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Scientific Capacity Building & Enhancement for Sustainable Development in Developing Countries

Strengthening Scientific Capacity in the Surface Ocean Lower Atmosphere Study (SOLAS): The 2007 SOLAS Open Science Meeting in Xiamen China

Final Report for APN CAPaBLE Project:
CBA2006-11NSY-Dai
Project Leader: Prof. Minhan Dai

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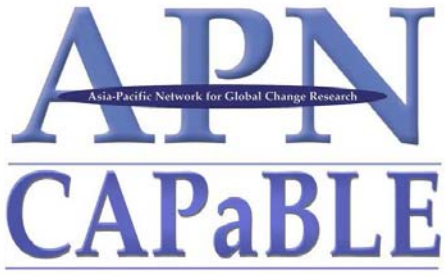

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Strengthening Scientific Capacity in the Surface Ocean Lower Atmosphere Study (SOLAS): The 2007 SOLAS Open Science Meeting in Xiamen China

CBA2006-11NSY-Dai

Final Report submitted to APN

August 14, 2007

www.apn-gcr.org

Overview of project work and outcomes

Non-technical summary

The Surface Ocean Lower Atmosphere Study (SOLAS) is a core project of the International Geosphere-Biosphere Programme (IGBP). SOLAS research strives to resolve the biogeochemical interactions between the air and sea, and the investigation of changes to air-sea interaction is one of the fundamental keys to understanding future global climate.

The third SOLAS Open Science Meeting was conducted from 6-9 March 2007 at the Xiamen International Conference and Exhibition Center (XICEC) in Xiamen, Fujian Province, China. Two hundred twenty-five scientists, students, and policy makers from 30 nations attended the conference, and APN supported seventeen participants from China, the Republic of Korea, Indonesia, Thailand, Bangladesh, India, Japan, and the USA. These funds supported the participants travel, subsistence, and registration fees for the conference, and this support was instrumental in creating a stimulating environment for collaboration between scientists and students from around the world.

Objectives

The present project aimed to:

- Provide opportunities for scientists and students from within the APN region to attend and participate in the SOLAS Open Science Meeting in Xiamen China, 6-9 March 2007.
- Develop capacity by providing opportunities to students and scientists within the APN region, particularly those from the developing nations, to attend the same conference.
- Maintain an environment at the conference to maximize the opportunities for collaboration and to develop synergistic relationships between scientists and students from the APN region and those from Europe and other areas.

Amount received and number years supported

The One-Year Grant awarded to this project was:

- US$ 20,000

Work undertaken : The SOLAS Open Science Meeting

Following from very successful conferences in Damp Germany (2000) and in Halifax Nova Scotia Canada (2004), the Surface Ocean Lower Atmosphere Study (SOLAS) decided to hold their next open science conference in the critically-important APN region. As China is becoming a world economic power, and due to the influence of its policies and scientific intellect on the field of air-sea interaction, China was chosen as the likely site. Furthermore, SOLAS colleagues at the Xiamen University volunteered to serve as hosts for this large event, and the stunning International Conference and Exhibition Center was chosen as the venue. The format for the meeting was chosen to provide substantial expertise and intellectual stimulation from a series of daily plenary talks (21 in all), long duration poster sessions which provided sufficient time and space for meaningful interactions between scientists and students (3 sessions), and afternoon planning and synthesis sessions where the community could gather in relatively moderate sized groups to develop new plans for those areas of SOLAS science deserving of new stimulation (11 sessions). In addition, evening social events and opportunities for sightseeing were made available, and this included a festive conference banquet on the last evening of the conference.

More information can be found at:
http://www.solas-int.org
http://www.solas2007.confmanager.com/

A conference brochure containing a list of participants, conference schedule, and a CD with poster abstracts is available by writing to: solas@uea.ac.uk

Results : APN Awards

This project provided travel awards to scientists and students from throughout the APN region to attend and participate in the 2007 SOLAS Open Science Meeting to be held 6-9 March 2007 in the city of Xiamen China.

SOLAS solicited for applications to this program in October and November 2006 via SOLAS network email and website communication. Approximately 30 applications were received by the December 1 deadline. A panel of reviewers was selected from the conference Scientific Organizing Committee (and included the Director of the Scientific Committee on Oceanic Research), and this committee vetted the applications. The selection criteria included the following requirements and guidelines: each participant was required to present original research within the SOLAS remit; applicants were required to submit a 400-500 word abstract of their presentation, along with a researched estimate of travel costs and a statement as to their employment status; participant must be a resident of an APN nation; priority is given to developing APN nations; and priority was given to nations other than the host (China).
The applications were scored for relevance and excellence, and the following individuals from developing (non-China) nations were chosen for award:

Nationality	**Name**	**Award**	**Email**
Thailand	Vanisa Surapipith	$600	vanisa@email.com
Bangladesh	Kawser Ahmed	$1500	kawser_du@yahoo.com
Indonesia	Ivonne Radjawane	$1200	ivonnemr@geoph.itb.ac.id
India	Yashvant Das	$1800	yashvantdas@rediffmail.com
India	Shilpy Gupta	$1500	shilpy@prl.res.in
India	Chandan Mahanta	$1500	mahanta_iit@yahoo.com
India	Anand Bhole	$2750	agbmtes@yahoo.com

Next, the applications from China were considered, and the following awards were made:

China	Haibo Hu	$400	huhb@ouc.edu.cn
China	Yan Zhang	$300	zhangy.fudan@gmail.com
China	Li Jianbing	$560	jblee0787@163.com
China	Yuan Zhang	$400	zhangyuan@ouc.edu.cn
China	Hao Ma	$500	mahao@tsinghua.org.cn
China	Jianjun Wang	$150	jjun@ustc.edu

Due to the generosity of the APN support, we were also provided the opportunity to review applications from developed APN nations. For these applicants, an additional standard of need was required, in that the applicants were required to demonstrate that participation in the conference would not be possible without APN support. Awards were provided for the following individuals:

Rep Korea	Jeong-Hee Shim	$900	jhshim@kordi.re.kr
Rep Korea	Ja-Myung Kim	$1100	jamyung@postech.ac.kr
USA	Karabi Biswas	$2200	bk.farhana@googlemail.com
Japan	Leni Yap-Djeto	$1000	llenigy@yahoo.com

Note that full special consideration was provided for these applications. The two Korean applicants are students, the US applicant is originally from Bangladesh, and the applicants from Japan were originally trained in India and the Philippines, respectively.

Each awardee was informed that the mechanism for support was made available by APN, and each were provided with APN and APN CAPaBLE logos to place on their poster presentation. Furthermore, a condition for acceptance of the award was established that the awardees must contribute to the final report to be submitted to APN.

