

# **Application of Ensemble Data Assimilation with WRF-Chem to an Asian Dust Air Pollution Event over Korea**

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Asian dust is well-known air pollution events throughout northeast Asia region, typically originating from arid areas of Mongolia and northwest China. It is strongly related to human activities and climate change, and its frequency has steadily increased over the past few decades. Thus adequate monitoring and prediction of Asian dust is very important. This can be best achieved using data assimilation, which optimally combines the observations with the model prediction.

In this study we address the Asian dust problem through data assimilation of the Ozone Monitoring Instrument (OMI) Aerosol Optical Depth (AOD) observations, using the Weather Research and Forecasting model with chemistry and aerosol (WRF-Chem) and the ensemble-based Maximum Likelihood Ensemble Filter (MLEF) data assimilation system.

We assess the capability of the coupled atmosphere-aerosol WRF-Chem-MLEF system to respond to a dust air pollution event over Korea. In particular, we examine the impact of aerosol observations on the meteorological initial conditions. Since the impact of aerosol observations on meteorological initial conditions is possible only due to the meteorology-aerosol cross component of the forecast error covariance, we additionally examine the structure of the coupled forecast error covariance matrix. The results indicate that the ensemble-based coupled forecast error covariance has an adequate complexity that allows more efficient use of available observations.

Key words: aerosol, Asian dust, data assimilation, WRF-Chem, maximum likelihood ensemble filter