6.172 Global synthesis of multi-year cloud condensation nuclei observations.

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Abstract:

Cloud condensation nuclei (CCN) influence the microphysical and optical properties of clouds. To predict cloud radiative properties, understanding the spatial and temporal variability of CCN concentrations in different environments is important. However,

currently, the effects of atmospheric particles on changes in cloud radiative forcing are still the largest contribution to uncertainty in climate forcing prediction (IPCC, 2013). Numerous field campaigns have explored detailed characteristics of CCN in many locations around the world. However, these short-term observations can generally not address seasonal or inter-annual variations, and comparison between sites is difficult. Here we present results of multi-year CCN number concentrations, as well as size distribution and chemical composition data covering at least one full year between 2006 and 2014. The 12 locations include ACTRIS stations (http://www.actris.net/) in Europe, and further sites in the Americas and Asia.

These sites allow for temporal and spatial characterization of CCN variability in different atmospheric regimes. Covered environments include marine, remote-continental, boreal forest, rain forest, Arctic and monsoon-influenced environments, as well as boundary layer and free tropospheric conditions.

Geometric mean diameters as well as the activation ratios on the basis of particles > 50 nm vary strongly among sites and throughout the seasons. For example, the rural-marine and rural-continental sites exhibit similar CCN concentration with little variation in the annual cycle, whereas in the boreal environment the annual cycle is more pronounced. Additionally, we investigate the persistence of CCN-concentrations over different timescales to explore meaningful averaging periods for global modelling of CCN. We find three different regimes: (1) CCN concentrations persist for a week or longer showing also seasonal patterns. (2) CCN concentrations persist for less than one week, and there is little seasonal pattern. And (3) CCN concentrations are highly variable and do not persist for longer than two days, however do show seasonal cycles.