



GPM: Global Precipitation Measurement

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<http://gpm.nasa.gov>

An international satellite mission that unifies and advances precipitation measurements from space for scientific research and societal applications.

Mission Overview

The Global Precipitation Measurement (GPM) is an international satellite mission to provide next-generation observations of rain and snow worldwide every three hours. NASA and the Japan Aerospace Exploration Agency (JAXA) will launch a “Core” satellite carrying advanced instruments that will set a new standard for precipitation measurements from space. The data they provide will be used to unify precipitation measurements made by an international network of partner satellites to quantify when, where, and how much it rains or snows around the world.

The GPM mission will help advance our understanding of Earth’s water and energy cycles, improve the forecasting of extreme events that cause natural disasters, and extend current capabilities of using satellite precipitation information to directly benefit society.

GPM: Building on TRMM’s Legacy

The Tropical Rainfall Measuring Mission (TRMM), launched in 1997, measures moderate and heavy rainfall in the tropics. TRMM has shown the importance of taking measurements at different times of day to improve observations of weather systems and real-time monitoring of hurricanes. The GPM Core Observatory will continue this sampling strategy, but will extend the observations to higher latitudes, covering the globe from the Antarctic Circle to the Arctic Circle.

The design of the GPM Core Observatory is an advancement of TRMM’s highly successful rain-sensing package, which uses an active radar capable of providing information on precipitation particles, layer-by-layer, within clouds, and a passive microwave imager capable of sensing the total precipitation within all cloud layers. Since light rain and falling snow account for a significant fraction of precipitation events in middle and high latitudes, the GPM instruments extend the capabilities of the TRMM sensors to detect falling snow, measure light rain, and provide, for the first time, quantitative estimates of microphysical properties of precipitation particles.

GPM Core Observatory

The foundation of the GPM mission is the Core Observatory satellite provided by NASA and JAXA. Data collected from the Core satellite serves as a reference standard that will unify precipitation measurements from research and operational satellites launched by a consortium of GPM partners in the United States, Japan, France, India, and Europe. The GPM constellation of satellites can observe precipitation over the entire globe every 2-3 hours. The Core satellite will measure rain and snow using two science instruments: the GPM Microwave Imager (GMI) and the Dual-frequency Precipitation Radar (DPR). The GMI captures precipitation intensities and horizontal patterns, while the DPR provides insights into the three dimensional structure of precipitating particles. Together these two instruments provide a database of measurements against which other partner satellites’ microwave observations can be meaningfully compared and combined to make a global precipitation dataset.

The GMI uses 13 different microwave channels to observe energy from the different types of precipitation through clouds for estimating everything from heavy to light rain and for detecting falling snow. As the satellite passes over Earth, the GMI constantly scans a region 550 miles (885 kilometers) across. The Ball Aerospace and Technology Corporation built the GMI under contract with NASA Goddard Space Flight Center.

The DPR provides three-dimensional information about precipitation particles derived from reflected energy by these particles at different heights within the cloud system. The two frequencies of the DPR also allow the radar to infer the sizes of precipitation particles and offer insights into a storm’s physical characteristics. The Ka-band frequency scans across a region of 78 miles (125 kilometers) and is nested within the wider scan of the Ku-band frequency of 147 miles (245 kilometers). The Japan Aerospace and Exploration Agency (JAXA) and Japan’s National Institute of Information and Communications Technology (NICT) built the DPR.

The GPM Core Observatory is being developed and tested at NASA Goddard Space Flight Center. Once complete, a JAXA H-IIA rocket will carry the GPM Core Observatory into orbit from Tanegashima Island, Japan in 2014.

GPM Science and Applications

Water is fundamental to life on Earth. Knowing where and how much rain and snow falls globally is vital to understanding how weather and climate impact both our environment and Earth’s water and energy cycles, including effects on agriculture, fresh water availability, and responses to natural disasters. Since rainfall and snowfall vary greatly from place to place and over time, satellites can provide more uniform observations of rain and snow around the globe than ground instruments, especially in areas where surface measurements are difficult. GPM’s next-generation global precipitation data will lead to scientific advances and societal benefits in the following areas:

- Improved knowledge of the Earth’s water cycle and its link to climate change
- New insights into precipitation microphysics, storm structures and large-scale atmospheric processes
- Better understanding of climate sensitivity and feedback processes
- Extended capabilities in monitoring and predicting hurricanes and other extreme weather events
- Improved forecasting capabilities for natural hazards, including floods, droughts and landslides
- Enhanced numerical prediction skills for weather and climate
- Better agricultural crop forecasting and monitoring of freshwater resources

Constellation and Partners

The GPM mission was initiated by NASA and the Japan Aerospace Exploration Agency (JAXA) and is designed to provide advanced global precipitation measurements within a consistent framework using the GPM Core satellite in concert with a constellation of partner satellites. Each constellation member has its unique scientific or operational objectives but contributes microwave measurements to GPM for the generation and dissemination of uniform global precipitation products for worldwide user communities. The agencies currently planning to contribute satellite data the GPM constellation include:

- NASA
- Japan Aerospace Exploration Agency (JAXA)
- French Centre National d’Études Spatiales (CNES)
- Indian Space Research Organisation (ISRO)
- National Oceanic and Atmospheric Administration (NOAA)
- European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- United States Department of Defense Meteorological Satellite Program (DMSP)