GOES-18 ABI Fire/Hot Spot Detection and Characterization (FDC) Release
Provisional Data Quality
October 12, 2022
Read-Me for Data Users

The GOES-R Peer/Stakeholder Product Validation Review (PS-PVR) for the GOES-18 Advanced Baseline Imager (ABI) L2+ Fire/Hot Spot Detection and Characterization (FDC) was held on October 12, 2022. As a result of this review, the panel chair declared that this product meets the criteria for Provisional Maturity.

The ABI L2+ FDC consists of four product outputs: metadata mask, fire radiative power (FRP), instantaneous fire temperature, and instantaneous fire size. The metadata mask assigns a flag to every earth-navigated pixel that indicates its disposition with respect to the FDC algorithm. It includes six fire categories:

- Processed fire: The highest fire confidence category, includes FRP, size, and temperature estimates
- Saturated fire: Also very high confidence fires, but the pixel was at instrument saturation so no properties could be determined
- Cloudy fire: A high confidence fire that appears to be partially obscured by cloud
- High possibility fire: A likely fire that did not meet the thresholds for the Processed category
- Medium possibility fire: Medium confidence fire category
- Low possibility fire: The lowest confidence class, a large number of false alarms are to be expected, also contains small and/or cooler fires

Each of the fire categories has a temporally filtered equivalent, which is triggered if fire was found within +/-1 pixel in the last 12 hours. Also included in the mask are flags that indicate why a pixel was excluded from consideration, including due to water, certain surface types, clouds, and bad data.

The FRP, size, and temperature fields represent the properties of a fire that would produce the same detected radiant energy for the pixel. Fires vary throughout their burn area in intensity, but the satellite measurement is a composite signal of the entire pixel. FRP, size, and temperature represent the composite properties of that pixel. A hypothetical fire with those properties would produce the same measured radiances. Due to this mixing of subpixel elements and diffraction in the sensor there are large error bars on these retrievals.

The FDC products are generated for every ABI Full Disk (FD) of the Earth, Contiguous United States (GOES-East) or Pacific United States (GOES-West) (CONUS or PACUS) regions, and Mesoscale (MESO) regions. (The GOES-18 satellite is in the western position.)

A full description and format of the FDC product can be found 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 the FDC products from GOES-18 ABI observations is described in detail in the "GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document for Fire / Hot Spot Characterization" (https://www.star.nesdis.noaa.gov/goesr/rework/documents/ATBDs/Enterprise/GOES-

R_AWG_ATBD_Land_FIRE_v2.7_Oct2020.pdf).

By definition, Provisional maturity 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.
- Product analysis is sufficient to communicate to users.
- Documentation of product performance exists.
- Testing has been fully documented.
- Product is ready for operational use and for use in comprehensive calibration/validation activities and product optimization.

Persons desiring to use the GOES-18 ABI Provisional maturity FDC for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the NOAA/NESDIS/STAR Algorithm Working Group (AWG) scientists for feasibility of the planned applications. These products are sensitive to upstream processing, specifically the quality of the calibration and navigation.

Known issues at this stage include:

1. Missing values occur randomly due to upstream L1b issues, typically in the form of rectangular blocks.
2. False alarms are known to occur due to relatively solitary water clouds (i.e. surrounded by ice clouds or cloud free ground) causing reflections that appear fire-like, particularly at high solar zenith angles.
3. False alarms due to surface heterogeneity, such as bare ground surrounded by vegetated fields, power plant cooling lakes, urban areas that are not properly screened out, coastlines, and others, are known to occur and tend to recur in the same locations at certain times of year – these most frequently manifest as low possibility and processed fires.
4. Co-registration errors in the L1b data between bands 7 and 14 can lead to numerous false alarms, particularly during the daytime hours and often manifesting as false alarms that follow geographic features. This is uncommon.
5. The temporal filtering is not functioning as designed and only considers the fire pixels of each scan mode separately, as a result those pixels should be treated the same as other fire pixels.
6. Detections and characterizations will differ between satellites, even when they contain the same instruments, due to viewing geometry, clouds in the line of sight, and surface topography.
7. The FDC does not process Hawaii or several other islands in the Pacific.

Please report any systematic false alarms and other concerns to the AWG FDC science team.

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

Contacts for specific information on the ABI L2+ FDC product:

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