Relevance to the APN CAPaBLE Programme and its Objectives

The APN Science Agenda consists of 4 elements:
Climate, Ecosystems, biodiversity, and land use, Changes in the atmospheric, terrestrial and

marine domains, and Use of resources and pathways for sustainable development. SOLAS directly addresses the first three of these agenda items. The biogeochemical interaction between the air and sea (that is, SOLAS science) is a critical component for understanding global climate and climate change. It is the ocean-based ecosystem which immediately connects the oceans with the atmosphere, and it is the transfer of biogeochemical components between the two fluids and the imminent changes of these processes which are fundamental determinants of future climate. Thus, strengthening the SOLAS network at the 2007 Open Science Meeting, through interaction of scientists and young researchers from developed and developing nations builds capacity in the APN region, brings greater understanding to the science agenda of APN, and has the potential to influence policy decisions for decades. In addition, a number of APN's goals are addressed by this project: Support regional cooperation in global change research on issues particularly relevant to the region; Strengthen appropriate interactions among scientists and policy-makers, and provide scientific input to policy decision-making and scientific knowledge to the public; Improve the scientific and technical capabilities of nations in the region; Cooperate with other global change networks and organizations; and Facilitate the development of research infrastructure and the transfer of know-how and technology.

Self evaluation and potential for future work

The SOLAS Open Science meeting attracted 225 scientists and students from 30 nations of the world. Feedback from participants indicate strongly that the conference was a success. The long-term legacy of this project remain to be seen, as the relationships developed will be instrumental in the development of research directions within the APN region and internationally for the next generation.

Acknowledgments

We are pleased that APN generously provided us with this mechanism of support, and we thank the APN for the interest in and support for the 2007 SOLAS Open Science Meeting.

Technical Report

Abstract

The third SOLAS Open Science Meeting was conducted from 6-9 March 2007 at the Xiamen International Conference and Exhibition Center (XICEC) in Xiamen, Fujian Province, China. Two hundred twenty-five scientists, students, and policy makers from 30 nations attended the conference, and APN supported seventeen participants from China, the Republic of Korea, Indonesia, Thailand, Bangladesh, India, Japan, and the USA. These funds supported the participants travel, subsistence, and registration fees for the conference, and this support was instrumental in creating a stimulating environment for collaboration between scientists and students from around the world.

Table of Contents

1.0 Introduction

The Surface Ocean Lower Atmosphere Study (SOLAS) is a core project of the International Geosphere-Biosphere Programme (IGBP). SOLAS research strives to resolve the

biogeochemical interactions between the air and sea, and the investigation of changes to air-sea interaction is one of the fundamental keys to understanding future global climate.

Following from very successful conferences in Damp Germany (2000) and in Halifax Nova Scotia Canada (2004), the Surface Ocean Lower Atmosphere Study (SOLAS) decided to hold their next open science conference in the critically-important APN region. As China is becoming a world economic power, and due to the influence of its policies and scientific intellect on the field of air-sea interaction, China was chosen as the likely site. Furthermore, SOLAS colleagues at the Xiamen University volunteered to serve as hosts for this large event, and the stunning International Conference and Exhibition Center was chosen as the venue. The format for the meeting was chosen to provide substantial expertise and intellectual stimulation from a series of daily plenary talks (21 in all), long duration poster sessions which provided sufficient time and space for meaningful interactions between scientists and students (3 sessions), and afternoon planning and synthesis sessions where the community could gather in relatively moderate sized groups to develop new plans for those areas of SOLAS science deserving of new stimulation (11 sessions). In addition, evening social events and opportunities for sightseeing were made available, and this included a festive conference banquet on the last evening of the conference.

2.0 Conference Outputs

A conference brochure was provided to each participant, and these files are included on the CD version of this report.
More information can be found at:
http://www.solas-int.org
http://www.solas2007.confmanager.com/

The conference brochure containing a list of participants, conference schedule, and a CD with poster abstracts is available by writing to: solas@uea.ac.uk

In addition, a special issue of the SOLAS Newsletter (Issue 5) focused on the Open Science Meeting and includes reports from the 11 Discussion Sessions held each afternoon of the conference. This newsletter is available for download at:
http://www.uea.ac.uk/env/solas/News1/newsletter.html

3.0 APN-Funded Participants

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Abstract
The flux of nitrogen (N) from pollution associated with anthropogenic activities along the Eastern Seaboard of Thailand is investigated and the resultant flux of nitrate to the adjacent oceans is assessed. Two industrial estates, Maptaphut and Laem Chabang, are found to be the key sources of nitrate (derived from oxides of nitrogen, NOx), which are emitted from fuel gas burning. Road traffic along the seashore also significantly contributes to the NOx budget. The total N input is estimated to be as high as 40 ktons per year. The transport due to recirculation (sea breeze) was found to be as far as 70 km off-shore during winter season, when northeasterly winds dominate. This is shown by simulation during the winter of 2002-03 using a Lagrangian dispersion model CALPUFF, driven by the meteorological database produced by MM5 (Penn State MM5) and nudged by observation from 12 surface stations and 1 RADAR/RASS for upper air profiles. The deposition rate of HNO3 in the adjacent coastal regions is calculated. The level of N input to the surface ocean was found supporting phytoplankton blooms and the

budget of N:P ratio is estimated along the eastern coast of Thailand. Increasing anthropogenic nitrate inputs to the marine ecosystem are showing impact on fisheries in the region.

Testimonial

"Grateful to the Asia Pacific Network support, my participation to SOLAS OSC 2007 in Xiamen enabled great exchange of ideas. It allowed me to see old friends as much as to meet new researchers from other parts of the world. The meeting with scientists who work in the related fields is also important for future collaboration. The quality of plenary talks was high such that one was fueled with motivations on various topics even those not formerly familiar. The planning and synthesis sessions were useful although more joint follow up will be needed on putting new information from interested people together. During the poster session, surprisingly I found a poster from Argentina that shared common focus on the nitrogen deposition over the water body; similar to my on-going observation for the Thailand Eastern Seaboard. We intend to explore further in the comparison of the modelling parameterization schemes. Back in Thailand, I have continually spread the SOLAS news to researchers in my network and encourage more activities. A new biogeochemical research group in Songkla University, situated in Southern Thailand that I visited immediately after Xiamen, expressed their interest to bring about more research campaign over the Andaman Sea, East Indian Ocean. Other subsequent meetings presented possibility to have different and young people to be more involved with SOLAS research. The SOLAS meeting in Xiamen was the first time in Asia and I believe, in a near future, Asian SOLAS could have regional workshops and show more exciting results to the worldwide SOLAS community."

