

NPP/VIIRS Active Fire Algorithm & Proving Ground

A rapid delivery system of enhanced VIIRS active fire data for fire management and fire weather applications

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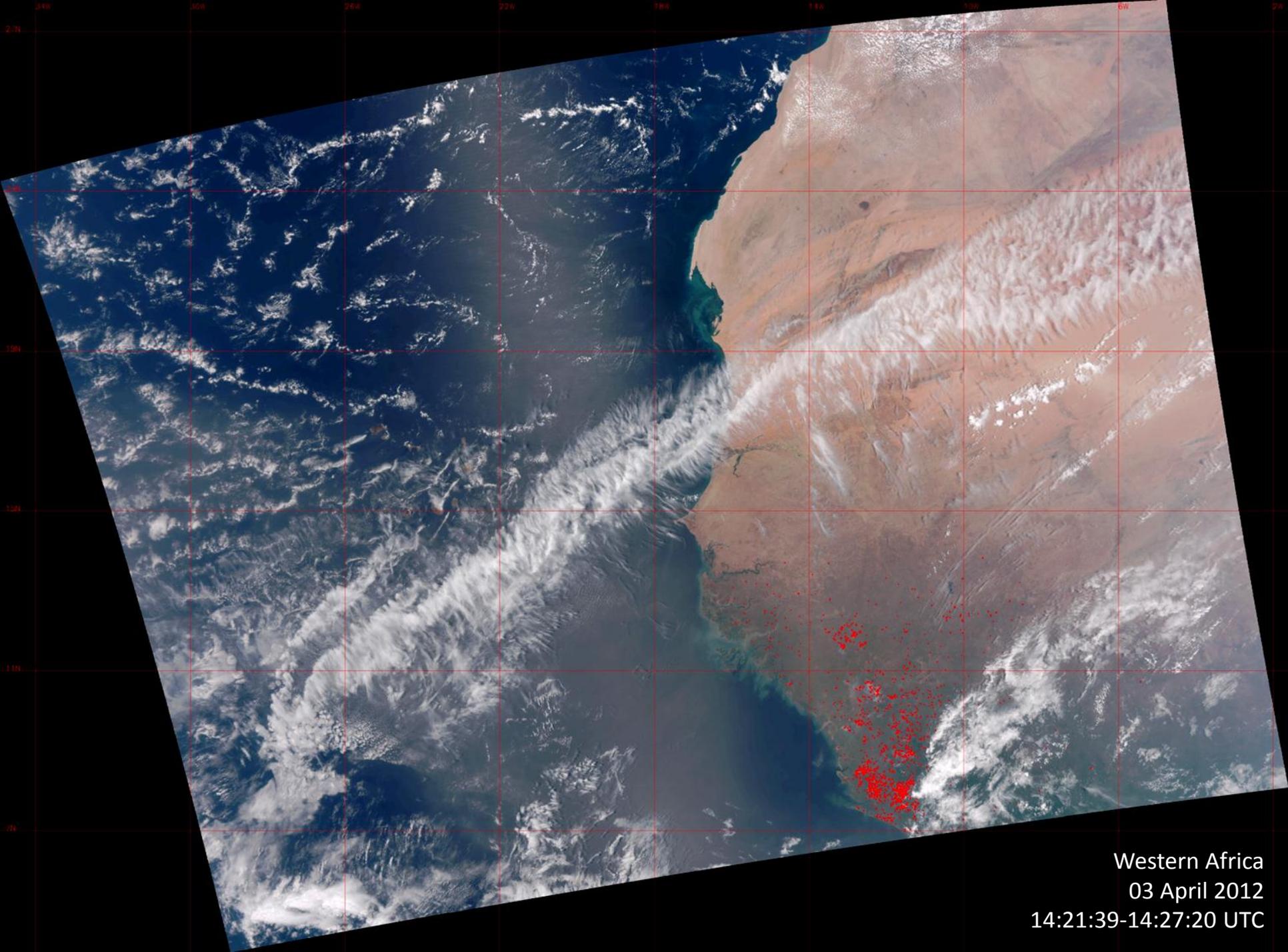
Chris Justice (UMD), Brad Quayle (USDA Forest Service)

Peter Roohr (NWS/NOAA)



