6.158 Seasonality, Interannual Variability and Regional Sources of PAN over North America: New Satellite Observations and Model Analyses .

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Abstract:

Nitrogen oxide radicals (NO_X = NO + NO_2) play a central role in controlling the oxidizing capacity of the troposphere, and peroxyactyl nitrate (PAN) serves as their chief reservoir. Observations of PAN are notoriously difficult to simulate in models because the stability of PAN depends strongly on vertical transport, and its formation is strongly influenced by non methane volatile organic compounds with uncertain emissions and complex oxidation chemistry. New observations of PAN from the Tropospheric Emission Spectrometer (TES) offer an unprecedented way to assess the spatial distribution, seasonality, and interannual variability of this species in the free troposphere. We analyze observations over North America using a combination of tools including backward trajectories and the GEOS-Chem chemical transport model to diagnose the sources of PAN as well as model deficiencies and their implications for free tropospheric oxidant distributions.

We plan to primarily focus our discussion on summer, when previous aircraft observations from multiple campaigns have suggested there is a reservoir of 200–400 pptv PAN between 4 and 8 km over northern midlatitudes. The new TES data does show an increase in PAN from spring to summer in the free troposphere over remote regions. We find no systematic differences in the distributions of PAN when retrievals are segregated by either the underlying NO_X emissions, or the presence of smoke in the atmospheric column. The data also demonstrates that the model overestimates PAN in the free troposphere over the southeastern U.S. Through an analysis of the enhancement ratio of PAN relative to simultaneous TES CO measurements, we find that the model is likely to systematically underestimate the contribution of fires to elevated PAN during summer months over western North America.