

Simulating GPM DPR snowfall observations by using combined weather radar and CloudSat measurements

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Global Precipitation Measurement (GPM) is a NASA Earth observation satellite mission planned for launch in 2013. The goal of the mission is to characterize the role of precipitation in the Earth's water cycle. The Dual-frequency Precipitation Radar (DPR) is one of main instruments of GPM, and will be used to characterize the three dimensional structure of precipitation. DPR will operate at K_u - and K_a -bands.

One of the biggest uncertainties in GPM retrieval algorithms is how the algorithms will work in cases of shallow light precipitation that are common in northern latitudes. Unfortunately, K_u/K_a -band radar observations are not readily available to study the performance of the algorithms in those cases. To augment the lack of observations, we have developed a procedure that can be used to simulate the output of the GPM K_u/K_a radar in realistic snowfall scenarios. The inputs of the simulation are coinciding CloudSat W-band radar and C-band weather radar observations.

As a starting point of the study, we have simulated the dependence of the Dual-frequency ratio (DFR) at the GPM frequencies from the C/W-band DFR. For these simulations a wide range of input parameters, such as particle size distributions, snow density, etc. were used. Our simulations, performed with Mie scattering, indicate that the K_u/K_a -band dual frequency ratio can be simulated with good accuracy from the C/W-band DFR. This implies that the GPM snowfall measurements can be simulated from combined data obtained from ground-based and space-based radars.

The results of simulations were applied to coinciding University of Helsinki C-band weather radar and CloudSat snowfall measurements, to generate synthetic GPM observations. To collect these observations, University of Helsinki (UH) was carrying dedicated sector volume scans along CloudSat track. The measurements were synchronized with CloudSat overpasses to achieve minimal spatial and temporal differences in observations.

Finnish Meteorological Institute and the University of Helsinki are in cooperation with the National Aeronautics and Space Administration (NASA) to organize a test measurement campaign in preparation for GPM. The campaign is scheduled to take place in southern Finland in the Autumn of 2010 and will involve *in situ* observations as well as remote measurements by ground-based, airborne and spaceborne radars. Included in the data sources are a NASA aircraft, the C-band radar operated by UH in Helsinki, and the CloudSat CPR W-band radar. During this campaign, the proposed procedure will be subjected to further evaluation.

References

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