NPP/VIIRS Active Fire Algorithm

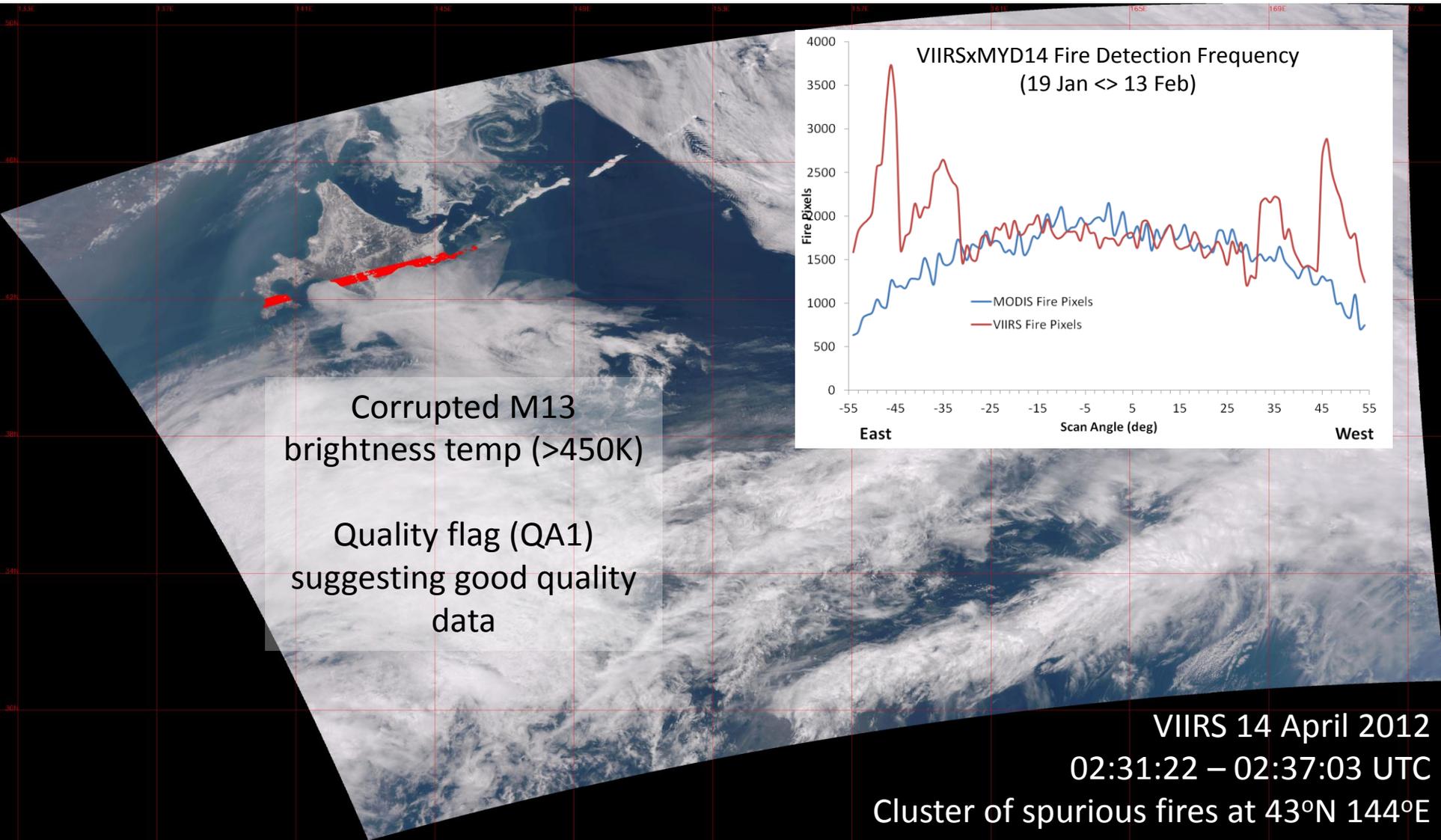
- VIIRS baseline active fire product builds on MODIS C4 algorithm
 - Product consists of simple file containing primarily latitude & longitude data for those pixels classified as thermal anomalies
 - Data typically distributed in four-granule aggregates (~5min of data)
 - New product requirements include the distribution of:
 - Mask (classification image) for all pixels in a granule (fire, land surface, clouds, water)
 - Fire characterization data (Fire Radiative Power)
- ⇒ Working with SDR teams & IDPS & ADL to fix current baseline active fire product discrepancies
- ⇒ Moving towards beta-quality status
- ⇒ Working on major algorithm overhaul in order to comply with new requirements and to modify code for latest MODIS C6 algorithm updates
- ⇒ Initial testing/implementation using LCF and NASA LandPEATE
 - ⇒ Operational implementation using ADL → IDPS chain



