Report on CSIR-NSFC Workshop on "Global Change: Oceans-Atmosphere-Land interactions driven by monsoon"
4-6 December 2006
National Institute of Oceanography, Dona Paula, Goa

In an effort to initiate and further Indo-China collaborations in scientific research the Council of Scientific and Industrial Research (CSIR) of India and National Natural Science Foundation of China (NSFC) have made an agreement on ***Working Programme of Scientific and Technological Cooperation between CSIR and NSFC (National Science Foundation of China) for the years 2006-2008*** at NSFC in Beijing on 21 March 2006. Under this programme and in the area of Oceanography & Earth Sciences including Natural Disasters several themes (Changing Environment, Ocean Variability, Land Ecosystems, Land-Ocean Interactions, Land-Atmosphere Interactions, Ocean-Atmosphere Interactions and Coupled Modeling) were identified for collaborative programs between CSIR laboratories and Chinese (NSFC/CAS) Institutions.

Based on the above initiative a CSIR-NSFC Workshop on **Global Change : Ocean – Atmosphere – Land interactions driven by Monsoon**, 4-6 December 2006 was organized by the National Institute of Oceanography at the International Centre, Goa. The CSIR and NSFC drew participants across the spectrum of Earth Sciences disciplines from their respective laboratories. Prof. Congbin Fu, Academician and Director of START Regional Office in Beijing, led a 16 member Chinese delegation. A 18 member team of Indian Scientists was led by Dr. S. R. Shetye, Director of the National Institute of Oceanography, Goa, that included participants also from other CSIR Institutions; National Geophysical Research Institute, Hyderabad, National Physical Laboratory, New Delhi and Centre for Mathematical Modelling and Computer Simulation, Bangalore. Detailed list of Chinese and Indian participants is given in ***Annexure I***.

A pre-Workshop meeting was held at 1800 hrs on 3 December with scientific (Prof. Congbin Fu and M. Dileep Kumar) and management/administrative (Prof. Yucheng Chai and Dr. Purnima Rupal) Coordinators (of NSFC and CSIR respectively) and Dr. Rajendra Prasad, Head of ISTAD (CSUR, New Delhi), which was Chaired by Dr. S. R. Shetye, Director (NIO, Goa). A general discussion was made on approaches and strategies to promote research collaborations. It was proposed to encourage the researchers on both sides to identify the tentative topics and collaborators and express their intentions during the concluding session on ***Future Strategies***.

During the inauguration on 4 December Dr. Rajendra Prasad, gave an account of genesis and expectations from the Workshop in his initial remarks. Following the inaugural addresses by Prof. Fu and Dr. Shetye, 26 scientific presentations were made in all on wide ranging topics covering Ocean-Atmosphere interactions, biogeochemistry, biological dynamics, Land-Ocean interactions, atmosphere, paleoceanography and Modelling. Details of the programme are given in ***Annexure II.*** Extensive discussions led both the sides to propose several new focused scientific investigations in the area of

Earth Sciences and Oceanography, with a particular focus on monsoon. The following 9 Joint proposals have been made details (as received from the proposers) of which are given in ***Annexure III***.

Proposal 1

Title: Indian Ocean-Atmosphere Interactions at Intra-seasonal to Inter-annual Scale (IndOAI)

Scope: The present IndOAI proposal aims to initiate a long-term cooperation to promote the scientific progress on the monsoon climate through the actions on observations, diagnosis and prediction.

Chief Collaborators:
Prof. Weidong Yu (FIO/SOA, China) and Dr. V. S. N. Murty (NIO, India)

Proposal 2

Title: Integrated Modelling Platform for Asian Monsoon

Scope: Developing a Monsoon Asia Modelling Platform by identifying and evaluating a modeling configuration with optimum performance and accessibility

Chief Collaborators:
Prof. Congbin Fu (IAP/CAS, China) and Dr. P. Goswami (C-MMACS, India).

