

Summary Report on APN workshop Building Asian Climate Change Scenarios

by Multi-Regional Climate Models Ensemble

January 28-29, 2010

International Conference Center, Tsukuba, Japan

Project Title: Building Asian Climate Change Scenarios by Multi-Regional Climate Models Ensemble

Reference Number: ARCP2009-16NMY-WANG

Project Leaders:

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Introduction

The first project workshop on APN project "Building Asian Climate Change Scenarios by Multi-Regional Climate Models Ensemble" was held in Room 406, Tsukuba International Conference Center, Tsukuba, Japan, at January 28-29, 2010. The objectives of the workshop are: 1) to brief the team on the execution and progress of the project; and 2) to discuss the next step that would be taken and future development of the project.

The workshop was attended by participants from 6 countries, including scientists of 11 groups, invited scientists, and observers (Appendix 1).

The workshop was locally hosted by Meteorological Research Institute, Japanese Meteorological Agency, and funded by APN. The workshop was also greatly supported by MAIRS (Monsoon Asia Integrated Regional Study).

Outcomes:

1, Progress reports from participating groups

On the first morning of the workshop, the leading scientists from each participating group presented their research results. The topics included:

- 1) The preliminary analysis of RCM downscaling for both reanalysis and ECHAM5 over Asian Monsoon regions;
- 2) Uncertainty analysis and biases correction in the regional climate simulation and projection;

- 3) Impacts of regional parameters and physical processes on Asian Monsoon climate change simulation;
- 4) Impacts of SST on tropical cyclone frequency and East Asia summer climate;
- 5) Added value of RCM downscaling and experiences on applying high resolution RCM in impact and assessment study over Japan;
- 6) Introduction of WCRP's the coordinated regional downscaling experiment (CORDEX).

All presentations can be downloaded from website www.mairs-essp.org.

2, Outcomes of discussion session

The discussion was centered on: 1) the progressing of the project; 2) the next steps that should be taken to implement the project objectives, i.e., analysis plan, design of new sensitive runs, related publication, etc.; and 3) the potential development and application of the project results.

The discussion session was chaired Prof. Dong-Kyou Lee and Dr. Shuyu Wang.

At the beginning of the session, the summary of project progress was given by Dr. Shuyu Wang. Then the discussion was centered on the following questions:

1) Review of project progress

A, Objectives, activities and expected outcomes

Firstly, the purposes, activities and expected outcomes of the project were presented to project team.

The objectives of the project are:

- To provide the high confident scenarios of regional climate change in Asia based on an ensemble of the results from multi RCMs.
- To provide a scientific base for impact, assessment communities and policy makers so that better understanding of monsoon Asia climate change will be achieved, by adequately detect and assess the sources and magnitudes of uncertainty in Asian climate change projection.
- To set up a regional climate modeling network and establish connection with other regional climate research networks around the world on the base of data and technique sharing.

The activities of the project include:

- Projecting high resolution regional climate change for 2040-2070 for Asia by using the ensemble of nice regional climate models;
- Based on the RCM simulations, detecting and assessing the sources and magnitudes of uncertainty in Asian climate change projection;
- Calculating the change and variance of controlling climate factor of Asian climate, i.e., Asian monsoon system, and its impacts on Asian climate;
- Exploring and developing new methods and techniques for regional climate model

outputs ensemble.

The expected outcomes from the project are:

- Database and related documentations which compliment model-simulated climate change climatology as well as variability for Asia will be produced;
- Scientific reports and papers will be generated on the subjects of high resolution climate change scenarios for Asia; the uncertainty in regional climate model downscaling; and the change and variance of Asian monsoon system, etc;

B, Models and required outputs

On the workshop, Dr. Hyun-Suk Kang from Korea Meteorological Administration was listed as one of the project collaborators. And in addition to the nine research groups which agreed to conduct the integration in project proposal, two more teams expressed the intention that their regional climate models would possibly carry out simulation for both current and future climate, and contribute to the final ensemble analysis and database.

