

4.108 Transmission electronic microscopy observations of aerosol mixing state in Japan - its relevance to CCN activity and air quality.

Presenting Author:

Joseph Ching, Meteorological Research Institute, Atmospheric Environment and Applied Meteorology Research Department, Tsukuba, Ibaraki, Japan, jching@mri-jma.go.jp

Co-Authors:

Kouji Adachi, Meteorological Research Institute, Atmospheric Environment and Applied Meteorology Research Department, Tsukuba, Ibaraki, Japan

Yuji Zaizen, Meteorological Research Institute, Forecast Research Department, Tsukuba, Ibaraki, Japan

Yasuhito Igarashi, College of Science, Ibaraki University, Japan

Mizuo Kajino, Meteorological Research Institute, Atmospheric Environment and Applied Meteorology Research Department, Tsukuba, Ibaraki, Japan

Abstract:

Aerosol particles are ubiquitous in the atmosphere, and their climatic importance is embodied in many ways. Acting as cloud condensation nuclei (CCN), promoting changes in cloud microphysical properties and therefore interfering the Earth energy budget, aerosols present one of the largest uncertainties in climate prediction. It is essential to understand how the role of aerosols as CCN evolves in various environments according to their physicochemical properties. In this study, we present the analysis of aerosols collected in three locations in Japan, with the technique of transmission electronic microscopy (TEM). (Electron microscopy particle database of Meteorological Research Institute can be accessed at <http://metemadb.kir.jp/>) Based on the TEM analysis, individual particles sizes and elemental compositions are revealed in great details and their hygroscopicity is derived. The TEM analysis of aerosol populations sampled at the three locations shows distinct composition, mixing state and CCN properties, indicating that the interactions between meteorology, atmospheric chemistry and local emissions differentiate the aerosol populations. In addition, the aerosol populations mixing state is characterized using an aerosol mixing state metric and the impact on cloud condensation nuclei (CCN) properties is quantified. This demonstrates that the CCN concentrations computed assuming internally-mixed aerosol populations are erroneous to various extent. Apart from their climatic importance, aerosol particles are closely related to air quality. Based on the information revealed by TEM, we compute the deposition efficiency of the transition metal content associated with the aerosols sampled in human respiratory tract using a deposition model and find that aerosol mixing state matters for the deposition efficiency. This research connects the valuable information of aerosols revealed by TEM to the investigation of aerosol impacts on air quality and climate.