

Evaluation of CloudSat rainfall retrievals over land using operational WSR-88D radar data

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Although the spaceborne W-band radar rain rate retrievals over water surfaces have been used as a standard CloudSat product for a number of years, rainfall retrievals over land have not reached the level when they are used extensively. This is due, in part, to large uncertainty of the path integrated attenuation (PIA) estimates over land compared to those over water. PIA estimates are the essential part of standard CloudSat retrievals of rainfall. CloudSat retrievals over land are available using the reflectivity gradient method, which is also based on attenuation of W-band signals in rain but does not require PIA estimates. This study presents intercomparisons of the CloudSat gradient methods rainfall retrievals with quantitative precipitation estimate (QPE) results from the National Weather Service (NWS) WSR-88D ground-based radar measurements. The comparisons were performed for predominantly stratiform precipitation events observed during CloudSat overpasses over the KGWX and KSHV WSR-88D ground radar sites. The closely collocated in space and time spaceborne and ground-based rain rate estimates were well correlated with a corresponding correlation coefficient of about 0.7 and a relative mean difference of 50-60%, which is on the order of magnitude of retrieval uncertainties from both spaceborne and ground-based radar measurements. The general agreement between experimental CloudSat retrievals and rather established and widely used WSR-88D QPE approaches provides evidence for robustness of spaceborne cloud radar rainfall retrievals over land.