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Use of Passive Microwave Observations in a Dual Frequency Radar Rainfall-Profiling Algorithm

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In this study, we investigate the use of passive microwave information in a rainfall profile algorithm for dual-frequency space-borne radars. In principal, dual-frequency space-borne radars allow for estimation of two-parameter drop size distribution (DSDs) at each range bin. However, the accuracy of the retrieved DSD may depend on the accuracy of other physical variables that may not be reliably estimated from radar-observations alone. Such variables include: the total path-integrated attenuation at both frequencies, the attenuation due to cloud, the attenuation in the melting layer. The information provided by coincident passive microwave observations can be used to improve the accuracy of the variables needed to retrieve the two parameter DSDs and implicitly the accuracy of the retrieved two parameter DSDs. This can be achieved by identifying the smallest number of variables that along with the two parameter DSDs (or Particle Size Distributions in the mixed and ice phase) are sufficient to simulate the passive microwave observations. These variables are determined along with the two parameter DSDs from actual passive and dual frequency radar observations using an optimal estimation procedure. The methodology is tested using both synthetic and real data originating from the Wakasa Bay experiment.