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## **Report on the Joint Research Activities on Modeling Studies for Asia**

**Network Center for EANET**

### **I. Introduction**

1. At present there are 52 EANET monitoring sites for the wet and dry deposition in the vast East Asian region. Therefore, numerical models are an essential tool for the data analyses of the EANET monitoring and for assessing the regional environment from the limited number of monitoring data. The numerical models interpolate and extrapolate the monitoring data objectively, which enables to reveal spatial distribution of pollutant concentration and deposition and their temporal variation.
2. However, air quality prediction by using the numerical models remains as a challenging problem due to large uncertainties associated with incomplete and/or inaccurate emissions information, initial boundary conditions, physical and chemical processes, and so on. Model intercomparison studies provide valuable information to better understand the controlling processes and an estimate of uncertainty associated with various model assumptions. It also play important roles in building the community of modelers and in stimulating necessary model evolution and improvement since a number of modelers must be jointly take part in the model intercomparison.

### **II. Joint Research Activities in MICS-Asia Project**

3. One of the joint researches implemented by the Acid Deposition and Oxidant Research Center (ADORC) serving as the Network Center for EANET is a model intercomparison study in Asia (MICS-Asia) project. The main objective of MICS-Asia is development of a better common understanding of the performance and uncertainties of chemical transport models (CTMs) applied in East Asia region and to build a modeling community involving Asian modelers.
4. The MICS-Asia Phase I was carried out during the period from 1998 to 2000 and focused on long-range transport and deposition of sulfur. Eight models participated in the Phase-I study. The outcome of the model intercomparison exercise was discussed at the 3rd Workshop on the Transport of Air Pollutants in Asia, held at International Institute for Applied Systems Analysis (IIASA), Laxenburg Austria in September 2000.

5. As it was concluded at the 4th Workshop on the Transport of Air Pollutants in Asia held at IIASA in October 2001, the research plans of MICS-Asia Phase II were discussed at the 5th Workshop on Transport of Air Pollutants in Asia held at IIASA in January 2003. While the Phase I focused exclusively on sulfur compounds, the Phase II was expanded to cover nitrogen compounds, ozone and aerosols to be critical for effective control of various environmental problems.
6. According to the outline of Phase II, participants prepared necessary common data and then carried out preliminary model simulations after the 5th Workshop. At the 6th Workshop held at IIASA in February 2004, the specifics of Phase II was discussed, taking into account the preliminary model intercomparison results reported by the participants. From the 7th (February, 2005) to 9th (February, 2007) Workshop, preparation of scientific papers of an overview of the MICS-Asia Phase II and some model intercomparison results regarding ozone, aerosols, deposition and relationship with global model had been discussed. The findings in the MICS-Asia Phase II activity were published in the special issues of *Atmospheric Environment* in May, 2008.
7. In line with the conclusion in 9th MICS-Asia Workshop, each participant has been proceeding to the complementary study for Phase II activities. From the 9th (February, 2007) to 11th (February, 2009) Workshop, the concrete contents to be conducted in Phase III in accordance with the interest and progress of each participant was discussed. All participants gave presentations concerning their modeling works and interesting topics to be conducted in MICS-Asia as Phase III project. It was highlighted that the Phase III should include multi-scale simulations, with sensitivity analyses for urban and regional scale emissions changes, source-receptor relationships for the regional scale and some activities that provide meaningful insights for the hemispheric transport of pollution. The detailed topics to be implemented in the Phase III as follows:
  - (1) Intercomparison and collaboration among MICS-Asia active members
  - (2) ADORC and EANET expect the support of the MICS-Asia project for the analysis of the monitoring data for the next Periodic Report on the State of Acid Deposition in East Asia (PRSAD). MICA-Asia will consider the explanation of the measured air concentration trends provided by EANET.
  - (3) Contribution to the HTAP 2010 Assessment Report
  - (4) Relation with Greenhouse Gas and Air Pollution Interactions and Synergies Project (GAINS)
  - (5) Relationships with United Nations Environment Programme (UNEP), Atmospheric Brown Cloud Project (ABC) and so on.
8. The collaboration with MICS-Asia and EANET must keep an important role important in the future. MICS-Asia could make a useful contribution to EANET to support the forthcoming

assessment. For this, any future work of MICS-Asia should make use of the available EANET data. This is even more important since many government monitoring data are hardly used by the scientific community. The outcome of MICS-Asia will provide important information for policy analysis which aims at analyzing long-term strategies for air pollution controls at local, national and regional levels in East Asia.

### III. New Joint Research Activities on Modeling Studies in Asia for EANET

9. From April, 2009, ADORC has launched new joint research activities on modeling studies in Asia. The outcomes of these joint researches will be expected to contribute to the next PRSAD. In May, 2009, ADORC signed a implementation arrangement of cooperative research with Institute of Atmospheric Physics, Chinese Academy of Sciences (IAP/CAS). Since Dr. Han Zhiwei, Dr. An Junling, Dr. Zhang Meigen, Dr. Wang Zifa are former researchers of ADORC and Japan Agency for Marine-Earth Science and Technology (JAMSTEC), they have appointed as collaborators for modeling studies. Furthermore, ADORC appointed Dr. Toshimasa Ohara, Dr. Tatsuya Nagashima at National Institute for Environmental Studies (NIES) and Dr. Kazuyo Yamaji at JASTEC as visiting scientists for modeling works. Research topics to be implemented by ADORC's collaborators are summarized as follows:

**(1) Model analysis of spatial and temporal variation of wet deposition and O<sub>3</sub>/aerosol covering whole EANET region**

Collaborator: Dr. Han Zhiwei and Dr. An Junling (IAP/CAS)

Model domain: 75° – 165°E, 5° – 60°N

Period: 2005

**(2) Model performance for wet and dry deposition focusing on accurate simulation of rainfall**

Collaborator: Dr. Zhang Meigen (IAP/CAS)

Model domain: the same as project (1)

Period: the same as project (1)

**(3) Model simulation of past ten years trend of wet deposition of EANET data**

Collaborator: Dr. Wang Zifa (IAP/CAS)

Period: 2000 – 2009

**(4) Model Analysis of EANET observational data on wet deposition/aerosol components concentration (filter pack) by RAMS/CMAQ (Regional Model)**

Collaborator: Dr. Toshimasa Ohara (NIES)

Model domain:  $6240 \times 5440 \text{ km}^2$  on a rotated polar stereographic map projection centered at  $25^\circ\text{N}$ ,  $115^\circ\text{E}$  (almost  $5^\circ\text{N} - 55^\circ\text{N}$ ,  $90 - 150^\circ\text{E}$ )

Period: 2000 – 2007

**(5) Model analysis of EANET observational data on wet deposition and aerosol concentration (filter pack) and by trans-boundary transport sensitivity in Northeast Asia by WRF/CMAQ (Regional Model)**

Collaborator: Dr. Kazuyo Yamaji (JAMSTEC)

Model domain: the same as project (4)

Period: 2005

**(6) Regional source-receptor analysis of surface ozone in Southeast Asia by a global CTM, CHASER (Global Model)**

Collaborator: Dr. Tatsuya Nagashima (NIES)