

Advances in Fengyun Satellite Precipitation Observations (2024-2026)

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This report presents recent progress in precipitation observation capabilities using China's Fengyun (FY) meteorological satellite series. Currently, FY satellites are equipped with diverse instruments—including active radar, microwave radiometers, and infrared imagers—enabling comprehensive precipitation monitoring from multiple perspectives. This summary highlights key developments during 2024–2026 and outlines future directions.

1. FY-3G In-Orbit Performance and Product Availability

The FY-3G satellite, China's first dedicated precipitation measurement satellite, has been operating stably for three years. All instruments, except for the Microwave Imager (MWRI), are functioning well. To date, 21 categories of scientific products have been publicly released and are accessible via the Fengyun Satellite Data Center. Comparative evaluations show that the Precipitation Measurement Radar (PMR) onboard FY-3G performs comparably to the GPM Dual-frequency Precipitation Radar (DPR). Ground-based weather radar and rain gauge data have been used to validate reflectivity consistency and precipitation rate estimates, confirming the reliability of FY-3G observations.

2. Enhanced Infrared Precipitation Estimation Algorithms

Improvements have been made to traditional infrared-based precipitation retrieval methods for geostationary satellites. On one hand, ground-based rain gauge data are now used to constrain hourly precipitation estimates. On the other hand, artificial intelligence approaches—such as the Unet neural network—have been introduced for infrared quantitative precipitation estimation. Preliminary results indicate that these AI-based methods outperform conventional physical retrieval techniques in accuracy.

3. Compensating for MWRI Anomalies Using Microwave Humidity Sounder

Following the malfunction of the FY-3 Microwave Imager (MWRI), alternative retrieval algorithms using the FY-3 Microwave Humidity Sounder (MWHS) have been developed for quantitative precipitation estimation. This adaptation partially mitigates the impact of MWRI data loss on global precipitation monitoring.

4. Contributions to Global Precipitation Observation

The unique orbital characteristics of FY satellites, particularly observations from the early-morning orbit, have been shown to provide valuable to the global precipitation observing system. Ongoing efforts at the National Satellite Meteorological Center aim to integrate FY satellite precipitation data into the GPM IMERG framework, with the goal of producing higher-accuracy global precipitation products.

5. Future Plans

In 2027, China plans to launch a new satellite equipped with an active precipitation measurement radar. Additionally, as a new generation of global geostationary meteorological satellites becomes fully operational, infrared-based precipitation estimation using global geostationary satellite mosaics is expected to advance further.