Western Africa
03 April 2012
14:21:39-14:27:20 UTC

Current status (following implementation of Mx5.3)

- Persisting spurious fire pixels due to corrupted input M13 data
- Potential overblown omission errors (subtle feature requiring ~4 weeks of data for proper quantification using near-coincident Aqua/MODIS data)



Validation Activities

Ground Verification – qualitative assessment

Use of coincident prescribed burns to verify active fire detection data using both I and M bands

Engaging:

- Individuals (private land owners)
- State agencies (fire/forestry departments)
- Federal agencies (USDA Forest Service)
- International community



Validation Activities

Ground Verification – qualitative assessment

Use of coincident prescribed burns to verify active fire detection data using both I and M bands

Fire information provided by USDA personnel

- Date and location of burn
- Area burned
- Fuel load & fuel consumption

National Forests in Alabama
2012 Rx Fire Smoke Monitoring
Notification to NOAA NESDIS Satellite Analysis Branch

The following information should be forwarded to the NOAA NESDIS team on each burn the morning of the burn:

Date of Burn: 3/27/2012

Name of Burn: Rattlesnake

Coordinates: 33°30'59" Lat -85°43'07" Lon (decimal degrees)

Burn Acres: 500

Hours of Active Burning: Start Time - 1000 (CST)
End Time: 1800 (CST)

Fuel Loading: 7.0 (tons per acre)

Estimated Fuel Consumption: 5.0 (tons per acre)

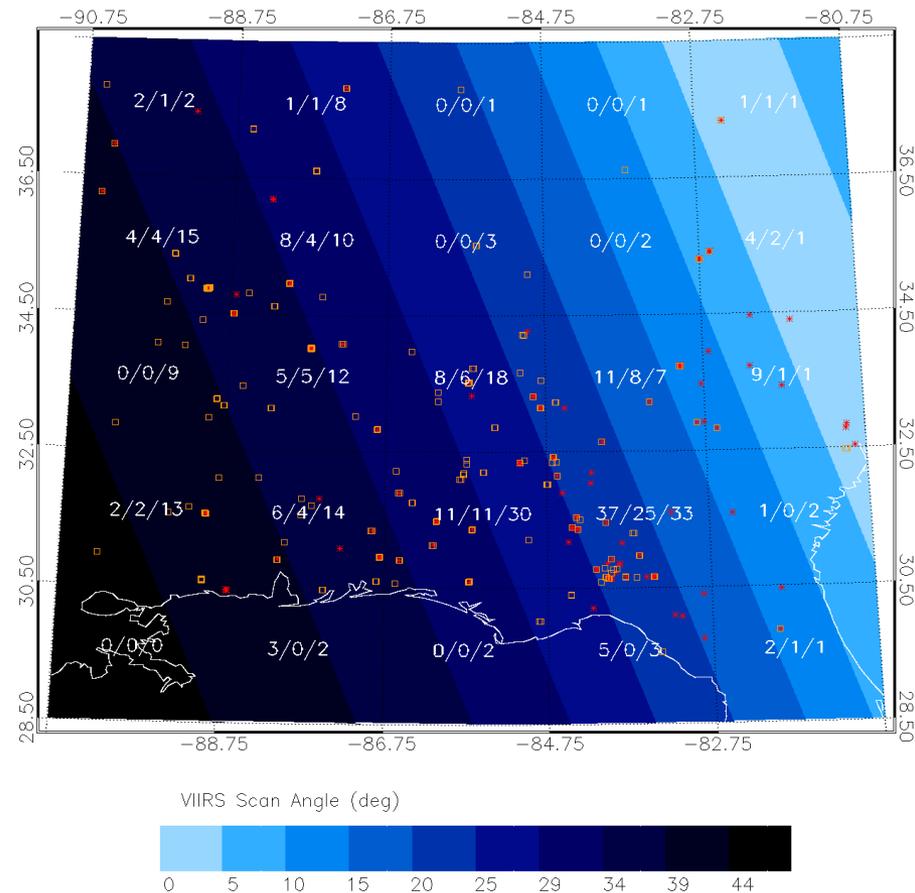
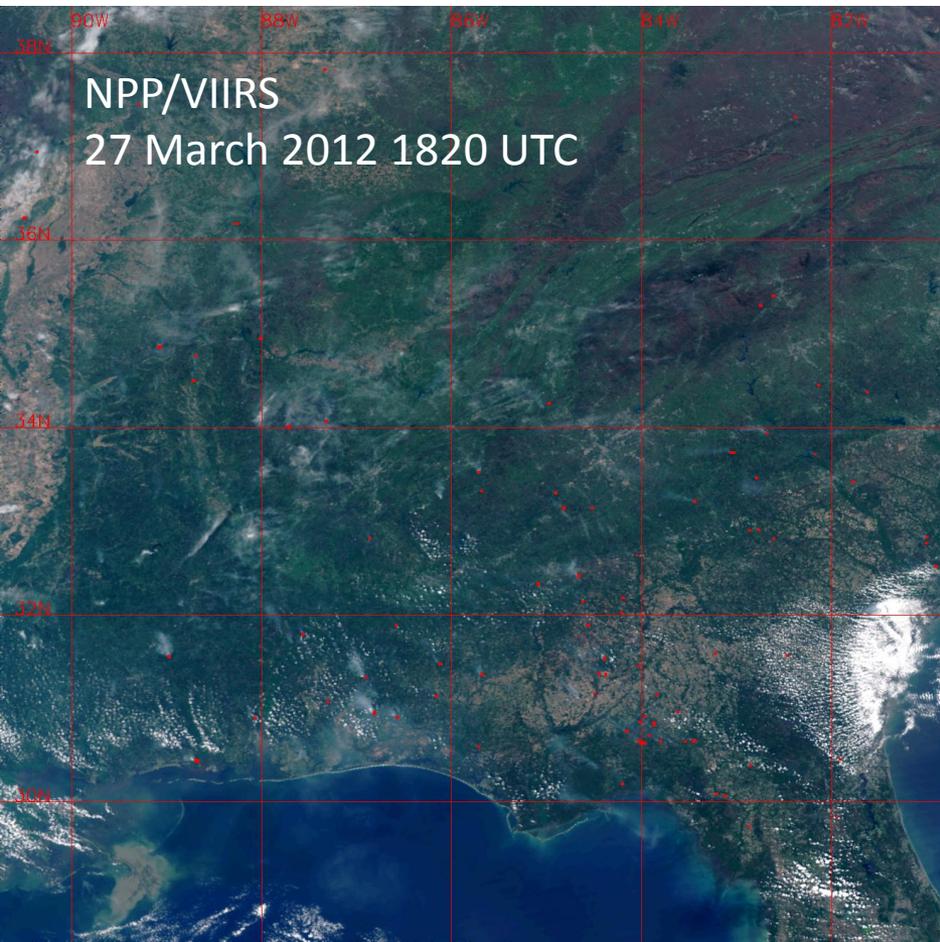


