Geophysical Research Abstracts
Vol. 16, EGU2014-9968, 2014
EGU General Assembly 2014
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Cross-track sensor precipitation retrievals for the Global Precipitation Measurement mission

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The utilization of observations from passive microwave cross-track, or sounders, for global precipitation estimation provides a number of distinct advantages including the potential to retrieve precipitation over cold surface backgrounds and improvements in temporal sampling. As part of the Global Precipitation Measurement (GPM) mission, observations from these cross-track instruments are being incorporated into the overall retrieval framework to enable better temporal and spatial sampling, particularly over regions where surface conditions provide a challenging background against which to observe precipitation. GPM is an international satellite mission and brings together a number of different component satellites and sensors, each contributing observations capable of providing information on precipitation. The joint US-Japan core observatory was launched in early 2014 and carries the GPM Microwave Imager (GMI) and the Dual-frequency Precipitation Radar (DPR). The core observatory serves as a standard against which other sensors in the constellation are calibrated, providing a consistent observational dataset to ensure the highest quality precipitation retrievals to be made. The conically-scanning GMI provides observations from 10.65 GHz through to 166 GHz with dual polarization capabilities, and two 183 GHz channels (+-1 and +-3 GHz) with vertical polarization. The highest frequencies provide resolutions in the order of 4.4x7.3 km. 885 km swath width. The DPR operates at 35.5 GHz and 13.6 GHz with swath widths 120 and 245 km respectively, and a vertical resolution of 250 m. The higher frequency radar will provide a sensitivity down to 12 dBZ, or about 0.2 mmh-1 equivalent rainrate, particularly useful for higher latitudes where light precipitation dominates.

Integration of the cross-track sensors into the overall retrieval scheme of the GPM mission is achieved through the GPROF retrieval scheme, utilizing databases based upon observational and modelled data sets. In particular, data from the Microwave Humidity Sounder (MHS) onboard the US NOAA and European MetOp satellites, together with the US Advanced Technology Microwave Sounder (ATMS) and the French-Indian Sondeur Atmosphérique du Profil d'Humidité Intertropicale par Radiométrie (SAPHIR) sounders, provide high-frequency observations. Unlike data from the passive microwave conical sensors, additional processing steps are required for the cross-track observations since the field-of-view resolution varies with scan angle, thus affecting the beam-filling of non-homogenous rainfall fields. Initial retrievals are presented using data from SAPHIR and MHS sensors and compared against 'first-light' results from the GPM core observatory.