

# S-NPP/VIIRS Active Fire Data Sets

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# Product Status

## ***750m Data Set***

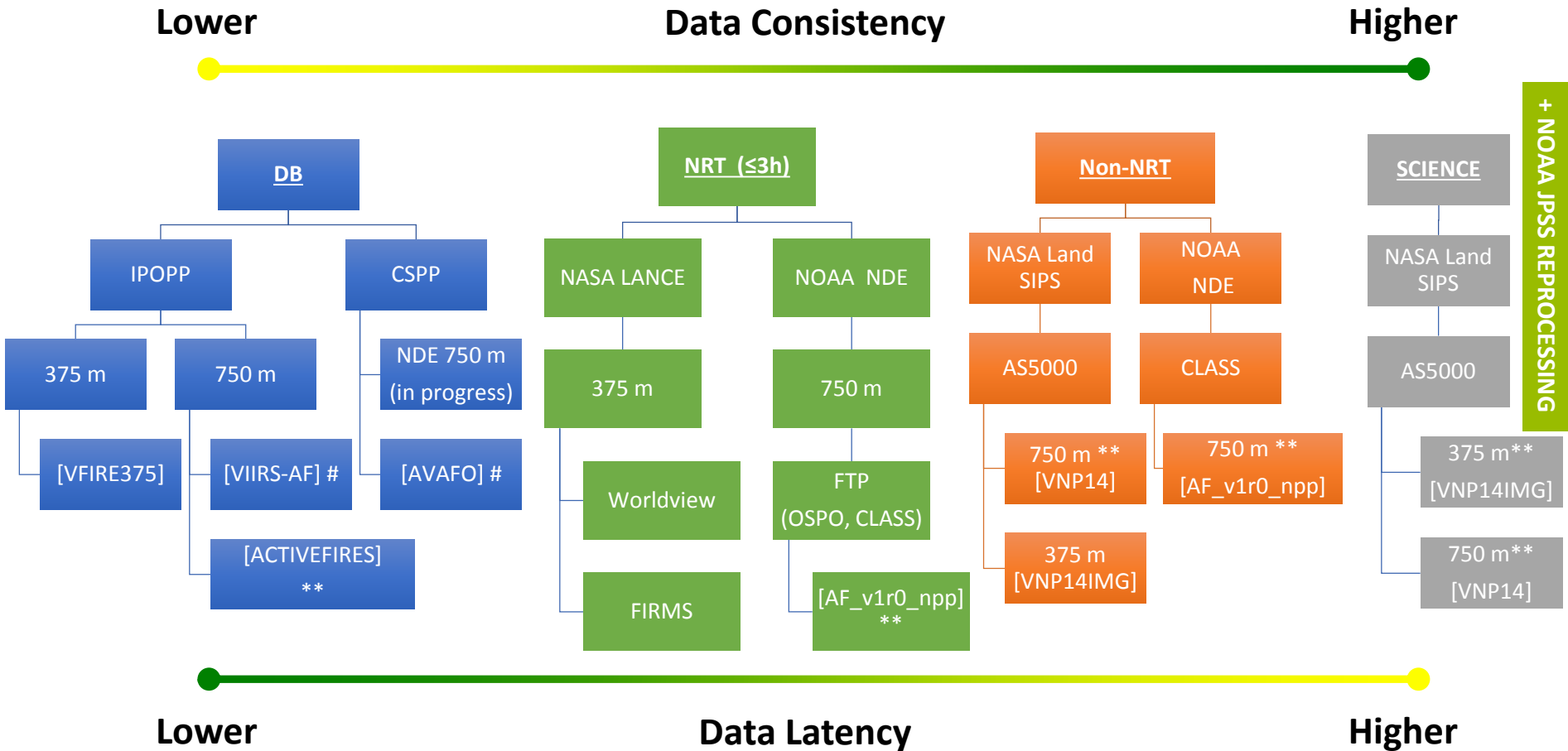
- Reprocessed Level 2 data (2012-2016) @ NASA/LandSIPS
  - **Algorithm version:** MODIS Collection 6 equivalent
  - **Input data:** Original Science Data Record (SDR) 6-min granules
  - **Output:** NetCDF format (HDF5 compatible) 6-min granules
  - **Caveat:** +180 corrupted SDR granules impacting output fire data (list available online)
  - **Availability:** Data archived at LPDAAC and LAADS
  - **Documentation:** ATBD and user's guide available online
- Forward Level 2 data processing @ NASA/LandSIPS and NOAA/NDE
  - **Algorithm version:** MODIS Collection 6 equivalent
  - **Input data:** NASA and NOAA running unique SDR versions
  - **Output data:** NetCDF of unique filename convention/granule size.  
**Caveat:** Small differences between NASA and NOAA-sourced files may occur due to unique input data
  - **Availability:** NASA data -> LPDAAC and LAADS, NOAA data -> CLASS (near-real time)
- Direct Readout
  - Available through IPOPP (CSPP??)


# Product Status

## ***375m Data Set***

- Reprocessed Level 2 data (2012-2017) @ NASA/LandSIPS
  - **Algorithm version:** Hybrid I-M band algorithm
  - **Input data:** Original Science Data Record (SDR) 6-min granules
  - **Output:** NetCDF format (HDF5 compatible) 6-min granules
  - **Caveat:** +550 corrupted SDR granules impacting output fire data (list available online)
  - **Availability:** Data archived at LPDAAC and LAADS
  - **Documentation:** ATBD and user's guide available online
- Forward Level 2 data processing @ NASA/LandSIPS and LANCE
  - **Algorithm version:** Hybrid I-M band algorithm
  - **Input data:** Original Science Data Record (SDR) 6-min granules
  - **Output data:** NetCDF format (HDF5 compatible) 6-min granules
  - **Caveat:** few outstanding bad SDR data still observed
  - **Availability:** NASA LAADS ftp; near real time data at LANCE/FIRMS
- Direct Readout
  - IPOPP running slightly deprecated version of algorithm

# VIIRS Active Fire Product Lineage



 pattern indicates this directory is outdated

\*\* marked products include FRP retrieval

# marked products describe discontinued algorithm

[ ] indicate official product name

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



# Product Information



National Aeronautics and Space Administration  
Goddard Space Flight Center

Search NASA.gov

GO

Sciences and Exploration



Home

Products

Validation

People

Tools

Publications

Links

Surface Reflectance

Surface Albedo

Active Fires

Snow Cover

Sea Ice Cover

Ice Surface Temperature

Land Surface  
Temperature

Vegetation Index

LAI/Fpar

MAIAC

Burned Area

Land Surface Phenology

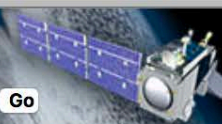
Black Marble

## NASA Earth Science Data Records

The NASA ROSES-13 call for the SNPP Science Team was for both the Science Team that would produce NASA Earth Observing System (EOS) continuity data products and for the establishment of multiple Science Investigator-led Processing Systems (SIPS) to produce the science data products to be developed by the Suomi NPP science teams. The new science team selections focus on developing the refined and/or alternative data products and Earth System Data Records (ESDRs) still needed to ensure that high-quality data records for Earth system science and applications that enable continuity with NASA EOS data products are available for all.

The activities to generate and distribute NASA Suomi-NPP VIIRS Land Science products include development of Algorithm Theoretical Basis Documents (ATBDs) prior to transition to operations at NASA's SIPS, and long-term archiving and distribution at the Land Processes Distributed Active Archive Center (LP DAAC). Most products have their heritage in the MODIS product algorithms, and in some cases early versions of the MODIS code were used by the operational VIIRS algorithm development teams. Based on these two criteria, the VIIRS Land Discipline Team, Land SIPS, and Validation leads have established priorities and phased plans detailing the production of Suomi NPP Land Science Products (see table below). The ATBDs for these products will include updates to reflect the latest MODIS (Collection 6) algorithm principles, as well as the VIIRS instrument capabilities and unique specifications. Finally, a subset of the VIIRS land product suite (Land SIPS-designated Type 2/3 products) will require, (1) a new prototype, (2) substantial algorithms modifications, and/or (3) a new approach that may result in significant additional product development.