Proposal 3

Title: Joint Indo-China Proposal for Ocean Biology Research

Scope: Plankton ecology through sea-truth and remote sensing studies

Chief Collaborators:
Prof. DanLing Tang (SCSIO, China) and Dr. N. Ramaiah (NIO, India)

Proposal 4

Title: Asian Rivers: Changes in sedimentological and geochemical characteristics of sediments from source to sink

Scope: Transformations of terrigenous materials during their transport to deep ocean

Chief Collaborators:
Prof. Shu Gao (NU, China) and Dr. V. Ramaswamy (NIO, India)

Proposal 5

Title: Late Quaternary paleoceanographic changes in the Northeast Indian Ocean and South China Sea using isotopic and trace elemental proxies from the deep-sea sediment cores

Scope: Understand the late Quaternary paleoclimatic and paleoceanographic changes in the Northeast Indian Ocean (NEIO) and South China Sea (SCS) and the effects of monsoons on the surface water masses of these regions.

Chief Collaborators:
Prof. Hongbo Zheng (SOES, TU, China) Dr. S. Masood Ahmad (NGRI, India)

Proposal 6

Title: Atmospheric pollutant transport and the impact of the Mega Cities of the Yantze River and the Pearl River Delta Regions in China and the Indo-Gangetic Plains Region in India.

cope: Studying the impact of mega-cities on atmospheric pollution and the trans-boundary transport using observations, other data sets, analysis and modeling.

Chief Collaborators:
Prof. Tong Zhu (CES, PU, China) and Dr. M. K. Tiwari (NPL, India)

Proposal 7

Title: To establish teleconnections in monsoon variations: Indian Ocean and East/South China Seas using biomarkers & Isotopic studies as proxies.

Scope: Understand variability in monsoons through studying sedimentary records in North Indian Ocean and China Seas and establish teleconnections between two regions, if any.

Chief Collaborators:
To be identified by Prof. DanLing Tang (SCSIO, China) and Dr. A. Paropkari (NIO, Goa)

Proposal 8

Title: Influence of River discharges on shelf and deep sea biogeochemical processes

Scope: Compare the significance of discharges from Indian and Chinese rivers and the resultant shelf and offshore biogeochemical processes and quantify their contribution on both regional and global scales.

Chief Collaborators:

Prof. Jing Zhang (ECNU, Shanghai, China) and Dr. M. Dileep Kumar (NIO, Goa)

Proposal 9

Title: **Modelling and Analysis of extreme Weather Events over China & India**

Scope: Analyze and simulate extreme events over both China and India using different data sets (station data, analysis etc) and a hierarchical modeling platform.

Chief Collaborators:
Dr Dong Wenjie (BCC, Beijing) and Dr P Goswami (C-MMACS, India)

The present CSIR-NSFC initiative and Workshop are aimed to address 'monsoon processes in both the countries' and are closely related to the Monsoon Asia Integrated Regional Study (MAIRS) - a new international global change program of the Earth System Science Partnership (ESSP). Consequently, during the discussion on the **Future Course** (Concluding Session) the need to take joint-initiatives to conduct "experiments on Global Change and monsoon driven processes" involving other countries of the Asia-Pacific region is also stressed.

Dr. Purnima Rupal announced the CSIR-NSFC joint call for proposals in the area of Oceanography and Earth Sciences along with the application format. The deadline for the receipt of project applications by CSIR and NSFC in respective countries is 31 December 2006.

The next meeting/workshop will be held in China, which will be finalized, after Prof. Congbin Fu's discussions with NSFC.

The Workshop ended by acknowledging the support from CSIR and NSFC.

Annexure I

CSIR-NSFC WORKSHOP [4-6 December 2006]

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Annexure II

The CSIR-NSFC Workshop on
Global Change: Ocean – Atmosphere – Land interactions driven by Monsoon

4-6 December 2006
National Institute of Oceanography, Dona Paula, Goa

3 December 2006

Arrival of Chinese and Indian participants	1500 hrs
Meeting of Co-ordinators Venue: Director's Chamber, NIO.	1800 hrs
Dinner (***Introductory Interactions***) Venue: International Centre, Dona Paula	1930 hrs

The Programme
Day One: 4 December 2006

Inauguration (0900-0930 hrs)

Welcome by Dr. M. Dileep Kumar	(0900-0905 hrs)
Genesis by Dr. Rajendra Prasad, CSIR	(0905-0910 hrs)
Remarks by Prof. Yucheng Chai, NSFC	(0910-0915 hrs)
Remarks by Prof. Congbin Fu, Scientific Coordinator	(0915-0920 hrs)
Remarks by Dr. S. R. Shetye, Director, NIO, Goa	(0920-0925 hrs)
Vote of thanks by Dr. Purnima Rupal, CSIR	(0925-0930 hrs)

