

Relationships between CCN and Cloud Microphysics over India as Observed in CAIPEEX

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The effect of aerosols on cloud microphysical and radiative properties has the greatest uncertainty of all known climate forcing mechanisms. A wide variation is noted for the sensitivity of cloud microphysics to aerosol and some were attributed to the different observational / analysis methods and natural variation. In the present study, extensive aircraft measurements carried out over Indian subcontinent were used to document the aerosol, CCN and cloud microphysical properties under Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) during pre-monsoon, active and break monsoon conditions. It is known that the concentration and spectra of the preexisting aerosol, namely cloud condensation nuclei (CCN), influences cloud droplet concentrations (N_c). Indeed alongwith the updraft velocity (w) at cloud base, CCN spectra determine initial N_c . However, N_c can subsequently be changed by mixing among cloud parcels, entrainment of out-of-cloud air (dilution and evaporation), and droplet coalescence. These factors are related to the first indirect aerosol effect (IAE) because many CCN are anthropogenic. Warm precipitation may also be influenced by CCN concentrations because droplet effective radius (R_{eff}), could be inversely related to N_c . This would relate to second IAE (precipitation inhibition). However, mean droplet radius or R_{eff} may also be separately influenced by the concentration of giant (GN) or ultragiant nuclei (UGN).

CCN were measured from the CAIPEEX aircraft N365JC by Droplet Measurement Technologies (DMT) CCN spectrometer. We present data from about 25 flights covering 6 regions over Indian subcontinent. Flights made CCN measurements at the cloud base before making for cloud profiling measurements. CCN concentrations and spectra at the cloud base show large variability during break and active monsoon regimes and over different aerosol source regions. The CCN concentrations are analysed with cloud droplet concentrations, cloud depth averaged cloud droplet effective radius to study the aerosol indirect effects. Presented will be the CCN concentrations, spectra and their relationship with cloud droplet concentrations, droplet effective radius.