GPM MISSION OVERVIEW AND U.S. SCIENCE STATUS

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Abstract

The Global Precipitation Measurement (GPM) Mission is an international satellite mission to unify and advance precipitation measurements from a constellation of research and operational sensors to provide "next-generation" precipitation products [1]. Relative to current global rainfall products, GPM data products will be characterized by: (1) more accurate instantaneous precipitation measurements (especially for light rain and cold-season solid precipitation), (2) more frequent sampling by an expanded constellation of microwave radiometers that include operational humidity sounders over land, (3) inter-calibrated microwave brightness temperatures from constellation radiometers within a unified framework, and (4) physical-based precipitation retrievals from constellation radiometers using a common *a priori* cloud/hydrometeor database derived from GPM Core sensor measurements .

The cornerstone of the GPM mission is the deployment of a Core Observatory in a unique 65^{o} non-Sun-synchronous orbit to serve as a physics observatory and a calibration reference to improve precipitation measurements by a constellation of dedicated and operational passive microwave sensors. The Core Observatory will carry a Ku/Ka-band Dual-frequency Precipitation Radar (DPR) and a multi-channel (10-183 GHz) GPM Microwave Radiometer (GMI). The DPR will provide measurements of 3-D precipitation structures and microphysical properties, which are key to achieving a better understanding of precipitation processes and improving retrieval algorithms for passive microwave radiometers. The combined use of DPR and GMI measurements will place greater constraints on possible solutions to radiometer retrievals to improve the accuracy and consistency of precipitation retrievals from all constellation radiometers.

The GPM constellation is envisioned to comprise 5 or more conical-scanning microwave radiometers provided by partners, augmented by 4 or more cross-track microwave sounders on operational satellites for improved sampling over land. GPM is currently a partnership between NASA and the Japan Aerospace Exploration Agency (JAXA). In addition to the joint development and deployment of the GPM Core Observatory, NASA will provide a second GMI to be flown on a partner-provided Low Inclination Observatory (LIO) in a non-Sun-synchronous orbit at ~40^{o} inclination to improve temporal sampling and near-realtime monitoring of tropical and mid-latitude storms, while JAXA will provide 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 humidity sounders on operational satellites such as the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP), POES, NPOESS, and European MetOp satellites. In addition, Brazil is planning for a GPM radiometer for the tropics, and data from Chinese and Russian microwave radiometers may be available through international cooperation under the auspices of the Committee on Earth Observation Satellites (CEOS) and Group on Earth Observations (GEO).

As a science mission with integrated application goals, GPM is designed to (1) advance precipitation measurement capability from space through combined use of active and passive microwave sensors, (2) advance the knowledge of the global water/energy cycle and freshwater availability through better description of the space-time variability of global precipitation, and (3) improve weather, climate, and hydrological prediction capabilities through more accurate and frequent measurements of instantaneous precipitation rates and time-integrated rainfall accumulation.

An overview of the GPM mission concept and science activities in the United States, together with an update on international collaborations in radiometer intercalibration and ground validation, will be presented.

References:

[1] A. Y. Hou, G. Skofronick-Jackson, C. D. Kummerow and J. M. Shepherd, “Global precipitation measurement,” *Precipitation: Advances in Measurement, Estimation, and Prediction* (Ed. Silas Michaelides), Springer-Verlag, pp. 131-164, 2008.