Latest developments related to the improvement of the operational NOAA VIIRS active fire product

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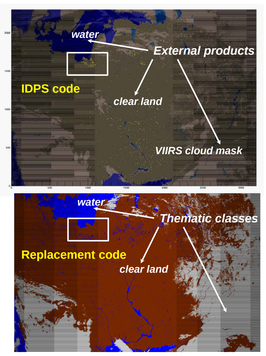
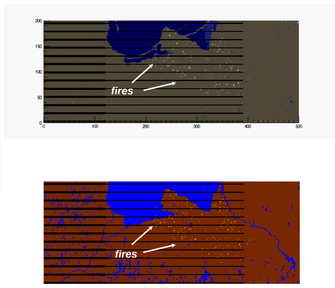
INTRODUCTION

The current NOAA operational active fire product from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership (NPP) satellite is based on 750m M-band measurements and delivers a list of pixels flagged as "fire" by the detection algorithm. This product is generated operationally within the Interface Data Processing Segment (IDPS). An improved product that also delivers a full spatially explicit fire mask and fire radiative power (FRP) over the entire globe has been implemented into NOAA operations. Product development is carried out in the framework of NOAA and NASA programs and though close interaction with the upstream VIIRS Sensor Data Record (SDR) Science Team, with the Direct Readout data provider and user community, and with developers of key operational applications that use VIIRS fire data as input. In this presentation critical issues related to input and output data quality, long-term monitoring, and further algorithm development efforts will be discussed to ensure the delivery of a high-quality data product to the end users.

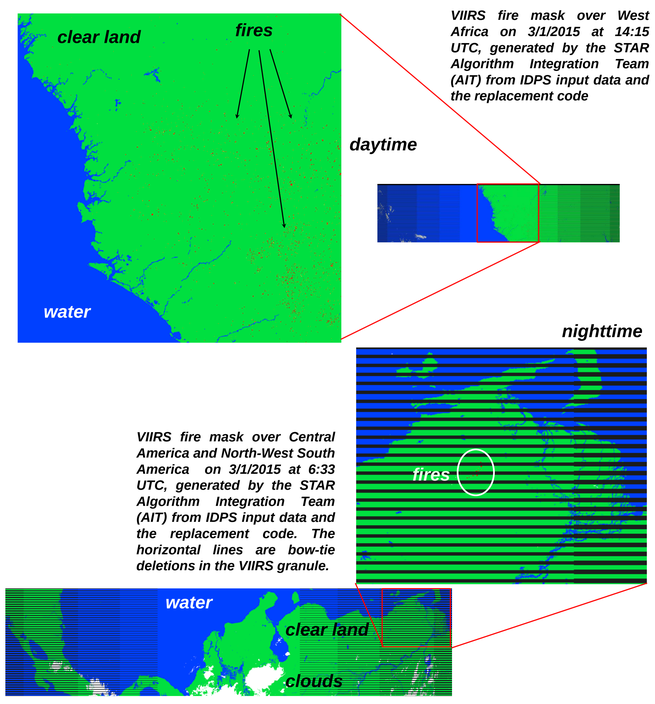
1. Enhanced 750m M-band product

- A new 750m VIIRS fire algorithm is transitioning into NOAA operations
  - global mask of thematic classes including water, cloud, non-fire clear land and fire at three confidence levels
  - fire radiative power for each fire-affected pixel
  - new algorithm elements to improve detection performance
- The product is tailored subset of the NASA science product for real-time NOAA operations





A comparison between the IDPS operational product and the replacement product on March 10, 2014 10:36-10:40 UTC.



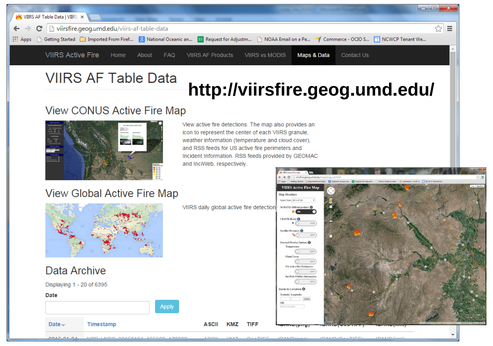
VIIRS fire mask over West Africa on 3/1/2015 at 14:15 UTC, generated by the STAR Algorithm Integration Team (AIT) from IDPS input data and the replacement code

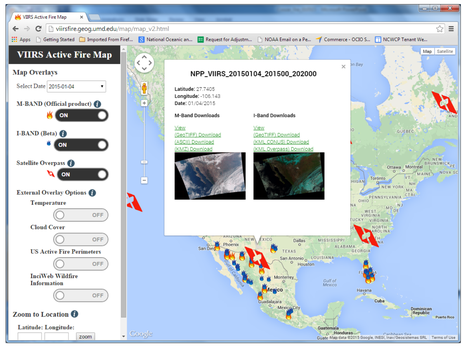
VIIRS fire mask over Central America and North-West South America on 3/1/2015 at 6:33 UTC, generated by the STAR Algorithm Integration Team (AIT) from IDPS input data and the replacement code. The horizontal lines are bow-tie deletions in the VIIRS granule.