Inaugural addresses

Prof. Congbin Fu (0930-1000 hrs)
Towards further understanding the function of Monsoon Asia in the earth system dynamics

S. R. Shetye, I. Suresh, D. Shankar, D. Sundar, S. Jaya Kumar, R.G. Prabhu Desai, P. Mehra, and P.Pednekar (1000-1030 hrs)
Local and Remote Forcing of the North Indian Ocean Circulation

Coffee/Tea Break (1030-1100 hrs)

Chair: Prof. Congbin FU

Session 1: Ocean-atmosphere interactions

S. S. C. Shenoi (1100-1125 hrs)
Role of ocean in the genesis and annihilation of the warm pool in the Arabian Sea: Results from Arabian Sea monsoon experiment

Zhaoyong Guan, Wei Qian , Ashok Karumuri, and Toshio Yamagata (1125-1150 hrs)
Influences of the Indian Ocean Sea Surface Temperature Anomalies on the Summer Climate in China

K V Ramesh (1150-1215 hrs)
High resolution Rainfall variability over south Asia

Weidong YU (1215-1240 hrs)
Symmetric atmospheric response to the asymmetric SSTA forcing during Indian Ocean Dipole

Xiu-Qun YANG (1240-1305 hrs)
Structure and dynamics of inter-decadal anomalies in the mid-latitude North Pacific ocean-atmosphere system

Lunch (1305-1400 hrs)

Chair: Dr. P. Goswami

V.S.N. Murty, M.S.S. Sarma, Yogesh Agarvadekar, A.S.N. Lakshmi and Anselm Almeida (1400-1425 hrs)
Upper ocean currents variability in the equatorial Indian Ocean from ADCP and OGCM simulations

Fan WANG, Yanhui ZHANG and Dunxin HU (1425-1450 hrs)
New evidences of subsurface water masses in the western tropical Pacific Ocean derived from Argo data

Session 2: Biogeochemistry

M. Dileep Kumar (1450-1515 hrs)
Monsoon biogeochemistry of the North Indian Ocean

S. W. A. Naqvi (1515-1540 hrs)
Oceanic Water-column Suboxia

Xiaodong Yan and Fu Congbin (1540-1605 hrs)
Modeling carbon budget of China forest ecosystem with climate change

Coffee/Tea Break (1605-1630 hrs)

Chair: Prof. DanLing Tang

Session 3: Biological dynamics

DanLing TANG, B. Satyanarayana, Hui Zhao, GuangMing Zheng, Ramesh P. Singh, Jian Hai and LV Ravi Kumar (1630-1655 hrs)
Changes in Chlorophyll-a in the Indian Ocean during the 2004 south Asian Tsunami period

A. C. Anil (1655-1720 hrs)
Changes in phytoplankton community: a perspective from monsoon influenced environment

Bangqin Huang, Jixin Chen, Jun Hu, Zhenrui Cao, Xin Liu and Huasheng Hong (1720-1745 hrs)
Phytoplankton community structure in the typical waters of China Seas and its response to the upwelling induced by SW monsoon
N. Ramaiah, G Mangesh, Veronica Fernandes, Jane Paul and V Rodrigues (1745-1810 hrs)
Biological productivity characteristics in different regions of the Indian Ocean

Dinner (hosted by the Director, NIO) (1930 hrs)
Venue: VIP Guest House

Day Two: 5 December 2006

Chair: Dr. S. W. A. Naqvi

Session 4: Land-Ocean interactions

Gao Shu (0900-0925 hrs)
Cathcment-coast interaction: an example from the Changjiang River system

Yucheng Chai (0925-0950 hrs)
National Natural Science Foundation of China (NSFC)

Shi Lun Yang (0950-1015 hrs)
Monsoon-driven seasonal cyclicity of hydrological and sedimentary processes in the outer Yangtze River estuary, China

V. Ramaswamy (1015-1040 hrs)
Carbon fluxes and burial in the ocean – the continental connection

Coffee/Tea Break (1040-1100 hrs)

