ANALYSIS OF THE VERTICAL DISTRIBUTION OF THE THERMODYNAMIC PHASE IN TROPICAL DEEP-CONVECTIVE CLOUDS

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Deep-convective clouds (DCC) play a crucial role in redistributing latent heat, in the hydrological cycle and the radiative energy budget of the Earth's climate. They exhibit a complex vertical microphysical structure, including different thermodynamic phases (liquid, mixed-phase, and ice) and a high variability of cloud particle sizes. The optical and microphysical properties determining their radiative effects are strongly controlled by particle growth processes occurring within the clouds. Aerosol particles may alter these properties by modifying the cloud droplet size distribution, precipitation-forming processes, the cloud top height, the depth of the mixed-phase layer, and the occurrence of lightning. In particular, the phase transition from liquid to ice phase is relevant for the development of precipitation.

Therefore, we investigate the vertical evolution (from cloud base to anvil) of the cloud microstructure during different phases of the cloud life cycle under pristine and polluted conditions. Vertical profile measurements of microphysical properties have been performed during the ACRIDICON-CHUVA campaign conducted in September 2014 over the Brazilian rain forest near Manaus.

This presentation will give a statistical analysis of the vertical distribution of the thermodynamic phase for polluted and clean aerosol conditions by comparisons of in situ measurements and passive remote sensing retrieval results. Since cloud penetration and so in situ measurements are limited due to the strong updraft and downdraft in DCCs, cloud side observations using the imaging SPECtrometer system of the Munich Aerosol Cloud Scanner (specMACS) have been applied during ACRIDICON-CHUVA. The retrieval method for phase discrimination uses the spectral slope of the reflected radiances in the near-infrared spectral range. The vertical allocation of the observed cloud element and the cloud distance is estimated from stereographic analysis of additional video camera data.