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Abstract

Transport of organic mater from continental margins to the open ocean plays an important role in the carbon cycle in the oceans. Phytoplankton bloom in coastal area is important with respect to trophodynamics and global bio-geochemical cycles. In order to estimate the supply of such organic carbon to the open ocean quantitatively, it is important to make a self-consistent ecosystem model. An attempt was made to model both physical and biological processes dynamically in the coastal area of Bangladesh. Present study focus on the variability of the inflow and outflow of the water masses which depends on monsoonal wind events which probably has an impact on the nutrient and phytoplankton dynamics in Bangladesh Coast.
A time-dependent, three-dimensional self-consistent ecological-physical model was developed to simulate some important biological and physical processes in the northern part of Bay of Bengal. This model was applied to coastal systems to ascertain changes in the biological community in response to changes in forcing arising from climate changes. This model will be able to quantify and explain the impact of meteorological forcing and the complex oceanic environments and to simulate some of the important biological and physical processes. Specifically, this numerical model is able to estimate the distribution of nitrate, ammonium, phosphate, dissolved oxygen, phytoplankton (chlorophyll-a), zooplankton, PON, and DON.

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Abstract

An important challenge in the sea-air interaction knowledge is to expand quantitative perception and projection of the uptake of atmospheric carbon dioxide by the oceans. The estimate of global ocean uptake of carbon dioxide is based on the emissions from fossil fuel burning. As an archipelago country, Indonesia is potential in absorbing the CO2 gas. So, the aim of this research is to calculate the ocean's carbon dioxide gas uptake potential, especially in Indonesian

waters region. The method in calculating the sea-air CO2 exchange is based on the basic flux equation considering the difference between partial pressure of atmosphere and sea surface that determine the direction of CO2 exchange, while the amount of gas transfer velocity depends on the wind velocity the sea surface. The result showed that in 1995 the Indonesian water released CO2 up to 2 moles per square meter per year. The capacity of oceanic uptake still increases by years, where in 2004, the oceans absorbed up to 5 moles CO2 per square meter per year. To predict the potential of Indonesia waters in absorbing CO2 until 2100, then two scenarios were conducted i.e. the basic condition scenario (B2 IPCC scenario) and the mitigation scenario based on Kyoto Protocol scheme. The mitigation scenario presumes a lower concentration of atmospheric CO2 compare with the basic scenario. The prediction result based on basic scenario in the year of 2050 showed that the Indonesian waters can optimally uptake up to -15 moles CO2 per square meter per year, but would begin to slow down due to decreasing of atmospheric CO2 concentration until 2100. Meanwhile, the mitigation scenario showed that the Indonesia waters trend in absorbing the CO2 is lower than the basic scenario.

Testimonial

"I'm very grateful to the APN for giving me a chance to attend the SOLAS Open Science Meeting 2007 in Xiamen, China. This SOLAS OSM was a brilliant opportunity to meet interesting people from many countries, broaden my mind and experience new cultures. All the sessions enriched my understanding of the surface-ocean lower-atmosphere system. I made many friends and it will help me to intercommunicate within this subject in the future. It is also a great opportunity to start new international and interdisciplinary collaboration. In addition, the hospitality of people in local organizing committee and SOLAS IPO should be highly acknowledged".

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Abstract

Some characteristic features of the planetary boundary layer (PBL) over a coastal station in Indian Peninsula during Arabian Sea Monsoon Experiment (ARMEX), which is the second observational programme under the Indian Climate Research Program (ICRP) during June-August 2002, are described in this paper. A very high-resolution data in the vertical was obtained over Goa during ARMEX-I observational campaign that was used to study the PBL characteristics during convectively active and suppressed episodes in June and July 2002, respectively. The soundings, viz. the vertical profiles of temperature, humidity, zonal and meridional component of wind, obtained from coastal station along the west coast of India are used for the present study using an one-dimensional multi–level PBL model with a TKE-closure scheme. The temporal evolution of turbulent kinetic energy (TKE), boundary layer height (BLH), sensible and latent heat fluxes are simulated for these specific convective episodes during ARMEX-I. The model simulated vertical profiles of potential temperature, specific humidity, zonal and meridional wind compare reasonably well with the observations.

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Abstract

Recent increases in emissions over heavily populated and rapidly developing East Asia may have significant global influence on air quality and climate. The effects of East Asian sources on ozone over U.S and Europe are predicted to be greatest in early spring. A campaign over the Bay of Bengal (BOB) region and the Arabian Sea (AS) region during spring (MAM), 2006 provided a comprehensive data set of tracegases and aerosol and their chemistry from a combination of aircraft, ground – based and shipboard platforms. However, some observation has been made over the AS during INDOEX but there has been no such extensive measurement for vertical distribution of ozone over the the BOB which acts as a passage for all the pollutant which is passing through Indo Gangatic plane. The major focus was on the export of ozone from the polluted continental region to the surrounding pristine marine region and their impact on global climate. Vertical profiles of ozone were measured using balloon-borne electro chemical ozonesondes. Relative humidity, air temperature and pressure were measured with RS-80 Vaisala radiosondes. 120 air samples were also collected in pre-evacuated glass bottles for the analyses of carbon mono oxide (CO), Methane (CH4) and Non Methane Hydrocarbons (NMHCs). The path covered over the BOB and the Arabian Sea is given below. The region and period of the campaign provide particularly challenging conditions. The meteorological conditions in springtime over the Bay of Bengal are characterized by the frequent passage of low pressure systems which interlace continental airmass with cleaner, marine air. The sharp rise in temperature and increasing solar insolation during springtime over this region lead to rapidly increasing photochemical activity. This concides with the annual peak in emissions of O3 precursors from biomass burning sources in southeast asia, contributing to large variability in O3 abundances over the BOB region. Furthurmore the flux of stratospheric air into the troposphere in the northern Hemisphere is greatest in spring, and much of this influx occurs in tropopause folds associated with deviations of jetstream that are most common over northeast Asia in springtime. Over the BOB, ozone shows large variability in the lower altitude region (0 – 5 km) and values are ~ 30 – 60 ppbv in this height range while after 5 km ozone remains ~ 50 ppbv and after that just below tropopause it shows a minima. In stratosphere ozone values are ~ 140 ppbv. Over Arabian Sea, ozone shows continuous increase in ozone concentration. Surface ozone concentration is found to be ~ 20ppbv which lower than the BOB and it increases and reached up to 80 ppbv. In stratosphere, ozone concentration has been found to be ~ 155ppbv. Surface CO and CH4 were found to be two times and 0.5 times higher over BOB than over the AS respectively. North BOB and south AS show higher concentrations of CO and CH4.

