify adaptation turning points) and case evidence of adaptation turning points in the Netherlands and China. The paper hopes to contribute to the ongoing debate on adaptation to climate change in the Rhine River and the Pearl River Delta by focusing on the specific situation where, due to climate change, the long-term sustainability of water supply in is risk. We aim to identify the moment in time at which safe water supply may be compromised due to climate change and the time window available for adaptation.

Experience so far is that expressing uncertainty in time (when will a critical point be reached) is easier to understand for stakeholders than the more typical presentation of the amount of change in a certain projection year. In addition, the assessment allowed for a meaningful dialogue between stakeholders and scientists about the amount of change that is acceptable, when conditions could be reached that are unacceptable, how likely these conditions are and what adaptation pathways to consider.

Approaches to Coping with the Threats of Floods and Droughts in the Pearl River Delta

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Keywords: Flood control Land mangement Adaptation Pearl River dela

The Pearl River Delta faces higher sea levels and more extreme hydro-climate events due to both intensive human activities and global climate change. With the rapid socio-economic development in the region, lots of lowland that can help soak up excess water during storms has changed into built-up area and more water is consumed in daily urban life and industries. The potential for floods as well as droughts to turn into costly and life-threatening disasters has increased. To cope with the threats of these potential disasters, several approaches have been proposed, including building up more dams upstream, developing water-saving societies, creating more wetlands near the estuary, etc. This presentation is going to give an assessment of the feasibility of these approaches and consequently provide some suggestions within the context of adaptive water and land management.

Poster

Predicting the Dispersal Corridors of Alpine Plant Pedicularis Longiflora (Orobanchaceae) based on GIS and Species Distribution Models

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Keywords: least cost path method Species Distribution Models GIS phylogeography Quaternary

Pedicularis longiflora experienced extensive populations' expansion in the Quaternary, the dispersal corridors are still unclear. According to the distribution patterns of haplotypes based on chloroplast DNA variation, two possible dispersal routes from the southeastern part of Tibetan Plateau (TP) to interior were identified based on Species Distribution Models (SDMs) and least cost path method. The populations of East Himalayas-Hengduan Moutains region expanded to the western part of TP along with the Yarlung Zangbo River valley and the north slope of Himalayas, the expansion trend was also proved by SDMs based on two historical periods containing the Last Interglacial and the Last Glacial Maximum. Identification of dispersal corridors has significant to the evolutionary history of alpine plants and the protection of special species in TP.

Land Surface Process Study and Modeling in Drylands and High-Elevation Regions

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Keywords: Land Surface Processes Drylands High-Elevation Regions

Drylands and high-elevation regions have sensitive responses to global changes. Land–atmosphere interactions in these regions also play an essential role in atmospheric circulation. However, some key processes of land–atmosphere interactions in these regions remain to be understood. Here, we introduce existing problems of land surface modeling in drylands and highelevation regions (mainly with reference to the Tibetan Plateau) and the efforts to resolve these issues, including the following three aspects. First, to identify land surface modeling uncertainties, we perform a climate model intercomparison and evaluation against observations in these regions. Second, to address the modeling deficiencies, a parameterization scheme for thermal roughness length is developed for drylands; a new thermal conductivity scheme is developed to take the impacts of soil organic carbon into account; and a soil resistance scheme is developed for evaporation. Third, the parameterizations is incorporated into land surface models (LSMs) and their effectiveness was evaluated.

Real Time Flood Inundation Modelling for Midnapore-Kharagpur Development Authority (Mkda) Planing Region of West Medinipur District, West Bengal (India)

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Keywords: Natural Disaster, Flood and Water Logging, Remote Sensing and GIS, FLO-2D Simulation Modeling, Real Time Display

Natural disaster like flood and water logging is a worldwide phenomenon. In India, during intense monsoon, not only the rural areas but the urban areas are also badly affected by water logging. Midnapore Kharagpur Development Authority (MKDA) planning region of West Bengal is not an exception. Application of GIS for real time rainfall runoff modeling is rapidly advancing and soon will be the frame work of a predictive early flood warning system. This research is a fundamental step to assess flood inundation and water logging vulnerability of MKDA and their real time display on map, which can aid the prioritization process of MKDA authority in their emergency sewerage clearance and mechanical water ejection during heavy downpour.

FLO-2D simplified the process of analytical solution in inundation modeling. It is a two-dimensional flood routing model that has been used to simulate runoff (channel flow, unconfined overland flow, street flow etc.) over complex topography. Spatial information on land use land cover, elevation, slope magnitude, slope direction, soil condition, and sewerage condition were incorporated in the model design; finally rainfall duration and amount are used as input to get the inundated areas as output. Most of the maps have been displayed as either grid element plots, line contour maps, and shaded contour maps. Shape files for importing results to GIS are automatically generated for most of the Mapper plots. By importing the DTM ground elevation points into Mapper and subtracting the ground elevation from the FLO-2D predicted maximum grid element water surface elevation, flow depths are computed for every DTM point. Model generated inundated areas of a real storm have been compared with actual inundated area extracted from microwave imagery (RADAR SAT-1) of the same date and with primary field survey map for validation of the model.

Prediction of Seasonal Monsoon Rainfall over the South Asian Region by Dynamical Downscaling

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Keywords: WRFmonsoon rainfall TRMM GPCP CMAP

Monsoon rain is of enormous importance to give shape to agriculture, economy and rhythms of life of the

Asian region. The WRF model was run with Kain-Fritch cumulus parameterization scheme and boundary layer is treated with Yonsei University scheme for simulating monsoon events of 2007 to 2010. Surface layer is treated using Monin-Obukhov with Carslon-Bolan viscous sub-layer option and Noah 4-layer land surface model is utilized with the above combination. The model is run perpetually for 4 months for each of the 4 years. The boundary conditions are updated at every 6 hours intervals using the NCEP/ FNL data. Both spatial and temporal variations of the rainfall are analyzed. Separated boxes are selected representing different geographical characteristics over the Bangladesh, Bhutan, India and Nepal for studying the monsoon rainfall. Observed rainfall by TRMM, GPCP, and CMAP are used for verification of the simulated rainfall. Results show that large scale seasonal distributions of rainfall simulated by the model are depicted fairly well as compared to the observations.

Climate Simulation over East Asian in Summer by a Variable-Resolution Model LMDZ

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Keywords: Variable resolution model Regional climate simulation Dynamical downscaling

A variable-grid atmospheric general circulation model, namely, Laboratoire de Météorologie Dynamique Zoom, version 5 (LMDZ5), with a local zoom over eastern China, is driven by European Centre for Medium-Range Weather Forecasts (ECMWF) Re-Analysis (ERA-interim) data and is used as a downscaling tool of east Asian climate in summer for the period 1979-2005. The performance of the LMDZ5 in simulating the regional climate features is thoroughly assessed through a comparison to both observational data and the reanalysis product.

The model can realistically simulate the climate distribution of the atmospheric circulation, including the large-scale monsoon airflows, the monsoonal meridional/zonal circulation, the water vapor transportion, the subtropical high over west Pacific, the total cloud cover, and the upper-level westerly jet. The model has a better capability in reproducing the atmospheric circulation in the middle and upper troposphere than that in the lower troposphere. The marked rainbelt observed along the Yangtze River Valley is missed in the simulation. This is due to the weakly reproduced monsoonal components in essence and is directly related to the weak western Pacific subtropical high, which leads to a fragile subtropical southwest monsoon on its western flank and results in a weaker convergence of the southwest monsoon flow with the midlatitude westerlies. The contribution of the tropical southwest monsoon to the moisture convergence over the Yangtze River Valley is too weak in the model.

The analysis demonstrates that a variable-resolution AGCM can be a useful tool for the dynamical downscaling of regional climate over eastern China, although the rain and temperature bias remains evident as with many other regional climate models.

Drought Assessment Using Different Hydro-meteorological Indices

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Keywords: Drought indices, KBK districts, SPI. hydro-meteorological parameters

Drought is a regional climatic phenomenon originating due to insufficiency of precipitation, leading to water deficit and causing economic losses. It is essential to look for an early warning system for drought mitigation and prevention in India with special emphasis to Odisha receiving severe drought at frequent interval.

Drought indices based on hydro-meteorological data plays a vital role to assess the drought situation. In the present study an attempt has been made to critically evaluate different drought indices based on meteorological, hydrological and agricultural information and data inputs. Moreover, satellite based drought indices are also evaluated as it is available more frequently and covers larger synoptic view. It has been observed the most of the Drought indices are based on either one or two parameters only and are independent of other drought indices. To test the validity various drought indices in a typical drought prone area of India, a detailed analysis was done in Kalahandi-Balangir-Koraput regions of Odisha, India receiving severe droughts in last 100 years. Monthly rainfall, potential evapo-transpiration, temperature, humidity, and other related data for 112 years from all the eight rain gauge stations were used in the analysis. Moreover, soil moisture, land use, soil, and topographical data for the last 10 years and daily discharge data for last 30 years collected from two sampling stations were also used for the analysis. It has been observed that satellite based indices in conjunction with hydro-meteorological parameters provided best results and minimizes the error.

Future Projections of Monsoon System over South Asia Using Climate Models

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Keywords: CMIP3, CMIP5, summer monsoon rainfall IPCC AR4,IPCC AR5,

The IPCC claims to have evidence of an anthropogenic effect on climate in earth's surface-air-temperature during the past century. Agriculture over South Asia region is exclusively depends on tropical monsoon system. Now global climate model output, CMIP3 and CMIP5 multi-model downscaled dataset (Meehl et al., 2007) are obtained for the present study (Maurer et al. (2009)). The dynamical downscaling technique mainly is used for the bias-correction/spatial downscaling method

(Wood et al., 2004) to a 0.5 degree grid, based on the 1950-1999 observed climate (Adam and Lettenmaier 2003). Results indicate that eleven AOGCM model outputs (BCM2.0, CGCM3.1, CNRM, CSIRO, GFDL_CM2.0, GFDL_CM2.1, ECHAM5, MRI, PCM, CCSM and HadCM3) are utilized for the basic understanding of future climate projections based on SRES A1B scenarios over south Asia region in three time-slices viz. 2020s, 2050s and 2080s and are validated with the baseline period (1961-1990). In the present study, the primary peak of summer monsoon rainfall is observed in northeast India (60 mm), while the secondary peak is noticed over west coast of India (50 mm). It is interesting to note that summer monsoon rainfall is increasing in 2020s (5 mm) and 2080s (20 mm) when compared with the 2050s. The spatial distribution of summer monsoon rainfall is appearing to shift towards the western part of Nepal and central India in 2020s and 2080s. Secondly, the temperature projections also represent 3.5°C rise in temperature over South Asia in 2080s when compared with the baseline period. Later the study extended by using IPCC AR5 (CMIP5) downscaled data under Rcp45 and the change in temperature and rainfall is increased by about 7% in 2050 and 11% in 2080s with CMIP3 global downscaled data. This study is of paramount importance for future hydrological study form the point of view of agriculture over South Asia.

Analysis of Microphysics and Convective Parameterizations in a Regional Climate Simulation of Warm Season 2005 over Kanto Area

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Keywords: Precipitation microphysics convection parameterization

Recently, many regional climate models (RCM)s are used primarily for downscaling coarse global resolution data to higher resolution data for regional and local basin scale impact studies. But, RCMs include a lot of model parameterizations that are sensitive to season, grid resolution, validation data, and the physical process on a specific geographical area. So, there is a need to understand the sensitivity of these model parameterizations in downscaling. This understanding is required to understand the extent of utility such as limitations of using downscaling output for other purposes such as hydrologic impact studies, where spatio-temporal representation of precipitation serves a major input. Following this line of thought, it is necessary to look at the sensitivity of the model parameterizations, which are microphysics and convection parameterization, handling the representation of precipitation in an RCM.

Consequently, this study aims to investigate the representation of warm season precipitation over Kanto Area using an RCM called Weather Research and Forecast (WRF) model. The main objective of the

study is to determine the capability of 24km, 6km and 2km model resolution in representing the spatio-temporal distribution of warm season precipitation over Kanto. It looks at the capability of the model and its sensitivity in representing precipitation caused by baui front and typhoon season in the area. It also investigates the differences of using single-moment from double-moment microphysics and comparison of single-moment microphysics schemes in the representation of precipitation. And, it aims to investigate the impact of usingexplicit and non-explicit convection parameterization for the 6km model resolution.

The simulations results are validated against with 0.05° (approx. 5.5km) grid daily APHRODITE rainfall product for the 24km and 6km model resolution and AMEDAS station data for the 2km model resolution. Statistical measures were used to validate the results such as spatial correlation, RMSE, and bias. Results are also checked against potential bias of the LBCs through the comparison of simulations with Era-Interim Reanalysis product. The microphysics schemes used were WSM6, WDM6, Lin, and Thompson schemes. While, the convection parameterizations schemes were Kain-Fritsch and Grell-3d schemes.

Numerical Simulations of Radiation Budget and Energy Balance Using Wrf Model over the Zioge Wetland

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Keywords: Wetland Numerical simulation Radiation budget Energy balance

Zoige Plateau Wetland is located in the upper reaches of the Yellow River. The research of surface energy and radiation distribution will benefit the environment of the Yellow River. The surface energy and radiation budget over the Zoige wetland were simulated by WRF mesoscale meteorological model during July 16, 2010 to August 15, 2010, which combined with MODIS satellite-derived underlying surface landuse-types and vegetation types, and the results were validated by observation data. The results indicate that the simulated radiations and heat fluxes from the WRF model generally agree well with the observations in sunny but poor in cloud and raining day. We found that the soil moisture, soil and vegetation type have significant impacts on the surface energy and radiation distribution. The average correlation coefficients being about 0.79, MAPE being about 13%. The proportions of sensible heat flux, latent heat flux and ground heat flux in the net radiation is are16.5%, 82.7% and 4.3% respectively. The daily integral value different underlying surface of net radiation is 1.8MJ•m-2.

