

Sensitivity Study on Generating Atmospheric Chemistry Reanalysis Field for the Contiguous United States Using Community Multi-scale Air Quality (CMAQ) Modeling System

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Three-dimensional multi-scale Air Quality (CMAQ) Modeling System has been used to generate ozone and particular matter (PM_{2.5}) forecasts for the US. Similar to the meteorological reanalysis products, gridded data sets that best represent the atmospheric chemistry are needed for air quality, climate, epidemiology, and many other fields in their research and policy-related studies. To emulate the success of the National Centers for Environmental Prediction (NCEP) and the National Center for Atmospheric Research (NCAR) reanalysis products, efforts have been spent to generate atmospheric chemistry reanalysis field by assimilating the AIRNow surface network PM_{2.5} observations and MODIS (MODerate Resolution Imaging Spectroradiometer) aerosol optical depth (AOD) into the CMAQ model. In this work, sensitivity tests are carried out to study the impacts of observation insertion frequencies and schemes, different observation and background error covariance formulations on the atmospheric chemistry reanalysis products using a three-dimensional variational (3D-Var) data assimilation method. July 2011 is chosen as a test period to coincide with the Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) field experiment. The field experiment observations as well as other un-assimilated observations will be used to evaluate the data assimilation performance. Effects of the data assimilation on aerosol components and their vertical distributions will be discussed. A data assimilation system using 3D-Var method to generate multi-year atmospheric chemistry reanalysis products will be proposed based on the sensitivity study results.