Chair: Dr. M. K. Tiwari

Session 5: Atmosphere

Lei Zhang, Jianping Huang and Wu Zhang (1100-1125 hrs)
Development of Semi-Arid Climate and Environment Observatory over Loess Plateau

T. K. Mandal (1125-1150 hrs)
Joint studies on pollutant transport across Indo-Chinese land & seas and their impact

Tong Zhu, Jing Li, Weili Lin and Feng Wang (1150-1215 hrs)
Atmospheric Tranport of Air pollutants to the Himalaya Mountain

Session 6: Paleoceanography

B. Nagender Nath, B. Ramalingeswara Rao, A.Aldahan, S.M. Gupta, D.V.Borole, G. Possnert and M.B.L. Mascarenhas-Pereira (1215-1240 hrs)
Tectonic and climatic forcing on the 3 million year sedimentary record from the Central Indian Basin

S. M. Ahmad (1240-1305 hrs)
Glacial-to-Holocene variations of stable and radiogenic isotopes in the surface- and deep-waters of the Bay of Bengal

Lunch (1305-1400 hrs)

Chair: Prof. Wenjie Dong

Rao V. P. (1400-1425 hrs)
Sedimentary record of the summer monsoon along the western margin of India

Session 7: Modelling

Wenjie Dong (1425-1450 hrs)
Study on Climate-Ecosystem Interaction through data analysis and Model simulation

Goswami P (1450-1515 hrs)
Issues in Monsoon Simulation and Forecasting

Yongqiang Yu (1515-1540 hrs)
A Coupled Ocean-Atmosphere-Land-Sea Ice GCM and Its application in IAP

Coffee/Tea Break (1540-1600 hrs)

Chair: Dr. S. R. Shetye

Session 8: Future Course (Concluding Session)

Open discussion on avenues for collaborations (1600-1730 hrs)

Mondovi River cruise (1830-1930 hrs)
Dinner (Hotel Riviera) (1945 hrs)

Day Three: 6 December 2006

Discussions at National Institute of Oceanography	(0900-1200 hrs)
Lunch	(1200-1300 hrs)
Departure	(1330 hrs)

Annexure III

Project Proposal 1

Proposal of Joint Research Project

Indian Ocean-Atmosphere Interaction at Intra-seasonal to Inter-annual Scale (IndOAI)

1. Background

China and India both have strong socio-economic demands on the better understanding of the monsoon climate and its variability. Driven by these common national requirements and the implementation of Indian Ocean Observation System (IndOOS), China and India are willing to enhance the cooperation on ocean-atmosphere interactions over the tropical Indian Ocean (TIO), which is of fundamental importance for the understanding of the monsoon system and its variations. The present IndOAI proposal aims to initiate a long-term cooperation to promote the scientific progress on the monsoon climate through the actions on observations, diagnosis and prediction. This goal will be realized in a step-by-step way and the present proposal determines the initial scope of work in the next 2-3 years.

2. Proposed scope of work

. Ocean-atmosphere interaction during the intra-seasonal oscillation (ISO)

ISO is believed to be one of the bricking elements of monsoon and is important for the monsoon break/active cycles. The following work is proposed:

Document the oceanic processes contributing to the large amplitude of SST variations during ISO, paying special attention on the advection and entrainment effects.

Explore the SST feedback to the ISO evolution.

Study the interannual variations of ISO modulated by TIO interannual variations.

. Ocean-atmosphere interaction during the monsoon evolution

It is an elementary issue to determine to what extent the monsoon is influenced by the ocean-atmosphere interaction. The following work is proposed:

Document the role of ocean in the monsoon onset and its march/retreat.

Compare the monsoon circulations in the AS, BoB and SCS.

Document the monsoon driven biogeochemical cycle and carbon budget in the TIO.

. Ocean-atmosphere interaction at the inter-annual time scale

Indian Ocean Dipole (IOD) and ENSO are important drivers of the tropical Indian Ocean inter-annual variations. The following work is proposed:

Explore the ocean-atmosphere interactions during the IOD events.

Study the interactions between monsoon and the ineranual variations.

3. Joint actions

The following joint actions are proposed,

- Data and model diagnosis.
- Exchange of knowledge and personnel through workshops and visits.
- Look for the possibility in the joint cruises for the process study and buoys maintaining.

