AEROSOLS IMPACTS ON CLOUD DYNAMICS

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This work aims to study the impacts of variations of ambient aerosols concentrations on the physical properties of precipitation over Vale do Paraíba. Numerous instruments were deployed in Instituto de Estudos Avançados (IEAv) at São José dos Campos during November 22, 2011 through January 10, 2012 to measure CCN concentrations (Cloud Condensation Nuclei), total particle concentrations, rains droplets size distributions (DSD) and standard atmospheric properties such as temperature, pressure and wind intensities and directions. The measured DSD were parameterized through the Momentum Method, achieving satisfactory results where the measured and parameterized rains intensity (RI) where linearly correlated with $R^2 = 0.9996$. A cluster analysis were applied to the parameter obtained (N_0, m and Λ), associating them to 7 categories representing different kinds of DSD. Those results were useful to characterize individual precipitation events. Through information such as CCN and temperature amplitudes and rain intensities, duration and total water accumulated, five daily patterns were defined, three of which related to precipitation events here referenced as Local Convection, Organized Convection and Stratiform Rain. The first's events of those days were selected to compare similar cases subjects to different concentrations of CCN. On the Stratiform Rain case, increase of 37% on total rain droplet concentrations (CTG) were observed comparing the most polluted cases against the cleaners. An increase of 11% on RI was observed, following the increase on CTG. On the Local Convection cases, increases on CCN concentration lead to greater mean mass weighed diameter (D_m). It was noted that on those events information about convective intensities were required to best characterize the impacts of aerosols loading on precipitation systems. Analyzing individual events with similar Convective Available Potential Energy (CAPE), it was noted increases on RI, although statistically not significant but physically important, following increases on CCN loading, reaching relative values of 229%. However, two mechanisms were observed that lead to that increase. One where increases on CCN lead to increases on CTG but decreases on D_m and the other was the opposite. The aerosols impacts on those parameters where observed to be generally opposite and increases or decreases on RI through CCN presence depend on the balance between those two effects. The Organized Convection cases analysis was inconclusive, but evidence was found that the CCN loading effects can be insignificant on those systems.