Validation Activities

Product Inter-comparison

VIIRS x Aqua/MODIS

Use of near-coincident Aqua/MODIS fire data to assess data consistency (qualitative&quantitative)



Validation Activities

Product Inter-comparison

VIIRS M-band x I-band

Use of coincident I-band fire data to assess M-band. Reduced ambiguity in I-band fire pixels as a result of higher spatial resolution



County Line Fire , Florida

April 11th 2012

NPP/VIIRS 375 m

Preliminary fire detection data

(red vector outline)

NPP/VIIRS Active Fire Portal

VIIRS Active Fire

JPSS
Joint Polar Satellite System

NPP- Land Product Evaluation and Testing Element
VIIRS Land Product Quality Assessment

Home About FAQ Contact Us

VIIRS fire detections

The Visible Infrared Imager Radiometer Suite (VIIRS) sensor was launched aboard the Suomi National Polar-orbiting Partnership (NPP) satellite on October 28th, 2011 and on January 18th, 2012 cooler doors for the thermal sensor were opened. Within hours data were being retrieved and fire detections produced. The 84 second swath quicklooks presented here highlight recent fire detections superimposed on corrected reflectance RGB images (bands 5-4-3). VIIRS data are still preliminary and will continue to undergo testing and calibration over the coming weeks before being released for public use.

Active Fire Team

- Ivan Csiszar
- Wilfrid Schroeder
- Louis Giglio
- Evan Ellicott
- Chris Justice
- Krishna Vadrevu

Links

- JPSS
- VIIRS
- University of Maryland
- NOAA
- NOAA-STAR
- USFS RSAC
- LOGIN

Southeast U.S. fires

The above image shows fires detected across a wide swath of central and southeastern U.S., stretching from northwest Missouri, to near the coast of South Carolina, and multiple detections across southern Georgia and Alabama

The work is conducted by the JPSS and NASA Active Fire team at NOAA/NESDIS/Star and the University of Maryland, in cooperation with NASA LandPEATE and the US Forest Service.