| EOS Products        | Algorithms<br>Delivered to Land<br>SIPS | Product Integration<br>and Testing | Draft ATBD<br>Delivery | Delivery of User's<br>Guide | Products Delivered<br>to assigned DAAC |
|---------------------|---|------------------------------------|------------------------|-----------------------------|--|
| Surface Reflectance | ✓                                       | ✓                                  | ✓                      | ✓                           | ✓                                      |
| LAI/FPAR            | ✓                                       | ✓                                  | ✓                      | ✓                           | Fall, 2017                             |
| Snow Products       | ✓                                       | ✓                                  | ✓                      | ✓                           | ✓                                      |
| MAIAC               | Fall, 2017                              | Spring, 2018                       | Winter, 2018           | Winter, 2018                | Spring, 2018                           |
| BRDF/Albedo         | ✓                                       | ✓                                  | ✓                      | ✓                           | Fall, 2017                             |
| Burned Area         | ✓                                       | Pending                            | ✓                      | Winter, 2018                | Winter, 2018                           |
| Active Fires        | ✓                                       | ✓                                  | ✓                      | ✓                           | ✓                                      |
| Vegetation Index    | ✓                                       | ✓                                  | ✓                      | ✓                           | Summer, 2017                           |
| LST&E               | ✓                                       | ✓                                  | ✓                      | ✓                           | Fall, 2017                             |
| Ice Surface Temp    | ✓                                       | ✓                                  | ✓                      | ✓                           | ✓                                      |
| Sea Ice Cover       | ✓                                       | ✓                                  | ✓                      | Fall, 2017                  | Fall, 2017                             |
| Phenology           | ✓                                       | Underway                           | ✓                      | ✓                           | Winter, 2018                           |
| Black Marble        | ✓                                       | Underway                           | Fall, 2017             | Fall, 2017                  | Fall, 2017                             |



## JPSS EDRs LTM Site

- Personnel
- Instrument Descriptions
- STAR JPSS Home

## EDR Products

- [Active Fires >>](#)
- Aerosols
- Albedo
- ATMS L-C TDR
- Clouds
- Cryosphere - Ice
- Cryosphere - Snow
- GCOM AMSR2 Products
- Imagery - DNB
- Land Surface Temperature
- MiRS Soundings
- NUCAPS Soundings
- Ocean Color
- Ozone
- Polar Winds
- Sea Surface Temperature
- Surface Type
- Vegetation Indices
- Vegetation Health

Data and images displayed on STAR sites are provided for experimental use only and are not official operational NOAA products. [More information>>](#)

## Browse: Active Fires

19 Nov 2017 - 11:27 ET / 16:27 UTC

Select a parameter:

Active Fires Frequency Map

Active Fires Frequency Map

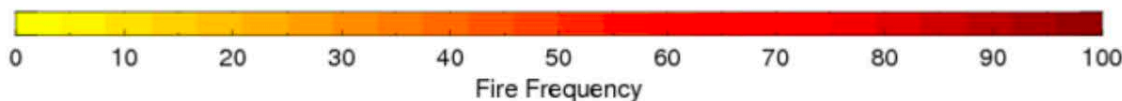
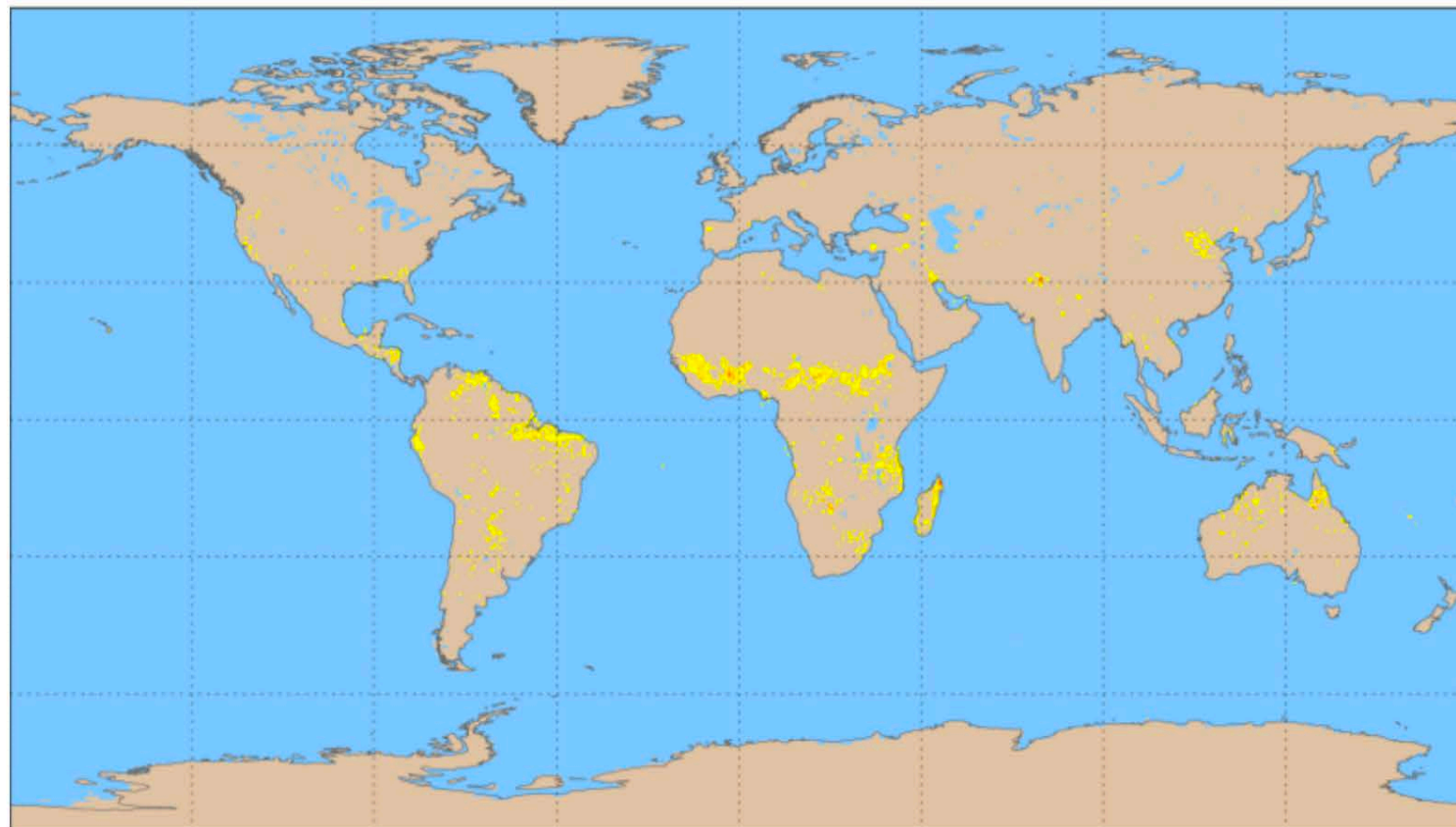
NDE - day-night composite

Select a Date:

11-18-2017

## Suomi NPP VIIRS - NDE Active Fires

18 Nov 2017





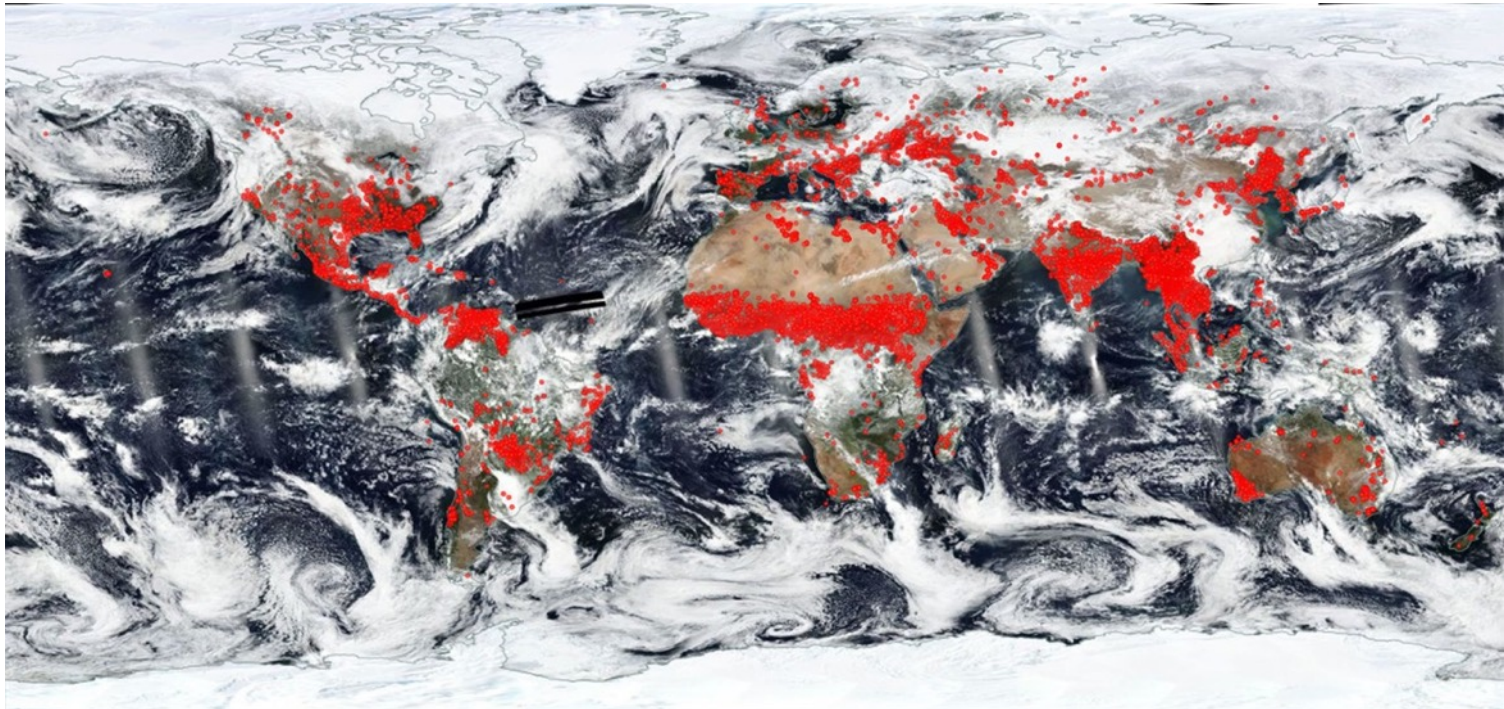
# NASA Land, Atmosphere Near real-time Capability for EOS (LANCE)