A New Verification Method for Spatial Soil Moisture Forecasting

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Keywords: Soil moisture numerical simulation spatial verification

As a key geophysical factor, soil moisture plays an important role in the study of climate, hydrology, agriculture and forestry. The future regional distributions of soil moisture data are usually obtained from numerical models. In turn, the spatial verification of soil moisture becomes a vital step in evaluating and improving numerical model performance and utilizing forecast results. Currently, verification methods for soil moisture data stem on the traditional strength verification parameters, such as, averaged error and root-mean-squared error. Those methods, however, provide only incomplete and sometimes inaccurate messages, which hinder a proper evaluation of a forecast model. Here we show that, based on SAL method, a novel object-based method, SAL-DN, can be used for spatial verification of regional soil moisture forecasts. Ideal and real tests show that SAL-DN can reveal the differences between the observed and forecasted soil moisture in three aspects: structure, magnitude and location. In general, these differences correctly reflect the actual situation. When the verification domain becomes very large, both the SAL-DN and other verification methods suffer from the same cancellation and/or averaging effects, which prevent a proper interpretation to the results. In this sense, a small verification domain is recommended for SAL-DN applications. Furthermore, comparing to SAL, SAL-DN is also capable to verify other spatial variables which have two kinds of centers, such as temperature. Therefore, SAL-DN method enables enhanced verification accuracy and broad applications.

Seasonal and Interannual Variations of Soil Moisture over China: Model and Its Climatology

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Keywords: CLM4.0 soil moisture simulation response

The Community Land Model version 4.0(CLM4.0) driven by the atmospheric forcing data of Princeton University was used to simulate soil moisture(SM) from 1961 to 2010 over China. The simulated SM was compared to the observations, National Centers for Environmental Prediction (NCEP) Reanalysis data

and SM retrieved from the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) product, the results showed that CLM4.0 simulation is capable of capturing characteristics of the spatial distribution and temporal spatial variation. The simulated SM reasonably reflected spatial distribution characteristics of measured SM, where the humid regions were located over Northeast China and jianghuai basin, dry region was located over Hetao region. But the simulated SM was systematic higher than the observations in every layer. The simulated SM revealed the measured variation trends of the different depths at different time scales. The spatial patterns of simulated SM and NCEP SM demonstrated reasonable consistencies, and the spatial patterns of simulated SM and AMSR-E retrieved SM showed consistencies to the northern area of 35° N; Based on the simulated SM of summer (June to August),it can be concluded that the spatial distribution in every layer were characterized by a gradually increasing pattern from the northwest to southeast. Dry regions were located over the Xinjiang, Qinghai, Gansu Provinces and western Inner Mongolia region, while the most humid regions were located over the Northeast Plain, jianghuai region and the Yangtze River basin. The SM increased from surface layer to deeper layer in general. The variation trends basically showed consistencies at all depths. SM mainly decreased to the northern area of 35°N besides western Xinjiang Province and partial regions of Northeast China, and SM mainly increased in Yangtze River basin, southern and southwestern China to the southern area of 30°N. The decreasing trends were more significant with soil depth increase in domain north of 35°N arid and semiarid regions. Under the global warming background, the simulated SM of summer demonstrated different responses to the precipitation variation. SM decreased in typical arid and semiarid regions, while SM increased in humid region. The variation distribution of SM and measured precipitation had consistencies. The humid region significantly responded to precipitation, and the correlation coefficient was 0.47, while the semiarid and arid regions were ranked in second.

A Study for Soil Moisture Using CLM4.0 Simulation over the Source Region of the Yellow River

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Keywords: CLM4.0 the Princeton University atmosphere forcing data soil moisture

The 3h Princeton University atmosphere forcing data from 1961 to 2010 was adopted to drive the Community Land Model 4.0(CLM4.0) in simulating soil moisture over the Source Region of the Yellow River this paper, modified the land surface data soil organic matter content and soil texture which decide soil thermal and hydrologic properties, the in-situ measurements in Maqu soil moisture net were implemented to validate, meanwhile the AMSR-E soil moisture product was provided by Vrije Universiteit Amsterdam was utilized for comparative analysis with the simulation results. The results show that:

CLM4.0 simulation result reveals the soil moisture characteristic in spatial distribution and changing trend in the Source Region of the Yellow River, the simulated soil moisture distribution is more reasonable when modified surface organic matter content and soil texture, the soil moisture simulated by CLM4.0 has a relatively lower than the ground observation value and the VUA AMSR-E soil moisture product, which shows that the numerical simulation need further improvements, improve the quality of atmosphere forcing data and land surface parameters will increase the accuracy of simulation results.

Comparative Characteristics of Different Soil Temperature with the Same Vegetation Cover in the Valley Tunka

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Keywords: Soil temperature

Tunkinskaya basin located in the western part of the Baikal Rift Zone and is a negative morphostructure bounded on the north ridge Tunkinskie loaches and south of the Khamar-Daban. For mountain frame hollow characteristic asymmetry, north side-high alpine mountains, south-vypolozhennye, dome-shaped, medium- lift.

The long history of the formation of rift Tunkinsky negative neotectonic movements and the central part of paleogeographic conditions resulted in the accumulation of a thick layer of loose sediments of different genesis.

Center of the basin is composed mostly of alluvial, fluvial and lacustrine sediments of limnological significantly reworked eolian, processes. They are represented by gravel and pebbles, various grades of sand, loamy sand, silts, peats. On the sides of the southern exposure particle size distribution has a coarser structure. Here are common mainly alluvial sediments and debris origin. The lower slopes of northern exposure in the area of Khamar-Daban folded sediments of small rivers and canyons, sometimes sandy strata of eolian and eolian-diluvial origin.

On soil temperature Tunkinskaya depression in the literature hardly paid attention. There are only a time series of observations obtained at the meteorological stations. These are important for understanding the nature of geomorphological, geotechnical, environmental processes was possible to obtain data using the instrument base on the basis of the contact temperature recorders--single-channel temperature recorder (thermochron) and deep temperature recorder (AIPT) [Kurakov et al, 2008]. AMTP recording elements arranged in the following depths: 0, 2, 5, 10, 15, 20, 30, 40, 60, 80, 120, 160, 240,

320 cm 1 measurement were performed every hour during the year from October 2011 analyzed the average daily value. According to the results of previous studies [Lokhov, Voropai 2012] this periodicity is sufficient to obtain reliable data on the temperature regime of soils, with an average daily measurement error no greater than 0.10C.

To study the temperature of various soils with the same vegetation were laid deep temperature recorder AMTP. In order to study the temperature regime of soils were selected three sites under pine forest. AMTP27 laid in sand, AMTP30 - sandy loam + broke stone AIPT32 - sandy loam. Measurements were carried out to a depth of 320 cm, as used at meteorological stations in Russia. Used data for the period from 01.09.2012 till 31.08.2013, the date of transition were calculated through 00C temperature and plotted.

These data indicate that the freezing of the soil is approximately equal to a depth of 1.2m, and then, starting from a depth of 1.2 m freezing varied. First freeze sandy soils, sandy loam, and then later sandy loam with rubble. So at a depth of 1.6 m date zero crossing in the sand 20/12/2012, in sandy loam - 27.12.2012, and in sandy loam with rubble - 21.01.2013. It the difference between crossing 00C sand and sandy loam at a depth of 1.6 m is a week, and between the sand and gravel mixture is sandy and month.

Defrost similar freezing , thawing first goes to a depth of approximately the same 60 cm, unlike freezing then thawing 1.2 m late in soils where sandy loam with gravel, and then, starting from a depth of 1.2 m, and the delay is in the ground with sandy loam. And at a depth of 1.6 m difference between 00C crossing sand and sandy loam is 11 days, and between the sand and a mixture of sandy and gravel is 50 days.

Maximum temperatures during the study period were observed on August 1 3 sites to a depth of 30 cm, and then the dates are different. At depths ranging from 40 cm to 120 cm maximum temperature in sandy and sandy loam + rubble falls on August 11, and in the sand on August 14, the difference is 3 days. At depths of 240 and 320 cm high first reached sandy loam (01 and 24 October), then sand (03 and 20 October) and then sandy loam + rubble (19.10 and 05.11).

Minimum temperatures fall on February 9 at AMTP 30, February 10, at AMTP 32 and 27 to a depth of 20 cm at a depth of 30 cm - 10, 11 and 11 February, respectively, 40 cm - 11, February 11 and 12 , at 60 cm - 12, 12 and 13 February and 80 cm - 13, 13 and 14 February. At depths of 120 and 160 cm at least the same in all soils, falls on February 26 and 27, respectively.

Temperature recorder data indicate a more intense freezing and thawing of sandy soils, loamy soils are then further sandy loam with rubble. This is due to more rapid heat transfer in the sand than in sandy loam and gravel.

Airborne Soil Dust and Its Importance in Buffering of Atmospheric Acidity and Critical Load Assessment, over the Semi Arid Tract of Northern India

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Keywords: Buffering of atmospheric acidity soil dust

Airborne soil dust and its importance in buffering of atmospheric acidity and critical load assessment, over the semi arid tract of northern India.

The Critical Load approach alongwith integrated assessment models has been used in the European nations for policy formations to reduce acidic emissions. This unique approach was applied to assess the of vulnerability of natural systems to the present day atmospheric pollution scenario. The calculated values of critical loads of sulphur (225 - 275 eq/ha/yr) and nitrogen (298 – 303 eq/ha/yr), for the soil system in Delhi, were calculated with respect to Anjan grass, Hibiscus and Black siris. The present loads of sulphur (PL(S) = 26.40 eq/ha/yr) and nitrogen (PL (N) = 36.51 eq/ha/yr) were found to be much lower than their critical loads without posing any danger of atmospheric acidic deposition on the soil systems. The study indicated that the system is still protective due to high pH of soil. The nature of buffering capability of calcium derived from soil dust can be considered as a natural tool to combat acidification in the Indian region. The results showed that the pollution status in Delhi is still within the safe limits. However, at the pace at which the city is growing, it is likely that in coming decades, it may exceed these critical values. In order to set deposition limits and avoid adverse effects of acidic deposition this approach can be applied in India too. Such approach is very useful, not only in abating pollution but also in devising means of cost optimal emission abatement strategies.

Meteorological Controls on the Inhomogeneous Snow Processes at Grid Scale in a Shallow Snowpack Region

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Keywords: Inhomogeneous snow processes snow model

Understanding inhomogeneous snow processes at the grid scale is crucial for distributed snow hydrology research in mountainous region. Many studies tried to find some empirically snow distribution patterns to represent the heterogeneity at the grid scale. However, it is doubt any patterns exists in a shallow snowpack region, and how meteorological factors influence the heterogeneity of snow distribution and ablation is not clear. This study focused on the meteorological controls on the heterogeneity of snow distributions at grid scale in a shallow snowpack region, by using the SNOWPACK model for scenario simulations, and examines the snow distribution patterns at a small grid scale in the region. The results of the study indicate, 1) Shortwave radiation has a major impact on the heterogeneity of snow distribution and ablation at the grid scale. Increasing shortwave radiation can greatly promote the heterogeneity of the snow distribution. The contributions of longwave radiation and air temperature to the heterogeneity of snow distribution are minor. The distribution of precipitation also influence the snow distribution and ablation obviously; 2) There are no stable distribution patterns for the shallow snowpack region. The relationships between snow cover fraction and mean snow water equivalent exhibits some regularity during different snowmelt periods.

Influences of Frozen Soil Dynamics and Climate Change on Hydrological Processes in Cold Region, a Case Study in the Upstream of Heihe River Basin

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Keywords: Distributed hydrological model frozen soil cold region

Frozen soil prevails in cold regions and it casts significant influences on water cycling. In the context of climate warming, the spatial and temporal dynamics of frozen soil and hydrological processes will also change. How these changes relate to each other is a key problem in researches on water cycling, and water resources assessment in cold regions. The objective of this study is to analyse and investigate the impacts of frozen soil dynamics, climate warming and permafrost degradation on hydrological processes in mountainous cold regions. To this end, a physically based distributed hydrological model with explicit full snow and frozen soil modules was tested in the upstream of Heihe river basin. The model was firstly simply calibrated and rigorously evaluated. Results showed that the model seemed acceptable and promising. To get greater insight into the hydrological processes, some scenario cases of climate warming and frozen soil free were set up and results were compared. Results showed that as permafrost degraded with climate warming, interaction between near surface water and groundwater may be enhanced, which may deepen the water pathways and increase the importance of groundwater in the water cycling.

The Land Use/Cover Change in the Heihe River Basin and its Implications Sustainable Water Resource Management, 2000-2011

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Keywords: Land use/cover change Water resources management Heihe River Basin

The Heihe River Basin is a typical inland river basin in the arid region of northwestern China. From the 1960s to the 1990s, a decline of downstream flow in the Heihe River Basin occurred due to large, artificial expansions of water and land sources and a lack of effective management of water resources. As a result, the ecosystem of the lower reaches deteriorated substantially. To restore this degraded ecosystem, a water reallocation scheme was initiated by the Chinese government in 2000, leading to agricultural and ecological changes in the middle reaches. In this paper, we produced three datasets of land use/cover in the middle reaches of the Heihe River Basin derived from moderate-resolution Landsat TM/ETM+ images from 2000, 2007 and 2011. Based on these data, we investigated changes in land use/cover from 2000 to 2011 and its implications for sustainable water resource management. The results demonstrated that land use/cover changed prominently in the middle reaches of the Heihe River Basin from 2000 to 2011. Farmland and construction areas expanded significantly. Forestland increased slightly. Grassland, water body and unused land decreased continuously during 2000-2011. Wetlands exhibited two different trends: a decrease of 5.78% from 2000 to 2007 followed by an increase of 5.46% from 2007 to 2011. The increase in farmland was primarily the result of economic interests, and the substantial expansion of farmland resulted in the overexploitation of groundwater and the transfer of water from ecosystems, which results in the gradual deterioration of the ecosystem in some areas. Thus, the management of water resources should be further strengthened to achieve the sustainable use of water resources for both ecological and socioeconomic sustainability and to balance upstream and downstream water demand.

