

# Characterizing Vertical Particle Structure of Precipitating Clouds from CloudSat and CALIPSO Satellite Observations

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Cloud-precipitation process takes one of the key roles in the climate system. The formation of precipitating system is especially important in the water cycle of the Earth. The precipitation system also influences the radiation budget of the Earth through the interaction with its cloud fields. Thermodynamic particle generation is an essential factor in the precipitation formation as it influences the life cycle of the precipitating cloud system through physical mechanisms such as latent heat release and aggregation processes.

In this study, we investigated the vertical hydrometeor particle type structure of precipitating cloud systems. Here, the hydrometeor particle type indicates cloud/precipitation phase and ice crystal shapes. Following the past works by Masunaga et al. 2008 and Matsui et al. 2016, we classified the precipitating cloud regimes into the following five categories: Shallow Warm, Shallow Cold, Mid Warm, Mid Cold and Deep. For the classification of the precipitating cloud regimes, the previous studies employed cloud top height from the Visible and Infrared Scanner (VIRS) and precipitation top height from the Precipitation Radar (PR) onboard the TRMM satellite. Here in this study, we determined the cloud and precipitation top heights from the CloudSat and CALIPSO observations to extend the analysis from the tropics to global. To determine the vertical particle structure, the hydrometeor particle type classification is also utilized from the CloudSat and CALIPSO using the algorithm developed by Kikuchi et al. 2017. While deep convective system was found to have relatively simple structure, dominated by randomly-oriented ice cloud, followed by snow and melted rain at the bottom, shallow cold system having moderately-thick cloud layer with low precipitation underneath consisted variety of particles, accompanying an addition of ice-plates and drizzles. The representative vertical profiles for all five categories will be given in the presentation. Furthermore, the cloud-top buoyancy estimation by Luo et al. 2008 using MODIS is investigated to address how cloud-top buoyancy effect the vertical profiles of precipitating cloud regimes.

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