Global coverage

Approx. 3 h data latency

VIIRS and MODIS active fire data distributed via FIRMS & MODAPS FTP

**VIIRS 20170315**



<https://worldview.earthdata.nasa.gov>

# Fire Information for Resource Management System (FIRMS)

Data

Disciplines:

Related Content

Tasmania, Australia

User Profile: Mark Trice

The Iberian Peninsula

Tropical Cyclone Enawo approaches Madagascar

EOSDIS Data News - 3/2/2017

More Resources

Common Metadata Repository (CMR)

Earthdata Search

Global Imagery Browse Services (GIBS)

LANCE: Land, Atmosphere Near Real-Time Capability for EOS

Worldview

Fire Information for Resource Management System (FIRMS)

FIRMS delivers global hotspots / fire locations in easy to use formats

FIRMS distributes Near Real-Time (NRT) active fire data within 3 hours of satellite overpass from both MODIS and VIIRS.

MODIS Active Fire Products

VIIRS Active Fire Products

Get hotspot/fire locations

Fire Email Alerts

Download Active Fire Data

Web Fire Mapper

Global Fire Maps

Web Services

More Information

- About FIRMS
- Publications
- Links
- FIRMS Frequently Asked Questions (FAQs)
- Citation Policy and Disclaimer

←

Data Information

→

←

including users' guides

→

→

Data

Disciplines:

Related Content

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More Resources

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LANCE: Land, Atmosphere Near Real-Time Capability for EOS

Worldview

Active Fire Data

Download active fire products from MODIS (MCD14DL) and VIIRS 375 m (VNP14IMGDTL\_NRT) for the last 24, 48 hours and 7 days in shapefile, KML, WMS or text file formats. The VIIRS 375 m active fire product is the latest product to be added to FIRMS. VIIRS data complement the MODIS fire detections but the improved spatial resolution of the 375 m data provides a greater response over fires of relatively small areas. [Read more about VIIRS...](#)

Data older than 7 days can be obtained from the [Archive Download Tool](#). Users intending to perform scientific analysis are advised to download the data.

Please note:

- MODIS C6 is available from November 2000 (for Terra) and from July 2002 (for Aqua) to the present.
- VIIRS 375 m NRT data is currently available from 8 January 2016 (NRT data are distinct from standard quality data).

Shapefile

KML

TXT

WMS

Archive Download Tool

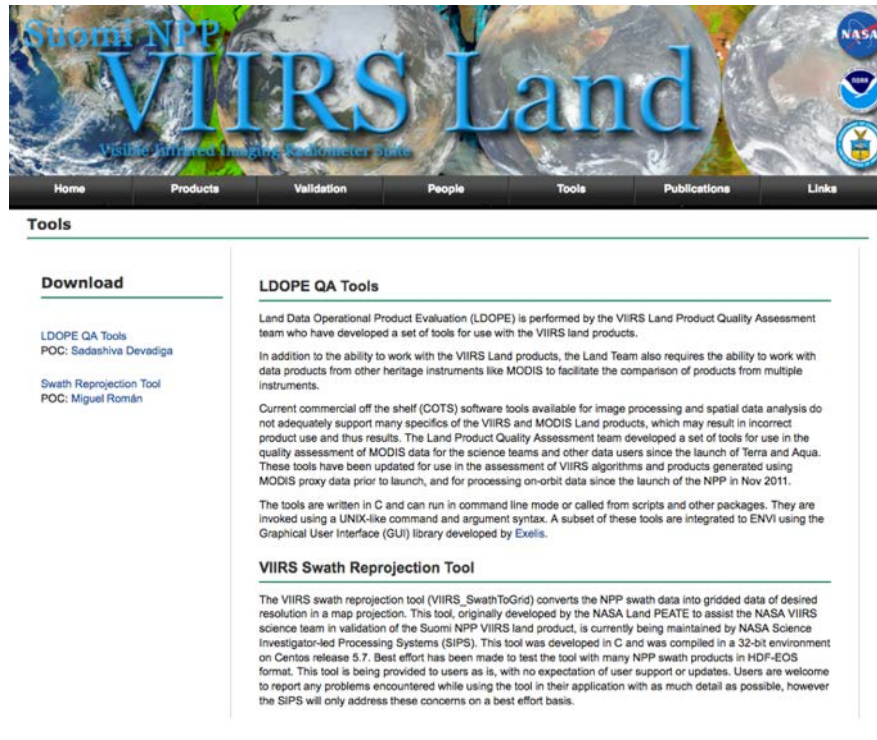
Global Fire Maps

<https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms>

# VIIRS Data Resources

## VIIRS Swath Reprojection Tool (command line – Linux)

<https://viirsland.gsfc.nasa.gov/Tools.html>



The screenshot shows the VIIRS Land website header with the text "Suomi NPP VIIRS Land Visible Infrared Imaging Radiometer Suite" and logos for NASA, NOAA, and the University of Maryland. Below the header is a navigation bar with links: Home, Products, Validation, People, Tools, Publications, and Links. The "Tools" section is expanded, showing a "Download" sidebar with links to "LDOPE QA Tools" (POC: Sadashiva Devadiga) and "Swath Reprojection Tool" (POC: Miguel Román). The main content area is titled "LDOPE QA Tools" and describes the Land Data Operational Product Evaluation (LDOPE) process, its purpose, and the availability of current commercial off-the-shelf (COTS) software tools for image processing and spatial data analysis. It also mentions that the tools are written in C and can run in command line mode or be called from scripts and other packages, and that they are invoked using a UNIX-like command and argument syntax. A subset of these tools is integrated to ENVI using the Graphical User Interface (GUI) library developed by Exelis. Below this, the "VIIRS Swath Reprojection Tool" section is introduced, stating that the tool converts the NPP swath data into gridded data of desired resolution in a map projection. This tool, originally developed by the NASA Land PEATE to assist the NASA VIIRS science team in validation of the Suomi NPP VIIRS land product, is currently being maintained by NASA Science Investigator-led Processing Systems (SIPS). The tool was developed in C and was compiled in a 32-bit environment on CentOS release 5.7. Best effort has been made to test the tool with many NPP swath products in HDF-EOS format. This tool is being provided to users as is, with no expectation of user support or updates. Users are welcome to report any problems encountered while using the tool in their application with as much detail as possible, however the SIPS will only address these concerns on a best effort basis.

