



Remote sensing of ice density and riming processes with Doppler radar

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Satellite radar–lidar measurements have facilitated advances in global estimates of ice cloud and precipitation, especially in remote maritime and polar environments. A major uncertainty is the composition and density of ice particles, which depend on ice growth processes such as aggregation, and riming in the presence of supercooled liquid droplets. The upcoming EarthCARE satellite, the first Doppler radar in space, will be capable of retrieving ice density by using Doppler velocity measurements to distinguish fast-falling rimed particles from lighter, slower aggregates.

In this study we use vertically-pointing Doppler radar measurements from the ARM mobile facility at Hyttiälä, Finland to retrieve the fractional volume of rimed ice and aggregate snow. The retrievals are made using CAPTI-VATE, the novel variational retrieval scheme developed for EarthCARE, and are compared against in situ measurements at the surface. These results will provide insights into ice growth processes, and will inform to what extent the new spaceborne Doppler radar capability stands to reduce uncertainties in retrievals of ice water content and the detection of mixed-phase cloud in polar regions.