4. Proposed team group

The IndoAI team group will consists of 4 Chinese scientists and 3 Indian scientists, namely

India
Dr. V. S. N. Murty, NIO (co-leader)
Dr. M. Dileep Kumar, NIO
Dr. S. S. C. Shenoi, NIO

China
Dr. Weidong Yu, FIO/SOA (co-leader)
Dr. Fan Wang, IOCAS
Dr. Lin Liu, FIO/SOA
Dr. Xuezhi Bai, IOCAS

Project Proposal 2

Project Title: Integrated Modelling Platform for Asian Monsoon

Background

The Asian Monsoon, covering India and China, is one of the most important regional circulation system in terms of its impact on a large fraction of the world's population. It is critical, therefore, to develop a common modeling platform to address questions of impact of climate change and sustainability. It is a huge task and requires a multi-institutional effort to integrate various components for an effective synergy. The present project is visualized as a long-term multi-institutional project with specific objectives to be realized in a phased manner.

The large dispersion in model performance with location is well known. The first necessary step towards developing MAMP, therefore, is to identify and evaluate a modeling configuration with optimum performance and accessibility. In this first phase of the project, jointly designed simulation experiments will be carried out with models available with respective groups to arrive at a common set of simulations. These common set of simulations will be then analyzed through jointly designed diagnostics analysis for objective and quantitative model inter-comparison.

Broad Goals

1. Development and Calibration of a Modelling Platform for Regional Weather and Climate: Monsoon Asia Modelling Platform (MAMP)
2. Validation of MAMP at different scales over different locations over Monsoon Asia
3. Impact Analysis and Multiple Scenario Forecasts for Land use, Aerosol and other natural and anthropogenic factors
4. Modelling and Quantification of Climate change on Regional Climate, Sustainability and vulnerability.

Institutional Team

China	**India**
Congbin Fu, IAP/CAS, Bejing	Dr P Goswami, C-MMACS
Yongqiang Yu, LASG, CAS, Beijing	NIO
Weidong Yu, Qingdao	NPL

Specific Objectives for Present Phase

1. Modelling and simulation of aspect of weather and climate over Monsoon Asia using different model configurations
2. Diagnostics and analysis to determine optimum model configuration for the Monsoon Asian Region.

The Activities Proposed

1. Development/Adaptation, Configuration and Calibration of Model
2. Development/Compilation and Organization of necessary database
3. Development/Incorporation of necessary data assimilation and simulation/forecast methodology
4. Model simulations for validation and skill quantification.
5. Process models for understanding and interpretation.
6. Workshops and other meta-scientific activities for Knowledge organization.

Project Proposal 3

Concept Note on:

Joint Indo-China Proposal for Ocean Biology Researches

Investigations on ocean biology parameters are of paramount relevance in our efforts to obtain a holistic picture of ocean processes including monsoon biogeochemistry, global climate change and human habitability. Understanding of both adverse and advantageous influences of physical, chemical and atmospheric regimes on marine biological processes is necessary for deciphering the dynamics of biogeochemical processes that often operate at intricate and at subtler levels. Oceanographers worldwide are investigating many components biology through direct measurements (shipboard, *in situ* sensors on mooring/drifting buoy assemblies) and indirect observations (remote sensing, aerial photography). Information from such efforts is used to interpret biological productivity characteristics, plankton species diversity dynamics, material export flux potential and possible alterations to seawater and atmospheric chemistry. Thus, it is imperative that a continued assessment of a specific set of biological characteristics is of immense necessity.

One of the important outcomes of the CSIR-NSFC Workshop is the recognition of expertise available with Indian and Chinese marine biologists. While remote sensing, phytoplankton pigment analyses for autotrophic community characterization are widely in use by the Chinese experts, it was evidenced that Indian experts harbor wide knowledge base of taxonomy (microscopic and phylogenetic) and biological productivity (chlorophyll, bacterial, micro and mesozooplankton) characteristics. Enmeshing and gelling of these expertise would certainly help in making the measurement/analysis-based and observation-based studies more meaningful and synergistic.

The following are some of the areas of common interest for pursuing advanced research in joint programmes. They can be useful also as beginners of long-term partnership between CSIR and NSFC.