## Reprojection Tool Input Requirements:

VNP14IMG\*.nc or VNP14\*.nc fire data files

VNP02IMG\*.nc or VNP02\*.nc geolocation files

Data converter to HDF/EOS

## VIIRS Fire University of Maryland website:

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

## VIIRS Fire Data Users' Guide:

<https://viirsland.gsfc.nasa.gov/Products/FireESDR.html>

## NRT data download options:

### NASA MODAPS (registered users) 375m fire data set:

<https://earthdata.nasa.gov/earth-observation-data/near-real-time/download-nrt-data/viirs-nrt>

### NOAA NDE (anonymous FTP) 750m fire data set:

<ftp://ftp-npp.class.ngdc.noaa.gov/>

Select:

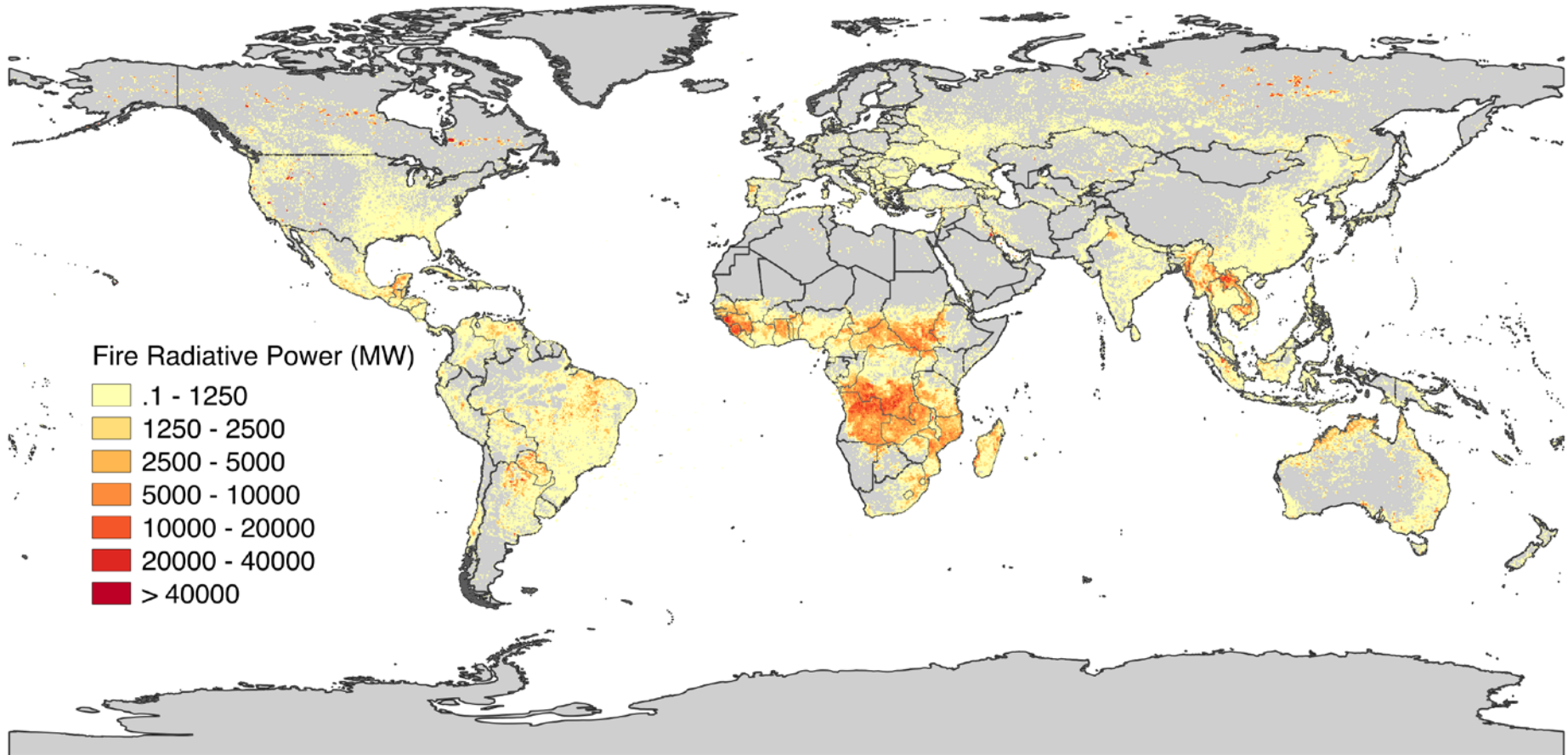
Date ->

NDE-L2 ->

*VIIRS-Active-Fire-EDR-NOAA-Enterprise-Algorithm*

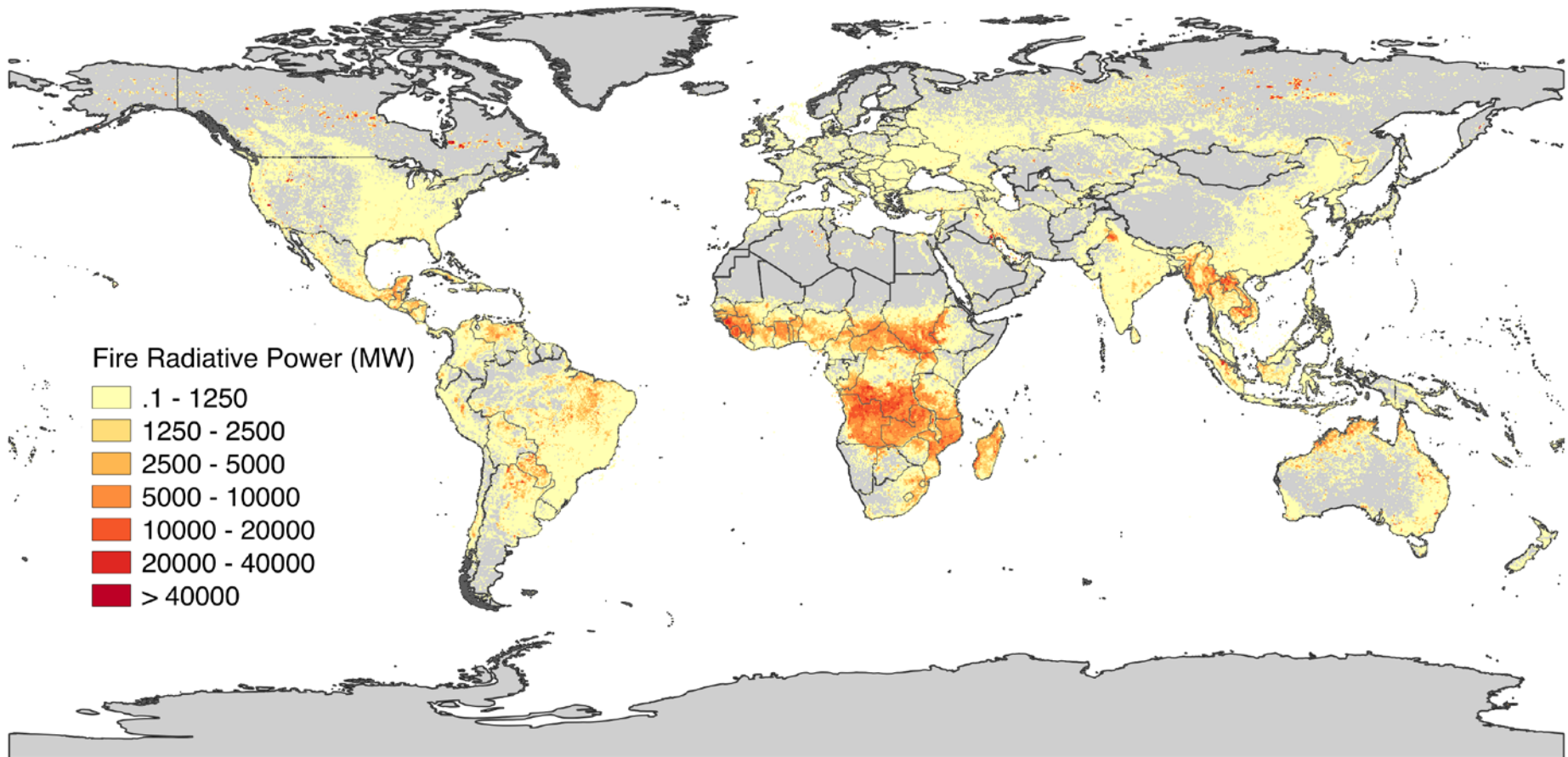


# Global FRP – Aqua/MODIS 1km



**Aqua/MODIS 1km - 2013**

# Global FRP – S-NPP/VIIRS 375m



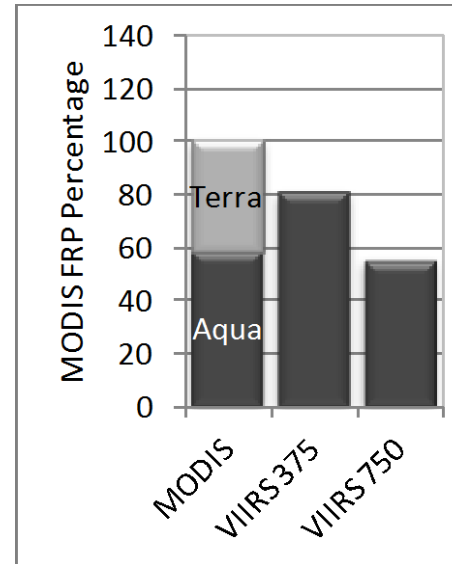
**S-NPP/VIIRS 375m – 2013**  
**50% higher FRP compared to Aqua/MODIS**