Contact: viirsfire@hermes.geog.umd.edu
Website Developed by: [Jon Nordling](#)

VIIRS Active Fire portal is a dedicated web site managed by NPP Active Fire science team containing information to help users familiarize with sensor data characteristics and active fire product performance

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

NPP/VIIRS Active Fire Portal

[Home](#) [FAQ](#) [VIIRS & MODIS](#) [Spurious Detections](#) [I-band](#) [Questions?](#)
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VIIRS Active Fire Product

Photoset April 10, 2012



Fire detections made by VIIRS (~1817 UTC) and MODIS-Aqua (~1848 UTC) of the "County Line fire" in the Osceola National Forest, Florida on April 7th, 2012.

A lightning-ignited fire, which started in the Pinhook Swamp, smoke from the "County Line" fire is clearly visible in the center of these 5-minute swaths. As of 4/10/2012, the fire had grown to roughly 11,000 acres (4,450 ha).

The grid plot shows numerous coincident fire detections between VIIRS and MODIS, both within this fire complex, and other fires in the swath, despite the nearly 30 minute difference in overpass.

Tags: County Line fire

ABOUT



VIIRS Active Fire

The Visible Infrared Imager Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership (NPP) satellite launched from Vandenberg Air Force Base at 0548 EDT on Oct. 28, 2011 and first-light shortwave data began to be transmitted on November 21st, 2011. After some delay, due to degradation of observed radiances in the visible and NIR bands, the thermal cooler doors were opened January 18th, 2012 and by the following day Suomi-NPP was acquiring its first fire detections.

VIIRS represents a continuation of high quality AF monitoring capabilities started with the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA EOS Terra and Aqua satellites, and also a significant improvement of the current capabilities of the Advanced Very High Resolution Radiometer (AVHRR) on the current NOAA operational polar satellites. Initial evaluation, following the activation of the thermal bands on January 18, 2012, has provided empirical evidence of the good quality of the VIIRS fire observations.

An introductory page provides links to more data-specific material

Common Questions and Issues

FAQs

Text

The Photo slider: To view the images on the main page simply click on one and it will expand in a new window. You can then click the image again to scroll from image to image or simply click the image next in line. Also, right-clicking the image will allow you "view image" in greater details.

Q. What is spatial resolution of the VIIRS AF product?

A. Through an aggregation scheme (see below) designed to reduce the pixel size growth with increasing scan angle, the pixels at nadir are 0.742 km x 0.776 km (along-track x along-scan).

Q. What is the VIIRS swath width?

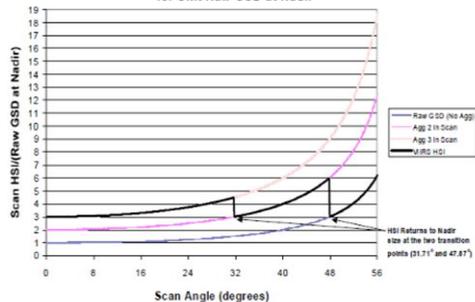
A. 3040 km during normal operations.

Q. What is the aggregation scheme and why?

A. The intention of the pixel aggregation was to provide a more uniform pixel size regardless of the scan angle. The official text:

The VIIRS detectors are rectangular, with the smaller dimension projecting along the scan. At nadir, three detector footprints are aggregated to form a single VIIRS "pixel." Moving along the scan away from nadir, the detector footprints become larger both along track and along scan, due to geometric effects and the curvature of the Earth. The effects are much larger along scan. At around 32 degrees in scan angle, the aggregation scheme is changed from 3x1 to 2x1. A similar switch from 2x1 to 1x1 aggregation occurs at 48degrees. The VIIRS scan consequently exhibits a pixel growth factor of only 2 both along track and along scan, compared with a growth factor of 6 along scan which would be realized without the use of the aggregation scheme.

Scan HSI as a Function of Scan Angle for Unit Raw GSD at Nadir



Data Anomalies

Spurious Detections

The following examples show anomalous (i.e. spurious) fire detections and describes how/when/why these occur.