1960-2010 Drought Analysis of Haihe River Basin in Northern China based on the Community Land Model

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Keywords: Drought Haihe River Basin Standard Precipitation Index (SPI) Community Land Model (CLM 4.0) Normalized Difference Vegetation Index (NDVI)

Drought is an abnormal meteorological phenomena. Generally speaking, drought means in a certain period of time, the amount of available water in a certain area is lower than the average value in history. For the past few decades, with climate change and the increasing influence of human activities, droughts have broken out frequently worldwide and caused significant losses in economy. Considering the spreading area, duration and the disaster losses, drought is one of the most serious natural disasters and caused significant socio-economic impact on human. Therefore, it is of great importance to research on historical droughts in a typical river basin suffering from droughts, so as to provide effective decision supports and quantitative basis for drought resistance activities.

Based on the Community Land Model (CLM 4.0) established in Haihe River Basin in the North China, the volumetric soil moisture (50cm depth) from 1960 to 2010 was simulated for each grid cell in the study area. A definition of drought severity was proposed by the formation of empirical cumulative probability distributions for each grid cell in each month. As for precipitation data, based on the observed data from stations in basin and its surrounding areas, the Standard Precipitation Index (SPI) for each month and each grid was calculated to figure out the features of meteorological drought. With the definition of certain thresholds, the droughts happened from 1960 to 2010 in Haihe River Basin were identified and categorized by agricultural drought and meteorological drought. The agricultural droughts were discussed as a focal point by its spatial, temporal and seasonal features. Meanwhile, the results of 2 indices (soil moisture and precipitation) were compared by the distribution of drought severity in the study duration. As the last point, drought's influence on vegetation index was discussed by the trend of the Normalized Difference Vegetation Index (NDVI) in Haihe River Basin from 1982 to 2006.

The results showed that there was an increasing trend of drought in Haihe River Basin in the past 50 years, especially in 1965, 1981, 1999 and 2006. The early 2000s drought is among the most severe and extensive droughts in the period of record. Compared with mountainous area, the plain area in the basin suffered more from frequently drought events and the range of droughts is still expanding. The increasing drought events in plain area in Haihe River Basin may have negative influence on socio-economy in Northern China in the future. As for the vegetation cover during the past 25 years, the NDVI value was increasing from 1981 to 2006 in Haihe River Basin, which indicates that the vegetation cover is expanding. However, there was a significant drop of NDVI value from the increasing trend during 1992-1994 and 1999-2003, which could be explained by the influence of drought caused by abnormal climate.

The preliminary results of this study reflect the characteristics of the droughts in Haihe River Basin and the influence of droughts on vegetation. The findings could be used to provide decision support for effective drought resistance activities and quantitative drought impact assessment.

The Influence of Geographical and Climatic Variables on the Similarity of Species Composition of Phytocoenosium between Different Areas of Alpine Meadows on Tibetan Plateau

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Keywords: Species composition Principal component analysis Jaccard's indices Environmental gradient Explanatory variable

Quadrat investigation on the plant species in alpine meadow of the Qinghai Tibetan Plateau is the basis for us to understand the influence of climatic and geographical variation on the changes of plant species and distribution, Here, we analyze the effects of geographic distance, climatic dissimilarity and elevation variation on species composition of vascular plants in alpine meadow communities on the Tibetan Plateau in China. We find a total of 165 species of vascular plants through the investigation of plant species in the 16 study sites of 6 regions. The average number of plant species doesn't accumulate with the increase of number of quadrats until the number of quadrats increase to 20. We used the Jaccard's and Simpson's indices to calculated species turnover between each pair of sites, and selected six variables to quantify climate at each site, and subjected values of the climatic variables to a principal component analysis. We applied a variance partitioning approach to disentangle the effects of geographic distance, climatic dissimilarity and elevation variation on similarity of species composition in alpine meadow communities. Geographic distance, climate dissimilarity, and elevation difference together explained 62% of the variation in compositional difference between alpine meadow communities; while the pure effect of each of the three sets of explanatory variables was very low. The fact that the vast majority of the variation explained by geographic distance, climatic dissimilarity and elevation difference cannot be independently attributed to either variable suggests that three main variables and others operate together in determining regional patterns of species composition in alpine meadows on the Tibetan Plateau.

Spatial and Temporal Variability in the Net Primary Production of Alpine Grassland on the Tibetan Plateau since 1982

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Keywords: Tibetan Plateau spatio-temporal patterns NPP trends CASA model net primary production

Based on the GIMMS AVHRR NDVI data (8 km spatial resolution) for 1982–2000, the SPOT VEGETATION NDVI data (1 km spatial resolution) for 1998–2009, and observational plant biomass data, the CASA model was used to model changes in alpine grasslandnet primary production (NPP) on the Tibetan Plateau (TP). This study will help to evaluate the health conditions of the alpine grassland ecosystem, and is of great importance to the promotion of sustainable development of plateau pasture and to the understanding of the function of the national ecological security shelter on the TP. The spatio-temporal characteristics of NPP change were investigated using spatial statisticalanalysis, separately on the basis of physico-geographical factors (natural zone, altitude, latitude and longitude), river basin, and county-level administrative area. Data processing was carried out using an ENVI 4.8 platform, while an ArcGIS 9.3 and ANUSPLIN platform was used to conduct the spatial analysis and mapping. The primary results are as follows: (1) The NPPof alpine grassland on the TP gradually decreases from the southeast to the northwest, which corresponds to gradients in precipitation and temperature. From 1982 to 2009, the average annual total NPP in the TP alpine grassland was 177.2×1012 gC yr-1(yr represents year), while the average annual NPP was 120.8 gC m-2 yr-1. (2) The annual NPP in alpine grassland on the TP fluctuates from year to year but shows an overall positive trend ranging from 114.7 gC m-2 yr-1 in 1982 to 129.9 gCm-2 yr-1 in 2009, with an overall increase of 13.3%; 32.56% of the total alpine grassland on the TP showed a significant increase in NPP, while only 5.55% showed a significant decrease over this 28-year period. (3) Spatio-temporal characteristics are an important control on annual NPP in alpine grassland: a) NPP increased in most of the natural zones on the TP, only showing a slight decrease in the Ngari montane desert-steppe and desert zone. The positive trend in NPP in the high-cold shrub-meadow zone, high-cold meadow steppe zone and high-cold steppe zone is more significant than that of the high-cold desert zone; b) with increasing altitude, the percentage area with a positive trend in annual NPP follows a trend of "increasing-stable-decreasing", while the percentage area with a negative trend in annual NPP follows a trend of "decreasing-stable-increasing", with increasing altitude; c) the variation in annual NPP with latitude and longitude co-varies with the vegetation distribution; d) the variation in annual NPP within the major river basins has a generally positive trend, of which the growth in NPP in the Yellow River Basin is most significant. Results show that, based on changes in NPP trends, vegetation coverage and phonological phenomenon with time, NPP has been declining in certain places successively, while the overall health of the alpine grassland on the TP is improving.

Turmeric, Ginger and Kaempferia is Creating Livelihood Generation for Poor Rural Tribal Women Communities (Self Help Group) in Chatabar Gram Panchayat of Khurda District in Odisha, India- Through Technological Innovation

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Keywords: Livelihood climate Change

Since Odisha is the second largest state in area of production of Turmeric (Curcumine longa) it is one of the most ancient species and today it is a valuable source of foreign exchange because of its multipurpose use in medicine, cosmetics and flavoring industries worldwide. Important value added products of turmeric are curcumin, essential oil, powder and oleoresin. Curcumin is now being used in anti-cancer drug development programme. Turmeric oil is used in aromatherapy, perfume industry and in preparation of mosquito repellant. Oleoresin of turmeric is used in flavoring industries as a replacement for the powdered rhizome and powder is used generally in cooking. Ginger (Zingiberofficinale) it is one of the important medicinal plant marketed all over the world in different forms such as raw ginger, dry ginger, ginger powder, ginger oil, ginger oleoresin, ginger wine etc. Kaempferia galanga the essential oil of this plant has been used to treat diseases like rheumatism, pile, cough, throat infection, bad breath, epilepsy and ulcer, anti-tumor and skin disorder. Chhatabar Grampanchayat' of 7 villages and 20 adjoining villages of Khurda district, Orissa consisting of 7 villages,revealed, majority of community belong to either Scheduled Tribes, Scheduled Casts or Other Backward Class

The community generates their livelihood basically from agriculture which is subjected to repeated natural disasters like drought and famine, over all climate change. Present project involves adoption of a biotechnology based alternate livelihood generation scheme through mobilizing the community production of value added products from their agriculture produce ginger, turmeric and kaempferia powder by standard method and essential oils, curcumin, oleoresin by steam distillation and selling of these value added products at national and international market through buy back arrangement with established private export units and concerned government organizations.

Active SHG groups operating in the locality are identified and through them villagers motivated about importance of medicinal plants products in national and global market.

Training and demonstration program continued for women, farmers and unemployed youths about production of value added products from ginger, turmeric and kaempferia. Special training sessions for SHG groups conducted on extraction of value added products, marketing of the products and sharing the benefits from the business. A customized production unit set up in organization's own land at RHC, Jamujhari of the panchayat and extraction of value added products (powder, essential oils, oleoresins)

carried out by the organisation with the help of village people and SHG of Chhatabar. Direct participation of self help groups in generating alternate livelihood scheme for the community through production of value added products like powders, essential oil and oeloresins.Generation of trained man power through conducting training at our laboratory.Involvement of unemployed youth (both educated and uneducated) as young entrepreneur to set up such low cost high return processing unit at different villages of the Gram Panchayat.

Prediction of Land Use Changes Based on Land Change Modeler (LCM) Method Using Remote Sensing: A Case Study of Muzaffarpur (Bihar), India

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Keywords: Remote Sensing Land Use Change, Land Change Modeler (LCM) IDRISI

Land use change models are tools to support the analysis of the causes and consequences of land use dynamics. Land use and land cover change (LUCC) has been recognized as an important driver of environmental change on all spatial and temporal scales. The primary objective of this paper is to predict and analyze the present and future growth of Muzaffarpur city and its surrounding, Bihar (India) using the Landsat satellite images of 1988 and 2010. These data are used for change prediction and for preparation of prediction map of year 2025 and 2035. IDRISI, Land Change Modeler (LCM) was used to analyze the land use and land cover changes between various classes during the period 1988-2008. Erdas Imagine software-9.3 were also used to prepare land use/cover classification using image processing supervised classification method in a multi-temporal approach. The prediction of land use land cover change was done on Neural Network built-in module in the Selva version of IDRISI. The accuracy was obtained as 72.28% for all the conversion types.

Geospatial Strategy for Adverse Impact of Urban Heat Island on Urban Environment and Natural Resources using LANDSAT ETM+ Sensors

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Keywords: NDVI Surface temperature Dynamic changes

We are living in the age of a rapidly growing population and changing environmental conditions with an advance technical capacity. This has resulted in wide spread land cover change. One of the main causes for increasing urban heat is that more than half of the world's population lives in a rapidly growing urbanized environment. Satellite data can be highly useful to map change in land cover and other environmental phenomena with the passage of time. Among several human induced environmental and urban thermal problems are reported to be negatively affecting urban residents in many ways. The built-up structures in urbanized areas considerably alter land cover thereby affecting thermal energy flow which leads to development of elevated surface and air temperature. The phenomenon Urban Heat Island implies 'island' of high temperature in cities, surrounded by relatively lower temperature in rural areas. The UHI for the temporal period is estimated using geospatial techniques which are then utilized for the impact assessment on climate of the surrounding regions and how it reduce the sustainability of the natural resources like air, vegetation. The present paper describes the methodology and resolution dynamic urban heat island change on climate using the geospatial approach for the Haridwar district of Uttrakhand, India. NDVI were generated using day time LANDSAT ETM+ image of 1990, 2000 and 2010. Temperature of various land use and land cover categories was estimated.

Estimate of Grassland Net Primary Productivity and Its Response to Environmental Variability in Northern China for 1980–1999: a Synthesis of Field Data

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Keywords: Grassland net primary productivity Field measurements Environmental variables Dominant factor Northern China

Reliable field-derived net primary productivity data for grassland are needed for the development of realistic carbon budgets in China to validate and calibrate global biogeochemical models. However, a review of databases commonly used to address these issues reveals serious gaps, in particular for 1980–1999. To fill this gap, a grassland in situ net primary productivity database comprising 653 samples for northern China for 1980–1999 was developed based on a literature review of published biomass and forage yield field measurements. The spatial pattern of grassland net primary productivity and its response to environmental variables, such as climate, soil and topography, were explored using spatial statistical analysis. Grassland net primary productivity were mainly distributed from 100 gC/m2a-1 to 500 gC/m2a-1, showing a significant difference among meadow, steppe and desert ($p<0.05$). Significant spatial autocorrelation was found for grassland net primary productivity for all samples except for those

in the Xinjiang. Net primary productivity increased with annual precipitation and declined with annual mean temperature. Specifically, precipitation has a greater impact on steppe and desert, and temperature on meadow. Grassland net primary productivity decreased with increasing altitude at less than 1500 m because of water limitation, and increased at higher altitude due to most distribution of meadow. Grassland net primary productivity is positively correlated with slope, but weakly correlated with aspect. Annual precipitation is the dominant factor affecting the spatial variability of net primary productivity, followed by soil quality, which has a positive effect on grassland net primary productivity.

