Estimating geometry of embedded supercooled liquid layers in mixed-phase clouds

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Clouds play important role in climate systems and they are currently poorly represented in weather models. Arctic environment is very sensitive to climate change [1]. An example of climate change impact of clouds is Greenland, where it has been observed that increasing ice melting is at least partially due to presence of mixed-phase clouds that affect the radiation budget [2] This causes motivation to study mixed-phase clouds especially in Arctic region. In mixed-phase clouds liquid droplets dominate cloud optical properties. Glaciation can transform clouds that cool Earth to clouds that cause warming effect. Mixed-phase clouds are also responsible for majority of precipitation falling at mid- and high latitudes. Therefore mixed-phase clouds plays also important role in hydrological cycle and play an important part of numerical weather predictions.

It is not easy to identify liquid cloud layers embedded in ice cloud or precipitation. In order to ascertain their impact a robust method for identification of these layers is needed. Identifying location of supercooled water droplets is the topic of this study. Conventional remote sensing instruments do not provide any direct measurements of super cooled water droplets. We show how structure of the radar reflectivity factor and vertical Doppler velocity observed by a cloud radar could be used to identify boundaries of embedded liquid layers. The proposed method is compared and verified against measurements from High Resolution Spectral Lidar (HSRL) that provide altitude of the layer base, sounding that give humidity profile and Doppler radar spectra measurements. Results show possibilities to estimate, embedded supercooled liquid layer geometry by studying radar reflectivity and Doppler velocity. During the presentation we will present results for identifying geometry of supercooled liquid layers for several cases recorded during BAECC experiment.

References

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