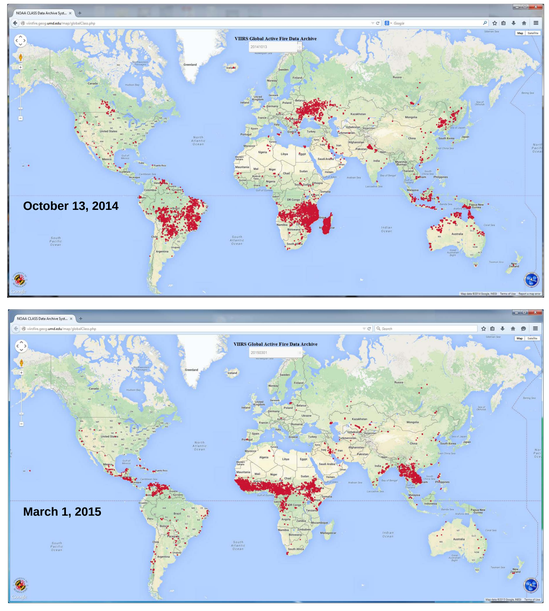
For more information on the implementation of the product see poster *3-48 VIIRS Active Fires algorithm integration in NPP Data Exploitation (NDE) environment: research to operations by Marina Tsidulko, Walter Wolf, Ivan Csiszar, Louis Giglio and Wilfrid Schroeder*

2. Product evaluation portal

The VIIRS Active Fire product evaluation portal enables users to view and download products in various formats and obtain detailed information on product characteristics and development status. The portal is also used by the Science Team as a monitoring tool and for visual inspection of product quality.







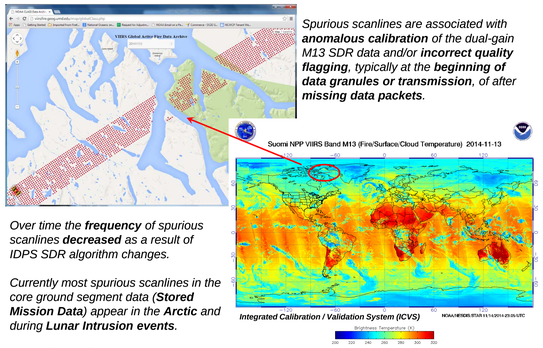
http://viirsfire.geog.umd.edu/

Data from NOAA CLASS: http://www.nsof.class.noaa.gov/

For more information on user outreach see poster *2-58 The VIIRS Active Fire Data for Fire Management: A review of the Proving Ground and Risk Reduction (PGRR) Project efforts Evan Ellicott, Ivan Csiszar, Wilfrid Schroeder, Louis Giglio and Chris Justice*

3. Input VIIRS SDR quality assessment

The quality of the VIIRS active fire product suite is highly dependent on the quality of the input Sensor Data Record (SDR) data. The Team has worked extensively to diagnose issues, promote algorithm updates and test impacts of SDR improvements on product quality.



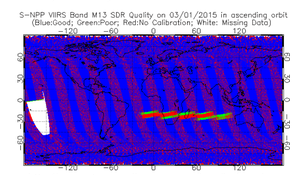
*Spurious scanlines are associated with **anomalous calibration** of the dual-gain M13 SDR data and/or **incorrect quality flagging**, typically at the **beginning of data granules or transmission**, of after **missing data packets**.*

*Over time the **frequency** of spurious scanlines **decreased** as a result of IDPS SDR algorithm changes.*

*Currently most spurious scanlines in the core ground segment data (**Stored Mission Data**) appear in the **Arctic** and during **Lunar Intrusion events**.*

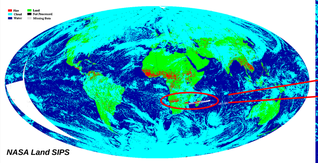
*Anomalies in **direct broadcast** data may occur **anywhere** .*

http://www.star.nesdis.noaa.gov/icvs/index.php

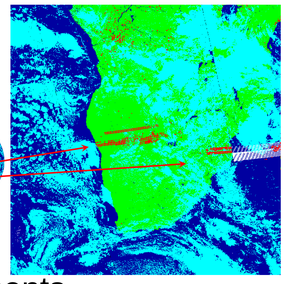


http://www.star.nesdis.noaa.gov/icvs/index.php

An example of false detections during a lunar intrusion event on March 1, 2015. The Active Fire team has been providing feedback to the VIIRS SDR team to help further improve the quality of the SDR product. The fire product shown was generated within NASA Land Science Investigator-led Processing System (SIPS).

