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Sensitivity of Microphysical Properties of Mixed-Phase Clouds on Model Resolution and Microphysics Scheme in ICON

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Microphysical processes in the mixed-phase clouds play an important role in modulating the earth's weather and climate. However, uncertainties in both observational data and model parameterization of microphysical properties (e.g., number concentrations of ice particles) constrains our ability to accurately simulate mixed-phase clouds and their impact with weather and climate models. Model configuration, such as one- or two-moment microphysical schemes, horizontal and vertical resolution of the model can affect the representation of cloud and precipitation processes and cloud radiative effects. For simplicity, many numerical models use 1-moment microphysical scheme to represent clouds. However, this scheme may not represent microphysical and precipitation processes accurately as it only predicts the mass or number mixing ratios of hydrometeors. To address this issue, the present study uses the Icosahedral Non-hydrostatic (ICON) model to assess the sensitivity of model configuration by comparing the predicted microphysical properties with the observations. In ICON, the one-moment microphysical scheme represents mass fractions of five cloud as well as precipitation particles such as: cloud water and ice, snow, graupel, and rain. Furthermore, the two-moment microphysical scheme in predicts both mass and number mixing ratios of hail and the five prognostic variables mentioned above. For the above discussed purpose, a case of observed mixed-phase clouds will be simulated with ICON. The profiles of the simulated cloud microphysical properties will be compared with the coincident aircraft and ground-based observations. Furthermore, various simulations will be performed by varying the vertical as well as horizontal resolution to analyse the changes in model predicted microphysical properties.