Testimonial

“I, Shilpy Gupta, am a research scholar at the Physical Research Laboratory, Ahmedabad, India. I am pursuing research in the Atmospheric Sciences. When I came to know that I got selected to attend this conference at China, I was a little bit worried about the funding but with the financial support from the SOLAS and SCOR I could attend this conference. When I reached at Xiamen airport, I was worried about how to communicate to them so that I could reach my hotel. Then I met an old couple who were observing me and trying to find out my problem. They came along with me and dropped me at my hotel. I was so grateful to them. This thing has touched my heart. Finally I reached my hotel and met the organizers of SOLAS and I found all of them very co-operative and helping. The theme of the SOLAS has fascinated me from the very first and I would like to say that it is one of the best opportunities to have an exposure in the newly evolving field of science (oceanography as well as atmospheric science). Myself being an atmospheric researcher had only heard about this topic but after attending the conference I could grasp the detail of few of the exciting topics, i.e. DMS, acidification etc. It is a very good platform to have interaction with various eminent scientists of different fields. SOLAS programme is now developing quite fast and I wish India also be one of the active participants of the SOLAS activities. It will be my pleasure to be a part of SOLAS in future. My special thanks to SOLAS for giving me such a memorable experience.”

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Abstract
Impact of episodic pulse of more than 5% of the global dissolved and particulate riverine carbon load from Ganges-Brahmaputra is perhaps the most important of the natural and human induced interactive forcing influencing future capacity of CO2 assimilation of the Indian Ocean. Bay of Bengal is one of the high productive areas of the world oceans and very high organic carbon fluxes of more than 3 g m-2 y-1 have been recorded in sediment trap experiments. Any potential climate change impact would enhance the uncertainty about the future effect on the flux from Brahmaputra-Ganges on the processes of the Indian Ocean. If any reduction in carbon flux materializes, Indian Ocean will starve of the current carbon flux with serious impact on the air-sea CO2 exchange and anthropogenic CO2 inventories. Air-sea CO2 flux variability impact due to such variations in entrained terrestrial input could be more pronounced than surface temperature or wind speed. Large uncertainty already exists concerning uptake of carbon by the Indian Ocean due to insufficient knowledge of processes controlling carbonate chemistry. The settling of particulate organic carbon decreases the total C and pCO2 of the surface layers, whereas the removal of carbonate from surface waters aids in increasing atmospheric CO2 by shifting the carbonate equilibrium. Changes in the ocean circulation due to reduced stratification would drastically change future anthropogenic CO2 flux. While carbon flux between upper and mesopelagic layers would be affected, it would be the reduced net flux of C that will control the ocean-climate interaction.

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Abstract
Aquatic ecosystems are the key to development of the aquaculture, Marine as well as inland for social and economic development of the world. The plankton ecosystems are important for aquatic production. Considering the biogeochemical response of plankton ecosystems, it is necessary to adopt environmental management plans for use of marine water for aquaculture production based on plankton ecosystems. Aquaculture is an innovative tool in the urban and also in rural agriculture to use and reuse water as well as coastal and brackish water. Aqua-culture has emerged as one of the most promising industries in the world with considerable growth potential and it is expected to contribute about a quarter to the global fishery harvest in year 2000. Availability of plankton ecosystems is a constraint in a aquaculture farming and marine ecosystem. Aqua farming has a multidimensional context in perspective marine food growth. It is tool for utilizing coastal land and water more economically and optimally to increase marine productivity, of both, land and water, through sustainable marine aquatic management. The countries in the Asia-Pacific region have vast and varied aqua farming resources Often these are the main source of food production in this region. An attempt has been made in this paper to develop the environmental management plan for marine aquaculture and aqua food production based on biogeochemical response of plankton ecosystems using innovative technologies from Indian experience. The paper also evaluates air-sea exchanges of CO2 and marine water quality criteria for increasing aquatic productivity.
Testimonial
“The SOLAS open science meeting was very useful to discuss my research project with international scientists and researchers. The meeting was helpful in deciding the future plans for research work on aquaculture. This meeting was also useful for networking with the international institutions and scientist communities for further collaborations. We would like to give sincere thanks to APN-Capable for giving the opportunity to participate in this meeting”.

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Abstract
Annual subduction rate of three types of the North Pacific subtropical mode waters has been calculated by using a general circulation model (LICOM1.0) for the time period of 1958-2001. The model experiments focus on interannual variation of ocean dynamical processes under daily wind forcing and seasonal heat fluxes. The mode water formation region is defined by a PV minimum at outcrop location. Model results show two maxima of the subduction rate (>100 m . yr -1) in the formation region of Subtropical Mode Water (STMW) and Central Mode Water (CMW), and it is consistent with a climatologically-calculated value. The subduction rate for Eastern Subtropical Mode Water (ESTMW) is smaller at about 75 m yr-1. The subduction rate shows clear interannual and decadal variations associated with oceanic dynamical variabilities. The average subduction rate of STMW is much smaller during the period of 1981-1990 and of CMW it has a negative anomaly before 1975 and a positive anomaly after 1978. The variability is in accord with that of Ekman and geostrophic advection and mixed layer depth. The interannual variability of the amplitude of the subduction rate for ESTMW is the smallest during 1970-1990 as a result of weak wind stress curl.

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Abstract
Role of Atmosphere as a source of chemical species to marine biota has been identified by many researchers. Especially, the coastal sea region can act as a receptor of the huge anthropogenic emission from the continent by medium and long range transport under the influence of the wind system. And quantifying atmospheric input to East China sea has been addressed since fast industrial development in the booming East China, composed of many big cities such as Shanghai, Hangzhou, Nanjing with petrochemical complex, steel plants, and other major industries emitting SOx and NOx. Atmospheric deposition processes are very important input way to the sea, in which dry deposition process is key one depending on many factors such as meteorological conditions, chemical species and surface properties etc. And many governing factors for atmospheric dry deposition processes over Ocean surface are still not clear due to liquidity of sea surface, usually with larger wind speed, stronger turbulence activity and variable roughness length. The aerodynamics gradient technique was applied to measure the deposition fluxes of atmospheric aerosol during May20-June01 in Yangshan island of the East China sea, 2006. The results from modelling and experimental efforts showed that air pollutants from the East China have great influence to atmopheric aerosol content in Yangshan island especially in high episodes, the max value reached 138 ug/m3 for ions and 316 ug/m3 for the TSP mass concentration; and there were obvious concentraion gradient in vertical sampling for nitrate, from which and meteorological data collected, the dry deposition flux and deposition velocity were estimated. The dry deposition velocities of nitrate got from gradient measurement were 0.5-2.5cm/s. Correspondingly, the dry deposition module was developed and applied to simulate the atmospheric dry deposition velocity over sea. The modeled deposition velocities of nitrate were 0.1-2.0cm/s, smaller than the observed one. However, in dry deposition module, considering the sea surface roughness as function of sea surf can improve friction velocity and further the modeled deposition velocity value in some degree. The dry deposition module verified by measurement data will be set in regional chemical transport model system to simulate the temporal and spatial variation in atmospheric deposition and quantify nitrogen input to the East China Sea.

