

GOES-16 and GOES-17 ABI L2+ Land Surface Reflectance
Provisional Data Quality
August 30, 2021
Read-Me for Data Users

The Peer/Stakeholder Product Validation Review (PS-PVR) for the GOES-16 and GOES-17 Advance Baseline Imager (ABI) L2+ Land Surface Reflectance Provisional Maturity was held on August 26, 2021. As a result of the review, the ABI Land Surface Reflectance (or bidirectional reflectance factor [BRF]) products were declared Provisional Maturity for both satellites. The influence of GOES-17 cooling system issue on the GOES-17 BRF product is negligible because BRF is a daytime product and is defined on the visible and near-infrared channels only.

The ABI L2 BRF provides the spectral land surface reflectance, i.e., a ratio between outgoing radiance at one given direction and incoming radiance at another given direction (same or different from the incoming direction). In this product, the outgoing direction is the direction of the satellite view, while the incoming direction is the direction of solar illumination. The BRF is produced at the following wavelengths: 0.47 μm , 0.64 μm , 0.86 μm , 1.61 μm , and 2.26 μm , corresponding to bands 1, 2, 3, 5, 6. The product includes associated data quality flags and percentage of each flag value, mean, maximum, minimum, and standard deviation of BRF of each band. The ABI BRF provides spatial and temporal continuous surface reflectance information. The ABI BRF under clear-sky condition is comparable and commits well with the ground measurements; the GOES-R BRF under cloudy-sky conditions provides the contemporary surface status under clear-sky condition, thus incomparable with the ground reference influenced by the cloud.

- *Measurement range:* 0-2
- *Temporal coverage:* Solar zenith angle at < 67 degrees. Daytime solar zenith angle
- *Refresh:* 10 minutes for FD, and 5 minutes for CONUS
- *Spatial coverage:* Full Disk, CONUS, Meso
- *Spatial resolution:* 2 km
- *Quality:* The requirement of ABI BRF product accuracy is 0.08; and that of precision is 0.08. According to the validation of the product from June-August, the product of the both satellites have met the requirement in all bands.

GOES-17 was placed into Mode 6 on April 2, 2019. Despite this change, its BRF product continues to be generated with the same refresh rate and spatial resolution.

A full description and format of the ABI BRF product will be available in a future revision of the Product Definition and User's Guide (PUG) document (<http://www.goes-r.gov/products/docs/PUG-L2+-vol5.pdf>). The algorithm used to derive the BRF product from GOES-R ABI observations is described in detail in the "ABI Algorithm Theoretical Basis Document for Surface Albedo" (https://www.star.nesdis.noaa.gov/goesr/documentation_ATBDs.php).

Provisional maturity, by definition, means that:

- Validation and quality assurance activities are ongoing and the general research community is now encouraged to participate.
- Severe algorithm anomalies are identified and under analysis. Solutions to anomalies are in development and testing.
- Incremental product improvements may still be occurring.
- Product performance has been demonstrated through analysis of a small number of independent measurements obtained from select locations, periods, and associated ground truth or field campaign efforts.
- Product analysis is sufficient to communicate product performance to users relative to expectations (Performance Baseline).
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.
- Testing has been fully documented.
- Product is ready for operational use and for use in comprehensive cal/val activities and product optimization.

Provisional 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 Provisional maturity BRF product 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, navigation, cloud mask, and Aerosol Optical Depth (AOD). Although the influence of FPM temperature on GOES-17 BRF is negligible, the input cloud mask do suffer from an impact during “warm” period. A quality flag marking the possible influence of FPM temperature on cloud would be written into the BRF after the cloud mask is integrated.

Status of the current GOES-16 and GOES-17 BRF products and any remaining known issues that are being resolved:

1. Missing BRF images occur randomly due to upstream AOD input not being available for a scene, thus causing the blocks of fill data. A mitigation plan is proposed by using closest AOD within the day and an AOD climatology in development by the STAR AOD team.
2. Some differences are noted in clear-sky retrievals between the science code output running at STAR and that coming from the ground system. Related updates are needed to the ground system implementation about the upstream AOD handling: 1) the AOD at the same timestamp is preferred than that from one-hour ago and the closest timestamp within the same day is acceptable when the current timestamp is unavailable, 2) the AOD input is suggested to be restricted by its quality flag by screening the low-quality flag.
3. The BRF1 (blue band BRF) is more sensitive to AOD input than other bands and shows a higher relative error in comparison with reference value from atmospherically corrected BRF

using AOD ground measurements, although all the channels are within the mission requirements.

4. A relatively limited summertime validation dataset was examined, so the panel recommends continuing to add to the validation dataset with a more diverse set of observations, particularly during the wintertime to capture some snow cases.
5. Statistics (mean, maximum, minimum and standard deviation) and some of the DQF percentage values in the metadata in the operational data files from the ground system are incorrect.
6. The G17 'warm period' mitigation flag denoting the influence to upstreaming cloud mask is invalid.
7. Access to BRF input intermediate product to four-level cloud conditions has inhibited the efficiency of product monitoring. It is expected that the four-level cloud mask will be written into the BRF quality flag in the future.

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