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Precipitation from the GPM Microwave Imager and Constellation Radiometers

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Satellite precipitation retrievals from microwave sensors are fundamentally underconstrained requiring either implicit or explicit a-priori information to constrain solutions. The radiometer algorithm designed for the GPM core and constellation satellites makes this a-priori information explicit in the form of a database of possible rain structures from the GPM core satellite and a Bayesian retrieval scheme. The a-priori database will eventually come from the GPM core satellite's combined radar/radiometer retrieval algorithm. That product is physically constrained to ensure radiometric consistency between the radars and radiometers and is thus ideally suited to create the a-priori databases for all radiometers in the GPM constellation. Until a robust product exists, however, the a-priori databases are being generated from the combination of existing sources over land and oceans. Over oceans, the Day-1 GPM radiometer algorithm uses the TRMM PR/TMI physically derived hydrometer profiles that are available from the tropics through sea surface temperatures of approximately 285K. For colder sea surface temperatures, the existing profiles are used with lower hydrometeor layers removed to correspond to colder conditions. While not ideal, the results appear to be reasonable placeholders until the full GPM database can be constructed. It is more difficult to construct physically consistent profiles over land due to ambiguities in surface emissivities as well as details of the ice scattering that dominates brightness temperature signatures over land. Over land, the a-priori databases have therefore been constructed by matching satellite overpasses to surface radar data derived from the WSR-88 network over the continental United States through the National Mosaic and Multi-Sensor QPE (NMQ) initiative. Databases are generated as a function of land type (4 categories of increasing vegetation cover as well as 4 categories of increasing snow depth), land surface temperature and total precipitable water. One year of coincident observations, generating 20 and 80 million database entries, depending upon the sensor, are used in the retrieval algorithm. The remaining areas such as sea ice and high latitude coastal zones are filled with a combination of CloudSat and AMSR-E plus MHS observations together with a model to create the equivalent databases for other radiometers in the constellation. The most noteworthy result from the Day-1 algorithm is the quality of the land products when compared to existing products. Unlike previous versions of land algorithms that depended upon complex screening routines to decide if pixels were precipitating or not, the current scheme is free of conditional rain statements and appears to produce rain rate with much greater fidelity than previous schemes. There results will be shown.