- Plankton ecology (both pelagic and benthic, tropical, subtropical, temperate and polar) in relation to physico-chemical characteristics of the study regions
- Analyses of their community structure through integration of sea-truth measurements and remote sensing
- HPLC based pigment analyses and construction of ecological succession in autotrophic assemblages
- Microautotrophic and heterotrophic interactions including biological productivity assessment and tropodynamic linkages

Contact Persons:

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Dr Anil A Chandrashekar

China: Prof Danling Tang
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Project Proposal 4

Asian Rivers: Changes in sedimentological and geochemical characteristics of sediments from source to sink

Investigators:
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More than 40% of the global river fluxes of sediments to the sea are by Asian Rivers. Most of the major rivers of Asia, like the Ganges-Brahmaputra, Indus, Yangtse, Pearl River etc. originate in the Himalayan-Tibetan region. The sediment fluxes from these rivers have a major bearing on global geochemical cycling of elements. These regions are strongly influenced by the monsoons and have also been subject to anthropogenic changes for thousands of years. Study of sedimentological and geochemical aspects of these rivers has critical implications for understanding geochemical cycling like that of carbon and its fluxes and burial, ecosystem changes tied to global warming and sea-level rise, and management of resources like soils, wetlands, groundwater etc.

Mineralogy and grain-size of sediments reflects its origin/source and transportation pathway. Grain size distributions of sediments can be interpreted in terms of hydraulic processes and nature of the source materials themselves and imprints imposed by erosion and transport, to the environmental conditions during deposition. One of the main requirements is to characterize grain size of fine-grained sediments in terms source or hydrodynamic conditions during transport especially to decipher the various particle size spectra of different rock types and how they are affected by different weathering processes. Also, it is necessary to determine if there are typical grain-size spectra associated with particular rock types and weathering processes? It is important to address the problem of, to what extent are source signals carried along the transport path and how can these be recognized? How are inherited size characteristics and source distributions modified in the course of transport and how do they respond to different transport modes?

Chemical weathering of silicate rocks is an important process for consumption of atmospheric CO_2. It is important to study the degree of chemical weathering of different rivers in the Asian region, as they cover a large area of the Earth's surface subject to rapid erosion due to high elevation and episodic monsoon processes. Geochemical studies of clastic sediments are also important in interpreting the crustal sources, evaluation of crustal composition and to estimate the average composition of the upper continental crust. Chemical weathering signatures are fingerprinted in the sediment and particulate geochemistry. Sediment geochemistry would also be used to evaluate the erosional fluxes related to changes in monsoon, sealevel and other short catastrophic events. Geochemical tracers would also be used to evaluate the anthropogenic influence on the material fluxes from the rivers.

Project Proposal 5

Title of the proposed project:

Late Quaternary paleoceanographic changes in the Northeast Indian Ocean and South China Sea using isotopic and trace elemental proxies from the deep-sea sediment cores

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Summary :

The aim of this collaborative study is to reconstruct the late Quaternary paleoclimatic and paleoceanographic changes in the Northeast Indian Ocean (NEIO) and South China Sea (SCS) and to understand the effects of monsoons on the surface water masses of these regions. This programme involves study of isotopic ($^{13}C/^{12}C$, $^{18}O/^{16}O$, $^{87}Sr/^{86}Sr$ & $^{143}Nd/^{144}Nd$) and trace elemental ratios (eg. Sr/Ca, Mg/Ca, Ba/Ca etc.) in planktonic and benthic foraminifera from the sediment cores of these regions. The isotopic records generated from the planktonic (eg. *G. ruber*) and benthic foraminifera (eg. *Cibicidoides* species) will be used to infer surface- and deep-water chemical characteristics during the last climatic cycle (i.e. 0-130 ka). The effects of the monsoons on the hydrographic changes in the NEIO and SCS will be studied in detail. These records will be compared to infer linkages between the Indian and East Asian monsoons. In addition to the foraminifera, radiogenic Nd and Sr isotopes from the non-carbonate fractions will be used to decipher the source and pathways of terrigenous sediments in these regions.

