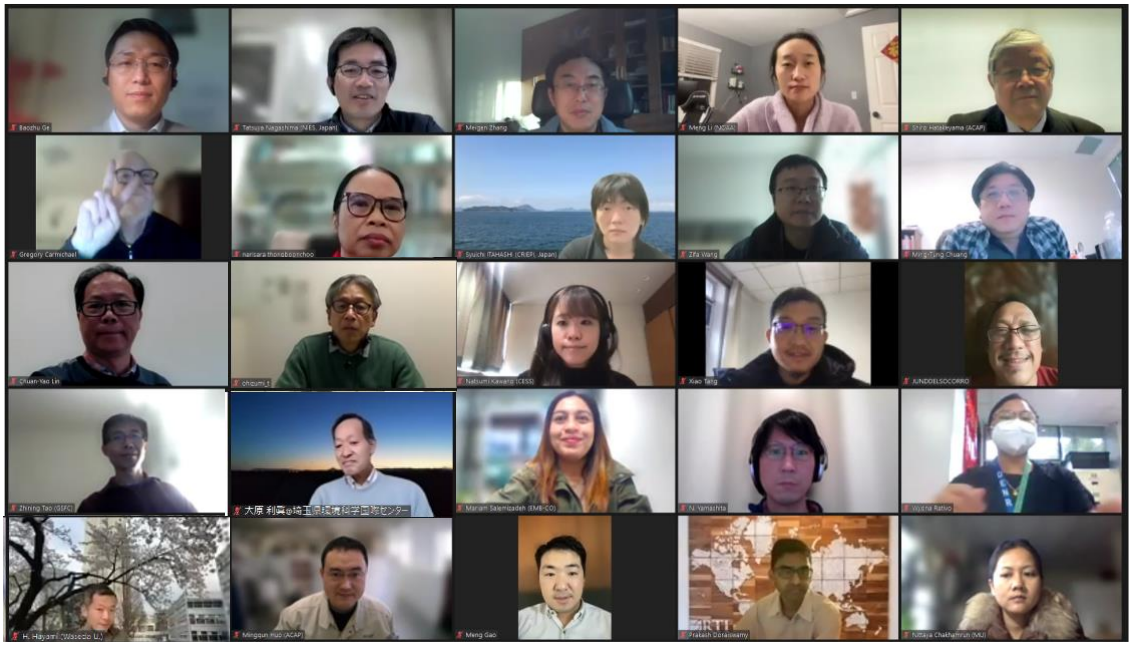
Summary of the 13th International Workshop on Atmospheric Modeling Research in East Asia



The EANET has developed a close relationship with the community of Model Inter-Comparison Studies for Asia (MICS-Asia) which is a project aiming at improving air quality and climate models not only by enhancing scientific understanding of the atmospheric environment but also by developing a common scientific understanding for policy-making in Asia. The International Workshop on Atmospheric Modeling Research in East Asia is a regular workshop of MICS-Asia which has received support from the EANET throughout the previous Medium Term Plans. Summaries of previous MICS-Asia workshops are available in the Reports of the Session of the Scientific Advisory Committee (SAC) on the EANET.

The Network Center for the EANET co-organized the 13th International Workshop on Atmospheric Modeling Research in East Asia with the community of MICS-Asia virtually on 22-23 December 2022. It consisted of two parts: discussions on the progress of the MICS-Asia Phase IV working groups and on activities in 2023; and presentations and discussions related to future activities of MICS-Asia. About 60 participants joined the workshop.

1. **Progress of working groups of MICS-Asia Phase IV and discussion on activities in 2023**

Four working groups are established in the MICS-Asia Phase IV: the Air Quality Model working group, the Air Quality and Climate Model working group, the Emission Inventory working group, and the Observation working group.

The fundamental objective of MICS-Asia is the intercomparison of air quality models. The Air Quality Model working group leads the MICS-Asia activities. The Air Quality Model working group focuses on the following core issues: the overprediction of oceanic ozone and of summertime ozone in polluted urban regions, the underprediction of sulfate and of reduced nitrogen deposition, and the understanding of reactive nitrogen. At the workshop, simulation designs including target years, model domains including resolution, sensitivity simulations, and process analysis were discussed. It was decided to finalize the details of standard simulations by the first quarter of 2023.

Nowadays, the relationship between air quality and climate change is a commonly studied scientific issue. One of the major focuses of the Air Quality and Climate Model working group is the study of the influence of climate change on the status of air quality. At the workshop, a model domain including resolution was discussed and the relevancy of setting up an Air Quality Model working group was pointed out. The working group participants agreed on setting target years based on scenarios for baseline, peak of CO_2 and the carbon neutral year. The baseline year was also discussed with the Air Quality Model working group.

The major objective of the Emission Inventory working group is to develop reliable emission inventories for model working groups. At the workshop, it was reported that a mosaic-based emission inventory in Asia (MIX) version 2.1 has been developed and ready for model working groups. Biogenic emissions will be developed with the MEGAN model after the simulated meteorological fields are provided from the Air Quality Model working group. It was confirmed that vertical profiles of emissions would also be discussed with the Air Quality Model working group.

