MERRAero: The MERRA Aerosol Re-analysis

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GEOS-5 is the latest version of the NASA Global Modeling and Assimilation Office (GMAO) Earth system model. GEOS-5 contains components for atmospheric circulation and composition (including data assimilation), ocean circulation and biogeochemistry, and land surface processes. In addition to traditional meteorological parameters, GEOS-5 includes modules representing the atmospheric composition, most notably aerosols and tropospheric/stratospheric chemical constituents, taking explicit account of the impact of these constituents on the radiative processes of the atmosphere. MERRA is a NASA meteorological reanalysis for the satellite era (1979-present) using GEOS-5. This project focuses on historical analyses of the hydrological cycle on a broad range of weather and climate time scales. As a first step towards an integrated Earth System Analysis (IESA), the GMAO is extending MERRA with reanalyses for other components of the earth system: land, ocean, biogeochemistry and atmospheric constituents. In this talk we will present results from the MERRA-driven aerosol reanalysis covering the Aqua period (2003-present). The assimilation of Aerosol Optical Depth (AOD) in GEOS-5 involves very careful cloud screening and homogenization of the observing system by means of a Neural Net scheme that translates MODIS radiances into AERONET calibrated AOD. These measurements are further quality controlled using an adaptive buddy check scheme, and assimilated using the Local Displacement Ensemble (LDE) methodology. For this reanalysis, GEOS-5 runs at a nominal 50km horizontal resolution with 72 vertical layers (top at ~85km). GEOS-5 is driven by daily biomass burning emissions derived from MODIS fire radiative power retrievals. We will present a summary of our efforts to validate such data set. The GEOS-5 assimilated aerosol fields are first validated by comparison to independent in-situ measurements (AERONET and PM2.5 surface concentrations). In order to assess aerosol absorption on a global scale, we perform a detailed radiative transfer calculation to simulate the UV aerosol index, comparing our results to OMI measurements. By simulating aerosol attenuated backscatter, we use CALIPSO measurements to evaluate the vertical structure of our aerosol estimates, in particular in regions where we have larger discrepancies with OMI. Finally, the consistency of our AOD estimates with estimates from MISR, MODIS/Deep Blue, OMI and PARASOL will be briefly discussed.

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