Abnormally high M13 values resulting in false detections - Dual gain calibration mismatch: *This anomaly appears to be a function of code error in which the switch between high gain and low gain M13 (MIR) channel was a result of incorrect low gain calibration coefficients. A new look-up table (LUT) is to be implemented and tested to address this issue.*



Performance Evaluation & Data Continuity

VIIRS x MODIS

VIIRS & MODIS

While the Visible Infrared Imager Radiometer Suite (VIIRS) sensor, aboard the Suomi-NPP satellite, and Aqua have similar orbital characteristics and compatible sampling of the diurnal cycle of fire activity, sensor differences, including pixel sizes, along-scan aggregation, and swath width result in inherent differences in the expected fire observations.

The standard product is comprised solely of a list of fire-pixel locations and the current the VIIRS detection algorithm is a "stripped down" version of the MODIS Collection 4 production code (see below).

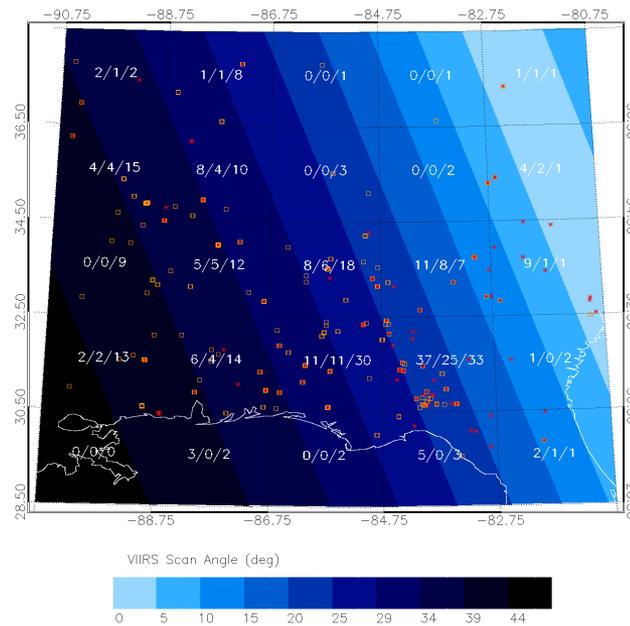
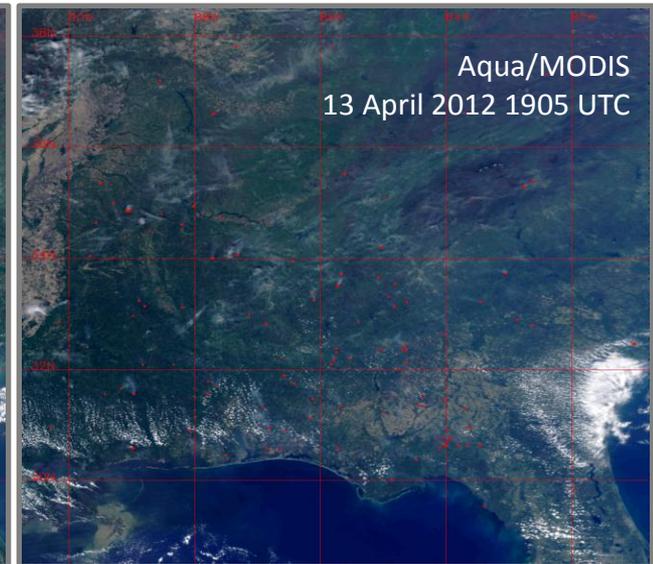
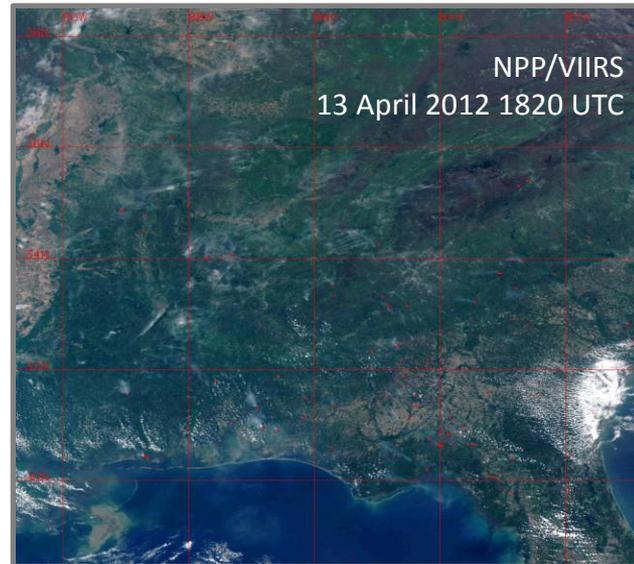
The MODIS (MODerate Resolution Imaging Spectroradiometer) sensors is on-board NASA's EOS Terra and Aqua satellites. More information is available on the NASA MODIS website.