# VIIRS 375 m, 750 m and MODIS 1km Top-of-Atmosphere FRP

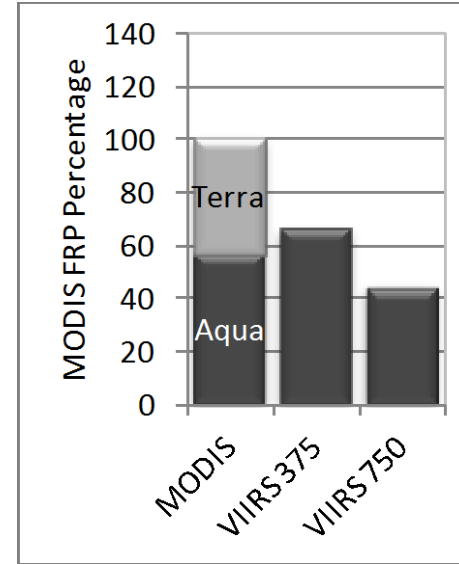
45% of daytime and 80% of nighttime  
VIIRS fire pixels have no match in  
Aqua/MODIS fire data

VIIRS systematically detecting more fires  
than same-day MODIS (Terra & Aqua) in  
areas dominated by small/low-intensity  
fires

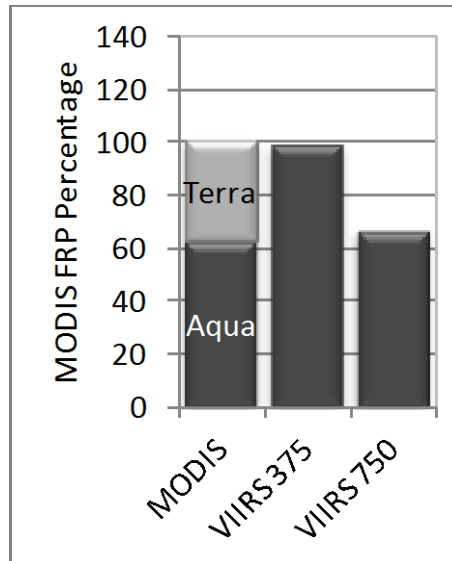
## North America



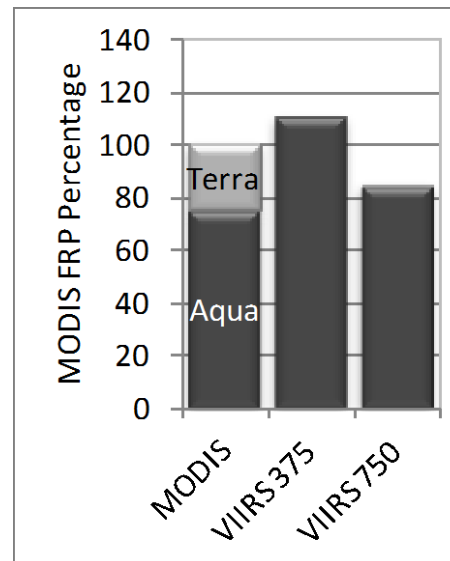
## Russia



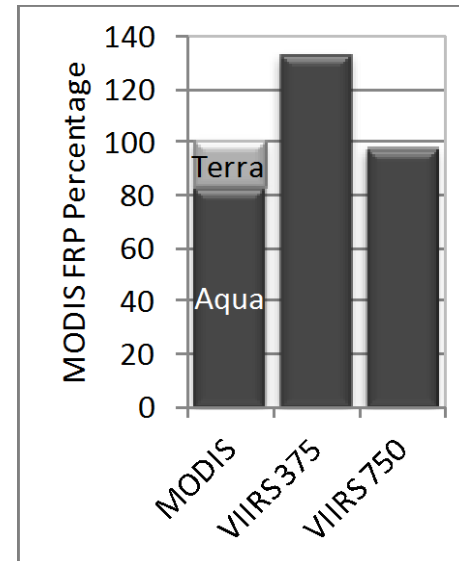
## South America



## Africa



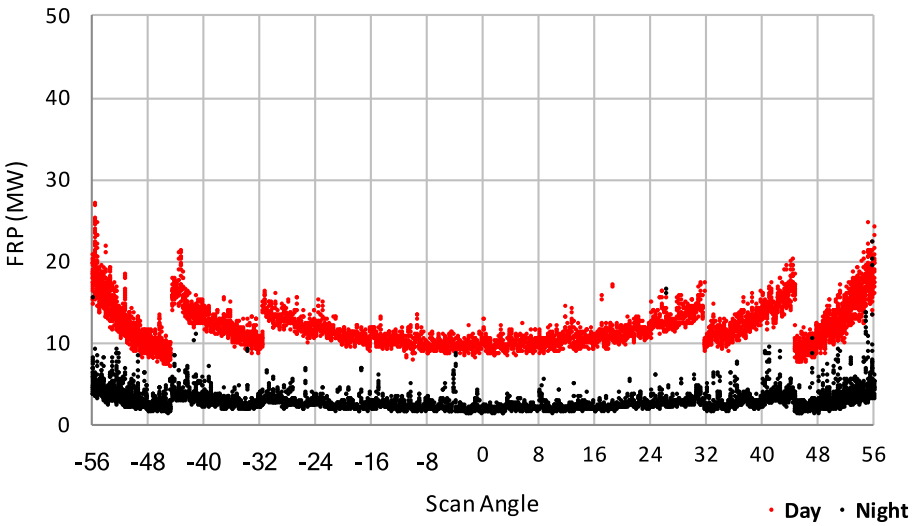
## South East Asia





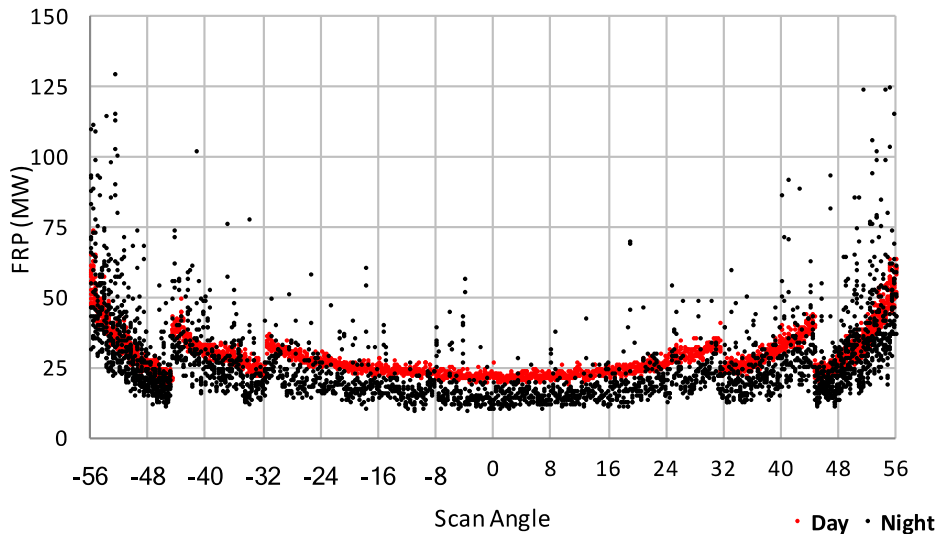
# VIIRS 375 m, 750 m, MODIS 1km FRP

S-NPP/VIIRS 375m Mean FRP

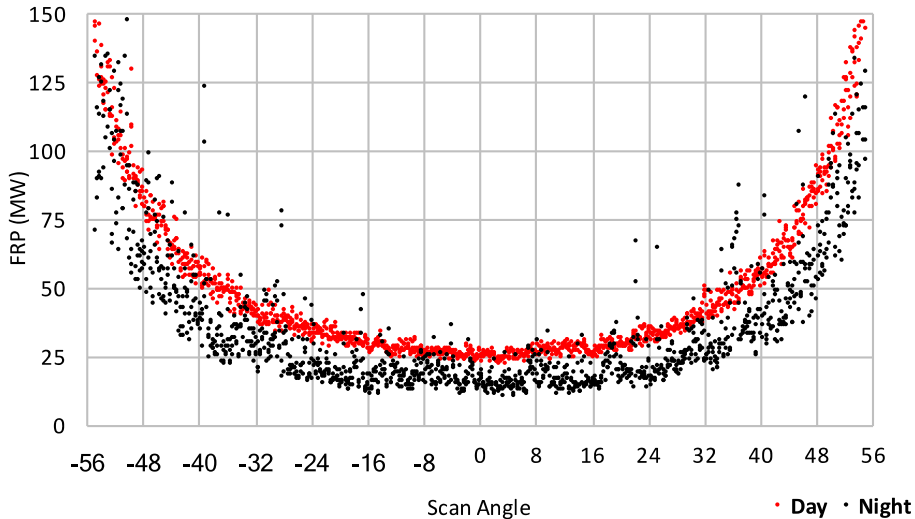


VIIRS data aggregation helps reduce detection performance differences due to changes in pixel size/scan-angle

