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CLOUD ACTIVATION PROPERTIES OF ORGANIC AEROSOLS OBSERVED AT AN URBAN SITE DURING CALNEX_LA

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ABSTRACT

Atmospheric aerosols strongly influence the global energy budget by scattering and absorbing sunlight (direct effects) and by changing the microphysical structure, lifetime, and coverage of clouds (indirect effects). Currently, the indirect effects of aerosols remain the most uncertain components in forcing of climate change over the industrial period. This large uncertainty is in part due to our incomplete understanding of the ability of aerosol particles to form cloud droplets under climatically relevant supersaturations.

During CalNex_LA study, size-resolved CCN spectrum and aerosol chemical composition by Aerosol Mass Spectrameter (AMS) are measured at an urban supersite in Pasadena, California from May 15 to June 10, 2010. Monodispersed aerosol particles are first classified using a differential mobility analyzer at a series of sizes ranging from 25 to 320 nm. The total number concentration of the classified particle is measured by a Condensation Particle Counter (CPC), and the CCN spectrum of particles is characterized by a DMT CCN counter at supersaturations ranging from 0.1% to 0.5%. The activation efficiency, defined as the ratio of the concentration of CCN to CN, is derived as a function of both particle size and supersaturation. This size-resolved CCN measurement allows us to focus on the influence of chemical composition on droplet activation, and to derive particle overall hygroscopicity (κ) at a range of particle sizes. As κ of typical ambient inorganic materials are well quantified, κ values of organic species are derived from the overall κ of the particles and its composition measured by an aerosol mass spectrometer. The derived κ of organics is examined as function of the O:C ratio to characterize the variation of hygroscopicity as aerosols age. This measured hygroscopicity of organics can be incorporated into advanced process models for improved representation of CCN spectrum to address the indirect effect of aerosol on climate.