10.6 Preparing MPAS-A for global retrospective air quality modeling: An evaluation of a 2016 simulation with comparisons to WRF.

Gilliam, Robert, Jerold Herwehe, Russell Bullock and Jonathan Pleim, *United States Environmental Protection Agency*

The US EPA has a plan to leverage recent advances in meteorological modeling to develop a "Next-Generation" air quality modeling system that will allow consistent modeling of issues from global to local scale. The meteorological model of choice is the Model for Prediction Across Scales-Atmosphere (MPAS-A) that has been developed by the National Center for Atmospheric Research in recent years. While CMAQ developers have been working on a method to couple CMAQ components to MPAS-A for full global chemical transport modeling, a team of weather modelers has been preparing MPAS for accurate meteorological simulations. This includes four dimensional data assimilation that allows for long simulations of past weather with no growth in error. We have also added the Pleim-Xiu land-surface model (P-X LSM), Asymmetric Convective Model 2 (ACM2) and Pleim surface layer, which are key components in the current meteorological model WRF.

The evaluation of MPAS-A and comparison to WRF includes a full annual 2016 simulation using both a 92-25 km and 46-12 km global mesh with finer meshes centered over the CONUS. Evaluation includes comparisons of the model runs to surface meteorology, PRISM precipitation, radiation and upper air rawindsonde measurements. MPAS-A generally compares well with WRF for most of 2016. Error levels in surface meteorology are at or below WRF levels during the cooler parts of the year and slightly worse during the summer. Precipitation totals are generally less than WRF and monthly PRISM estimates during the cooler half of the year, but more mixed differences during the warm season. Patterns of precipitation (spatial correlation), however, are well replicated. Solar radiation in MPAS-A is higher than WRF and measurements, indicating a lack of clouds in MPAS-A versus WRF. Finally, a comparison of 92-25 km and 46-12 km meshes shows clear improvements in surface meteorology as grid scale is reduced. The comparisons indicate the meteorology of MPAS-A is sufficient for retrospective global air quality modeling.