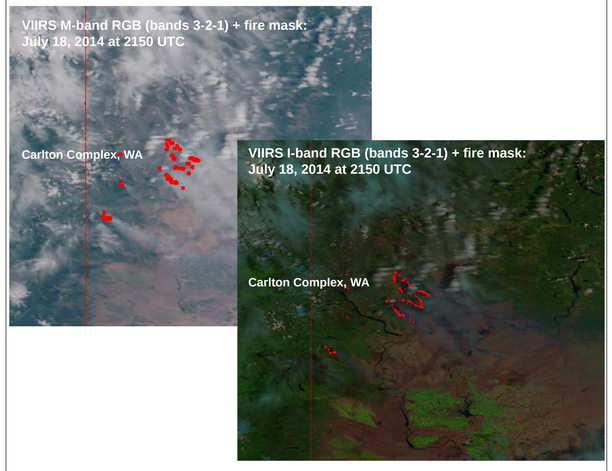


http://landweb.nascom.nasa.gov/NPP_QA/



4. Future improvements

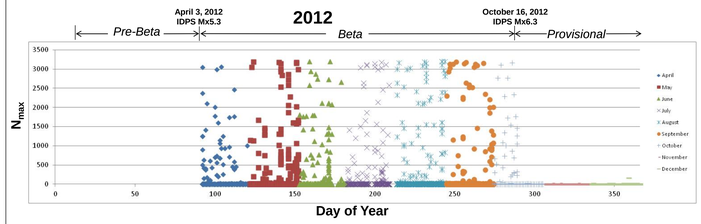
An experimental VIIRS fire product, based on VIIRS 375m I-band data, has been developed. While the VIIRS I-bands are not optimal for the characterization of high temperature events, the product performs well and is being implemented to support real-time applications to take advantage of the high spatial resolution and low detection limits. This product is a good candidate for future enhancements within the NOAA operational framework.

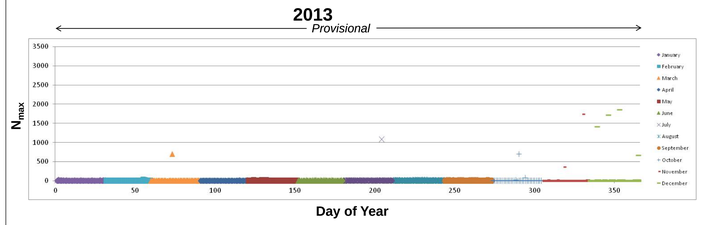


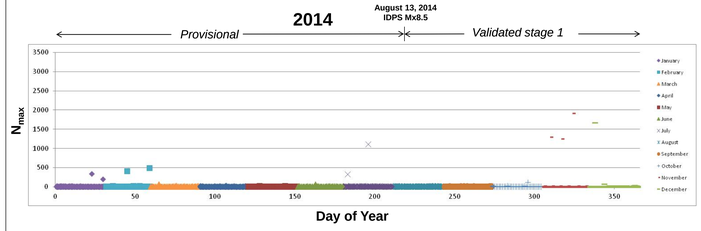
A comparison of the 750m M-band and 375m I-band VIIRS fire detection products

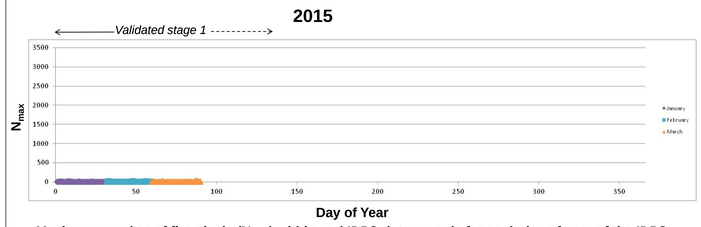
4. Long-term monitoring

A long-term monitoring system is being developed to facilitate real-time product quality monitoring, reactive product maintenance and retrospective analysis. The entire data record of the IDPS product is being analyzed to document product history. Improvements in product quality were used as benchmarks for defining product maturity stages.









Maximum number of fire pixels (N_{max}) within and IDPS data granule for each day of year of the IDPS data record.

A quality indicator used to detect spurious scanlines is the number of detected fire pixels within individual scanlines. For normal conditions, even in the presence of large and multiple fires, this number remains under ~200. Outliers indicate anomalous conditions.

Acknowledgments

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Key references

Csiszar, I., W. Schroeder, L. Giglio, E. Ellicott, K. P. Vadrevu, C. O. Justice, B. Wind, 2014: **Active fires from the Suomi NPP Visible Infrared Imaging Radiometer Suite: Product status and first evaluation results**, *J Geophys Res Atmos*, 119, doi:10.1002/2013JD020453.

Schroeder, W., P. Oliva, L. Giglio, I. A. Csiszar, **The New VIIRS 375 m active fire detection data product: Algorithm description and initial assessment**, Remote Sensing of Environment, Volume 143, 5 March 2014, Pages 85-96, ISSN 0034-4257, http://dx.doi.org/10.1016/j.rse.2013.12.008