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Cloud Condensation Nuclei and Chemical Composition of size-resolved particles in a Brazilian megacity: Effect of NPF event, biomass burning and sea salt from remote regions on the CCN properties

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Atmospheric aerosol particles are an important source of cloud condensation nuclei (CCN). Their microphysics and chemical composition can directly affect development of clouds and precipitation process[1,2]. Only a few studies in Latin American have reported the impact of urban aerosol on the formation of CCN and their contribution to global climate change[3]. In this study, we simultaneously measured size distributed particle number concentration (PNC), CCN, black carbon (BC) and elemental concentrations (EC) in aerosol samples from São Paulo city. The PNC was measured by DMPS (model 3936) operated with a DMA (model 3080) and CPC (TSI, model 3010). The CCN was measuredby a single-column continuous-flow stream-wise thermal gradient CCN chamber (DMT CCNC-100). The BC and EC were determined in polycarbonate filter collected by Cascade Impactor (MOUDI-MSP), using a smoke stain reflectometer and an ED-XRF (EDX 700; Shimadzu), respectively. During the study period, which was August to September 2014, four events of new particle formation (NPF), characterizing secondary process of aerosol formation were noted. The total PNC varied between 1106 and 29168 cm^{-3}, while CCN presented concentrations of 206 to 12761 $cm^{-3}$for SS=1.0%. The PNC showed different concentrations during diurnal and nocturnal periods with average of 16392±7811 cm^{-3} and 6874±3444cm^{-3}, respectively. The activated ratio (CCN/CN) presented diurnal and nocturnal values of 0.19±0.10 and 0.41±0.18, while apparent activation diameter ($D_{act,a}$) was estimated to be 110±29 and 71±28 nm (SS=0.6%), respectively. Combining EC and BC results with air mass trajectory analysis (Lidar aerosol profiles and Hysplit air trajectories), apportionment events were identified for sea salt and biomass burning from coastal and continental regions, respectively. The nocturnal AR and $D_{act,a}$presented values of 0.46±0.11 and 49±15 nm (SS=0.6%) for sea salt events as opposed to 0.33±0.14 and 64±30 nm (SS=0.6%) during biomass burning events. Although statistically not robust, it was observed diurnal and nocturnal tendencies for CCN properties (AR, $D_{act,a}$), which were accompanied by small variability for sea salt and biomass burning events.

References

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