Evaluating the Net Primary Productivity in the Grasslands of Southern China from 2001 to 2010 Using a New Land Portfolio Assessment Model

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Keywords: Productivity of Southern China's grasslands Spatial and temporal pattern of NPP Land portfolio assessment model Ecosystem modelling Grassland ecosystem

Grassland ecosystems play important roles in the global carbon cycle. The net primary productivity (NPP) of grassland ecosystems has become the hot spot of terrestrial ecosystems. To simulate the NPP in the grasslands of Southern China, we built a land portfolio assessment (LPA) model according to the framework and theory of this model. The model was driven by two parameters: leaf area index and photosynthesis accumulation (PA). PA is represented by the amount of net photosynthetic production based on fixed-point observation and the inherent implication of NPP. PA(x, t) is the PA on x pixel in t month, which is influenced by various climatic factors, especially precipitation and temperature. In this study, monthly temperature, monthly precipitation and monthly solar radiation were selected as the main influencing factors for building the equation for PA(x,t). The model was designed as followed: NPP(x,t)=LAI(x,t) PA(x,t)

(1)where NPP(x,t), LAI(x,t) and PA(x,t) stand for the NPP, LAI and PA on x pixel in t month respectively.LAI is one of the important parameters of the LPA model. The output is apportioned according to Beer–Lambertas law: LAI(x,t)=Ln(I/I0)/K

(2)where I0 and I are the light intensities over the canopy and base of the vegetation, respectively, K is the extinction coefficient for canopy and I/I0 is light transmittance. Studies indicate that a significant linear relationship exists amongst I/I0, K and NDVI. Therefore, taking the NDVI value as the independent

variable, and I/I0 and K as the dependent variables, the linear equation is as follows:I/I0=a1×NDVI(x, t) + b1

(3)K= a2×NDVI(x, t) + b2

(4)Inserting the actual independent variable values of Eqs. (3) and (4) into Eq. (2), we obtain a new equation that represents the relationship between LAI and NDVI.LAI(x, t)＝Ln(a1×NDVI(x, t)+b1)/(a2×NDVI(x, t)+b2)

(5)where a1, b1, a2 and b2 are undetermined coefficients.

(6)where T is the monthly temperature on x pixel (°C), t1 is the modified coefficient for temperature, W is the monthly precipitation (mm), w1 is the modified coefficient for precipitation, R stands for the monthly radiation and r1 represents the modified coefficient for solar radiation. The results showed that the NPP values in the study area had a decreasing trend from east to west and south to north and that the mean NPP was 320 g C m-2 yr-1 from 2001 to 2010. Correlation analysis showed that the correlation coefficient (r) between NPP and highest monthly mean temperature of a year was maximum (0.6422), and the r value between NPP and annual precipitation was minimum (0.3821). Using trial and error, the LPA model accurately simulated the NPP dynamics of Southern China's grassland ecosystem, and the results were biologically realistic.

Mobile Message Delivery and Internet Based Decision Support Systems for Zud Early Adaptation in Mongolian Pastoralists

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Keywords: Early warning system Climate change adaptation Mobile message system

Herders in Mongolia are mostly affected by climate change more than urban residents. Because herders' livelihood is dependent with seasonal difference, weather conditions, and landscape resources of vegetation, water, natural zones, soil productivity and others. During the last 2 decades, herders had taken most affection of climate change impacts on their hard herding condition and lower households' income. Therefore, these householders have very high socio-economic vulnerability and they needed early adaptation systems from climate changes of increased zud (colder and snowed winter than multiyear average) frequency, drought, dust storms and low precipitation. (Lessons from the Dzud:

Research result of Vulnerability of herders2009-2010) This study is developed early warning system for both herders and local governance based on mobile message service and internet based decision support systems. Mobile message based forecasting system is including weather information, forage information, and possible non snowed areas information that can be help to herders to manage their pastoral herding a daily.Internet based decision support system is including livestock numbers, carrying capacity of pasture, herder's location, possible moving plan, marketing information and collaborative sums that can be help to the local governors' to make best solutions on survive of climate impacts. Finally this system started practically from August 2013 in the one sum of Mongolia that gives a good information system for herders and good feedback for researchers.

Climate Change Impact and Adaption Options for Urban Low Income People of Bangladesh: The Contextual Variation, Opportunities and Barriers

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Keywords: Urban Slum Flood Risk reduction framwork adaptation option opportunities barriers

Climate change is a global phenomenon; the adverse effects are evident and natural disasters are more frequent. Apart from rural people, the urban low income people are the worst sufferer of climate change impacts who live in informal settlement (slums). Slums are high-density areas with poor housing and lack of basic services. The vulnerability of these settlements is increased as their low income, social recognition, poor access to information limit their ability to move to safer environment. Moreover, these people have a significant deficit in adaptive capacity due to lack of protective infrastructure, financial support, socio economic condition, technology and limitation in urban government. Slum people are mostly garments workers, day laborers, street hawkers and unable to work during flood which results in increased expenditure and reduced income. For example, during flood in Karail Slum of Dhaka city, the income level is reduced whereas expenditure increased for food by 23% and transportation by 56%. In this case, their main priority is to meet their basic need rather than to expend for disasters. This research has focused on urban flood with case studies from two low income settlements of Dhaka and Khulna city of Bangladesh. Khulna is in coastal area and in Dhaka city most of the slums are located in low lying areas or flood flow zone. This research has developed a 'Risk Reduction Framework' to derive the flood impacts on these low income people, adaptation options and opportunities. Later, barriers have been identified to implement those options. Here, two different case studies have been taken to understand how the climates change impacts vary with location and consequently the adaptation options have been changed. Ignoring the variation in adaptation options and barriers may worsen the urban life especially the low income people which ultimately impact the development of the country.

Impact of Climate Change on Rainy Days in Bangladesh during 1950-2009

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Keywords: Trend of rainy days Climate change Extreme rainy days Bangladesh

The impact of climate change on annual rainy days has received a great deal of attention by scholars worldwide. Many studies have been conducted to illustrate that changes in annual rainy days is becoming evident on a global scale. Bangladesh is likely to be one of the most vulnerable countries in the world due to climate change. In the present study, 60 years (1950-2009) daily rainfall data of 13 meteorological stations of Bangladesh Meteorological Department (BMD) have been used. Seasonal and yearly trend of rainy days (greater than 01 mm/day) are studied. Variation of three threshold rainy days named: Moderated Heavy (22-44 mm/day), Heavy (45-88 mm/day) and Very Heavy (greater than 88 mm/day) are also studied. The country is divided into two regions named: wet region and dry region. All the stations show positive trend of yearly variation of rainy days except in Srimongal (situated in northeastern part of Bangladesh) during 1950-2009. All the four seasons (winter, pre-monsoon, monsoon and post-monsoon) showed positive trend of rainy days during the study period 1950-2009. The country's averaged three threshold rainy days also showed positive trend. The yearly averaged rainy days in the wet region (122 days) was higher than that of dry region (105 days) during 1950-2009. The averaged rainy days in the winter, pre-monsoon, monsoon, and post-monsoon period was 04, 23, 77 and 10 days, respectively. The wet (dry) region showed negative (positive) trend of rainy days during 1950-1979 whereas wet (dry) region showed positive (negative) trend of variation of rainy days during 1980-2009. The country's averaged rainy days showed negative trend during 1950-1979 and positive trend during 1980-2009. These changes indicate that the climate of Bangladesh is changing. The yearly averaged increase of rainy days was 0.35 days/year.

The Correlation Analysis between the Changed Trend of Extreme Precipitation and Flood Disasters in China

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Keywords: Flood disaster extreme precipitation events the affected area

China is a vast country, geographical conditions differ a great deal, and many parts of the east area are affected by the special monsoon climate. This determines the uneven space-time distribution of precipitation in our country, precipitation's annual variation is obvious. Population increase, economic development, land development, property density increases continuously, lead to the increase of fragility of the carrier and exposure degree. Combined with the flood disasters, they caused serious damage. Extreme precipitation is the main natural factors causing floods, namely disaster-causing factors. This paper used the precipitation data and flood events' information of the last five decades, space-time distribution of extreme precipitation events and flood characteristics were studied. The results showed that: For nearly 60 years, the occurrence of flood had distinct stages, the affected area was large during 50s to the mid of 60s, and it was around 10 million hectares of ups and downs, there was less extreme precipitation events during the mid of 60s to the early 80s, so the affected area was small during this period. Extreme precipitation events had an obvious increasing trend during the early 80s to 90s, the affected area significantly increased, the number of collapsed houses and the direct economic losses were large also, since the 2000, the affected area reduces gradually, and the direct economic losses had a slight fluctuation. Extreme precipitation events are mainly distributed in Southwest region, the middle and lower reaches of the Yangtze River region, southern China, extreme precipitation events have obvious increasing trend as the years. In the middle and lower reaches of the Yangtze River, the Meiyu period is from the mid of June to the early July, and it is the precipitation concentration period, it's also the flood concentration period, the period from May to June and the period from August to September are the precipitation concentration period in Southern China, extreme precipitation events increased rapidly in 90 s in the middle and lower reaches of the Yangtze river region and Southern China, the whole Yangtze River basin suffered a severe flood event, which is only next to 1954, combined with the flood in the Songhuajiang and Nenjiang area, 29 provinces, cities and autonomous regions were affected, hundreds of millions of people were affected by the flood, nearly 5 million houses collapsed, more than 2000 hectares of land flooded, economic losses of more than RMB 160 billions . Precipitation is relatively concentrated in Huang-huai-hai region during July and August, it is easy to cause floods in summer, extreme precipitation events concentrated in the Bohai rim region. The rainy season is short in northeast China, the precipitation is relatively large in July, there were more extreme precipitation events in the 80 s. June is the precipitation concentration period in Southwest China's Guizhou province, Sichuan province, Chongqing province and Yunnan province's precipitation is large during June to August, extreme precipitation events in Southwest China were more and more concentrated in 60 s to 80 s. Inundated area was 167000 hectares in Yunnan province in 1986, accounted for 6% of the cultivated land area, accounted for 16.9% of the all kinds of natural disasters inundated area, the number of extreme precipitation event increased after 2000 in Southwest China.

The Variations Trend of Droughts in China in Recent 50 Years

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Keywords: Drought disaster

Drought is one of the most serious natural disasters in China which results in the most severe losses every year. Under the background of global climate change, drought is getting more and more serious. Based on the gridded climate data of China provides by National Climate Center and the disaster statistic data, taking the precipitation anomaly percentage as the standard of drought grade, we have analyzed the tendency and interdecadal change of droughts, the spatial distribution of droughts and the disaster situation during the last 50 years. The results show that there is an about 20-year-cycle of drought in China, and the drought situation presents clear regional spatial differences. Arid areas which are at much drier tendency are mainly located in Northeast China, North China and eastern of Northwest China. In addition, the West Tibet and parts of Southwest China also presented a tendency of drying. During the recent 50 years, droughts occurred in most regions of China more than 10 times and in some areas even up to 30 times or more. The seriously drought areas mainly occurred in western part of Northwest China, North China and central China. Due to the cyclical fluctuations of precipitation, droughts presented a periodical change. According to our analysis, there are three high-value phases of drought areas: the period of 1958-1962, the period of 1971-1981 and the period of 1999-2002. The drought area of each year is almost up to 20 million hectares, and even more than 30 million hectares. During the past 50 years, the drought was becoming more and more serious, drought area reveals an increasing tendency and showed a negative correlation with the interannual variability of precipitation anomaly percentage.

Spatial-temporal Variation of Drought in China during the Past 52-Years

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Keywords: Drought SPI China 3D drought extraction spatial-temporal variation climate anomaly

Under the background of global climate change, drought has been becoming more and more frequent and severe over many regions of the world. During recent years, China has suffered few devastating droughts that resulted in enormous losses. In order to reveal the spatial-temporal variation of drought in China during the past 52-years, SPI (Standardized Precipitation Index) was calculated based on 〖0.25〗^° *〖0.25〗^° grid monthly precipitation data ranging from 1961 to 2012.In the three dimensional SPI

space (longitude*latitude*time), we developed a three dimensional identification method considering both the spatial and temporal characteristics of drought to extract drought events during the past 52-years. The spatial distribution of drought events was analyzed using EOFs (Empirical Orthogonal Functions). Mann-Kendall trend test method was employed to analyze the temporal trend of drought frequency and severity. Drought event lasting from 201012 to 201112 and spreading from North China Plain to Southwestern China, was ranged as the most severe drought event. The early 1960s and 2000s are the two periods with higher drought severity. Southwestern China shows an increasing trend of drought, especially in the 2000s. Xinjiang region and Tibet Plateau show a decreasing trend. The teleconnections between drought events and climate anomalies was also discussed. It is showed that El Nino event may lead vast drought events over eastern China in few months ahead. It is also pointed out that the propagation from climate anomalies to drought events need further research.

Influence of Indian Ocean Warming on the Monsoon Intraseasonal Oscillation

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Keywords: MISO Indian Ocean warming

The Indian Ocean sea surface temperature (SST) during the boreal summer has shown a significant warming of 0.3 degreeC in the recent decade (2001-2010) compared to a former decade (1979-1988) and it is most pronounced in the central tropical Indian Ocean. By using reanalysis and satellite-derived datasets, we investigated how the monsoon intraseasonal oscillation (MISO) over the south Asian summer monsoon (ASM) region has been influenced by the recent warming in the Indian Ocean. It is found that the MISO variance has increased over the ASM region in the recent period compared with the earlier decade. It is also noted that the characteristic northward propagation of the MISO has slowed in 2001-2010, resembling more of a standing oscillation near the equator. Mechanisms implicated in the observed MISO changes are explored by conducting several model sensitivity experiments with an atmospheric general circulation model (AGCM). The model experiments suggest that the mean SST increase over the Indian Ocean and the associated changes in the air sea interaction, the mean increased moisture convergence, and changes in the large-scale circulations are responsible for the change in characteristics of the MISO. The influence of the recent Indian Ocean warming on the MISO characteristics must be understood fully since they determine the seasonal amount of rainfall over the Indian subcontinent. An examination of future projections of the MISO using model MPI-ESM-LR from the CMIP5 archive also gives consistent result.