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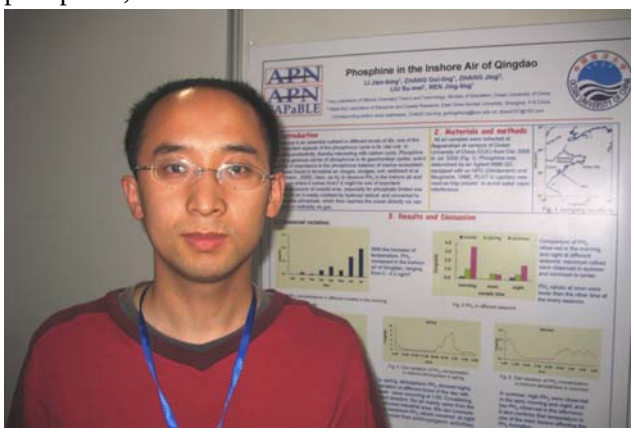
Abstract
Phosphine, a volatile phosphorus compound, might be of importance to the phosphorus cycles in the atmosphere. For relatively reduced phosphine, hydroxyl free radicals induced by UV from daylight cause its cleavage and oxidation. Phosphine will be converted to water soluble phosphate, which will reach the ocean or land via rain or aerosol. It has dual effects for negative



influences as acid rain and positive effects as nutrient, especially for oligotrophic water. Phosphine in the inshore air from Qingdao was investigated from Oct 2005 to July 2006 using a chromatographic method. The results showed that the maximum value occurred in summer and the minimum value occurred in winter due to the balance of production and consumption. In summer, more phosphine is produced mainly by microbe at higher temperature. In winter, consumption of coal will not produce more phosphine because much lower phosphine or even no phosphine was detected in the boiler gas, and low phosphine was produced by microbe due to the low temperature. Diel variation of phosphine was also observed with the maximum phosphine occurrring at night and minimum PH3 occurring at daytime. In daytime, lower phosphine occurred because it is oxidized by hydroxyl radical. Phosphine in inshore air is easily diffused to atmosphere above the ocean, then it maybe one of phosphorus sources of ocean.

Testimonial
“I am so thankful that I had the chance to enjoy such an important conference. It offered me the opportunity to communicate with many authorities and young Ph.D students from all over the world. Although I am interested in phosphine, I received plenty of advice from different field experts. At the same time, the plenary talks and posters let me know that the SOLAS field contains so much knowledge, I learnt of many ideas and technology related to DMS and halogenated hydrocarbon to enhance my future work. Also, I appreciated the southern Chinese art and culture that was integrated into the atmosphere. In the end, I have encouraged my classmates in our university to apply for SOLAS Summer School with me.”

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Abstract
Usually, there is a vertically uniform layer of temperature (isothermal layer), salinity (isohaline layer) and density (mixed layer) in the upper ocean. Underneath it there is a layer with strong vertical gradient such as the thermocline (in temperature), the halocline (in salinity) and the pycnocline (in density). In most cases, the temperature determines the density, so the isothermal layer depth (Ht) is identical to the mixed layer depth (Hd). There are areas of the world ocean where the Ht is deeper than the Hd. The layer difference between Ht and Hd is defined as the barrier layer (BL), which has strong density (salinity) stratification and weak temperature stratification. Less turbulence in the BL than in the mixed layer due to strong density (salinity) stratification isolates the mixed layer from the cold thermocline water. This process affects the ocean heat budget and the heat exchange with the atmosphere, which caused a high sea surface

temperature (SST) above the BL. Studies on the BL and related physical mechanisms have been devoted to the open ocean such as in the tropical Pacific, the north Pacific and the Indian Ocean. However, little attention has been given to the BL that occurs in the regional seas. Some studies found that there exist BL in the South China Sea, where the depth is usually more than 1000m and just like the open ocean. Nearly no studies focus on the BL in the shallow water such as the marginal sea. The East China Sea (ECS) is a large marginal sea located in the northwest Pacific Ocean. The strong western boundary current-Kuroshio brings the salty water and Yangtze River discharge large amount of fresh water into the ECS. Many previous works show that the precipitation strongly contributes to the formation of BL, but researchers have found that the Amazon river runoff could be responsible for the formation of BL in the tropical Atlantic Ocean. Thus, we may also expect Yangtze River runoff contribute to the formation of BL in this particular region. This analysis based on the high resolution CTD data firstly confirms the existence of BL in the ECS in summer 1998. We show that the fresh water from Yangtze River discharge play an important role in determining the density structure. The distribution of BL thickness is agreed with the distribution of salinity. According to the different formation area, we find three kinds of BL in the ECS. The first kind of BL is very thin and no more than 2m in Yangtze River mouth. The second kind of BL is relatively thick caused by the fresh water pool in the east of continental shelf. The third kind of BL is in the encountering area of the Taiwan warm current and the diluted water, which is the thickest in the ECS. As we known the BL has strong effect on the environment in the upper ocean. With the construction of great dams in Yangtze River, the discharging of fresh water will change, both in time and volume. The study of BL variation in the ECS will be more meaningful in the future.

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Abstract

The application of ^234Th-^238U disequilibria to study the particle dynamics in the euphotic zone of the South China Sea during the 2002 spring cruise had been made. The contents of the particulate organic carbon (POC), ^234Th(dissolved and particulate) and 238U at three stations were determined and profiles of ^234Th/^238U) A.R. in water column were discussed. Profiles of dissolved and particulate ^234Th and a steady state box model were used to quantify dissolved 234Th scavenging fluxes, particulate ^234Th removal fluxes and their resident times. The agreementof the results derived from two different approaches showed that 234Th was an excellent tracer for carbon cycle.

Testimonial

“It's the first time for me to attend an international conference and my poster about POC in South China Sea was accepted. Frankly, I am a little nervous not only for my poor oral English but also for my first manuscript which is not very good. Because I have not gone on board to sample and do experiments myself resulting that my work is in fact based on other one's former data and poor artwork of the poster, I am not fully confident.

However, I actually learn much from this meeting including improvement in English language, how to make posters and how to communicate freely with foreigners. Except for these, it is most important that I become to get in touch with the frontier of the SOLAS and meet many famous scientists”.

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Abstract
Four years of bulk, high-volume aerosol samples were collected during the cruise of Chinese National Antarctic Research Expedition from Shanghai, China, to the Southern Ocean to Zhongshan Station in the Eastern Antarctica. The results were also compared to the cruise from China to Arctic. Nss SO42- peaked near cities (Shanghai), but the four years records of MSA peak near maritime Antarctica. We suggested two possible sources for MSA: phytoplankton and animals (penguins or seals) feces.

