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Global-scale Measurements of Aerosol Properties from the Atmospheric Tomography (ATom) Mission

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Aerosols in the remote marine atmosphere are important components of the earth's chemistry-climate system. In these regions, cloud condensation nuclei (CCN) are often limited in abundance, and the radiative properties of clouds are particularly sensitive to changes in CCN concentrations. Aerosol particles affect tropospheric chemistry through heterogeneous processes and by serving as sources and sinks for compounds. Measurements of the remote tropospheric aerosol provide important constraints for the Eulerian global models that are used for analysis and prediction, and Lagrangian models that are used to evaluate sources and understanding of transport and chemical and physical processes. The Atmospheric Tomography Mission (ATom) was designed to improve understanding of chemistry and climate processes in the remote atmosphere over the oceans. Using the long-range NASA DC-8 research aircraft, ATom was composed of four sets of flights over the middle of the Pacific and Atlantic Oceans, from $\sim$82°N to $\sim$86°S. During these flights, the DC-8, repeatedly ascended and descended between $\sim$0.15 and $\sim$12 km in altitude. The four flight sets were completed in August-September 2016 (ATom-1), January-February 2017 (ATom-2), September-October 2017 (ATom-3), and April-May 2018 (ATom-4). The payload included fast-response aerosol size distributions, bulk and single-particle aerosol composition and aerosol optical properties, along with many reactive, tracer, and greenhouse gas-phase species.

Initial results from analysis of the Atom aerosol observations will be summarized, including: evidence for the global-scale importance of new particle formation in the upper tropical troposphere for CCN abundance; the first global-scale measurements of free tropospheric sea-salt concentrations that provide strict limits on halogen abundance in the upper troposphere; the distribution of organic, biomass-burning, black carbon, and dust particle concentrations that constrain sources, transport, and removal; and aerosol composition measurements that show organic aerosol loss in the remote troposphere and that place constraints on aerosol pH, which influences a number of aerosol chemical processes. Access to the ATom dataset, future data products, and opportunities for further analysis will also be discussed.