Project Proposal 6

BROAD THEME TITLE: JOINT STUDIES IN POLLUTANT TRANSPORT ACROSS THE INDO-CHINESE REGION AND ITS IMPACT

Justification:

Due to food production, urbanization and other development activities and necessity to meet the energy requirements, the Asian continent, particularly China and India, the two most populous and fastest growing countries in the world, is projected to emerge as the largest contributor of anthropogenic emissions driving climate change in the world in the coming years. The Indo-Gangetic Plains region of India and the Pearl River Delta region of China, are regions of intense agriculture production; they include several mega cities; and due to their peculiar geographic setting, coupled with high population density, they also witness large scale pollution cover and associated haze and fog phenomena in the winter seasons. The radiative forcing due to this combined effect of surface and carbonaceous aerosol over the above regions is certainly changing and may influence climate variability and climate change. Scientific institutions associated with NSFC in China and CSIR in India have been conducting scientific investigations to delineate the associated atmospheric pollution processes and their impact on climate and agriculture. Transboundary transports of pollutants generated not only on the two sides of the Himalaya mountain, but also from the neighboring continents have been noticed. Semi-decadal scale changes in the haze and fog occurrence patterns are also being noted, driven perhaps by changes in soil moisture regime due to agricultural intensification or chemical changes in pollution loads linked to fast changing development activities. These cannot be overlooked because of the damage caused by dense fog to winter crops. Studies of the dynamics of industrial transformation in mega-cities as major contributor of GHG emissions and environmental implications thereby to urban and peri-urban regions have been initiated in both the countries recently and require detailed attention. Increasing surface ozone levels in and around mega cities can cause noticeable impact on plant productivity in certain regions in both the countries.

China and India equally share the above concerns. The coordination of scientific efforts among NSFC and CSIR institutions on the in the form of a few joint projects over a period of time carved out of the above broad theme of atmospheric research would expedite generating an improved scientific base, that is necessary for examining development imperatives by these two largest economies of the Asian Monsoon region.

Such joint efforts will also result in realization of an operational network of stations for joint campaign mode observation and modeling by scientists and institutions of the two countries for tackling future atmospheric research projects of mutual benefit in the area of global change.

The joint-project where collaboration can begin right away is the following:

Title:

Atmospheric pollutant transport and the impact of the Mega Cities of the Yantze River and the Pearl River Delta Regions in China and the Indo-Gangetic Plains Region in India.

Scientific activity elements involved:

(a) Coordinated observation campaigns of pollutants at Hanle and Darjeeling in India and at selected sites in the Tibetan Plateau region of China to understand seasonality of trans-boundary transport of atmospheric pollutants from within and outside the Asian region and its future trend.
(b) Observation, where essential, and analysis of anthropogenic atmospheric emissions and their spread from selected mega-cities of the specified regions and link these to industrial energy consumption and population growth patterns to be able to project future impacts scenario.
(c) Understanding impact on radiative forcing.
(d) Regional scale modeling.

Collaborators:

From the Chinese side:
(a) Lanzhou University, CAS, China
(b) Peking University, China
(c) Institue of Tibetan Plateau, CAS, China
(d) Nanjiang University of Information and Technology

From the Indian side:
(a) National Physical Laboratory, New Delhi, India
(b) Central Road Research Institute, New Delhi, India
(c) Centre for Mathematical Modeling and Computer Simulations (C-MMACS), Bangalore, India

Chief Collaborators:
Prof. Tong Zhu (CES, PU, China) and Dr. M. K. Tiwari (NPL, India)

Note: 1. Exchange of scientists for training, sharing of expertise and joint analysis work, participation in relevant joint workshops, publication of joint scientific reports and publications will be common to all the above Joint-Projects.

Note: 2. NPL will be deriving inputs/support from non-CSIR institutions in some of the studies using mechanisms already existing. Among these are Bose Institute, Kolkata and Indian Institute for Astrophysics, Bangalore for observations at Darjeeling and Hanle sites, respectively, Tata Energy Research Institute, New Delhi for energy consumption studies, etc.

Project Proposal 7

WRITE-UP ON PROPOSED PROPOSAL IN THE AREA OF OCENOGRAPHY AND EARTH SCIENCE FOR CSIR-NSFC JOINT CALL

BY
DR.ANIL PAROPKARI

For India & China, essentially an agro-based economy, stakes are high in the understanding of monsoon intensity and monsoon dynamics, on which the agricultural production depends. Off course almost all aspects of social and economic activities of all nations critically dependent on climate and its variability. Knowledge of past variability of monsoon in India and China can provide clues to the present and future scenarios.

