Submission Title:

Tropospheric ozone in the NASA GEOS model: Effects of satellite NO2 data assimilation and improvements in background NOx chemistry

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Abstract

Tropospheric ozone is a major atmospheric oxidant, the primary source of the hydroxyl radical, and a greenhouse gas. In the troposphere, it is produced from the oxidation of carbon monoxide and volatile organic compounds in the presence of nitrogen oxides (NOx=NO+NO2) or has its origins in the stratosphere. The tropospheric ozone burdens in global atmospheric chemistry models disagree by a factor of 1.5, indicating an incomplete understanding of ozone sources and sinks. Here we examine the tropospheric ozone simulation in NASA Global Modeling and Assimilation Office's (GMAO's) GEOS model with the GEOS-Chem chemistry mechanism (version 14.2), using observations from satellites, aircraft, ozonesondes, and surface sites. This modeling framework is used to produce GMAO's GEOS Composition Forecasts (GEOS-CF), and it has been updated extensively with new emission inventories, improved model physics, satellite data assimilation capability, and an up-to-date chemical mechanism that includes tropospheric halogen chemistry and NOx recycling from particulate nitrate. Earlier versions of the model using GEOS-Chem version 12.0 showed an underestimate in tropospheric ozone in the northern hemisphere. We evaluate the ozone simulation in the updated model, focusing on the effects of assimilating satellite NO2 data from the Ozone Monitoring Instrument (OMI), constraining stratospheric ozone to satellite data, and updates to the NOx chemistry. We will examine changes in the vertical profiles of tropospheric ozone over the US in support of the Tropospheric Emissions: Monitoring of Pollution (TEMPO) and discuss implications for the tropospheric ozone budget.