Abstract:
Evaluations of global model forecasts of aerosol composition and aerosol precursors are inherently limited by the availability of the observations needed for objective statistical analysis. Beginning in July of 2016, the NASA sponsored Atmospheric Tomographic Mission (Atom) conducted campaigns in all 4 seasons, sampling from pole to pole over both Pacific and Atlantic oceans, and from the surface to 13 km altitude. This program has provided snapshots of global atmospheric composition in unprecedented spatial detail using state of the art aerosol and gas-phase instrumentation aboard the NASA DC-8 aircraft. During the ATom-1 mission deployment of July/August 2016 in particular, the DC-8 aircraft encountered large aerosol contributions from biomass burning, dust storms, anthropogenic and sea-salt sources. The focus here is on using the ATom-1 dataset to evaluate aerosol and their precursors within the online version of the global Finite-Volume cubed-sphere dynamical core (FV3) model, currently configured with the GOCART aerosol mechanism. The results are also compared with retrospective aerosol forecasts from the Flow-following finite-volume Icosahedra Model (FIM) developed at NOAA/ESRL/GSD. The FIM results include forecasts using 3 different aerosol mechanisms: GOCART used in FV3, GOCART aerosol coupled to gas-phase chemistry, and a more complex modal aerosol approach coupled to gas-phase chemistry. This inter-model evaluation exposes strengths and shortcomings in predicting aerosol from the various sources within the different model configurations. The results also highlight the importance of ATom-type sampling programs as a guide and reference for future global aerosol and composition model development efforts.