Hazard Assessment of Glacial Lake Outburst Flood and Potential of ICTs for Coping: A Case of Eastern Himalaya of Nepal

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Keywords: Climate change, GLOF, Hazard, Tiptala, Glacial Lake Kanchanjungha, Conservation, Disaster

Alarming rate of retreat of glaciers and formation of glacial lakes in higher elevation of Nepal Himalaya has been reported to be related with the pronounced atmospheric temperature rise in the region. However, due to the limited researches in the highland areas, there is huge information gap to formulate the adaptation strategies to cope with the climate induced disaster in vulnerable mountain community and fragile ecosystem. Glacier Lake Outburst Floods (GLOF) are the growing climate induced hazards in the Himalaya. This study tried to come up with the potential impacts in burst scenario of a glacial lake in highland of eastern region of Nepal and potential role of Information Communication Technologies (ICT) in coping strategies. In this study, I analyzed the climatic data of the Eastern Himalaya Region of Nepal available from Department of Hydrology and Meteorology (DHM), Government of Nepal, and also prepared the latest map of the glacial lakes using google earth and ArcGIS application in the upland of the Kanchanjungha Conservation Area of the region. To study the potential impacts of GLOF, Tiptala glacial lake (Khemama Taal) located at 4990 masl was chosen based on its size and accessibility. Google earth and ArcGIS application was used to identify and in mapping the glacial lakes in the highland. I used key informants interviews in the study area to discuss their perception towards climate change, glacial hazards and potential of ICTs for coping strategies of the communities to the climate related problems. Mapping of glacial lake in the highland using Google earth and ArcGIS application found 46 glacial lakes of varying sizes. Six of those glacial lakes were found bigger than 0.1 sq. km in size and total area covered by all glacial lakes was in the region found to be over 2.5730 sq. km. Field study to the Tiptala glacial lake found the lake in risk of burst considering the present geographical situation, landslides near the outlet of the lake, and past GLOF record from the same lake. Though the larger portion of the downstream area of the Tiptala glacial lake falls on wilderness area, few villages, pasture lands for Yaks, foot trails, and bridges across the Tamor river are in risk. Currently, there is very limited access to modern communication technologies in the area due to its remoteness and less purchasing capacity of people living in the area. Interview with key informants show that access of local residents to modern information communication technologies help them update with the current happenings and broaden their knowledge which ultimately assist in coping strategies and adaptation of climate induced disasters in the region by early and informed decision making.

Reliability Testing of the Daily Observed Precipitation Records and Detection of Extreme Events' Trends for the Assessment of Climate Change Impacts in the Upper Indus Basin and Surrounds

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Keywords: Hydrological Impacts Extremes Data Reliability Trends

Quality assessed meteorological data input to the hydrological models is of prime importance to get reliable outcomes for the assessment of impacts of changing climatic conditions on the hydrology as well as volumes and timings of flows in a catchment. Pakistan water resources are highly vulnerable under the global warming and experiencing frequent hydrological and climatological extremes. The rivers of the Indus basin drive most of its river flows from snow and glacier melts lying in the Pakistan's Northern Mountains. It is reported that glaciers in the Hindu Kush-Karakoram-Himalaya (HKH) region are retreating and have serious implications for the water resources. To assess the impacts of climate change on flows of Indus River and its tributaries it is necessary to have a quality assessed climatological data as an input to the Hydrological Model. It is therefore recommended to make sure (through the use of different statistical tests) that the data sets to be used are homogeneous and free of artificial variations/trends. Therefore, the present study is being conducted to obtain reliable climatological data using some advanced statistical analysis to remove uncertainties and in-homogeneities. The presence of uncertainties and in-homogeneities in the hydro-meteorological data (due to factors, such as station locations, changes in instrumentation, changes in the local environment and urbanization, introduction of different observing practices) limit the reliability of output from Hydrological models and cannot be used for impact assessment studies. For this study observed daily precipitation (snowfall and rainfall) data for 50 years (1961 to 2010) for 16 Pakistan Meteorological Department (PMD) stations have been used for quality and reliability testing and trend analysis using homogeneity analysis and parametric and non-parametric trend analysis. Three different homogeneity tests naming Pettitt's test, Standard Normalized Homogeneity test & Buishand's test were applied on the daily precipitation records. The precipitation records that proved to be homogeneous were used to ascertain seasonal and annual trends using Mann-Kendall (MK) test and simple linear regression. The data obtained after applying the above mentioned tests identified the quality of data, missing data, non-realistic climatic variations and trends of series. Quality assessed data will be further used with more confidence as input to hydrological model to get realistic simulated flows.

Long-term Summertime Sea Surface Temperature Variability in the Taiwan Strait

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Keywords: Sea surface temperature, ENSO

This study was part of Taiwan Integrated research program on Climate Change Adaptation Technology (TaiCCAT). Long-term (1982–2012) advanced very-high-resolution radiometer (AVHRR) data collected at a resolution of 0.04º clearly indicated the sea surface temperature (SST) warming and variations associated with El Niño Southern Oscillation (ENSO) in the Taiwan Strait (TS) in summertime. Between 1982 and 2012, the spatially averaged warming trend in the TS was 0.057 °C/yr. However, during the last 10 years studied, the warming phenomenon appears to have paused, and a slight cooling rate (0.03°C/yr) was measured. Moreover, the monthly transition of SST from Jun to July became increasingly sharp.

The 1st mode (70%) of the Empirical Orthogonal Function (EOF) analysis indicated a SST warming trend. The warming occurred especially in the eastern strait and reached a rate of 0.065–0.08 °C/yr. In addition to this long-term warming, the 2nd mode of the EOF analysis performed on the last 19 years (because the signal of long-term SST warming was weak) revealed a pattern (10%) that explained the inter-annual variation of the SST, which was strongly correlated with wind speed. Strong winds enhanced the upwelling along the China coast, eastern Taiwan Banks, and southern Peng-Hu Islands, whereas the temperature in eastern TS increased because of increased transport of the warm waters of the South China Sea. The inter-annual variation of the southwesterly wind could be affected by both ENSO and the background Pacific Decadal Oscillation (PDO) phase. The strongest upwelling in the TS that was associated with the southwesterly wind tended to occur when ENSO and PDO were in phase.

Application of Linear Regression Ensemble Forecast in Air Quality Muti-Model Forecast System

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Keywords: Air quality ensemble forecast linear regression

Large uncertainty still exists in air quality model. In this study, based on multi-model air quality forecast system, ensemble forecast methods are established to reduce the uncertainty in air quality models. Firstly, the performances of the three models (NAQPMS、CAMx、CMAQ) in EMS-Beijing are evaluated. Then ensemble forecast methods are used to improve the forecast skill. The results shows: (1) the ensemble mean ensemble method cannot perform better than the best model in forecasting tendency or minimizing deviation; (2) Linear Regression (REG) forecasts tendency more accurately. If an appropriate training length (36 days) is chosen, the bias averaged by all stations is reduced to 5.79 μg/m^3, the correlation between observation and prediction reaches 0.54 and the RMSE (root mean square error) is reduced to 60.48μg/m^3, which are better than best model. The ensemble forecast skill for pollutant case is further improved due to this method modified the system bias largely.

Implication of Forest Land Cover Degradation and Climate Change on Drying up Natural Spring and Effects on Poor Ethnic Community of the Chittagong Hill Tracts

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Keywords: Forest Land Cover Natural Spring Climate Change Chittagong Hill Tracts

Mountains cover approximately one-quarter of the world's surface and are home to 12% of the human population. Mountain ecosystems play a critical role in world development by providing key environmental services such as freshwater and biodiversity conservation. Likely in Bangladesh, Chittagong Hill Tracts (CHT) supports almost 80% of the country's total biodiversity. It is a distinct region in terms of its ethnic, cultural and environmental diversity to the rest of Bangladesh. Given the importance of this area, there are significant development gap between this area and plain land area due to its isolated location, geographic features and complex terrain. It lacks most basic infrastructure facilities such as communication, access to safe drinking water and basic health services. Like other natural resources, people are dependent on springs and streams for water which is interestingly the main reasons for the location of different settlements. It is assumed that a hundred years ago, about 200,000 springs were flowing over the CHT area. However they are in decline and CHT peoples are finding it increasingly difficult to access safe water for their needs. This study has shortlisted fourteen springs with different flow conditions; dead, reduced flow and full flow from the three districts; Rangamati, Khagrachari and Bandarban. Different methods have been used for data collection; geological and climatic data, satellite imagery and community interviews. Four major reasons have been identified for degradation of spring flows; deforestation, land use changes, changes in climate and physical interventions. Among these four reasons study has found that deforestation is the most significant reasons for drying up the springs. Between 1989 and 2003, 50% of dense forest was lost over the CHT

area. The most severe condition was observed in Khagrachari district (approximately 95% losses). Population pressure and livelihoods were identified as the dominant factors causing degradation of natural forest and land use change in the study area. Deforestation generally increases soil erosion rate, by increasing the amount of runoff and reducing the protection of the soil from tree litter. As a result less water is percolated to recharge groundwater and eventually dries up of the hilly water sources. Moreover these springs are largely recharged by rainwater infiltration. Climate change impacts, manifested in the form of decreased rainfall increased sunshine hours and evaporation have reduced the natural groundwater recharge and results in drying up of natural springs.

Preliminary Study of the Land Use and Cover Changes in the Central Economic Development Region of Mongolia from 1990 to 2012

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Keywords: Land use and cover changes central region of Mongolia

The land use and cover changes on regional scale is of most importance because of global change concerns. The central region of Mongolia is one of the biggest economic development area (474841 км2) due to recent mining activity as well as other activity. Most of the studies for land use and cover changes in Mongolia have been focused on the national scales, but study of regional scales such as economic development region is less studied. Our objective was to assess land use and cover changes over the past 22 years under rapidly increasing mining and human activities in the Central region of Mongolia using satellite imagery (Landsat TM, +ETM) based on RS and GIS. Results indicated that there is a most significant decrease (46%) in dry steppe area. Also, area of eroded due to mining activity has increased by 2.7 times over the last 22 years. Therefore, lake and ponds, forest, typical steppe, wetland steppe, dry steppe, alluvial steppe and very dry steppe have decreased by 29.4%, 18.7%, 14.8%, 12.4%, 6.2%, 3.3% and 2.5% respectively. In opposite, area of forest steppe, desert steppe, semi desert steppe, sandy desert, urban, agriculture and sandy area have increased by 26.8%,6.4%, 20.9%, 52%, 31.5%. 11.1% and 5.2% respectively. It likewise, 23.6% (112063 km2) of total area in central region of Mongolia are directly influenced by external impacts. Their land use and cover changes were a greatly affected from following factors. From 1990 to 2012, livestock population increased by 66%, totally 1657 numbers (91675 km2) of mining and exploration licenses given on-hand, incoherence activities of individually explore mining are increased. Due to above activities, the regional ecosystem being imbalance, and land degradation is more obvious and serious deterioration of the soil and pastures, and the forage grass of high quality was gradually recessed or replaced by inferior plants.

Study on Soil Moisture Transformation Mechanism based on Hydrogen and Oxygen Stable Isotope Tracing

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Keywords: Stable isotope, unsatuated zone,soil water

The north China plain is one of important grain production base in China, irrigated crops is the dominant user of extracted groundwater. The exploitation of groundwater gradually increases. Groundwater overdraft threatens the future of irrigated agriculture and food security in the North China Plain. Improved understanding of water cycling through the soil–plant–atmosphere continuum in the North China Plain is necessary for improving the sustainable utilization of limited water resources.

In this subject, stable isotopes will be used to study farmland soil water transformation mechanisms in the North China Plain. In combination with precipitation, irrigation water, soil water, stem water isotope characteristics analysis, we will explore the depth of the root water uptake for the main crops (winter wheat and summer corn) in the North China Plain. Supported by the method of water balance, the isotopic information and linear mixing models, evapotranspiration will be segmented under the condition of irrigation. By observing soil moisture content and water potential in the study area, dynamic variation rule of soil water will be analyzed. In combination with the method of water balance, the isotopic message and isotope linear mixing models, we will calculate the soil water exchange flux at the interface. And by the Darcy's Law, we would finally get the water transformation model in the unsaturated zone. In addition, supported by the crop water use efficiency combined with crop production under different irrigation quantity, we would reach the optimal irrigation quantity. This would help reduce water production and waste under the condition of guaranteeing the crop production. 26 precipitation samples have been collected from 2013.6 to 2013.10. The isotope analysis reached the meteoric water line in the study area was: δD= 7.3 δ18O+1.74. Its slope is less than the slope of the Global Meteoric Water Line, which indicated that evaporation changed obviously in the process of rainfall. 17 soil water samples have been collected from 2013.6 to 2013.10, and isotope analysis reached the conclusion that the average value of δ D and δ 18O was respectively -47.0 and -6.78 in the surface soil water(0~20cm) . And in the subsoil water(20~200cm), the average value of δ D and δ 18O was respectively -63.3 and -8.72, which also indicated that soil water evaporation caused the isotope enrichment. Supported by data analysis, the isotope distribution varied with growth stages. In combination with soil water isotope information and stem water isotope information, we would obtain the main range of the water uptake depth during the growth stages of winter wheat and summer corn.

This study would help enhance our understanding about the progress of soil moisture transpiration through the soil–plant–atmosphere continuum, and provide theoretical basis for improving the efficiency of agricultural water in the north China plain.

Analysis of Plant Morphogenesis and Inflorescence Architecture on Three Solanaceae Species

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Keywords: Plant architecture, tomato capsicum petunia, meristem state

Inflorescence and plant architecture has close ties to the yield and quality of crop especially horticultural crop, and is the key research of the model of plant structure and function. Inflorescence classification based solely on morphology makes some botanical terms blurry. The architecture of the inflorescence and plant provides a new insight for classification of inflorescence and plant. Using three Solanaceae plants namely, tomato, petunia and sweet pepper, we determined the modular structure of these plants at the meristem level. By analyzing the mutant phenotypes, we deduced the impact of genes on meristem activities and plant architecture. Based on the existing researches, we use the "Veg" (vegetativeness) value, which is characterized for the vegetative growth capacity and can relate the regulation of genes on meristem activities with plant architecture. At the gene level, we analyzed the link of the development process of the mutant plants on tomato to the "Veg" value of the meristem, which can provide a theoretical basis for the study on the molecular mechanism of plant architecture and systematic and evolutionary botany.

The key results are presented as follows:
(1) The construction of modular structure by maintenance and transformation of meristems were illustrated in these plants. By comparing the plant architectures, the following parameters are defined to model the architecture of these plants: the number of sympodial units, the number of phytomers per sympodial unit, the type of reproductive structure (inflorescence or flower). We found that plants apparently vary different in morphology can be simply transformed.

(2) Association of development process on tomato plants with different meristem states which can provide the genes regulation of the value of "Veg" in meristem activities with schematic diagram in the development of tomato wild-type and mutant plants, so we can conclude that the tomato SP gene reduced the "Rep" value of the meristem while the SFT and FA gene increased this value.

