Validation of space-based snowfall estimate by using a combination of weather radar and surface measurements in southern Finland

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Space-based observations of snowfall are utilized to investigate the role of snow in a changing climate. Satellite instrumentation such as on-board with CloudSat or Global Precipitation Measurement (GPM) missions provide nearly the needed spatial and temporal resolution, although both active and passive sensors have their own challenges, e.g. active sensors suffer from the clutter contamination (blind zone) and passive sensors from the coarse resolution and unambiguous snowfall retrieval due to the snow-covered surface emissivity. The uncertainties affect the detection and quantitative estimation of snowfall. Maahn et al. [1] investigated the influence of the blind zone on the measured reflectivity and precipitation amounts. Von Lerber et al. [2] presented a ground validation dataset, which is generated from detailed characterization of snowfall microphysics with surface observations and spatial precipitation measurements with ground-based weather radar. This dataset can be utilized to test and improve retrieval snowfall algorithms, as was demonstrated in the study with GPM Microwave Imager (GMI) measurements.

Here results from the comparison between snowfall estimates of GMI and ground-based C-band weather radar are shown. The surface observations were carried out at the University of Helsinki research station in Hyytiälä, which is about 64 km east of the Ikaalinen radar of Finnish Meteorological Institute. The quantitative snowfall estimates are computed by applying event-specific relations between the equivalent reflectivity factor and snowfall rate to weather radar observations. The relations are derived using retrieved ice particle microphysical properties measured by video disdrometer and precipitation gauge. The detection skill and retrieved surface snowfall precipitation of GPROF - detection algorithm [3] are then assessed over Southern Finland. Based on the 26 studied overpasses, a clear dependence of detection skill on cloud echo top height and underestimation of snowfall rate by factor of 3 are shown.

References

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