EGU21-3691, updated on 05 Dec 2022
https://doi.org/10.5194/egusphere-egu21-3691
EGU General Assembly 2021

The microphysical characters of wintertime mixed-phase clouds in North China.

Xuexu Wu[1,2], Minghuai Wang[1,2], Daniel Rosenfeld[1,3], Delong Zhao[1,4], and Deping Ding[4]

[1]School of Atmospheric Sciences, Nanjing University, 210023 Nanjing, China
[2]Joint International Research Laboratory of Atmospheric and Earth System Sciences & Institute for Climate and Global Change Research, Nanjing University, China
[3]Institute of Earth Sciences, The Hebrew University of Jerusalem, Jerusalem 91904, Israel
[4]Beijing Weather Modification Office, Beijing, China

We use aircraft observation data to investigate the microphysical characters of wintertime mixed-phase clouds in North China, including the cloud particle number concentration (N_c), the liquid water content (LWC), the ice particle number concentration (N_i), the ice water content (IWC), the particle spectrum distributions (PSDs) and the effective diameter (D_e). For wintertime mixed-phase clouds, the average N_c and N_i were 170±154 cm^{-3} and 26±39 L^{-1}, respectively; the average LWC and IWC were 0.05±0.06 and 0.07±0.09g/m^3, respectively; the D_e for cloud particles was 10±4 μm. When compared to the results from other regions, including East Europe, North America, Southern Ocean and Tibetan Plateau, we found that the wintertime mixed-phase cloud in North China has larger N_c, smaller LWC, IWC and D_e, and narrower PSDs. The main reason might be the larger aerosol loading and smaller water content in the atmosphere in winter in North China. With increasing temperature, N_c and LWC increased, but N_i and D_e decreased. The dominate physical processes in wintertime mixed-phase cloud were aggregation process and riming process. As the temperature increased, the peak concentration of ice PSD decreased, but N_i increased and the ice PSD became wider, indicating more ice crystals and the ice crystals became larger at higher temperature. With temperature increasing, the ice habit also changed, and the amount of plates, irregular crystals and their aggregates increased. What's more, with the existence of larger LWC at higher temperature, the ice crystals gradually tightened and their surface became more complicated as well. Therefore, both aggregation process and riming process were more active at higher temperature, but riming process changed much more. This work fills the gap in the observation of wintertime mixed-phase clouds in north China, and the results suggest that the wintertime mixed-phase clouds have some unique microphysical characters.