The participating models and teams are listed as following:

- **RIEMS**, Institute of Atmospheric Physics, Chinese Academy of Sciences, China
- **WRF**, School of Atmospheric Sciences, Nanjing University, China
- **ReGCM3**, National Climate Center, Chinese Meteorological Administration, China
- **SNU RCM**, School of Earth and Environmental Sciences, Seoul National University, Republic of Korea
- **NCEP RSM**, Department of Atmospheric Sciences, Yonsei University, Republic of Korea
- **MM5**, Korea Meteorological Administration, Republic of Korea
- **NHRCM MRI**, Meteorological Research Institute, Japan
- **NIED RAMS**, Flood and Landslide Research Department National Research Institute for Earth Science and Disaster Prevention, Japan
- **CCAM**, Marine and Atmospheric Research, the commonwealth Scientific and Industrial Research Organisation, Australia
- **IRAM**, Department of Meteorology, School of Ocean and Earth Science and Technology, University of Hawaii, USA
- **WRF**, Iowa University, USA

The required outputs from participating model will be in common netCDF formation for general usage.

For surface variables, the following daily averages and 3-hourly outputs are required:

- Daily average *MSLP, maximal/minimal temperature, snow water equivalent, surface maximum wind speed*
- 3-hourly: *2m temperature, RH, convective precipitation, large scale precipitation, evaporation, 10m wind (U,V), surface radiation (up/downward shortwave radiation, up/downward longwave radiation), latent heat, sensible heat, column soil moisture, total runoff*

For upper level variables, the following daily averages and 3-hourly outputs are required:

- Daily average: *U, V, T, H at 200, 500, 850 hPa*
- 3-hourly: *radiation fluxes at TOA (upwelling shortwave radiation, upwelling longwave radiation), cloud fraction, surface precipitable water*

C, Domain and GCMs

On the workshop the WCRP CORDEX domain was decided to be adopted for project integration. The project will focus on East Asia Monsoon System, which still can't be properly reproduced in most GCMs. With the new domain the climate change information for Indo-China Peninsula would be generated and provided to climate change and adaptation scientists in the region. In addition the current domain covers more West Pacific Ocean, therefore the changes in tropical cyclones and accompanying climatic extreme such as heavy rainfall will be taken into consideration in the modeling system.

According to the presentations in the first day of the workshop, the RCM results using ECHAM5 outputs as driving fields show biased monsoon circulation and precipitation, due to either incorrect SST or streams. More analysis will be needed to assess the bias and uncertainty arising from ECHAM5 driving fields. The studies concentrate on SST bias from GCM and its impact on monsoon system will be analyzed.

Under the circumstance that integrations of IPCC AR5 GCMs are behind the schedule, the project decides to stick to ECHAM5 as baseline GCM, and at the same time the project contacts individual modeling groups around the world, such as MIROC and GFDL2.1, etc., for more boundary conditions.

2) Analysis

A, Deadline for data submission

All modeling groups will submit the RCM simulation results for both current climate (1980-2000) and future climate projection (2040-2070) by July 1, 2010.

B, Deadline for observation data submission

Gridded observation (CRU, APHRODITE, etc), station data from China (Dr. Deming Zhao), Japan (Dr. Kurihara) and Korea (Prof. Lee) will be distributed to project groups by the time of June, 2010. Dr. Togtohyn Chuluun will be contacted for the observation in Mongolia. MAIRS IPO will provide necessary help in collecting observation data in India. START Southeast Center will provide data over Southeast Asia region.

C, Analysis plan and leading teams

The analysis will be around following scientific topics, and accordingly the analysis teams will be grouped:

- Projection of regional climate change (Lead by IAP, NJU, ...)
- Climate variability (Lead by IAP, NJU, ...)
- Monsoon system: response and feedback, possible change of on/off sets (Lead by YSU, ...)
- Extremes: heavy rain (frequency), heat wave, drought (frequency), tropical cyclone

- (frequency and intensity) (Lead by SNU, MRI, Hawaii Uni., ...)
- Aridification (Lead by IAP, ...)
 - Uncertainty analysis in the projection (Lead by IAP, NJU, SNU, ...)

Participating group is free to join any team and take part in the analysis, according to its own scientific interests and research objectives. For example, model groups using similar physical schemes can be teamed up, to set up study on physical scheme's effects on regional climate system and climate change projection

Finally, it's also agreed that climate statistician should be contacted and brought into the project, so that the ensemble analysis can be more efficiently designed and achieved. It should be encouraged to introduce statistical downscaling as the useful complement of model results.

