GOES-16 ABI L2+ Rainfall Rate / QPE (RRQPE)
Full Data Quality
May 15, 2024
Read-Me for Data Users

GOES-R Advanced Baseline Imager (ABI) L2+ products will achieve Full Validation maturity by default after two years of Provisional and Operational use with no major anomalies reported (minor product improvements may still be occurring). As a result, GOES-16 Rainfall Rate / QPE (RRQPE) is considered Full Validation maturity as of March 30, 2020.

The ABI Rainfall Rate / QPE product assigns each earth-navigated pixel a rainfall rate ranging from 0 to 100 mm/h. Only infrared channels are used to determine the rainfall rate. The rainfall rate product is generated for every ABI Full Disk (FD) of the Earth every 10 minutes whether the satellite is in Scan Mode 6 or 4.

A full description and format of the RRQPE product can be found in the Product Definition and User's Guide (PUG) Volume 5: Level 2+ Products, located on OSPO's GOES-R documents webpage: https://www.ospo.noaa.gov/Organization/Documents/goes-r.html. The baseline algorithm used to derive the RRQPE products from GOES-16 ABI observations is described in detail in the "GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document for Rainfall Rate / QPE", located on STAR's GOES-R ATBD webpage: https://www.star.nesdis.noaa.gov/goesr/documentation_ATBDs.php.

The Enterprise Rainfall Rate product is being run in the NESDIS Common Cloud Framework (NCCF) rather than the GOES-R Ground System and will be replacing the baseline version as the operational Rainfall Rate dataset in June 2024. The algorithm used to derive the enterprise product can also be found on STAR's GOES-R ATBD webpage.

Full maturity, by definition, means that:
- Validation, quality assurance, and anomaly resolution activities are ongoing.
- Incremental product improvements may still be occurring.
- Users are engaged and user feedback is assessed.
- Product performance for all products is defined and documented over a wide range of representative conditions via ongoing ground-truth and validation efforts.
- Products are operationally optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations.
- All known product anomalies are documented and shared with the user community.
- Product is operational.

Users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized. Persons desiring to use the GOES-16 ABI Full maturity Rainfall Rate products for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the NOAA

algorithm working group (AWG) scientists for feasibility of the planned applications. This product is sensitive to upstream processing, such as the quality of the calibration and navigation.

Status of the RR/QPE product and any remaining known issues that are being resolved:

1. Missing values occur randomly due to upstream L1b issues.
2. Parallax effects, which can produce displacements away from the satellite sub-points as high as 20 km for towering cumulonimbus near the edge of the satellite scan area. The Enterprise Rainfall Rate product corrects for parallax shifts.
3. False alarms may occur due to incorrect identification of thick cirrus clouds as raining, such as cirrus anvils from thunderstorm complexes and the Central Dense Overcast (CDO) in tropical systems. In general, infrared (IR) approaches are unable to detect critical precipitating features when they are obscured from above by a layer of optically thick cloud. The Enterprise Rainfall Rate product does significantly improve on the Baseline product in this regard.
4. Stratiform precipitation and / or convection from clouds with very warm cloud-top temperatures may be missed by the algorithm. This is another area where the Enterprise Rainfall Rate product significantly improves on the Baseline product; however, significant underestimation in these instances continues to be observed. The product can be used with greatest confidence for deep convective rainfall.
5. Incorrect location of fine-scale surface rainfall features caused by wind shear. Since hydrometeors falling through and from a cloud are carried along by the ambient winds, highly sheared vertical wind profiles can produce significant displacements (on the order of kilometers in extreme cases) between the cold cloud tops and the surface rainfall. Efforts are being made to correct for this in a future version of the algorithm.

Contact for further information: OSPO User Services at SPSD.UserServices@noaa.gov

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