S-NPP/VIIRS 750m Mean FRP

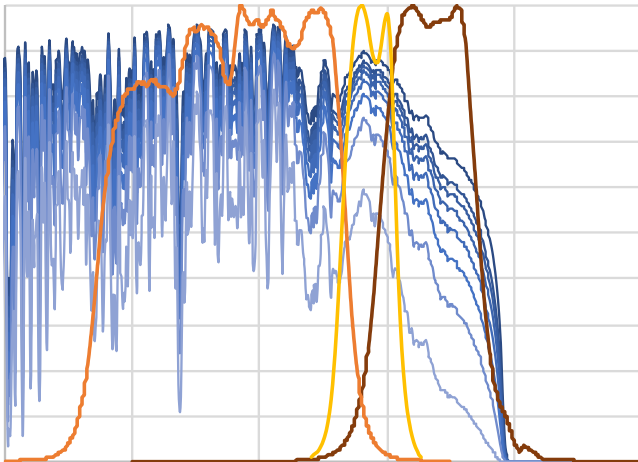


Aqua/MODIS 1km Mean FRP

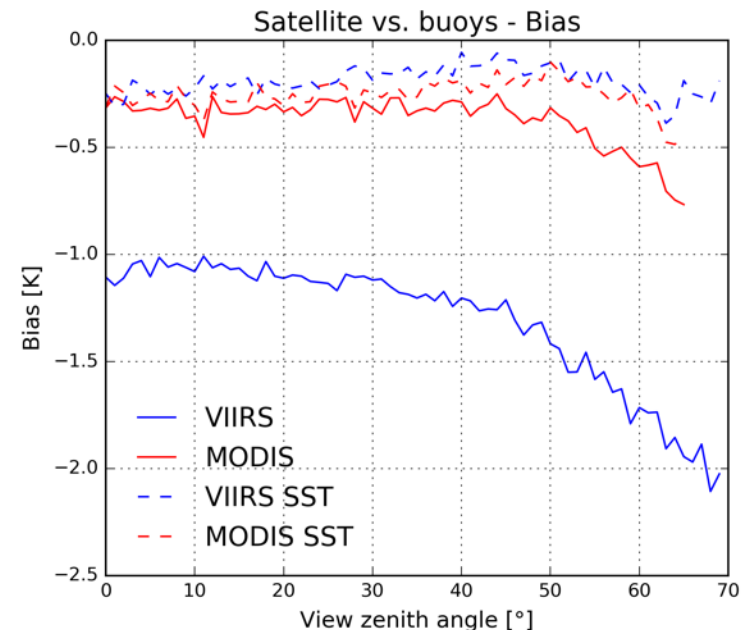
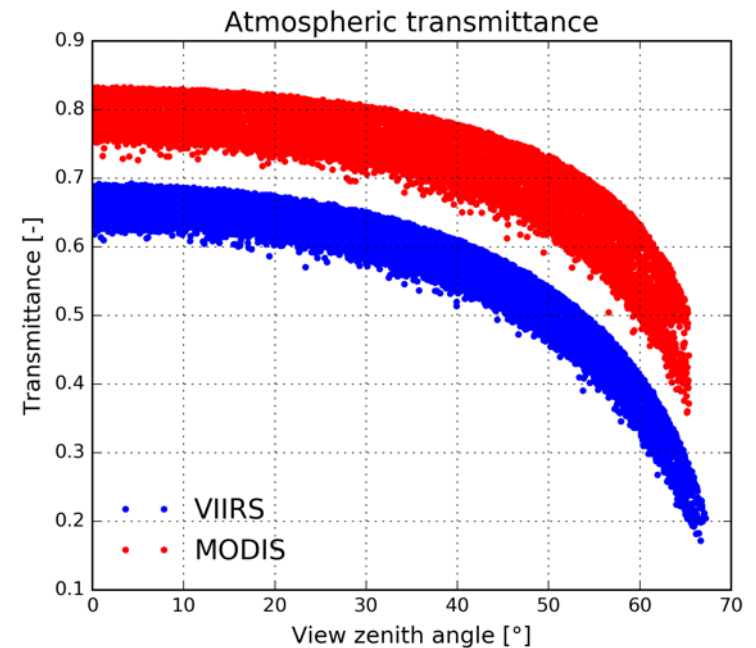


# FRP Data Considerations

- Majority of VIIRS bowtie pixels are deleted onboard the spacecraft prior to data downlink. MODIS bowtie pixels are still present in Level 2 data resulting in potential double counting at far-off nadir angles
- VIIRS mid-IR band overlaps with CO<sub>2</sub> absorption band causing FRP underestimation
  - Provisions added to Level 2 data to facilitate atmospheric correction implementation