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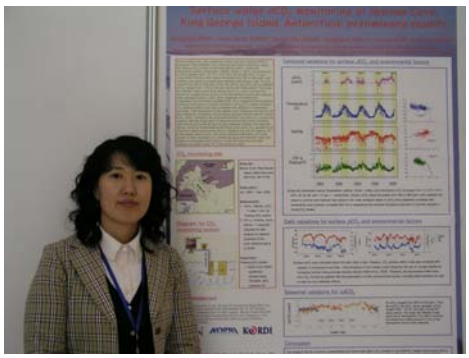
Abstract
Surface water pCO2 was observed continuously from Jan 2003 to Nov 2006 at Marian Cove, King George Island, Antarctica, using the flowing pCO2 system at the King Sejong Station. During the observation period, temperature, salinity, nitrate + nitrite, and chlorophyll a (chl a) ranged from -2–2.5°C, 31.0–34.5, 20–30 µM, and ~10 µg L-1, respectively. Surface pCO2 values fluctuated from 300 to 480 µatm, with relatively low values in summer and relatively high values in fall. Air pCO2 ranged from 365 to 378 µatm. Thus, the pCO2 (air pCO2 minus seawater pCO2) ranged from -80 to 100 µatm during the study period. The study site (Marian Cove) acted as an atmospheric CO2 sink in summer but served as a weak source of CO2 to the atmosphere during other seasons. Daily averaged values of pCO2 were negatively correlated with temperature and positively correlated with chl a, suggesting that elevated biological production in summer resulted in strong CO2 uptake. However, CO2 variation within a day was correlated with variation in temperature and tides. Tidal turbulence in the coastal ocean influences the sea-to-air gas transfer by increasing vertical mixing and gas transfer velocity. Therefore, we recommend further long-term CO2 monitoring together with the observation of other environmental factors, including tidal turbulence as well as sea-ice and meltwater effects. This research will be crucial for understanding the factors that affect CO2 variation in an Antarctic coastal environment and for validating the role of Antarctic CO2 in the global carbon cycle. This study presents preliminary, yet novel, results of high-resolution CO2 monitoring along the Antarctic coast and begins to investigate which factors control the seasonal and daily variation in surface water CO2 of an Antarctic coast.



Testimonial
“SOLAS Conference at Xiamen, China, was a highly stimulating and informative meeting, and was the first time for me that all participants are interested on only one focus “gas exchange”. The plenary talks by top-level scientists and posters by young scientists satisfied my scientific curiosity and gave me a chance for knowing other research areas of air-sea interactions. By attending the meeting, I also have a chance to establish communication links, research co-operation with other scientists involved in gas exchange, surface ecosystems and climate change. And the delicious food and fantastic performances served at the banquet were felt by the Chinese traditional cultures. Overall, I enjoyed the meeting very much and I was greatly inspired by new knowledge and ideas. I am sure that this experience will steer my future research direction. I wish to give grateful thanks to SOLAS APN for supporting my participation at the conference.”

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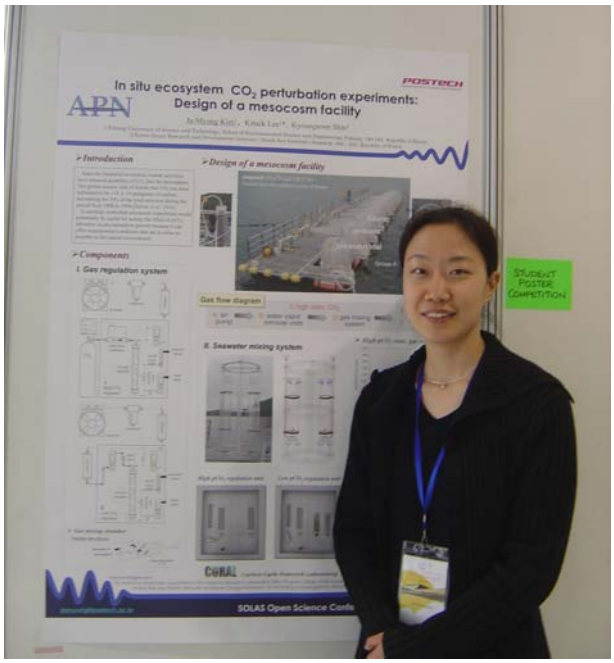
Abstract
Enclosed experimental system is used as a useful tool for manipulative experiment due to a greater degree of control and replication. Large scale mesocosm study could be one way of approach for merging the advantages of an enclosed incubation study and the benefits of a natural scale experiment. In order to investigate the effect of seawater CO2 concentration on the growth rate of natural assemblage of mixed phytoplankton, we designed and developed a mesocosm system including nine impermeable enclosures; each has a transparent cap, a CO2 concentration regulator, and a bubble-mediated seawater mixer. Nine enclosures (3000 liters) were set up in the southern coast of Korea (34.6°N and 128.5°W). The CO2 gas regulation unit consists of a mass flow controller and a gas mixing chamber produced the air at the target CO2 concentration of 250, 380, and 750 µatm. The gas with regulated concentration was used in circulating the water and fumigating the head space. Seawater mixers reduced the errors of determining particulate parameters in the enclosure by mixing seawater homogeneously.
Testimonial



"The time that I spent at the SOLAS conference in Xiamen was one of the most valuable experiences that I have ever had. It reminded me of the things that I have to learn and keep in mind as a young scientist and a professional expert in the future. Many talks lectured by respectable scientists and discussions allowed me to realize that publishing research products is no less important than enjoying a research itself. Sharing ideas, being encouraged or even being severely criticized by others could take me one step forward. I learned directly this importance of communication through the poster session in the conference. Someone asked me such a practical question and others seriously advised the way of solving problems. I was surprised at so many people taking an interest in my research than I had expected. It was actually the first time when I started to feel that I am being helpful for other people's study then I get proud of it.
I would like to give many thanks to Asia Pacific Network, the organization that granted me a travel fund, and I also appreciate all participants who took an interest in my research. It was a truly great time."