We connect the internal factors that affecting plant species with external morphological characteristics from the gene, meristem and plant architecture level, and we realize the classification of three species of Solanaceae plant, which so as to provide the basis for solving classification of inflorescence and plants.

Identification of Groundwater Hydrochemical Variables Influencing Water Quality in Recharged Area by the Yellow River Using Geochemical Factor Analysis

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Keywords: Groundwater quality Factor analysis Recharge area

Factor analysis(FA) has been successfully used to sort out hydrologic process-response relationships from commonly collected groundwater chemical and physical data, for its advantages in reduction of large-scale datasets into a smaller group of factors with minimum loss of information, and then provides more understandable insights into spatially and temporally distribution differences and interrelationship among all of the variables. Fifty three groundwater quality samples from wells, located in irrigation recharged area by the Yellow River in North China Plain, were analyzed for major dissolved constituents, besides some physical parameters, like pH, electronic conductivity, dissolved oxygen, oxidation-reduction potential and T, were measured in situ. The present study shows the combined application of FA and hydrochemical facies for identification of main factors affect groundwater quality and their interrelationship, and result of this study clearly demonstrate that FA is a reliable tool for differentiation of natural and anthropogenic processes affecting groundwater chemistry, and point- and non-point- source pollution.

Research on the Groundwater Salinization in Yang River-Dai river Basin ViaHydrochemistrical Methods

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Keywords: Groundwater salinization seawater intrusion hydrochemical index the grade of salinization

This study implies field trip and water sampling in Qinhuangdao Yang-Dai river basin, EC and TDS measurement on the spot, and indoor testing on cation and anion,understanding the level of groundwater salinization. Six parameters , including Cl-、TDS、Li-、SAR、SP、Potential salinity, were chosen to build an AHP(Analytic Hierarchy Process) to calculate the weights of every parameter. Arcgis was also applied to find out the grade of groundwater salinization (no, slight, moderate and serious

salinization) via normalization and rasterization. Analysis of the causes of the groundwater salinization, the most serious salinization areas including Zaoyuan village, Wanggezhang village , moderate salinization areas including Duzhai village, Xiluzhuang village, Jiangying village, mainly due to seawater intrusion. Slight salinization areas includes Fangezhuang village, Dawanzi village, Xinglongzhai village. There are more than a dozen paper mills nearby Fangezhuang village. The reason of salinization are seawater intrusion and industrial wastewater pollution. The salinization of Dawanzi village and Xinglongzhai village is due to agricultural wastewater, sewage caused by groundwater.

Ecohydrological Analysis of Groundwater Exploitation Effects on Subei Lake Basin in Coal Energy Base of Ordos, Northwestern China

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Keywords: Subei Lake Basin Ecohydrological Analysis Groundwater Exploitation Ordos Energy Base

The Dongsheng-shenfu Coalfield of Inner Mongolia Autonomous Region is an important component of the Ordos Energy Base in China. Water resources support the exploitation of coal and development of related industries. Haolebaoji well field of Subei Lake Basin is a typical, large well field and acts as an important source of water-supply in this coalfield. However, increasing mining activities could significantly influence water chemistry and water supply. So it is necessary to recognize the surface water and groundwater evolution trend and assess the eco-hydrological impact of large-scale, intensive groundwater exploitation in the Subei Lake Basin.

Hydrogeochemistry and isotopes were used to understand the origin and geochemical evolution in the Subei Lake Basin. Groundwater and lake water samples were taken, and the isotopic compositions δD, δ18O and major ions were analyzed. In terms of hydrogeological conditions in study area, groundwater can be divided into three types: the Quaternary groundwater, the shallow Cretaceous groundwater, the deep Cretaceous groundwater. Tri-linear diagrams and correlation analysis were used to reveal the hydrogeochemical characteristics of water resources. Na+ and Cl- are the dominant elements in the composition of lake water, while Na+,Ca2+ and HCO3- are major cations and anions in groundwater. The stable isotopes of oxygen and hydrogen in groundwater cluster along the global meteoric water line, indicating that groundwater is of meteoric origin. Comparing with shallow Cretaceous groundwater, deep Cretaceous groundwater is depleted in heavy isotopes indicating that deep Cretaceous groundwater was probably recharged during a time period, when the climate was more wetter and colder than today.

Groundwater numerical simulation was used to evaluate potential hazards of intensive over-exploitation of groundwater. Based on the validated groundwater flow model, a groundwater flow prediction model, the present situation of groundwater withdrawal adopted, was developed. Groundwater dynamic trend of the next 30 years was predicted from a macroscopic perspective. The results show that groundwater depression cone will take shape in confined aquifer of the study area, the maximum drawdown of depression cone will be 24.28m.The average velocity of groundwater level drawdown is 0.8m per year in the next 30 years. Subei Lake dependant on groundwater recharge will be likely to shrink to some degree due to groundwater withdrawal. So it is likely to have negative effects on eco-hydrology of Subei Lake Basin.

Rainfall-Runoff Modeling Using Soil Conservation Service Curve Number Method and Artificial Neural Networks

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Keywords: Rainfall-runoff modelling Kosi Basin SCS-CN and ANN

In Himalayan regions, the precipitation-runoff relationships are amongst the most complex hydrological phenomena, due to varying topography, rainfall, soil moisture, and land-use/land-cover. The upper part of the Himalayan basins is partly and poorly gauged, which makes it difficult to assess the rainfall and their consequences on runoff at different locations of the catchment area. The rainfall runoff models are most frequently used in hydrology. In the present study, two popular models Soil Conservation Service's-Curve Number (SCS-CN) and Artificial Neural Networks (ANN) have been adopted for rainfall-runoff modeling in Kosi Basin. Spatially distributed catchment characteristics of Kosi Basin have been generated using SRTM digital elevation model of 90m resolution in ArcGIS platform using HEC-GeoHMS. The HEC-HMS model was run with SCS-CN method to estimate daily runoff from daily rainfall data by selecting proper model parameters. Curve Number (CN) values are assumed based on the land use /land covers of the study area. Two types of Hydrologic Soil Group (HSG) B and C are assumed with CN values 40, 58, 69 and 76 in Antecedent Moisture Conditions-II during growing season. Daily Rainfall, Water Level and Discharge data collected for the monsoon period (June to October) during the years of 2005 to 2009. SCS-CN method used in HEC-HMS requires a large number of input datasets. To overcome that situation, an attempt has been made to use ANN model available in STATISTICA to simulate rainfall-runoff process and predicted runoff using rainfall as input for different data combinations. Both the Multilayer Perceptron (MLP) network and the Radial Basis Function (RBF)

network have been considered for rainfall-runoff modeling. Results indicated that for Kosi Basin, the runoff prediction approach (ANN technique), in spite of requiring much less data, predicted daily runoff values more accurately than semi-distributed conceptual runoff prediction approach (SCS-CN method). The Root Mean Square Error (RMSE) r2 values for all three discharge sites Barahkshetra, Bhimnagar and Baltara are found satisfactory from 0.75 to 0.99. Further, performance evaluation using error statistics of results obtained during calibration, testing and validation of the data.

Future Summer Precipitation Changes over East Asia as Projected by Multi-RCMs under the A1B Emission Scenario

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Keywords: Regional Climate model precipitation

Regional climate change projections for the middle of the twenty-first century has been produced for East Asia, as part of the RMIP (Regional Climate Model Intercomparison Project for Asia). Adopting CORDEX East-Asia domain and 50-km horizontal resolution, nine regional climate models (RCMs) are nested with the ECHAM5/MPI-OM (the European Centre-Hamburg model version 5/Max Planck Institute Ocean Model) to generate the 20-year control climate and 30-year regional climate projections (2041-2060) for the IPCC A1B emission scenario.

The evaluation of models' performance on control climate against observation shows that all of the modes could reasonably simulated spatial distribution and seasonal variations of precipitation. Compared with driving GCM ECHAM5, most of the RCMs produce higher spatial pattern correlation coefficients with observations for (annual, seasonal) precipitation. The spatial patterns of summer precipitation variability simulated by RCMs resemble the observations more closely than the ECHAM5's.

Analyses on the potential change of precipitation projected under the A1B scenario present relative large difference among the ECHAM5 and RCMs. The ECHAM5 results show that the summer precipitation tend to increase over southeastern China, India and Indo-China Peninsula, but decrease over the north of China. All of the nine regional climate model's results showed that the summer precipitation tends to increase over the northwestern China, but inter-RCM difference is remarkable in the east of China. Most of the models project an enhanced interannual variability of summer precipitation over the southeastern China in the twenty-first century.

Sedimentary Environment and Climate Change since Last Six Hundred Years in the Xinghua Bay Area of Western Taiwan Straight

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Keywords: Late Holocene Subtropical monsoon Coast zone Sedimentary environment Diatom

The coastal area of Fujian province in the southeastern of China is the important economic zone as one of the famous start point areas of maritime silk road since last one millenary at least. During the late Holocene of sea level relative down on the whole of this region, regression contributed the huge plain in the inner bay for economic and social development, and sea level fluctuation and subtropical monsoon climate change impacted the offshore sedimentary environment in deeply. Xinghua Bay in the offshore of northwestern Taiwan Straight accepts discharge matters via Mulan River and Lujang River from inland of Fujian. Grain size and diatom analysis to a sediment core from mouth area of this Bay, exposed the sedimentary dynamic and climate change process since last six hundred years recovered by 104 cm sediments. Age model of the core created by measured sediment ratio estimation utilizing exceeding 210Pb analysis. The clayey silt is the common one in the five sediments types of this core, silt sand appeared in some layer as well. The different ecological species and their percentages of warm water species, brackish species and freshwater species varied in the core making up two main diatom assemblage zones at least.

During the period of AD 1400 - 1835, lower value of diatoms, higher percentages of brackish species and fresh water species, and much sand sediments appeared with clay reducing. These sedimentary phenomena interpreted the offshore with a relative lower sea level stage and strong hydro-dynamic. Meanwhile, lower warmer species could be matched with the Ming-Qing little ice age in China and the Little Ice Age record in north Atlantic region.

On the other hand in the top section of the core since late nineteenth century to present, diatoms abundances were considerable with relative higher warm water species, and clay components increased as well. These obvious characters indicated the coast area within a strong monsoon period. Moreover, last 150 years is also the fast development stage in Fujian coast economic zone. Therefore, strong human impact on nutrients input to support phytoplankton vegetation as apparent high diatom abundances in this layer.

In addition, history documents recorded the coast region of Fujian suffered earthquake frequently in last six hundred years. The grain size component abrupt changed with diatom content sudden decreased in the core probably caused by strong earthquake. For instance, 100cm (~AD 1444) could be linked with the big earthquake happened in AD1445 in Fujian coast zone. And 72-70cm (AD 1612-1600)could be linked to large earthquake occurred in AD 1604. While, the extremely geological event's influence effect should be studied further to clarify sedimentary environment change.

Risk Analysis of Snow Disaster in the Pastoral Areas of the Qinghai-Tibet Plateau

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Keywords: Qinghai-Tibet Plateau snow disaster risk pastoral area

Snow disaster is one of the top ten natural disasters worldwide, and the most severenatural disaster to affect the pastoral areas of the Qinghai-Tibet Plateau. Based on thehazard harmfulness data collected from historical records and data collected from entitiesaffected by this hazard in 2010, a comprehensive analysis of the 18 indexes of snow disasteron the Qinghai-Tibet Plateau was conducted, encompassing the hazard harmfulness, theamount of physical exposure the hazard-bearing entities face, the sensitivity to the hazard,and the capacity to respond to the disaster. The analysis indicates that: (1) areas at high-riskof snow disaster on the Qinghai-Tibet Plateau are located in certain areas of the counties ofYecheng and Pishan in the Xinjiang region; (2) areas at medium-risk of snow disaster arefound between the Gangdise Mountains and the Himalayas in the mid-western area of theQinghai-Tibet Plateau, and the southeastern part of the southern Qinghai Plateau; (3) the riskof snow disaster is generally low throughout the large area to the south of 30°N and the regionon the border of the eastern Qinghai-Tibet Plateau. Overall, the risk of snow disaster inhigh-altitude areas of the central Qinghai-Tibet Plateau is higher than that at the edge of theplateau.

Sensitivity of Time Scales of Climate Change on China’s Industrial Output

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Keywords: Climate variable production function time scale sensitivity

How to comprehensively evaluate the impact of global climate change on humans, especially on economic system, is one of the hottest academic topics discussed in recent years. Existing studies on the impacts are classified into direct and indirect ones. However, generous efforts have merely been invested on the latter one while the direct impact of climate change on economy was often neglected. It is of essential importance to explore the waves of economy under the background of climate change. This paper studies the fluctuations in the impact of climate change on China’s industrial output based on different time scales based on production function method by introducing climate variables in order to find out the optimal time scales of impact extent of industrial output sensitive to climate change. The production function takes temperature and precipitation data as well as capital stock, labor force and

industrial value added in 1981-2008 from panel database of China’s 38 sub-industries on the same time scale as input and output elements respectively. It is concluded that most of the sub-industrial outputs are sensitive to temperature and precipitation and 4-7 years are their optimal time scales. Besides, industrial output is more sensitive to temperature than to precipitation, that is, its impact is not significant. This paper argues that, combined with detailed classification of sub-industries, the following three aspects should be paid particular attention for Chinese industry’s response to climate change. First, policy makers should appropriately suppress the processes of products of metal, steel and rubber industries. Additionally, chemical, cement, steel and other industries should adjust and optimize their industrial energy consumption structures as well as implementing carbon capture and storage technology to achieve the transformation into green energy consumption, clean energy in particular. Furthermore, China should insist on strategies of balancing the corporate development between light and heavy industries, giving priority to the development of high-tech industries, such as computers, electronics and communications equipment manufacturing industries characterized by lower energy consumption and emission intensity.

