

VIIRS Active Fires ARP Release, Provisional Data Quality
October 23, 2013
Read-me for Data Users

The JPSS Algorithm Engineering Review Board released the VIIRS Active Fires (AF) Applications Related Product (ARP) to the public with a Provisional level maturity on 16 October 2012. Provisional quality is defined as:

- Product quality may not be optimal
- Incremental product improvements still occurring
- Version control is in effect
- General research community is encouraged to participate
- Users urged to consult the EDR product status
- Ready for operational evaluation

The Board recommends that users be informed of the following product information and characteristics when evaluating the VIIRS Active Fires ARP.

1. Product requirements and status: Product requirements are now documented in the Joint Polar Satellite System (JPSS) Level 1 Requirements Supplement (L1RDS) and include a spatially explicit fire mask and fire radiative power (FRP) retrieval for the Active Fires product over the entire globe, including water. These requirements apply only to future satellites, starting with JPSS 1. Appendix D of the L1RDS describes performance exclusions for the Suomi NPP products. For the Active Fires product the exclusions reduce the requirements to the delivery of a list of pixel locations with fire detections over land, making them equivalent to the heritage requirements of the National Polar Orbiting Environmental Satellite System (NPOESS). The current IDPS product was designed to meet these heritage requirements and the Provisional evaluation was also performed against these heritage requirements.

The Suomi NPP VIIRS Active Fires ARP is based upon the MODIS (Moderate Resolution Imaging Spectroradiometer) Thermal Anomalies and Fire product Version 4 code, adapted for use with the VIIRS data. The VIIRS Active Fires ARP provides the latitude and longitude of pixels in which the algorithm detected hot targets, which are predominantly fires burning at the time of the observation.

2. Product evaluation: Quantitative evaluation to date is predominantly based on correlative analysis with the Aqua MODIS Thermal Anomalies and Fire product (MYD14). Though the VIIRS processing algorithm is an earlier version of the current MODIS algorithm, the differences do allow for product inter-comparison for Provisional evaluation. Starting with IDPS Build Mx5.3, which included a correction for the aggregation of native resolution VIIRS observations into moderate resolution VIIRS M13 pixel radiances, the observed differences between VIIRS and MODIS fire counts are consistent with those expected from the differences in spatial sampling. This consistency continued over the entire evaluation period for Provisional status, ending in August 2013.

A major remaining issue with the Beta maturity product was the occurrence of corrupted M13 brightness temperature values (>450 K) and corresponding spurious fire detections along single scans; alternating omission of fire pixels between successive scans; and spurious fire pixels coinciding with the terminator. Spurious fire detections appeared, when a) incorrectly calibrated M13 pixels were not flagged in the VIIRS SDR product, and b) M13 pixels with poor calibration or no calibration data were flagged in the VIIRS SDR product, but were still processed by the Active Fire ARP code. These typically resulted in all clear land pixels flagged as “fire” along entire scan lines, on average once a day at a random location over the globe. The anomalies were mostly related to an anomalous pattern of on-board calibration sector sequence for dual-gain band states, including VIIRS band M13 (see the VIIRS SDR Beta Read-me file, item #6).

A correction for the dual-gain switching sequence anomaly in VIIRS SDR was implemented on October 15, 2012 at NOAA NESDIS as part of the IDPS Mx6.3 build. Based on product quality monitoring of the Active Fires team, the frequency of occurrence of spurious fires dropped significantly after that implementation. The JPSS VIIRS Active Fires Algorithm and Validation Team therefore considers the start date of product Provisional quality the first day following the implementation of IDPS Build Mx6.3.

3. Known errors: Some spurious detections remain after the implementation of IDPS Build Mx6.3. These errors have been related to VIIRS SDR calibration substitution and sync loss anomalies. Spurious detections along scan lines for the Provisional product occur now about once a month. The Active Fires team is working with the VIIRS SDR team to diagnose and eliminate these anomalies.
4. Quality flags: Currently the quality flags in the Active Fires data product or the input VIIRS SDR product do not provide an unambiguous identification of data anomalies. Users are advised that bit #6 in Quality Flag 2 (“Bad SDR Data”) of the Active Fires ARP is not set properly and may indicate good input data quality for faulty data, or bad input data quality for good data. Filtering spurious fire pixels based on this bit or on the quality flags in the input SDR data is therefore not recommended for the Provisional product. Data anomalies are typically identifiable by an anomalously high number of contiguous fire pixels.
5. Future work: The next step in the Active Fires ARP validation process is the move to Validated Stage 1 status, which depends on: 1) further reduction of spurious detections due to VIIRS SDR quality flag issues, 2) ability to perform product validation over a limited sample of reference data from airborne, high resolution satellite, and in-situ data.

Further work also includes the development and operational implementation of a product that meets the new Level 1 requirements ready to process VIIRS data from the JPSS 1 satellite. These algorithm changes incorporate new MODIS Collection 6 algorithm components, and the tuning of the algorithm to VIIRS sensor characteristics.

Additional information on the Active Fires algorithm is available at <http://viirsfire.geog.umd.edu>

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