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Abstract
Halogens displaced from sea salt represent an important source of free halogen atoms in the marine atmosphere. Hence, reactions involving halogen cycling from sea salt can influence ozone within the marine boundary layer which can alter the oxidising capacity (the ability of the

marine boundary layer to destroy reduced organic species of natural and anthropogenic origin) and alter the flux of potentially harmful UV radiation to surface waters. Size resolved aerosols were sampled over the Atlantic Ocean during two interhemispheric cruises between 49N and 52S in Sept-Oct 2001 and May-June 2003. Samples were collected using high volume aerosol sampler, and analysed for fluoride, chloride, bromide and other ions (e.g. sulphate, nitrate, nitrite, ammonium, sodium, potassium, calcium and magnesium) by ion chromatography. Size distribution of non sea salt fractions of the ions of interest, five-day air parcel back trajectories and interspecies correlations were used to identify the processes regulating the halogen ions cycling in marine atmospheric aerosols, as well as to characterise the sources of these halogens aerosols over the Atlantic Ocean. Both depletion and enrichment of bromide and chloride with respect to sea salt were observed in open ocean aerosols. Fluoride in all samples and bromide in submicron mode aerosols were found to be below detection limit. In general, chloride was depleted both in supermicron and submicron modes in the northern hemisphere air but enriched in the southern hemisphere air. Bromide in supermicron aerosols was mainly depleted with a very few exceptions in the south. Acid displacement of halogens could not account for the entire deficit of halides in Atlantic Meridional Transect (AMT) aerosols, and autocatalytic mechanism of halogen loss appeared to have a significant role in bromide depletion. Urban emission sources from Europe and South America, mineral dust from the Saharan and Patagonian arid region, and biomass burning from Southern Africa and South America have been shown to influence halogen depletion and enrichment in aerosols over the Atlantic Ocean.

Testimonial

"Those were the final moments of splendid fire works to celebrate the spring there when I landed in Xiamen. A full-moon was glowing in the sky and I felt naturally welcomed there! Next day was passed in exploring the scenic parts of Xiamen and the Gulangyu Island, and meeting and greeting other participants at the Ice Breaker evening. Following days were going to be absorbing, and I was looking forward to it. Most of the plenary talks provided an overview of the progress in the relevant subject. During the poster sessions, it was very useful to share

views with the audience on the findings of my own research and other scientists' works. A range of new ideas, be it complementary or conflicting, evolved during the Planning and Synthesis sessions, which have been recorded for future plans and references. Last but not the least was the excellent overall arrangement. Commitments of the conference organisers, well-researched programmes, the superb conference venue, charismatic cultural shows, and Chinese cuisine have all contributed to it. Five days of science and fun passed very quickly! Then, I travelled to Beijing for personal vacation. I also did a bit of science during my vacation when the China Radio International interviewed (broadcast from March 30 through 31) me about the objectives and focus of SOLAS and the open conference, the reason for choosing China as a venue, and roles of China and other countries in SOLAS and so on. Participation in this conference was the one of my best experiences. It brought me the scope of sharing knowledge and views, building network with co-workers in the world, reaching the audience of the China Radio with SOLAS information and experiencing Chinese heritage and contemporary lifestyle. I gratefully acknowledge the generosity of Asia Pacific Network for Global Change Research (APN) that made my participation possible. Thank you, APN and all the best!"

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Abstract

Nutrient loading from fish feed may alter the composition of surface phytoplankton. There are now more than 20 fish cages found in San Pedro bay, which had been identified as a mariculture zone in Leyte and Samar. It has been known that dinoflagellates causing harmful algal blooms, particularly Pyrodinium bahamense var. compressum are present in these waters. In Bolinao, Pangasinan it was determined that the cause of recurrent fish kills were the phytoplankton blooms periodically experienced in the bay. It is reasonable to expect that these unfortunate incidents in Bolinao that also occurred in Dagupan which are long established mariculture areas, may also happen in San Pedro Bay, Leyte unless we take measures to forestall it. The necessary prerequisite to doing this is to monitor the phytoplankton community and its production in the Bay. This paper reports the results from the three days consecutive daily sampling of phytoplankton during August, October, and December of 2005 and March, 2006. With the use of GPS, six sampling stations were visited. Four stations among them had fish cages while the other two stations had no fish cages. Two 1L water samples were collected from surface waters of the stations. For the stations with cages, two 1L samples were taken from inside and another two 1L samples from outside of the cages. pH, salinity, temperature and dissolved oxygen and visibility were also recorded.

Testimonial

"The SOLAS Convention in Xiamen was filled with unexpected pregnant moments. Starting from the lucent city at night, the extra lavish ornamentations, the feast-like meals, our hosts' warm welcome down to the very helpful people of the city. My research is on phytoplankton brought about by the Philippine's perennial problem on Paralytic Shellfish Poisoning (PSP). I was happy to find people working on the same field using the latest technologies during the first poster session. Most of topics though have to be digested. Strange themes these mineral dust particles, Eddy Covariance, Microlayers(!) are. I found it hard to relate when scientists in my country still grapple with ecological problems such as HAB's in eutrophied mariculture areas, oil spills, siltation due to deforestation, etc…I wish we could have these kind of studies too. Our archipelagic country will be the first to lose land if the oceans continue to swell. We even loose some of our islands just by the mere rising tides! It is good that people from countries like mine are updated on current theories. Kudos to APN and SCOR for funding our travels to Xiamen and to the organizers of the conference, my congratulations for a job well done!"

4.0 Conclusions

The 2007 SOLAS Open Science Meeting was a highly successful event which attracted 225 scientists from 30 nations of the world. The intention of the meeting was to provide a forum for open exchange of ideas and development of collaboration among the scientists and student participants. All indications are that this event will provide meaningful relationships for many years to come. We thank APN for their CAPaBLE program and for providing us with the means to provide significant opportunities for research advancement to the scientists and students of the APN region.

Appendix

SOLAS Open Science Meeting

6-9 March 2007-08-15 Xiamen International Convention and Exhibition Center Xiamen, Fujian Province, China

Scientific Organizing Committee
Chair: Guang-Yu Shi, China
Minhan Dai, China
Peter Liss, UK
David Ho, USA
Osvaldo Ulloa, Chile
Jill Cainey, Australia
Veronique Garcon, France
Uli Platt, Germany
Mitsuo Uematsu, Japan
Maurice Levasseur, Canada
Patricia Matrai, USA
Caroline Leck, Sweden
Shizuo Feng, China

Conference Advisory Committee
Zhisheng An, Vice-Chair of IGBP
Yiyu Chen, Director of NSF-China
Juayang Li, Chair of China IGBP

Honorable Conference Chairs
Dexing Wu, President of the Ocean University of China
Huasheng Hong, Chair of China SCOR

Local Organizing Committee
Chair: Minhan Dai, Xiamen University
Guang-Yu Shi, Institute of Atmospheric Physics
Huiwang Gao, Ocean University of China
Biao Wang, Institute of Atmospheric Physics
Shaoling Shang, Xiamen University
Weidong Zhai, Xiamen University

Local Secretary from Xiamen University
Lidan Chen
Mengmei Lin
Shuang Yang
Vera Shi

SOLAS International Project Office
Jeff Hare
Emily Breviere
Georgia Bayliss-Brown

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Funding sources outside the APN

Co-funding for the SOLAS Open Science Meeting was also provided by the following organizations:

Org	Approx Amt	Comment
SOLAS	$30000	For facilities, meals, administration, etc
SCOR	$8000	For scientists / students developing nations
NERC	$9000	For students / post-docs from the UK
NSERC	$2000	For students / post-docs from Canada
CFCAS	$2000	For students / post-docs from Canada
ACCENT	$9000	For students / post-docs from Europe
IGBP	$20000	For participation of SOLAS SSC Members

In addition, support for the conference venue, entertainment and meals, logistics, and other local costs have been provided by the Chinese Academy of Sciences, the National Natural Science Foundation of China, and Xiamen University. Funds from conference registrations will be used to support the travel of the 21 invited plenary speakers and to support the balance of the local costs.