Our Ocean Cultural Coping Strategies to Climate Change - a Case Study from Dan

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Keywords: Cultural adaptation Dan and Cultureocean climate change

Almost all of China's vast territorial ocean in the monsoon region, and thus the impact of climate change on China's territorial ocean should not be overlooked, we must attach importance to, but to really take precautions to reduce the devastating effects of climate change to the minimum degree. This requires us, when you start prevention strategies have to be more careful and detailed research and planning, and thus was able to develop a more scientific and effective coping strategies. Among the many coping strategies, looking from the perspective of ethnology, cultural response becomes more prominent and important, and more effective. The reason is that national culture is the human society after the birth, and the ecosystem in which the co-evolution of the product, which is located between ecosystems, have reached a mutually fitting relationship, have successfully withstood the climate-related natural Baptism risks. This allows, in the course of history, national culture has had a dynamic response to climate change adaptation endowments. This is also the reason for making this article, our territorial ocean in response to climate change, we must start the fundamental theory of cultural adaptation strategies lies. Earning in the coastal area of Dan and their culture, it has a dynamic response to climate change adaptation endowments, and history has proven effective and scientific possess the ability to adapt. In other words, the cultural construction of Dan's marine environment is the basis of the construction process so that they, in fact, have adapted to the various elements of the sea and the ecological

environment, eco-system to meet the three indicators proposed Ethnology acculturation environment. Specific performance, one has to avoid the Dan cultural climate risks brought about the marine environment, such as the ability to avoid climate change. Second Dan culture with active maintenance strategy marine environment and stable operation, to avoid ecosystem vulnerabilities - Protection and management of mangroves. Third Dan have the ability to compensate for the shortage of resources and cultural aspects, such as the settlement of maritime fresh water scarcity, the scarcity of fresh vegetables shortage of resources - traditional frame fields planted widely used. Therefore, the start Dan culture of territorial ocean to deal with climate change is feasible. If supplemented by modern scientific and technological achievements, the Dan cultural way to resolve climate change will be the moment of transformation and innovation, and the ability to resist risks will be significantly improved to ensure the security and stability of China's territorial ocean.

On the Practical Value of Floating Farming in Modern China

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Keywords: Central America former Spanish era floating farmland rackfields

Based on floating farming applied during the former Spanish era in the Mexico Basin of Central America,the present study is to make an analysis of such floating farming and to make a comparison between such technique and ancient Chinese rack fields so as to explore the similarities of the core technology of the two farming practices as well as its feasibility and practical value of such traditional floating farming in modern.

Ecological Restoration and Water Resource Protection in Southwest Karst Rocky Desertification Disaster Area of China: A Case Study of Mashan Miao

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Keywords: Rocky desertification ecological restoration water resources indigenous ecological knowledge

The topography and landscape of karst rocky desertification mountains are with the features of lacking water and soil, fierce heat, unstable rocks, which are unfavorable to water resource interception and storage. To improve the ability of water resource interception and storage of the land surface, it needs to

rely on ecological system's growth and propagation. Nevertheless, local peoples' indigenous ecological knowledge, technics and skills are based on the protection, reformation and control of local ecological system, which can avoid negative factors. To adapt to the ecological environment in Mashan region, there are five aspects concluded by local Miao people. First, traditional livelihoods of local Miao follow the principle of no-till farming. Second, traditional plantation follows the way of compounded multi-species sowing. Third, climbing plants that tend to grow on the land surface, and bushy plants and simple-moss-kind plants and fern-kind plants, can cover rocks after growing, a part of which can be a replacement of soil's water storage function; it can become a saturated air barrier of water vapor between plants and bedrock as well. Fourth, local villagers from different ethnic groups concerned about the plants with underground tubers. Fifth, they attach importance to the combined function of agriculture, animal husbandry, apiculture, economic forest industry. These traditional livelihoods take advantage of the environment which is with less water and soil, and avoid the ecological fragility, so as to ensure a sustainable operation of ecosystem and ethnic culture. Thus, to set down countermeasures for water resources in local region, the key is to fully explore and explain local ecological knowledge, technics and skills from local ethnic groups. With the help of modern science and technology to promote local ecological knowledge, and innovation of technics and skills, it is to steadily improve the functions of water resource interception, storage, regeneration and purification in southwest karst rocky desertification disaster area, to ensure water supply in the Pearl River Basin in the course of sustainable socio-economic development in China.

Changes of Wind Characteristics over the Lake Baikal Region Due to the Large Scale Atmospheric Processes

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Keywords: Climate change atmospheric circulation

Wind is an air movement relatively to the Earth's surface. Usually, the horizontal wind component measured by weather station devices (wind vane, anemometer etc.) is implied. In the free atmosphere it is defined by pilot balloon observations. According to many authors wind regime over the Russia territory has significantly changed. This concerns, first of all, the wind speed which decreased almost over the entire territory with gradation redistribution at most stations.

In this work we evaluated long-term changes of wind characteristics in the Irkutsk region for 1977-2006. As the source information we used monthly data on wind speed and direction for 31 meteorological stations located in this region. Trends of wind characteristics and their relations with changes of

atmospheric circulation have been evaluated.

The annual values of wind speed do not exceed 4.0 m s-1. During the spring season (April-May), the monthly averaged values are maximal (3.5-4.0 m s-1). Repeatability of calms in this period is reduced by 2-3 times compared to winter. In January, the average monthly speed is reduced to 1.0 m s-1. The most prominent positive trend of annual mean wind speed during the study period was at Ust-Uda weather station (0.60 m s-1 per decade) and the negative one was at Novonukutsk (-0.29 m s-1 per decade).

Over the most part of the territory the greatest repeatability is defined for calms conditions (up to 49%, weather station Inga), west (up to 42%, Tayshet), and north-west winds direction (up to 38%, Ikey). On the average, there are an increase of frequency of the north-west (12.5% per decade) and the north-east (5% per decade) wind directions and decrease of calms conditions (20% per decade).

Correlation coefficients were calculated between the atmospheric indices and time series of repeatability of wind direction and calm for 1977-2006. Index for western-type circulation by A.A. Girs (W) during the study period has trend of 34 day per decade. Correlation coefficients for this type vary from 0.35 to 0.71 for different wind characteristics. Thus, increased frequency of W type has increased frequency of winds of west component. There is also a high correlation (0.40-0.69) between the indices of circulation by B.L. Dzerdzievsky and western wind directions.

The results of quantitative assessment of zonal and meridional atmospheric circulation intensity over the south of East Siberia (we used atmospheric circulation index by A.L. Katz) also confirms the positive trend of west to east air transport. The intensity of the zonal atmospheric circulation is characterized by pronounced positive trend, especially since the mid-1970s.

Tree-ring Based Investigations of Environmental Variability in the Tyva Mountains and Mongolian Altai

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Keywords: Dendrochronological analysis Tyva Mountains Mongolian Altai climate change

The study region includes the Mongun-Taiga mountain massif, the Western Tanno-Ola mountain range (The Tyva Mountains, Russia) and adjacent areas to the Tavan Bogd mountain massif (Mongolian Altai) and is characterized by continental and extra-continental climate and, at that, there are several modern

glaciation centers.

Mostly the economy of this trans-border region is based on subsistence agriculture and any changes in environmental patterns can influence on sustainable development of the region. Investigations based on dendrochronological data give an opportunity to extend climatic records by revealing relations between tree-ring growth and climatic parameters, to make reconstructions of these parameters and make predictions of regional environmental changes. Special importance in such arid agrarian regions also has dendroglaciological and dendrohydrological researches.

During the expeditions of Saint-Petersburg State University in 2012–2013 the dendrochronological data was collected on the upper and lower tree lines (2300–2400 m, 1900–2000 m, respectively) on the north-facing slopes. Sample cores were taken from 446 living trees of Larix sibirica from 35 sites. Site selection, data gathering and dendrochronological analysis using basic dendrochronological techniques were made.

By this moment two regional chronologies are obtained. There are common periods of high tree-ring growth (1762-1783, 1800-1811, 1890-1905, 1994-2008) and low growth (1734-1761, 1812-1835, 1843-1895, 1911-1920, 1980-1988). Also we detected cyclicity in tree-ring growth using spectral analysis and revealed 11-year solar cycle and 30–35 year Bruckner cycle.

Dendroclimatological analysis showed that up to 75 % of tree-ring growth variability could be explained by climate. The tree-ring growth is limited mostly by June and July temperature. The strongest statistically significant correlation between June temperature from the nearest meteorological station and tree-ring growth (r=0,6) was revealed. Such correlation allowed to receive temperature reconstructions that show temperature depression in the second half of the 19th century (the end of the Little Ice Age) with subsequent temperature increase of 2°C. In the XX-XXI centuries temperature level was above average but there is no significant positive trend. The relationship between tree-ring growth and precipitation is more difficult because of its spatial inhomogeneity in the mountainous regions. Mostly tree-ring growth negatively correlates with May-June precipitation (r=-0.4). Preliminary dendroglaciological analysis between tree-ring chronologies and glaciological parameters of the largest Mongun-Taiga mountain massif glacier revealed positive statistically significant correlation between the glacier ablation and adjacent regional chronology.

We are planning to make additional data gathering in the region and continue investigation of variability of climatic characteristics, glaciological and hydrological parameters and the history of catastrophic events such as fires for the last several centuries. Limited forest resources and unsustainable forest utilization intensify the actuality of carrying out various dendrochronological researches.

Estimating of Fire Impact on Ecosystem and Carbon Emission of Boreal Forest of Siberia, Russia

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Keywords: Forest fire fire intensity boreal forests ecosystem post-fire succession

Boreal forests of Siberia are globally important as they constitute one of the world's major carbon pools and contain relatively undisturbed ecosystems. Fire is the main forest disturbance factor, covering up to several million hectares of forests annually, most of them in Eurasia. Fires occur annually in forests of Siberia. Expected changes in climate are predicted to increase fire activity and result in heavier fire effects and increasing the burned area. In order to assess fire impact on forest ecosystem, experimental fires aimed to modeling fire behavior were conducted in light-coniferous stands that make up for about 74% of the total forest land of Siberia. Surface fires of varying intensity are most common in these forests. Experimental fires were mostly surface fires of varying intensity, sometimes with a crowning component. Our long-term post-fire monitoring allowed us to identify vegetation succession patterns in Scots pine and larch stands after fires of known behavior. The initial post-fire succession stage is known to depend on site conditions, pre-fire forest type, and the last fire type and intensity. The fire influenced the main physical, chemical, and biological soil properties. Deep fire-caused changes occurred in forest floor in terms of its fractional composition, physical and chemical parameters. Post-fire microorganism population, biomass and activity dynamics depended on the forest floor consumption. Forest fires reduced soil invertebrate density and diversity. Post-fire changes of different forest components in pine stands were found to take longer period of time compared to larch stands. Increasing carbon emissions from the forest stands with time can be attributable to the destructive processes caused by tree mortality and forest floor accumulation prevailed over photosynthetic assimilation.

Development of Virtual Research Environment for Northern Asia Climatic and Ecological Studies

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Keywords: Environmental informatics regional manifestations of global change

Volumes of environmental data archives are growing immensely due to recent models, high performance computers and sensors development. It makes impossible their comprehensive analysis in conventional manner on workplace using in house computing facilities, data storage and processing software at hands. One of possible answers to this challenge is creation of virtual research environment (VRE), which should provide a researcher with an integrated access to huge data resources, tools and services across disciplines and user communities and enable researchers to process structured and qualitative data in virtual workspaces. VRE should integrate data, network and computing resources providing interdisciplinary climatic research community with opportunity to get profound understanding of ongoing and possible future climatic changes and their consequences.

Presented are first steps and plans for development of VRE prototype element aimed at Northern Asia climatic and ecological monitoring and modeling. Recently developed experimental software and hardware platform aimed at integrated analysis of heterogeneous georeferenced data "Climate" (http://climate.scert.ru/, Gordov et al., 2013; Shulgina et al., 2013; Okladnikov et al., 2013) is used as a VRE element prototype and approach test bench. VRE under development will integrate on the base of geoportal distributed thematic data storage, processing and analysis systems and set of models of complex climatic and environmental processes run on supercomputers. VRE specific tools are aimed at high resolution rendering on-going climatic processes occurring in Northern Eurasia and reliable and found prognoses of their dynamics for selected sets of future mankind activity scenaria.

Currently the VRE element is accessible via developed geoportal at the same link (http://climate.scert.ru/) and integrates the WRF and «Planet Simulator» models, basic reanalysis and instrumental measurements data and support profound statistical analysis of storaged and modeled on demand data. In particular, one can run the models, preprocess modeling results data, using dedicated modules for numerical processing perform analysis and visualize obtained results. New functionality recently has been added to the statistical analysis tools set aimed at detailed studies of climatic extremes occurring in Northern Asia. We plan to expand the integrated models and computational modules sets.

VRE element "Climate" under development already provides specialists involved into multidisciplinary research projects with reliable and practical instruments for integrated research of climate and ecosystems changes on global and regional scales.

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The Fire Effect on Ground Vegetation Succession in Larch Stand of Siberia

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Keywords: Boreal forest succession Larix sibirica, Fire ground layer

Fire is an important ecological factor effecting forest succession in boreal forests. Fires in larch stands account for about 15% of the total number of fires in Russia. Fires in southern boreal forest account for up to 39% of the total area burned in Russia and up to 70% in Siberia (Ivanova, 2005). Scots pine or larch (Larix sibirica Ledeb.) stands account for up to 90% of the total coniferous forest area of the Lower Angara region (Zhukov, 1969).

The study area is located in southern taiga in mixed larch (Larix sibirica Ledeb.) herbs/mosses stands representative of the Lower Angara region, Siberia (Russia). The aim of this work was to investigate the changes of ground layer (shrubs, herbs and mosses) after experimental surface fires of varying severity (up 1300 to 4190 kW). Fire experiments were conducted on six plots (2 ha each) during summers of 2006, 2007-years. The post-fire ground layer was analyzed based on percent cover, species composition and biomass.

Fire severity had a clear effect in initial succession in study area and it clearly had an impact on percentage cover and biomass of ground vegetation. It was determined that species richness doesn't increase after fire. The mean number of species (on 1 m2) was higher before fires, then after ($p < 0.05$) and it depends of s ($p < 0.05$). Fires of low and moderate severity cause decreasing of cover and biomass of herbs ($p \leqslant 0.002$). Early successional species such as Epilobium angustifolium L. and Calamagrostis epigeios (L.) Roth invaded in burned areas immediately after high fires, their cover and biomass strongly increased after 2, 3 years ($p < 0.05$).

