6.154 Understanding the origin of CCN in the remote troposphere.

Early Career Scientist

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Abstract:

The ability to fully define aerosol-cloud-climate interactions requires an understanding of the budget of primary (emitted) and secondary (produced in situ) cloud condensation nuclei (CCN) in different regions and factors that control changes in their abundance. Aerosol indirect radiative forcing, which is controlled by CCN abundance, is the largest uncertainty in climate forcing.
Global earth system models incorporate aerosol microphysics to describe the evolution of size-resolved aerosol properties that determine CCN abundance. One of the most important parameters contributing to CCN uncertainty in these models is the aerosol size distribution. Specifically, the uncertainty in the diameter of the Aitken mode accounts for 40% of model variance in CCN abundance in remote oceanic regions. Dry deposition of the accumulation mode contributes 30% to model variance. These findings clearly point to the need for improved understanding of aerosol production mechanisms, sinks and transformations especially in the remote troposphere. Only if these processes are understood can models evaluate the global CCN budget and thus the role of CCN in controlling cloud radiative properties, lifetime and extent.
The Atmospheric Tomography (ATom) airborne research experiment will sample the remote troposphere over the Atlantic and Pacific basins with near-pole-to-pole coverage in July and August 2016. A total of four such global circuits will be made, one in each season. These flights will scan the atmosphere in continuous ascents and descents between 0.2 and 12km, giving both the latitudinal and vertical distribution of the aerosol.

Here we present preliminary results of the first deployment. Dry particle size distributions between ~ 65 to 1000 nm in diameter will be measured with a suite of fast-response size distribution instruments. Preliminary results should include the spatial variation in the abundance of CCN-sized particles and their association with regions of new particle formation and with long-range transport from continental sources.