The Observation working group reported recent trends of concentrations of air pollutants in East Asia based on the EANET monitoring data and on the 4th Periodic Report on the State of Acid Deposition in East Asia (PRSAD4). Necessary observation data needed to be surveyed and collected and these will be discussed with the model working groups. Collaboration with other international scientists, such as with the Tropospheric Ozone Assessment Report (TOAR)-II experts was recommended.

2. **Presentation and discussion related to future activities of MICS-Asia**

During the workshop, seven researchers in modeling and impact assessment studies provided presentations.

Dr. Christian Hogrefe, from the U. S. Environmental Protection Agency, introduced the Air Quality Modelling Evaluation International Initiative Phase 4 (AQMEII4) subtitled Diagnostic Analysis of Atmospheric Deposition Through Grid and Point Model Intercomparisons. AQMEII4 has two major activities: first, Regional Model Intercomparison and second, Single Point Model Intercomparison. AQMEII4 applies detailed dry deposition diagnostics (pathway and land-use-specific deposition velocity and grid-scale net dry deposition fluxes, component resistances) to a range of air quality models and their deposition schemes. Dr. Hogrefe informed that a special issue in Atmospheric Chemistry and Physics will be open for submission in August 2023.

Dr. Baozhu Ge, from the Institute of Atmospheric Physics, Chinese Academy of Science, gave a presentation on enhanced wet deposition of nitrogen induced by a landfalling typhoon over East Asia. Following major findings were reported: based on model simulations by the NAQPMS modeling system, he clarified a "pumping effect" mechanism of landfalling typhoon, which uplifted the air pollutants in the ground surface into the high altitudes, then transported and deposited via the in-cloud scavenging process; the "pumping effect" would have profound effect on the wet deposition in the typhoon-affected regions, especially the coastal marine regions; and the landfalling were identified as the largest contributors to the deposition in the typhoon-affected regions.

Dr. Natsumi Kawano, from Center for Environmental Science, in Saitama, Japan, gave a presentation on the impact of future climate change on tropospheric ozone in Japan using the WRF-CMAQ modeling system and the RCP8.5 scenario. Following major findings were reported: through the impact of climate change, a high ozone concentration zone centered in eastern China could be formed and expanded toward Japan, particularly significant in summer; increasing biogenic VOC especially isoprene, change in local circulation patterns transporting ozone from East Asia and enhanced photochemical reactions would lead to high ozone concentration during summer.

Dr. Syuichi Itahashi, from the Central Research Institute of Electric Power Industry, Japan, shared a presentation on the changes in transboundary aerosol components due to the emission variations in East Asia. In the study, causes of recent dramatical improvement of $PM_{2.5}$ air pollution status in Japan and transboundary aerosol components have been analyzed with observations and model simulations. It was found that improved $PM_{2.5}$ in China attributed to $PM_{2.5}$ in Japan and sever $PM_{2.5}$ air pollution over East Asia have been improving. However, it was pointed out that $PM_{2.5}$ components are still

needed to be analyzed, and this matter could be one of the major topics of MICS-Asia Phase IV.

Dr. Xiao Tang, from the Institute of Atmospheric Physics, Chinese Academy of Science, gave a presentation on high-resolution aerosol data over China simulated by the NAQPMS modeling system and an inversed emission inventory. In his presentation, he introduced a 7-year $PM_{2.5}$ composition dataset over China during 2013-2019 produced based on the modeling of NAQPMS with the inversed emission. This dataset includes five compositions of $PM_{2.5}$ in China with 15 km and 1-hour resolutions. Dr. Tang pointed out that preliminary validation showed the dataset had relatively high accuracy, but more independent data with long time series would be needed to validate the data.

Dr. Naoyuki Yamashita, from the Forestry and Forest Products Research Institute, Japan, shared a presentation on the critical load of soil acidification and surface water eutrophication in the EANET Participating Countries. This study showed a critical load map in East Asia updated and verified by EANET data. It was found that the estimated map of the critical load exceedance for eutrophication is more plausible for assessing the risk in East Asia than that for soil acidification and eutrophication (N saturation) risks not only in Northeast Asia but also in tropical Asia. In his presentation, Dr. Yamashita suggested needs for atmospheric modeling such as regional models for cations deposition and with high spatial resolution considering the complex topography in the Asian mountainous regions.

Dr. Baiyao Xu, from Nanjing University, China, gave a presentation on the impacts of meteorological factors and ozone variation on crop yields in China related to the carbon neutrality objectives in 2060 based on RegCM-Chem-YIBs. Major findings were as follows: regional emission reductions dominated the increase in yield by reducing the ozone concentration, whereas global climate change led to yield loss mainly through meteorological factors; crop production loss caused by meteorological factors in 2060 would be mitigated by the ozone reduction. Given the advantages of declining ozone concentration, regional emission reductions would likely benefit crop growth. However, global climate change may offset the benefits and threaten food production in China. Therefore, more strict emission reduction policies and global climate change mitigation actions are necessary to ensure food security in China.

Find out more about the 13th International Workshop on Atmospheric Modeling Research in East Asia on EANET website.