The MODIS active fire detections are based on the contextual algorithm developed by Giglio et al. (2003) and currently is up to Collection 6 in the reprocessing chain. Reprocessing of the entire MODIS data archive is periodically performed to incorporate better calibration, algorithm refinements, and improved upstream data into all MODIS products. The updated MODIS data archive resulting from each reprocessing is referred to as a collection. Later collections supersede all earlier collections.

Each active fire location represents the center of a 1 km pixel that is flagged by the algorithm as containing a fire within the pixel.

The collection 6 improvements include:

- Reduce false alarms in Amazon caused by small forest clearings
- Processing to extend to oceans and other large water bodies
- Detect off-shore gas flaring
- Dynamically adjust potential fire thresholds
- Detect smaller and/or cooler fires
- Improved cloud mask
- Improved detection confidence estimate
- Updated FRP retrieval



Gridded statistics: AA/BB/CC

AA – number of VIIRS fire pixels (red symbols)

BB – number of VIIRS fire pixels with overlapping Aqua/MODIS fire pixels

CC – number of Aqua/MODIS fire pixels (orange symbols)

User feedback

Active Fire team maintains an active communication link with primary users (USDA Forest Service)

Forms and email contact are also available for non-regular users to facilitate exchange of information and relevant material

Submit

Submit a Text Post ▾

Title *(optional)*

Post

B *I* ABC | HTML

I accept the [Terms of Submission](#)

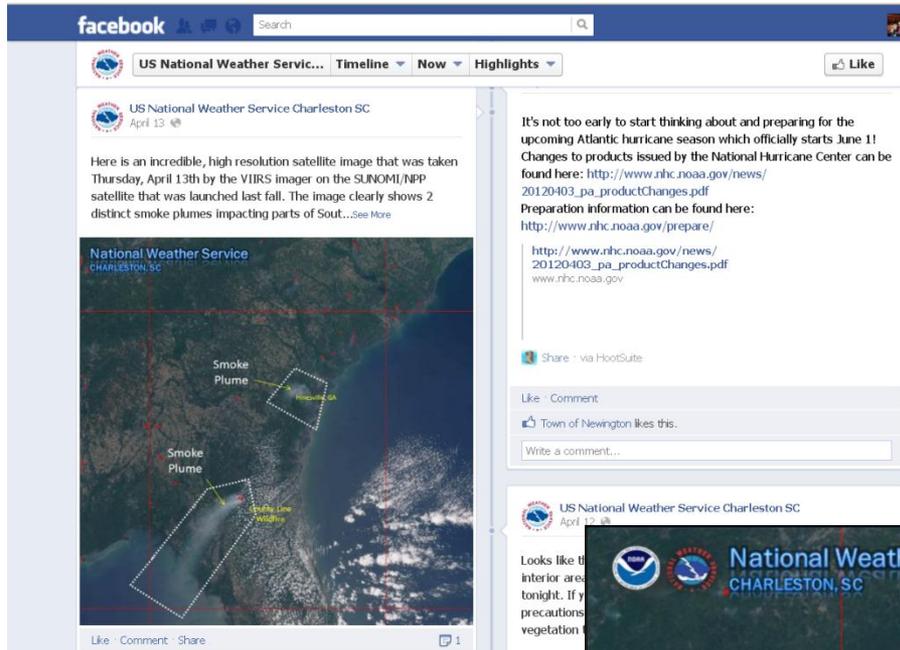
Email (required) Name (required) **Submit**

Questions?