Marine sediments are sinks for lipids from diversity of inputs, both autochothonous and allochothonous and these lipids may be extensively modified by microbial and chemical process. These factors can often be differentiated and some extent quantified, from detail examination of the individual lipid present. Marine sedimentary records are good indicators of long-term paleoenvironmental changes of regional and global nature, such as the effects of glacial interglacial cycles and paleoceanographic changes that occurred millions of years ago.

Increase in capability of modern equipment such as GC/MS, LC/MS, HPLC, make it possible to attempt the reconstruction of palaeoenvironmental conditions of deposition and sedimentary diagenitic history, even when compounds may be present in very low concentration. Fundamental to this approach is the reorganization of biomarkers.

Carbon isotope analysis of individual biomarker compounds provides a powerful source of paleoenvirnomental information. The analytical combination offers ways to explore the origins of organic matter, the effect of diagenesis, and the type of depositional settings that neither bulk organic matter characterizations nor traditional biomarker analysis can individually provide. The advantages arises partly because different organisms that synthesize the same biomarker will often fractionate carbon isotope differently, thereby adding source specificity, and partly because $\delta^{13}C$ the values of individual molecules are not effected by diagenesis as long as the carbon skeleton remains intact, thereby preserving source specificity.

After discussion with Prof. Danling TANG, Professor and other delegates of South China Sea Institute of Ocenology, Chinese Academy of Science & from Literatures concludes Chinese are good in compound specific $\delta^{13}C$ and our present knowledge in Geo-organic chemistry over Indian Ocean, I propose to propose a joint project proposal for mutual benefit on the topic mentioned below:

"**TO ESTABLISH TELECONNECTIONS IN MONSOON VARIATION DURING LATE QUATERNARY TO MIOCENE; INDIAN OCEAN AND EASTERN CHINA /SOUTHERN CHINA SEA USING BIOMARKERS & ISOTOPIC STUDIES AS PROXIES"**

Project Proposal 8

Influence of River discharges on shelf and deep sea biogeochemical processes

The North Indian Ocean and China seas receive world's largest discharges from rivers in forms of water and suspended solids. The dissolved constituents include nutrients and therefore will have a direct bearing on the primary production in the respective oceans. On the other hand, freshwater discharge also leads to surface stratification that would strongly affect the vertical mixing processes in the surface ocean. The discharge of mineral materials from land to sea facilitates faster scavenging of organic materials from surface to deep ocean. This mechanism obviously accounts for long-time storage of atmospheric carbon in marine sediments.

Despite the general knowledge of these processes we still have limited information on the quantitative significance of river discharges on the neighbouring oceans. Therefore, it is important to exchange information between India and China to compare the significance of driving forces and the resultant biogeochemical processes and quantify their contribution on both regional and global scales. This program will be firmed up after the return of the Chinese collaborator from the cruise.

Chief Collaborators: Prof. Jing Zhang (ECNU, Shanghai, China)
Dr. M. Dileep Kumar (NIO, Goa)

Project Proposal 9

Modelling and Analysis of extreme Weather Events over China & India

Background

High-impact weather events like heavy rainfall, heat and cold wave, flood and cloud burst have very strong socio-economic implication. A proper understanding of these events, as reflected by our ability to forecast them, however, is still a challenge. It is now recognized that both large-scale circulation and local features play critical roles in genesis and evolution of these events, and that the trends in these occurrence and intensity of these events have significant local characteristics. The purpose of the proposed work will be to analyze and simulate such events over both China and India using different data sets (station data, analysis etc) and a hierarchical modeling platform.

Objectives

1. Analysis of High-impact weather events over South Asia covering China and India.
2. Development and evaluation of modeling strategy for simulation of high-impact weather events.
3. Diagnostics and sensitivity analysis for understanding mechanism and trends in high-impact weather events.

The Team

Chinese	**Indian**
Dr Dong Wenjie, BCC, Beijing	Dr P Goswami, C-MMACS
	Sh K C Gouda, C-MMACS

Activities Proposed

1. Calibration and configuration of meso-scale and GCM for simulation of Extreme weather events.
2. Sensitivity studies to determine processes responsible for genesis and evolution of extreme weather events.
3. Development and evaluation of down-scaling techniques for identification and assessment of extreme weather events.

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