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. Building upon the success of the U.S.-Japan Tropical Rainfall Measuring Mission (TRMM), the National Aeronautics and Space Administration (NASA) of the United States and the Japan Aerospace and Exploration Agency (JAXA) will deploy in 2013 a GPM "Core" satellite carrying a Ku/Ka-band Dual-frequency Precipitation Radar (DPR) and a conical-scanning multi-channel (10-183 GHz) GPM Microwave Imager (GMI) to establish a new reference standard for precipitation measurements from space. The combined active/passive sensor measurements will also be used to provide common database for precipitation retrievals from constellation sensors.

For global coverage, GPM relies on existing satellite programs and new mission opportunities from a consortium of partners through bilateral agreements with either NASA or JAXA. Each constellation member may have its unique scientific or operational objectives but contributes microwave observations to GPM for the generation and dissemination of unified global precipitation data products. In addition to the DPR and GMI on the Core Observatory, the baseline GPM constellation consists of the following sensors: (1) Special Sensor Microwave Imager/Sounder (SSMIS) instruments on the U.S. Defense Meteorological Satellite Program (DMSP) satellites, (2) the Advanced Microwave Scanning Radiometer-2 (AMSR-2) on the GCOM-W1 satellite of JAXA, (3) the Multi-Frequency Microwave Scanning Radiometer (MADRAS) and the multi-channel microwave humidity sounder (SAPHIR) on the French-Indian Megha-Tropiques satellite, (4) the Microwave Humidity Sounder (MHS) on the National Oceanic and Atmospheric Administration (NOAA)-19, (5) MHS instruments on MetOp satellites launched by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), (6) the Advanced Technology Microwave Sounder (ATMS) on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP), (7) ATMS instruments on the NOAA-NASA Joint Polar Satellite System (JPSS) satellites, and (8) a microwave imager under planning for the Defense Weather Satellite System (DWSS).

Relative to current global rainfall products, GPM's "next-generation" precipitation data 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, (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.

GPM is a science mission with integrated applications goals. GPM will provide a key measurement to improve understanding of global water cycle variability and freshwater availability in a changing climate. The DPR and GMI measurements will offer insights into 3-dimensional structures of hurricanes and

midlatitude storms, microphysical properties of precipitating particles, and latent heat associated with precipitation processes. GPM will also provide high-resolution data in near realtime (within 3 hours of observations) for societal applications that include accurate position fixes of storm centers for improved track prediction, precipitation assimilation for improved operational weather forecasts, monitoring and predictions for floods and landslides, as well as management of freshwater resources.

An overview of the GPM mission design, the U.S. program status, and international science collaboration on GPM will be presented.