The percent cover and biomass of mosses decreased after fire any severity ($p < 0.05$) and slowly increase after the fire ($p < 0.001$). Green mosses (Pleurozium schreberi (Willd. ex Brid.) Mitt.and Hylocomium splendens (Hedw.) Schimp.)were killed by fires of high severity. The moss Marchantia polymorpha L. dominated on mineral level. Fires of low and moderate severity killed moss layer partially (20—40% surface).

Observed Climate Extreme Indices in Siberia

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Keywords: Climate extremes regional climate change

Last decades more frequent occurrence of weather anomalies in Russia, particularly in Siberia, leads to strong local ecosystem and socio-economical disasters. To improve our understanding of observed climatic abnormal changes in Siberia, we need to get accurate knowledge of the nature and reasons of climate extremes. In particular we need to analyze changes in abnormal behavior surface of air temperature, precipitation amount, atmospheric pressure and wind and to study possible reasons of their occurrence.

The spatial changes in selected atmospheric parameters have been studied using meteorological field with high spatial resolution from ECMWF ERA Interim Reanalysis and APHRODITE JMA datasets over the time period 1979-2012. The climatic indices based on prescribed statistical thresholds (such as extremely hot/cold nights/days, very heavy rainfalls or prolonged periods without precipitation) has been considered. The temporal dynamics of the indices behavior have been studied using linear regression analysis. All calculations have been realised using information-computational web-GIS system "Climate" (http://climate.scert.ru/) developed to support collaborative multidisciplinary investigations of regional climatic changes and their impacts. The archive of results is available for further applications in the system.

Obtained results show that seasonal dynamics of daily temperature extremes is asymmetric for tails of cold and warm temperature extreme distributions. Namely, the warming during winter cold nights is stronger than during warm nights, especially over the north of Siberia. Increases in minimum temperatures are more significant than in maximum temperatures. Warming determined at the high latitudes of the region is achieved mostly by winter temperature changes and less due to autumn temperature changes (case of autumn temperature extreme changes is not presented here). South area of Siberia has slight cooling during winter (mostly out of cold temperature extremes) and during summer (associated with warm temperature extreme decrease). Changes in daily precipitation extremes are spatially inhomogeneous. The largest increase in frequency and intensity of heavy precipitation is observed in the north of East Siberia. Decrease in very wet days is determined in the central area of West Siberia and the south area of East Siberia.

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The Target Design of Wheat Breeding and Cultivation Technique Extension under Climate Change in Dryland in North of Shaanxi

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Keywords: Wheat Breeding goal, Cultivation techniques To promote

The climate warming, especially in winter temperature had significant effect on growth of winter wheat. In the dry land, climate warming will also enable the drought intensified. Climate warming, the crop growth and development of itself, in fact, is not a bad thing, warm resources increased, more conducive to the growth of crops.

On the basis of meteorological data in Pucheng county in north of Shaanxi from 1959 to 2010, It is be fund that the monthly mean temperatures in January is continue to rise, and change is more and more, and to the first 10 years of this century the largest increase. Dryland wheat sowing period, the average temperature change is not obvious in late September. After sowing, the average temperature rise, in early October, and is also the larger increases in the first 10 years of this century.

In order to adapt to climate change, the breeding goal was design. 1, the adaptability of varieties should be stronger; because of climate warming, exacerbated by the drought. The more excellent resistance on cold, drought, green dry ability; and resistance on pest; early maturing were required; 2, Because climate change , the heat resources increased, yield potential became large; production target is 5000 ~ 6000 kg/hm2; to be improved varieties tolerance to fertilizer (water) and lodging resistance ability; three elements of yield of wheat should be optimization. 3, The development direction should be high quality and specialization.

In order to cope with climate change, wheat cultivation technology scheme was improved in Northwei dryland. In addition to soil fertilizer and field management normal, the resistance cultivars with high yield and good quality and tolerance with cold and drought were used, suit time to sowing, the prevention and control of pest.

The key of techniques extension: all the villagers to participate in the formulation of the selected varieties and cultivation techniques, demonstration households standards, selected demonstration households, model demonstration; when farmers need, technical training, especially the female farmer technician training were complement after dinner for rural women to participate. How much investment villagers are all known, and the villagers can active to involvement. After every training or visiting the demonstration field, the villagers are all participatory evaluation. It is showed that the extension of wheat varieties in dryland and cultivation techniques are effect obvious: the income from 4500 to 5400 kg/hm2; a decrease of 40% chemical fertilizer using, reduce the using of 30% chemical pesticides; through participatory technique extension, and farmers special female farmers enhance the ability of participate in community activities.

On the Ecological Value of Traditional Farming System of Fish Keeping in Rice Fields of the Dong Communities

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Keywords: the Dong Communities rice, fish, and duck system ecological value ecological adaptation

The Dong 侗族 is one of Nationalities with big population in South China and currently live in the border of Hunan 湖南 with Guizhou 贵州 and Guangxi 广西 Provinces. There are high mountains and lofty hills in their living areas, and also sporadical dams among mountains. The Dong people build rice fields in the light of local conditions under this environment, splitting mountains and channeling, erecting water wheels to draw water to irrigate farmlands from deep creeks. During long-term experiences accumulation, the Dong people gradually developed a set of agricultural farming pattern of rice and fish symbiosis, which is fit for their ecological environment. Most current rice fields in the Dong communities are "cold, shady and rusty fields." Rice fields in the Dong Communities cannot compare with those of the Han in the middle and lower reaches of Yangtze River 长江中下游 and Zhujiang Delta 珠江三角洲, where rice fields only need to be built lower dams to separate river systems and rice fields, and a large area of rice fields are easily formed. In addition, the water, soil, light, and heat of the rice fields are balanced. However, in the Dong communities, building rice fields should contend water and land with mountains, and only small areas of rice fields can be built, and the water, soil, light, and heat of each field are different. A farming pattern of "rice and fish symbiosis" (Ch. 稻鱼共生) in the Dong communities is an ecological agriculture with a little input and high output in each field. 10 percentage of land can support 90 percentage of the population. But during the development, modern agriculture is confronted with a series of insurmountable ecological hidden worries. For example, environmental pollution, ecological disintegration, uniformity of animal and plant species, and so on. Especially, the wide use of fertilizer and pesticide not only pollute environment and crops, but also gather in the body of humans to affect people’s health. While modern agriculture is criticized, how to further explore the sustainable potential of traditional agriculture and promote its valuable ecological worth is becoming a hot topic. This article takes a traditional farming pattern of "rice and fish symbiosis" of the Dong people as a case study, proving its ecological value and resources efficiency, and hopes to provide some beneficial references to develop and use traditional agriculture.

"Three-Zone" Environment of Wuling Mountain Area and Traditional Ecological Industry: A Case Study of Poverty Alleviation of the Golden Tea Industry of Baojing County

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Keywords: Wuling Mountain Area the "Three-Zone" Theory the Golden Tea trinity

Wuling Mountain Area 武陵山区 includes 71 counties on the border of Hunan 湖南 with Hubei 湖北 and Guizhou 贵州 provinces, as well as Chongqing 重庆 Municipality. Wuling Mountain Area with 71 Counties and cities has the area of 171,800 square kilometers, 1,376 townships, and 23,032 administrative villages including 11,303 impoverished villages. Through long-term researches more than 20 years, Prof. Yongkang Zhang 张永康 in Jishou University and his colleagues found that there are three potential environmental advantages in Wuling Mountain Area under the influence of geographical location, climate, soil, and geological structure. Thereafter, Prof. Zhang proposed the "Three-Zone" Theory (Ch. 三带理论) of Wuling Mountain Area. One is Germ Fermentation Zone Theory (Ch. 微生物发酵带理论) of the climate. Wuling Mountain Area locates at the Northern Latitude 28°±2°that is fit for developing fermentation products. Wuling Mountain Area is right in the fermentation zone which is fit for developing liquor, sauce, vinegar, and salted products; another one is Rich Selenium Zone Theory (Ch. 富硒带理论) of the soil. The content of selenium in the soil is between 0.2ppm and 0.8ppm, which belongs to the rich selenium zone where natural food with rich selenium can be fully developed; last one is Linolenic Acid Zone Theory (Ch. 亚麻酸带理论) of the phytocoenoses (Ch. 植物群落). A large area of kiwi fruit 猕猴桃, Eucommia 杜仲, pepper 花椒, etc. are planted in Wuling Mountain Area, and high content and high quality Linolenic acid can be extracted from the plants, indicating that a Linolenic acid zone exists in the phytocoenoses of Wuling Mountain Area. Vigorously developing the "three-zone" industries on the basis of the "three natural zones" is an innovation of poverty alleviation 扶贫 of Wuling Mountain Area. The orientation and core of "three-zone" industrial development are to establish the "three-zone" ecological industrial brands, building a "three-zone" ecological industrial cluster, and pushing forward the formation of industrial cluster trinity (Ch. 三位一体) of "three-zone" agriculture, industry, and tourism. In addition, adopting the developmental pattern of industrial circular economy, we finally can transform resource advantages of the "three-zone" into economic advantages, achieving poverty alleviation by ecological industries, and promoting overall competitive strength of Wuling Mountain Area. This article takes the developmental pattern of the Golden Tea (Ch. 黄金茶) ecological industry brand of Baojing County 保靖县 in Wuling Mountain Area as a case study, proving and analyzing how the Golden Tea ecological industry applies the "three-zone" environmental advantages, advancing and achieving industrial cluster trinity of the "three-zone" agriculture, industry, and tourism in the local area. The Golden Tea industry in

the light of local conditions and with a traditional pattern of respecting the subject (Ch. 主体) pushes forward the development and poverty alleviation of Wuling Mountain area, promotes self-development ability of the poor areas, and establishes innovative systems of poverty alleviation. The developmental experiences and inspiration of the Golden Tea industry are building a distinctive and effective way of poverty alleviation (Ch. 扶贫) and synergy development (Ch. 协同发展) of Wuling Mountain Area.

Regional Climate Model Inter-comparison Program in Asia: Ensemble Simulation and Analysis of Extreme Temperature Indices

LI Qian
TANG Jianping

Based on the model results from Regional Climate Model Inter-comparison Project (RMIP) over Asia for present-day climate simulation (20C, 1981-2000) and the observed daily surface air temperature data of 756 meteorological stations, we calculated the STARDEX extreme indices about temperature to evaluate the model performance. Five synthetic methods, i.e. the equal weighting (EW), the weighted mean, multivariate linear regression (Multi-linear), the reliability ensemble averaging (REA), and performance-based ensemble averaging (PEA), are applied for ensemble simulation of extreme temperature based on the results of 10 RMIP regional climate models (RCMs). Our analyses show that the RMIP models are generally able to simulate climate extremes and their trend patterns as represented by the indices in comparison to meteorological stations data. After ensemble analysis, the spread amongst five ensemble results for several temperature indices is reduced compared to RMIP models. Among the five synthetic approaches, the skill and stability of Multi-linear is worst and it isn't credibility to analysis extreme temperature for ensemble. The Weighted-mean and the REA approaches produced reliable ensemble results that are most consistent with observation in spatial distribution and annual variation of extreme temperature indices.

Evaluation of Uncertainty in the Regional Climate Simulation Driving by Different Reanalysis over China

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Keywords: reanalysis datasets, regional climate model, lateral boundary, uncertainty , vapor

To investigate the ability of WRF model in simulating the regional climate over East Asia summer monsoon region, long term ensemble simulations with different initial and lateral boundary conditions for summer covering the period of 1982-2001 are generated. The driving datasets are NCEP/NCAR,NCEP/DOE,NCEP/CFSR,JRA25,ERA40,ERAIN and MERRA respectively. Results show that all experiments are skillful in revealing the spatial distributions of summer mean surface air temperature and precipitation,but the temperature at cold centers are underestimated, especially when using NCEP/NCAR, ERA40 and ERAIN as driving datasets. On the contrary, the temperature at warn centersare simulated warmer than observation. The simulated precipitation amounts by RCMs are less than the observations over Northwest and Southwest China, while overestimation appears in the southwest coastal region,especially for the experiments with Exp-CFSR,Exp-ERA40 and Exp-ERAIN. The simulations are able to reproduce the inter-annual variations of both temperature and precipitation averaging over the sub-regions, but overestimations are noted for most sub-regions. It is also found that all experiments give a better performance in simulating the spatial patterns of upper geopotential height, temperature, zonal wind and specific humidity than meridional wind. At the middle and high level of tropospheric,the simulation is warmer and dryer than ensemble mean of reanalysis over the regions where high-pressure and anti-cyclonic bias are found, while it's colder and wetter over the areas with low-pressure and cyclonic bias. It is worth to be noted that the experiments forced by different reanalysis data exhibited remarkable differences in reproducing both surface and upper atmospheric variables, which means that biases in the driving datasets can cause large uncertainties in simulated results. The ensemble of simulations shows better performance than each single experiment result. The quantitative analysis of model spread among individual members caused by different driving datasets is conducted. The differences between the forcing reanalysis can cause large uncertainties in simulation results. The analysis shows that the model uncertainties are primarily caused by uncertainties in water vapor influx across the lateral boundaries in the reanalysis.

Estimation of Snow Water Equivalent Based on Remote Sensing Data

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Water produced by snowmelt is an important part of the annual water cycle in the Eastern Kazakhstan, in some cases contributing high fractions of the annual runoff in a watershed. In this case, accurate estimation of snow water equivalent (SWE) has been significantly recognized to improve management and analyses of water resources in region. An attempt is made to study the snowmelt runoff in Ulba and

Uba rivers by estimating of the snow water equivalent. However, remote sensing techniques are innovative way in deriving the snow water equivalent. A novel snow depth and water equivalent data estimated from passive microwave brightness temperature is proposed based on remote sensing data and temperature of the layered snowpack. In this paper has done comparison of the Advanced Microwave Scanning Radiometer Earth Observing System and *in situ* snow water equivalent values of three gauge stations in East Kazakhstan. The Advanced Microwave Scanning Radiometer Earth Observing System's snow water equivalent values are retrieved for five years from 2007 to 2011.