The Global Precipitation Measurement (GPM) Mission: Overview and U.S. Status

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Abstract

The Global Precipitation Measurement (GPM) Mission is an international satellite mission specifically designed to unify and advance precipitation measurements from a constellation of research and operational microwave sensors. The cornerstone of the GPM mission is the deployment of a Core Observatory in a 65° non-Sun-synchronous orbit to serve as a physics observatory and a transfer standard for inter-calibration of constellation radiometers. The GPM Core Observatory will carry a Ku/Ka-band Dual-frequency Precipitation Radar (DPR) and a conical-scanning multi-channel (10-183 GHz) GPM Microwave Radiometer (GMI). The first space-borne dual-frequency radar will provide not only measurements of 3-D precipitation structures but also quantitative information on microphysical properties of precipitating particles needed for improving precipitation retrievals from passive microwave sensors. The combined use of DPR and GMI measurements will place greater constraints on radiometer retrievals to improve the accuracy and consistency of precipitation estimates from all constellation radiometers.

The GPM constellation is envisioned to comprise five or more conical-scanning microwave radiometers and four or more cross-track microwave sounders on operational satellites. NASA and the Japan Aerospace Exploration Agency (JAXA) plan to launch the GPM Core in July 2013. NASA will provide a second radiometer to be flown on a partner-provided GPM Low-Inclination Observatory (LIO) to improve near real-time monitoring of hurricanes and mid-latitude storms. NASA and the Brazilian Space Program (AEB/IPNE) are currently engaged in a one-year study on potential LIO partnership. JAXA will contribute to GPM data from the Global Change Observation Mission-Water (GCOM-W) satellite. Additional partnerships are under development to include microwave radiometers on the French-Indian Megha-Tropiques satellite and U.S. Defense Meteorological Satellite Program (DMSP) satellites, as well as cross-track scanning humidity sounders on operational satellites such as the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP), POES, the NASA-NOAA Joint Polar Satellite System (JPSS), and EUMETSAT MetOp satellites. Data from Chinese and Russian microwave radiometers may also become available through international collaboration under the auspices of the Committee on Earth Observation Satellites (CEOS) and Group on Earth Observations (GEO).

The current generation of global rainfall products combines observations from a network of uncoordinated satellite missions using a variety of merging techniques. Relative to current data products, GPM’s “next-generation” precipitation products will be characterized by: (1) more accurate instantaneous precipitation estimate (especially for light rain and cold-season solid precipitation), (2) more frequent sampling by an expanded constellation of microwave radiometers including operational humidity sounders over land, (3) intercalibrated microwave brightness temperatures from constellation radiometers within a unified framework, and (4) physical-based precipitation retrievals from constellation radiometers using a common a priori hydrometeor database constrained by combined radar/radiometer measurements provided by the GPM Core Observatory.

An overview of the GPM mission concept, the U.S. GPM program status, and updates on international science collaborations on GPM will be presented.