[Login](#) or [sign up](#) for Tumblr to ask a question

Ask

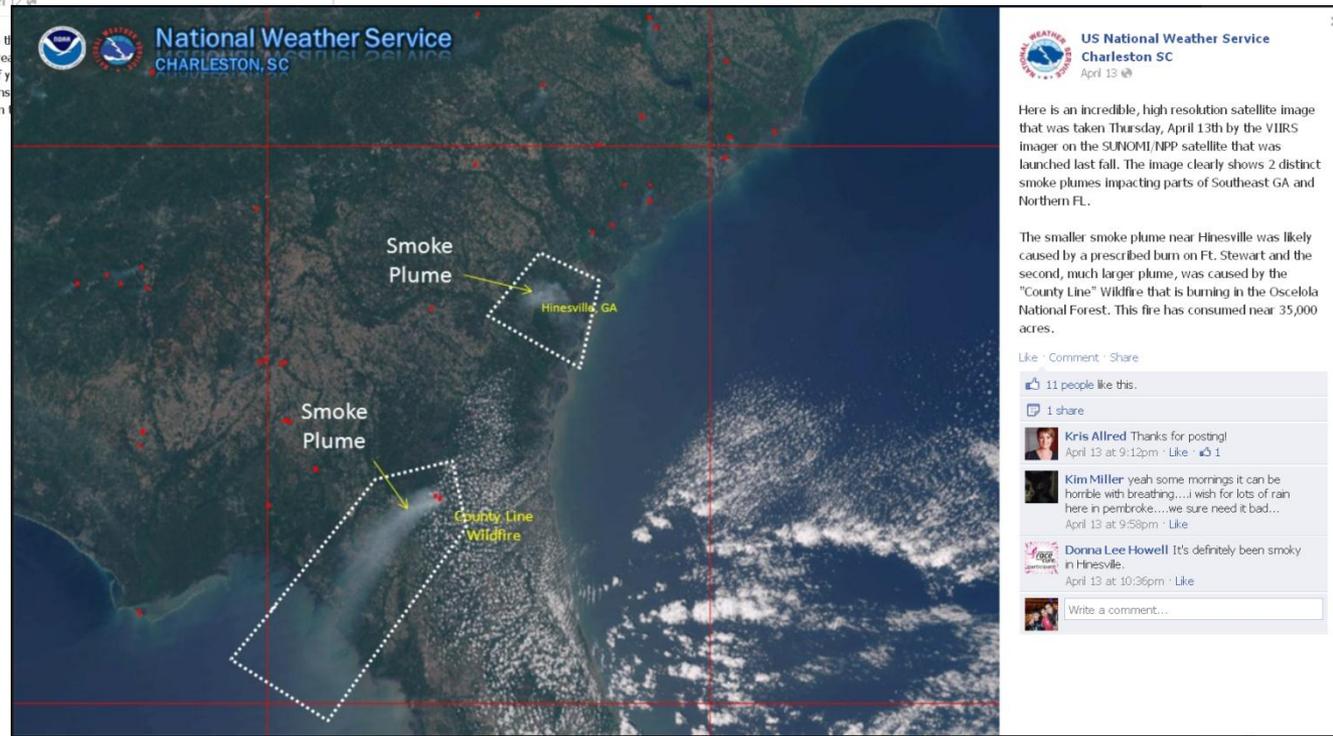
User Outreach



NWS South Carolina:

"Here is an incredible, high resolution image that was taken Thursday, April 13th by the VIIRS Imager on the Suomi/NPP satellite..."

Image of County Line fire in Florida and other fires in South Carolina (Source: NPP Active Fire team at UMD)



User Outreach

The screenshot shows the NASA Earth Observatory website interface. At the top, there is a navigation bar with the NASA logo and the text "EARTH OBSERVATORY". Below this are menu items: "Home", "Images", "Global Maps", "Features", "News & Notes", and a search bar. The main content area is divided into two sections. The top section features a satellite image of Southern California, showing the Salton Sea and San Diego. A red dot labeled "fire" is visible in the desert region. Below the image is a caption: "Southern California" and "download large Southern California image (356 KB, JPEG, 1245x831)" and "acquired January 19, 2012". The bottom section features a satellite image of South Sudan, showing a large area of fire detections marked with red dots. Below this image is a caption: "South Sudan". To the right of the main content area, there is a sidebar with the following elements: a title "First Fire Images from VIIRS" with the date "January 26, 2012", social media sharing buttons for Facebook, Twitter, and YouTube, a "Share" button, an "Image Location" section with a world map, and a "More Images of the Day" section with two small image thumbnails. At the bottom of the sidebar is a blue button that says "EARTH OBSERVATORY SUBSCRIBE TODAY".

First light images for VIIRS active fire detection product posted on NASA Earth Observatory and picked up by several other sites/blogs

Images were produced by the NPP Active Fire team at UMD approximately 18h after activation of cooler doors following first visually confirmed fire detections over Easter Africa

Way Forward

- Overall user feedback has been very positive and several groups in the U.S. and abroad are offering to help with initial testing/verification
- Expand VIIRS fire product portal
 - Populate with additional information to inform users of product issues + updates
- Engage/expand the greater user community and seek their feedback
 - Provide sample imagery over major fire events
- Work with regional networks seeking feedback and to foster independent validation

⇒ Using all the above, move on to declare beta- and provisional-quality status of VIIRS baseline active fire product