GOES-17 ABI L2+ Aerosol Detection (ADP) Release
Provisional Data Quality
June 27, 2019
Read-Me for Data Users

The GOES-R Peer/Stakeholder Product Validation Review (PS-PVR) for Advanced Baseline Imager (ABI) L2+ Aerosol Detection (ADP) Provisional Maturity was held on June 27, 2019. As a result of this review, the PS-PVR panel recommended that the GOES-17 ABI Aerosol Detection (ADP) product be declared Provisional validation maturity.

Up to date information on the GOES-17 cooling system issue can be found on the following web sites:
https://www.goes-r.gov/users/GOES-17-ABI-Performance.html
http://cimss.ssec.wisc.edu/goes-r/abi-/band_statistics_imagery.html

The table shown below is pulled from the above web site and is an estimate of cooling system impacts for 2019. The table lists time periods of potential saturation. Users should be vigilant for potential anomalies during these times. The BCM may be usable during some of these time blocks.

| Date Range | Saturation increase/decrease | Time of Day |
|---|---|---|
| 1 Jan - 26 Feb | Channel saturation goes from marginal to unusable by 26 Feb. | Saturation can occur between 0830 - 1730 UTC. |
| 26 Feb - 20 Mar | Channel saturation goes from unusable to marginal. | Saturation can occur between 0900 - 1700 UTC. |
| 20 Mar - 13 Apr | Channel saturation goes from marginal to unusable by 13 Apr. | Saturation can occur between 0900 - 1700 UTC. |
| 13 Apr - 26 May | Channel saturation goes from unusable to marginal. | Saturation can occur between 0900 - 1700 UTC. |
| 26 May - 20 Jul | No Channel saturation | |
| 20 Jul - 30 Aug | Channel saturation goes from marginal to unusable by 30 Aug. | Saturation can occur between 0900 - 1700 UTC. |

| | | |
|---|---|---|
| 30 Aug - 23 Sep | Channel saturation goes from unusable to marginal. | Saturation can occur between 0930 - 1630 UTC. |
| 23 Sep - 16 Oct | Channel saturation goes from marginal to unusable by 16 Oct. | Saturation can occur between 0900 - 1700 UTC. |
| 16 Oct - 12 Dec | Channel saturation goes from unusable to marginal. | Saturation can occur between 0900 - 1700 UTC. |

*The GOES-R Series Level I Requirements (LIRD) are not yet updated to reflect the operational Mode 6; however, for completeness the LIRD requirements are stated here: Aerosol Detection shall be produced every 10 minutes for Full Disk, 15 minutes for CONUS, and 15 minutes for Mesoscale.*

GOES-17 was placed into Mode 6 on April 2, 2019. The cadence of L2 products for Mode 6 are different from Mode 3 and the official requirements defined in the GOES-R L1RD. Aerosol Detection is now produced every 10 minutes for Full Disk, every 10 minutes for CONUS, and every 10 minutes for Mesoscale.

The ABI L2+ ADP includes the flags describing the presence of aerosol (including smoke/dust) in the atmosphere over land and over ocean, associated quality flags to indicate the confidence level (low, medium, and high) for the detected smoke/dust and also flags to indicate within/out of the sun-glint region and within/out of valid solar/viewing zenith angle range. All flags are reported as binary 1/0 (yes/no).

The ADP is produced during the daytime over clear-sky and snow-free regions, over both land and water; with view zenith angle less than 90 degrees and solar zenith angle less than 87.5 degrees.

- *Measurement range*: binary yes/no (present/not present) for smoke/dust for conditions when aerosol loading is high (conditions when aerosol optical depth is generally greater than 0.2).
- *Temporal coverage*: ADP is produced only during daytime with solar zenith angles less than 87.5$^{o}$.
- *Refresh*: ADP is produced every 10 minutes for the Full Disk (FD) and every 5 minutes in the Continental United States (CONUS) domains and the Mesoscale domain; it represents instantaneous detection at the time indicated in the files. The scan patterns are expected to change in the future to produce the ADP product at 1-minute refresh rate for Mesoscale domain.
- *Spatial coverage*: ADP is produced in the Full Disk (FD), the Continental United States (CONUS) AND also Mesoscale domains. Low solar and satellite elevation (i.e. solar zenith angle larger than 60$^{o}$; viewing zenith angle larger than 70$^{o}$) reduces the spatial coverage in the top 2 confidence smoke/dust flag data.

- *Spatial resolution*: ADP is produced in fixed grid, with a resolution ranging from 2 km at sub-satellite point to ~20 km at the edge of earth view.
- *Quality*: A preliminary evaluation of GOES-17 smoke/dust detection in ADP against both AERONET measurements and CALIPSO Vertical feature mask product indicates that accuracy, probability of correction detection (POCD) and probability of false detection (POFD) are about 98-99%, 82-88% and 0.6-15.3% for smoke detection, and 98-99%, 80-82% and 12-22% for dust detection. Qualitatively, GOES-17 ADP L2 product shows the capability to detect events at high latitude (>70 degree, such as Alaska and Northern Canada). However, as mentioned above, their confidence levels are excluded from top 2, due to large viewing angles.

  In general, the smoke/dust flags with top 2 confidence levels, which automatically exclude data within sun-glint region and out of valid solar and viewing zenith angle range, are recommended for quantitative applications due to their better overall performance.

Full description and format of the ADP product is in 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 ADP from GOES-17 ABI observations is described in the "GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document for Aerosol Detection Product" (https://www.star.nesdis.noaa.gov/goesr/documents/ATBDs/Baseline/ATBD_GOES-R_Aerosol_ADP_v2.2_Mar2018.pdf

Provisional maturity, by definition, means that:

- Validation 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 establish product performance 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; and
- Product is ready for operational use and for use in comprehensive cal/val activities and product optimization.

Users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized. Users desiring to use the GOES-17 ABI Provisional maturity ADP 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. These products are sensitive to upstream processing, such as the quality of the calibration, navigation, snow/ice mask and cloud mask.

Known product issues:

1. False smoke detection over thin clouds over land at large viewing/solar angles.
2. Occasional false low confidence dust detection over bright surface at large viewing/solar angles.
3. *AS daytime and threshold based product,* impact on ADP from FPM temperature anomaly is minimum in general. However, there are potential impacts on dust detection, over both land and ocean. Potential false dust detection may appear 1-2 hours after starting warming-up around UTC:9:00 (depending on season) and potential missing dust detection, if there are dust events, may appear at cooling-down time period (1-2 hours before FPM temp become normal, around UTC:16-18:00, depending on season).

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

Contacts for specific information on the ABI L2 ADP product:
Shobha Kondragunta: shobha.kondragunta@noaa.gov
Jaime Daniels: jaime.daniels@noaa.gov