

***CLOUD ACTIVATION PROPERTIES OF ORGANIC AEROSOLS OBSERVED AT  
URBAN SITES DURING CALNEX-LA AND CARES***

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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 two recent field campaigns, size-resolved cloud condensation nuclei (CCN) spectrum and aerosol chemical composition were characterized at urban supersites in Pasadena, CA (CALNex-LA) and Cool, CA (CARES) in summer, 2010. At both sites, monodispersed aerosol particles were first classified using a differential mobility analyzer at sizes ranging from 25 to 320 nm. The activation efficiency of the classified aerosol, defined as the ratio of its CCN concentration (characterized by a DMT CCN counter) to total CN concentration (measured by a condensation particle counter, TSI 3771), is derived as a function of both particle size and supersaturation, which ranges from 0.08% to 0.39% during CalNex-LA and 0.15% to 0.45% during CARES. Aerosol chemical composition was characterized using a high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS).

At both sites, increases in aerosol mode diameter, organics mass loading, and aerosol organics volume fraction were often observed from ~10:00 AM to 16:00 PM during week days. Some of these increases are attributed to the morning traffic pollution from downtown LA and downtown Sacramento, respectively. Positive matrix factorization (PMF) analyses of AMS measurements at both sites were carried out and the organics O:C ratios are examined. Particle overall hygroscopicity ( $\kappa$ , Petters and Kreidenweis, 2007, ACP) was derived from the size-resolved CCN measurements ranging from 0.2 to 0.3 under the range of measured supersaturations. The derived particle  $\kappa$  increases with increasing particle diameter, which is consistent with observed decrease in organics volume fraction as particle size increases from 100 nm to 300 nm. Based on the particle hygroscopicity and aerosol chemical composition, the organics hygroscopicity ( $\kappa_{Org}$ ) was derived and correlated with the O:C ratio. The comparison of aerosol source, aerosol chemical composition and organics hygroscopicity between the two sites will be discussed.

Besides particle critical supersaturation, the influence of organics species on droplet growth is also examined. Size-classified organic particles exhibit similar growth kinetics when compared to  $(NH_4)_2SO_4$  particles with the same critical supersaturation, suggesting aerosol organics observed during CalNex-LA and CARES do not inhibit droplet growth through reducing the mass accommodation coefficient of water vapor.

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