3) New sensitive runs

The possibility to have sensitive runs on near future prediction, the impact of land cover/land use changes and climate change hot zones has been discussed among the project groups.

For near future prediction, due to the limited ability of driving GCMs, it might be difficult for RCM to detect the correct signal. For land cover/land use changes, it is noticed that no land cover/land use change is included in previous IPCC report, and the processes are important for near term projection. The project will consider organizing small groups of scientists to investigate the impact of land cover/land use changes on regional climate change. The feasibility and advances of applying very high resolution RCM on climate change hot zone were discussed.

4) Publication

To contribute to IPCC AR5 assessment report, the paper would be drafted following the project objectives and analysis results, and submitted by 2011. The paper will be either published or accepted by early 2012.

The results from APN project RMIP II (10 years run by 6 RCMs) will be distributed and analyzed. The paper will be drafted and publication will be prepared accordingly.

5) Other thoughts and continuous analysis of RMIP II results

- How to combine the interests of
 - Climatologists
 - End users/stakeholders
- Importance of communication
 - Among the RCM groups
 - With the "outsiders"

Action Items:

At the conclusion of the workshop the participants reached the agreement on the following action items:

- 1) Continue to analyze the ECHAM5 downscaling results finished by individual groups, around the topics such as the impact of biased SST on monsoon climate simulation
- 2) Collect and distribute observation data for model validation
- 3) Conduct integrations over new project domain for both current and future climate
- 4) Keep in close touch with GCM modelers for up-to-date GCM results
- 5) Form analysis team and set up to work on scientific tasks to implement project objectives

Acknowledgment:

The workshop was funded by APN, and locally supported by MRI/JMA. Dr. Kazuo Kurihara and Ms. Shizuko Miyashita put great effort to ensure the workshop's success. Dr. Ailikun and Ms. Ying Yang from MAIRS IPO provided great support in organizing the workshop. Additional supports come from each participating groups.

Attachment 1:

**APN Workshop on Building Asian Climate Change Scenarios by Multi-Regional Climate Models
Ensemble**

January 28- 29, 2010, Tsukuba, Japan

Day one: Jan 28 (Thursday)

9:10-9:30

Registration

9:30-9:40

Opening and group photo

※Opening Speech by Dr. Kazuo Kurihara, Dr. Shuyu Wang

※Approval of agenda

※Group photo

9:40-13:00

**Presentations of the Latest Research Results Related to APN Project,
Chair by Dr. William Gutowski**

9:40-10:00

- Dong-Kyou LEE: *Uncertainties in regional climate modeling over Asia*

10:00-10:20

- Kazuo KURIHARA: *Non-hydrostatic Regional Climate Models in MRI*

10:20-10:40

- Song-You HONG: *Future climate change scenarios in summer over Korea using a multi-nested downscaling system*

10:40-11:00

- John McGregor: *CCAM simulations for RMIP3*

11:00-11:20

Coffee Break

11:20-11:40

- Koji DAIRAKU: *Assessment of dynamical downscaling in Japan and preliminary experiments for intercomparison in Asia*

11:40-12:00

- Yunqing WANG: *Impact of Indian ocean SSTA on East-Asian summer climate: observations and Regional Climate Model simulations*

12:00-12:20

- Jia WU: *High resolution climate change simulation of the 21st century over East Asia by RegCM3 - A preliminary analysis*

12:20-12:40

- Jianping TANG: *Regional climate simulations of precipitation and surface air temperature during 1982-2001 over CORDEX East Asia domain*

12:40-13:00

- Deming ZHAO: *Preliminary analysis of RIEMS simulation over Asian region*

13:00-14:30

Lunch

14:30-18:00

RCM development and application, Chair by Prof. Dong-Kyou Lee

14:30-14:50

- William GUTOWSKI: *The coordinated regional downscaling experiment (CORDEX)*

14:50-15:10

- Jens CHRISTENSEN: *On the role of systematic model biases and a way to correct for them*

15:10-15:30

Attachment 2

**APN Workshop on Building Asian Climate Change Scenarios by Multi-Regional Climate Models
Ensemble**

January 28- 29, 2010, Tsukuba, Japan

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