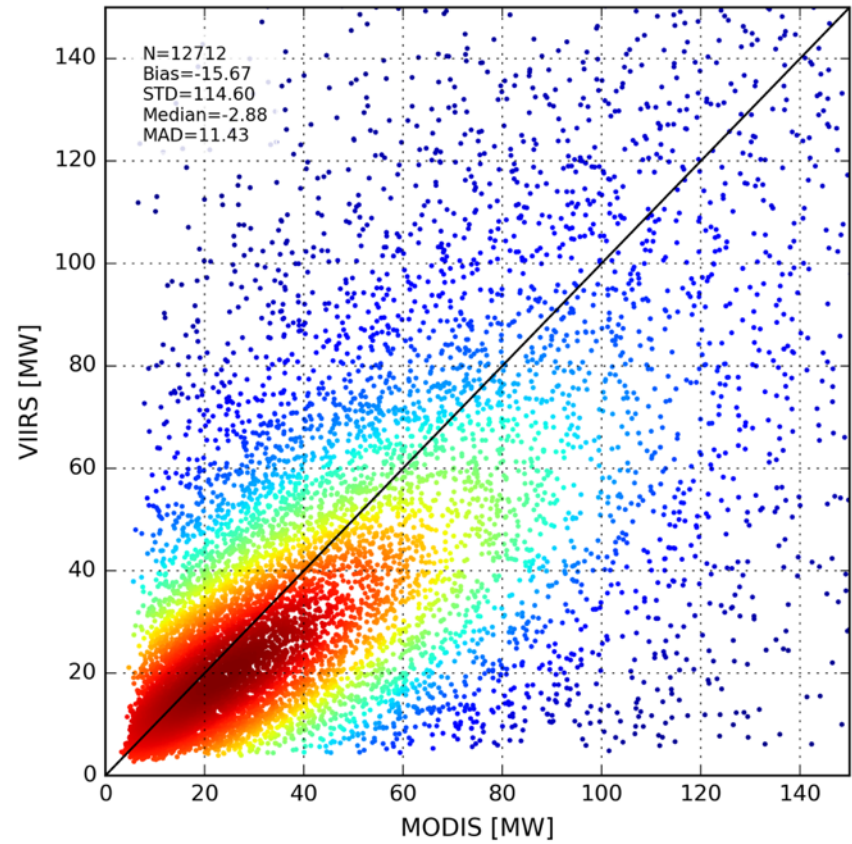
B-22 SRF



# Cross-Validation of MODIS x VIIRS FRP Data

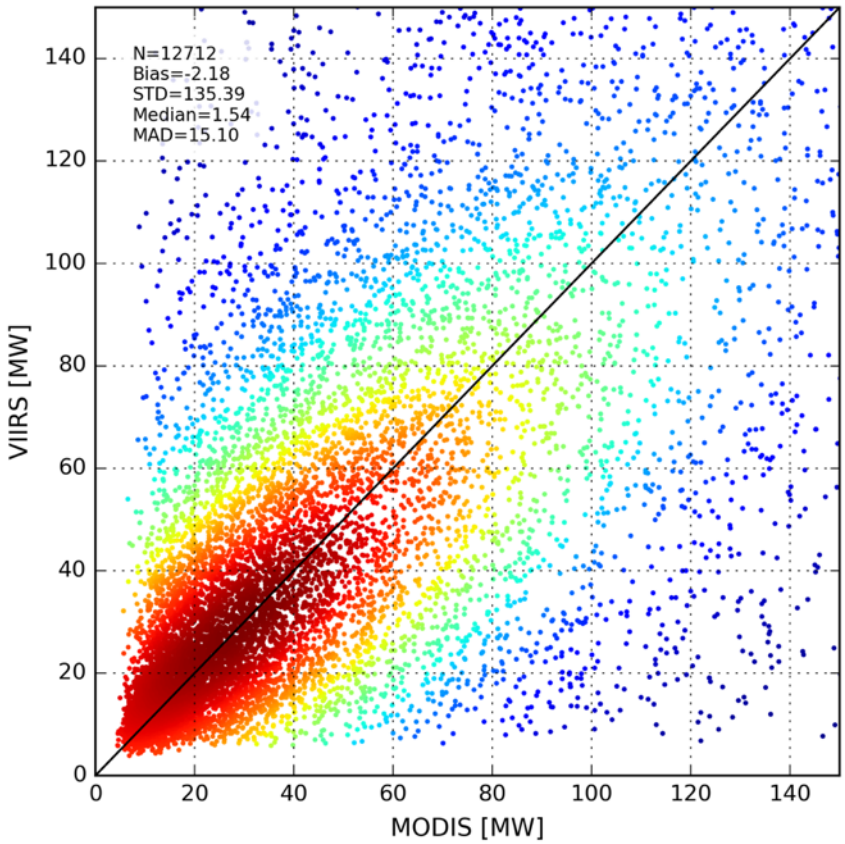
FRP retrievals corrected for atmospheric attenuation using  
MODTRAN + MERRA-2 (0.625° x 0.5°)

FRP TOA



Before atmospheric correction

FRP



After atmospheric correction

# Data Validation –July 2017, Brazil

Two  
drones  
flying in  
tandem



Payload #1:  
5-channel  
radiometer

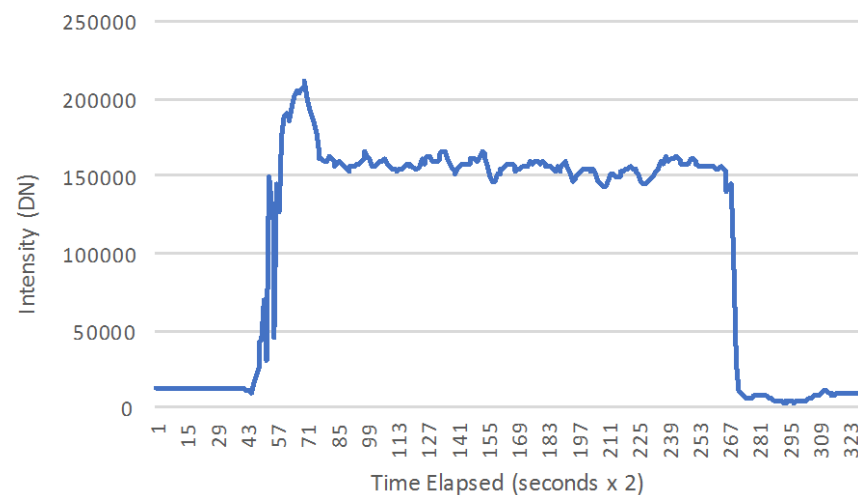
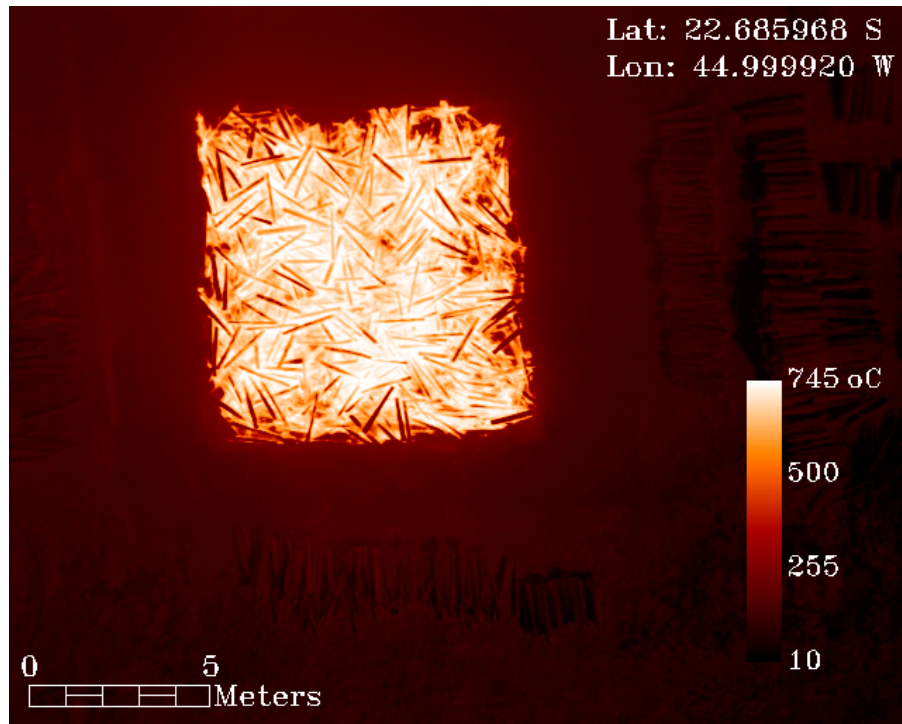


Payload #2:  
Infrared  
camera (FLIR  
Vue Pro R)

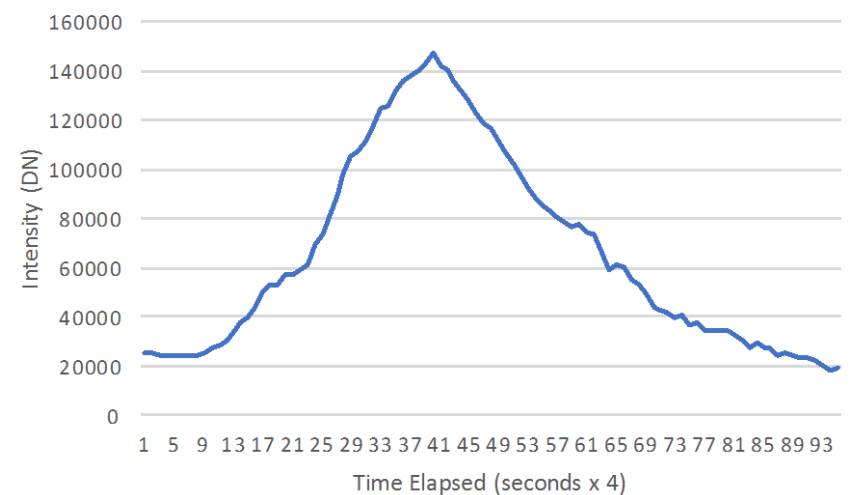
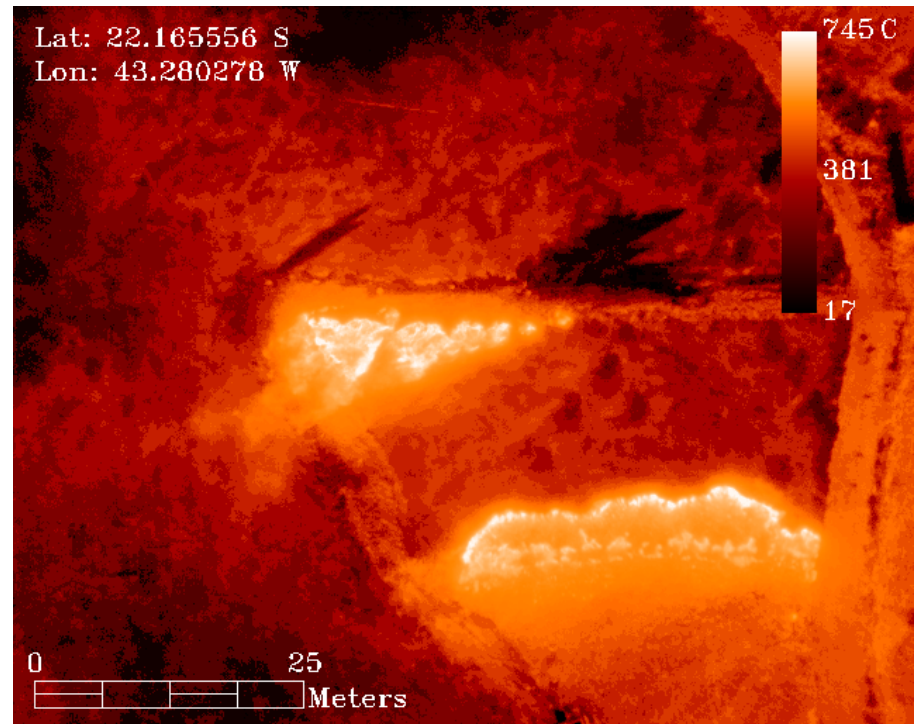




