

AAS020-16

Room:102

Time:May 22 16:00-16:15

Development of a Next Generation System for Monitoring the Atmospheric Environment and Estimating the Emission Inventory

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It is a great concern that human activity seriously affects the atmospheric environment. The anthropogenic and natural emissions, and distributions of ozone must be accurately estimated from advanced observations.

We are developing the data assimilation system of atmospheric minor constituents, such as carbon dioxide, aerosol and ozone, for monitoring the atmospheric environment and estimating the emission inventory. The data assimilation system incorporates an ensemble Kalman filter, because it can be set up without considering the forward model including complicated chemical reactions and atmospheric transports. Observation data of minor constituents are assimilated into a coupled model of chemical transport and general circulation (CTM-GCM). The model is driven by the objective analyses of meteorological parameters.

A prototype was set up and optimized individually for carbon dioxide, aerosol and ozone. An observational system simulation experiment (OSSE) on carbon dioxide was performed to evaluate contributions of the surface, airborne and the GOSAT observations. CARIPSO aerosol observations were successfully assimilated for the first time and shown to greatly improve Asian dust (Kosa) predictions. Data assimilation parameters for ozone and related species were carefully optimized considering complicated chemical reactions through an OSSE. Now, our efforts are shifted to assimilation experiment of real data.

Keywords: Data assimilation, Minor constituent, Carbon dioxide, Aerosol, Ozone