

# New global precipitation observation pioneered by GPM/DPR

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The Global Precipitation Measurement (GPM) mission is an international cooperate satellite project to achieve highly accurate and highly frequent global precipitation observations. GPM was conceived as a satellite precipitation observation project, following the Tropical Rainfall Measurement Mission (TRMM) satellite launched in 1997 and continuing observation until 2015.

The GPM mission consists of the GPM Core satellite jointly developed by the U.S. and Japan and Constellation Satellites that carry microwave radiometers and provided by the GPM partner agencies. The GPM Core satellite carries the Dual-frequency Precipitation Radar (DPR) by the Japan Aerospace Exploration Agency (JAXA) and the National Institute of Information and Communications Technology (NICT) and the GPM Microwave Imager (GMI) provided by National Aeronautics and Space Administration (NASA). The GPM Core satellite was launched in February 2014 and achieved its prime mission period planned for 3 years in 2017. It has been continuing its observation as the extended mission phase after that.

JAXA develops the DPR Level 1 algorithm and the NASA-JAXA Joint Algorithm Team develops the DPR Level 2 and DPR-GMI combined Level 2 algorithms. The DPR, the DPR-GMI combined algorithms and the latent heating algorithm were updated, and those products were released in October 2018 as Version 0.6. Using dual frequency information of DPR, the latest Level 2 products include information such as precipitation phase at surface, heavy ice precipitation and so on.

From May 2018 in the extended mission period, the scan pattern of the Ka-band radar has been changed to realize matched beam observation in full swath. The new algorithm applying to the changed scan pattern is now under development.

The accumulation of satellite precipitation radar observation data from TRMM to GPM has exceeded 20 years. The calibration factors of TRMM/PR were re-examined to have consistency between DPR/Ku. The same GPM Ku-band radar L2 algorithm now applies to the TRMM/PR, so that the long radar precipitation data exceeding more than 20 years are now available.

JAXA also develops the Global Satellite Mapping of Precipitation (GSMaP), that is hourly and 0.1-degree horizontal resolution global rainfall map.

GPM/DPR information is used as a database to make more quantitative use of passive microwave sensor information, which is the main input in GSMaP.

Compared to the TRMM/PR era, since the DPR covering mid and high latitudes has been used, and the estimated precipitation accuracy has been improved from the GSMaP product version4.

It is available through the “JAXA Global Rainfall Watch” website (<https://sharaku.eorc.jaxa.jp/GSMaP/index.htm>). GSMaP product family includes different data latency products and rain gauge calibrated products and so on. The GSMaP near-real-time version (GSMaP\_NRT) product provides global rainfall map in 4-hour after observation, and an improved version of GSMaP near-real-time gauge-adjusted (GSMaP\_Gauge\_NRT) product has been released since Dec. 2018.

The GSMaP real-time product called GSMaP\_NOW is providing data at the earliest timing. It has been realized using the geostationary satellite Himawari-8 operated by the Japan Meteorological Agency (JMA) since November 2015. Since Nov. 2018 the domain of GSMaP\_NOW has been extended to the region of the geostationary satellite METEOSAT operated by the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) in November 2018. JAXA is further developing the GSMaP\_NOW to provide global real-time rainfall product.

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