2007 SOLAS Open Science Meeting Programme:

Tuesday 6th March

Time	Event	Location
09:00	Opening Ceremony	Conference Hall
	Chair: Minhan Dai	
Plenary Talks	Chairs: Brian Ward and David Ho	
09:35	Barry Huebert	Conference Hall
	"Eddy covariance as a means of improving gas exchange parametrizations"	
10:10	Coffee	Conference Hall
10:40	Lise Lotte Soerensen	Conference Hall
	"Air-sea exchange of CO_2 in the Polar Regions"	
11:15	Phil Nightingale	Conference Hall
	"Do we understand the sea to air flux of volatile iodine species?"	
11:50	Lisa Miller	Conference Hall
	"The solid air-sea interface: Gas transport in sea ice"	
12:25	Lunch	Gulang Banquet Hall
14:00	Craig McNeil	Conference Hall
	"Air-sea gas exchange at extreme wind speeds"	
Poster Chairs: David Erickson, Jacqueline Boutin and Shao-Ling Shang		
14:35	Poster Session: Focus 1	Exhibition Hall
16:15	Coffee	Exhibition Hall
16:45	Planning and Synthesis Sessions	
	"Comprehensive Earth System Modeling: Air-sea Flux Treatments and Climate Impacts"	
	Convenors: David Erickson and Jim Gunson	Meeting Room 303
	"SOLAS in the Southeast Pacific – VOCALS"	
	Convenors: Barry Huebert and Paty Matrai	Meeting Room 304
	"Biogeochemical Cycling and the Sea Surface Microlayer"	
	Convenors: Michael Cunliffe, Colin Murrell, Rob Upstill-Goddard	Meeting Room 401
18:15	End	

Wednesday 7th March

Time	Event	Location
Plenary Talks	Chairs: Nicholas Metzl and Truls Johannessen	
09:00	Minhan Dai "Carbon dynamics in marginal seas- fluxes and processes"	Conference Hall
09:35	Véronique Garçon "Eastern boundary upwelling systems as natural SOLAS laboratories"	Conference Hall
10:10	Coffee	Conference Hall
10:40	Laurent Bopp "New insights on the pre-industrial atmospheric pCO_2 inter-hemispheric gradient"	Conference Hall
11:15	Kitack Lee "Excess carbon export in high latitude oceans following the spring bloom: Global implications of nitrogen fixation-mediated carbon export"	Conference Hall
11:50	Andy Watson "Towards near-real-time monitoring of the ocean sink for atmospheric CO2"	Conference Hall
12:25	Lunch	Gulang Banquet Hall
Poster Chairs: David Kieber, Richard Rivkin and Hui-Wang Gao		
14:00	Poster Session: Focus 2	Exhibition Hall
15:40	Coffee	Exhibition Hall
16:00	Planning and Synthesis Sessions "SOLAS and the Paleo-Ocean" Convenors: Tom Pederson and Isabel Cacho-Lascorz	Meeting Room 303
	"What are the challenges for SOLAS Data Integration?" Convenors: Tom Bell, Gwen Moncoiffe, Jim Gunson, and Lu Wang	Meeting Room 304
	"Satellite, Data and Synthesis" Convenors: Uli Platt and Thomas Wagner	Meeting Room 401
	"CO_2 Fluxes in Coastal Oceans and its Role in SOLAS Budgeting" Convenors: Wei-Jun Cai, Lei Chou, and Minhan Dai	Meeting Room 402
17:15	Visit to Xiamen University and Dinner	
20:30	End	

Thursday 8th March

Time	Event	Location
Plenary Talks Chair: Mitsuo Uematsu and Maria Kanakidou		
09:00	Eric Saltzman "Air-sea transfer of global atmospheric cycling of sulphur, nitrogen and carbon"	Conference Hall
09:35	Joyce Penner "Solar UV flux, DMS and climate: Is there a connection?"	Conference Hall
10:10	Coffee	Conference Hall
10:40	Jill Cainey "Particle formation at Cape Grim, Tasmania"	Conference Hall
11:15	Tong Zhu "Heterogeniety of SO2 and NO2 reactions on atmospheric particles and their climate and ecosystem implications"	Conference Hall
11:50	Roland Von Glasow "Halogens in the marine boundary layer- origin, cycling and relevance for the atmosphere"	Conference Hall
12:25	Lunch	Gulang Banquet Hall
14:00	Wu-Ting Tsai "Using numerical simulations to help understand transport processes at the air-sea interface"	Conference Hall
Poster Chairs: Urumu Tsunogai, Alex Baker and Wei-Dong Zhai		
14:35	Poster Session: Focus 3	Exhibition Hall
16:15	Coffee	Exhibition Hall

16:45 Planning and Synthesis Sessions
"SOLAS CODiM (Comparison of Oceanic Dimethylsulfide Models"
Convenors: Maurice Levasseur and Jim Gunson Meeting Room 303
"Future Large-Scale Field Experiments in SOLAS"
Convenors: Peter Liss, Barry Huebert, and Andy Watson Meeting Room 304
"Sub-micrometer Primary Marine Aerosol Emissions"
Convenors: Douglas Nilsson and Gerrit de Leeuw Meeting Room 401
"Aerosol Iron Solubility – In Search of Some Clarity"
Convenors: Alex Baker and Peter Croot Meeting Room 402
18:15 Banquet Gulang Banquet Hall
21:30 End

Friday 9th March

Time	Event	Location
Plenary Talk Chairs: Cliff Law and Rafel Simó		
09:00	Maurice Levasseur "Microbial DMS(P) production in the sub-arctic Atlantic and Pacific: Does iron matter?"	Conference Hall
09:35	Shigenobu Takeda "Biogeochemical responses of plankton ecosystem to artificial and natural iron enrichments in the N-W Pacific"	Conference Hall
10:10	Coffee	Conference Hall
10:40	Colin Murrell "Microbiology of the sea surface microlayer and cycling of trace gases"	Conference Hall
11:15	Tom Pedersen "Nitrogen, oxygen, physics and export production: Links to climate in the late Quaternary ocean"	Conference Hall
11:50	Doug Wallace "Sun, sea and dust: SOLAS in the Tropics"	Conference Hall
12:25	End	

List of Participants: SOLAS Open Science Meeting, Xiamen China, 6-9 March 2007

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