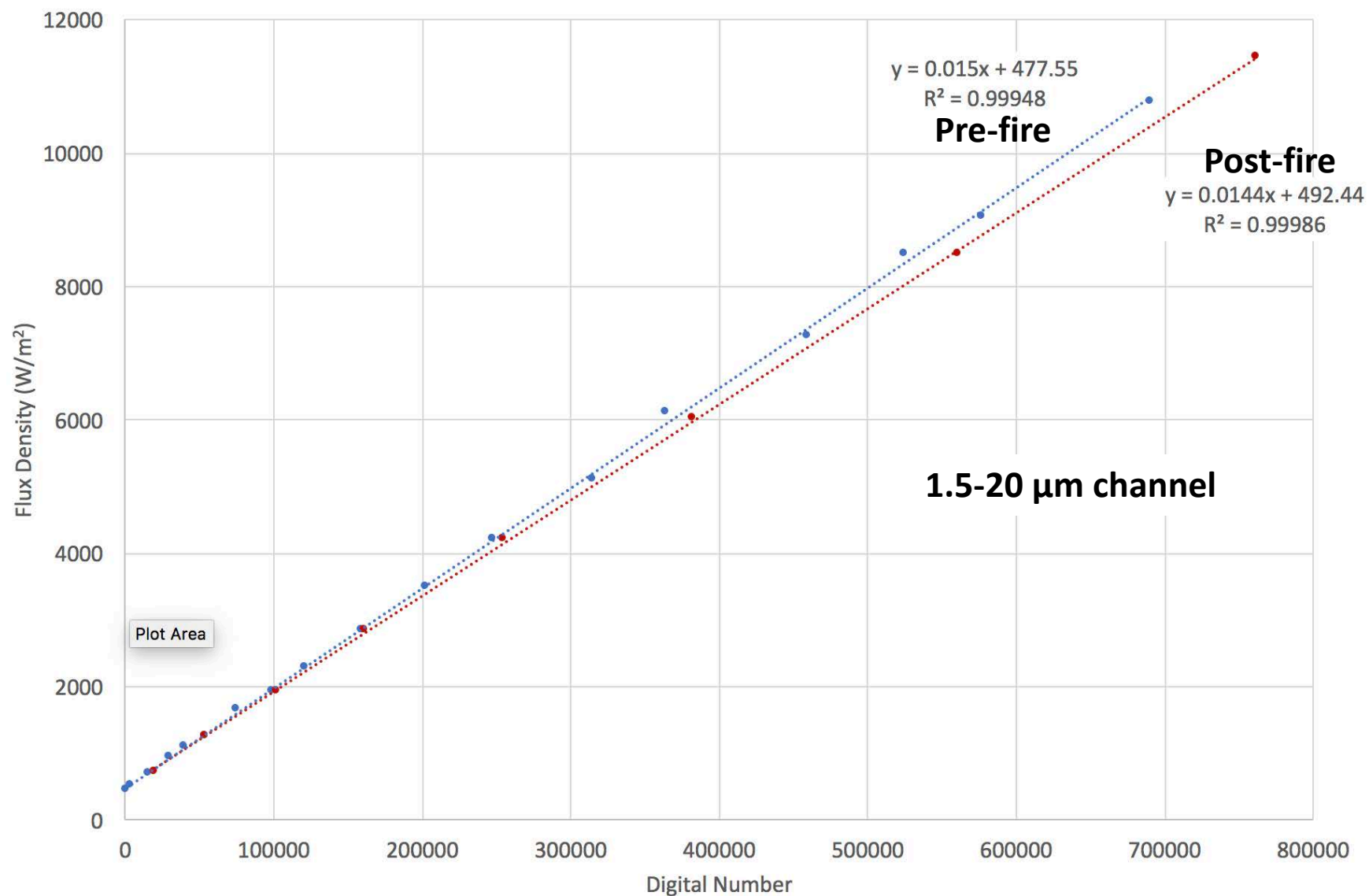
## Pseudo-Static Heat Source



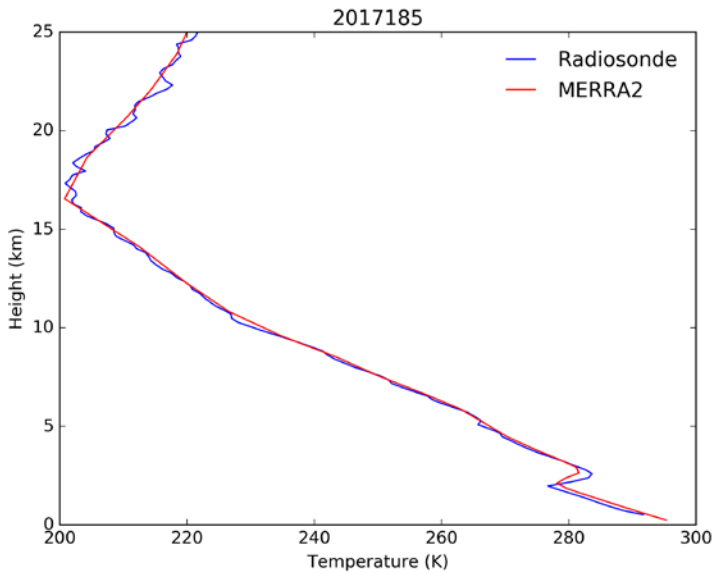
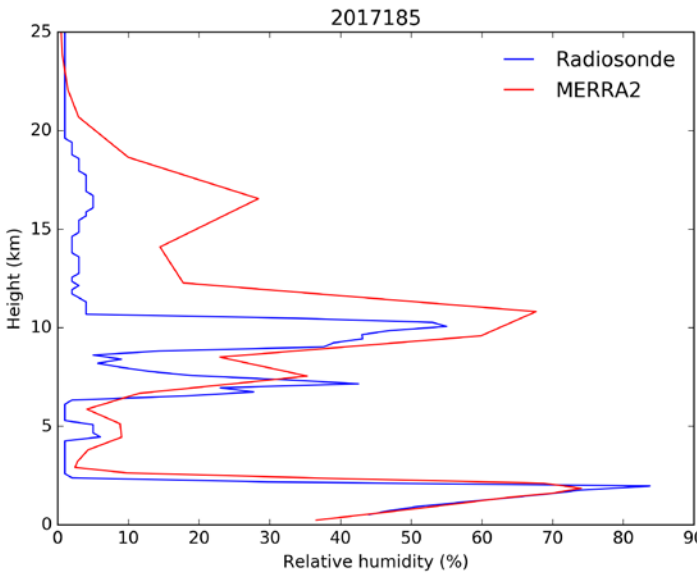
## Grass Fire



# Multi-spectral Radiometer – Channel 4 Data Calibration



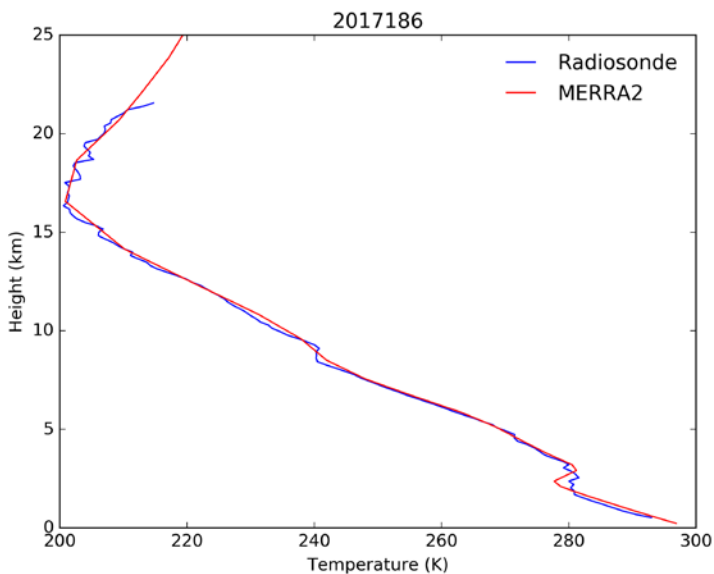
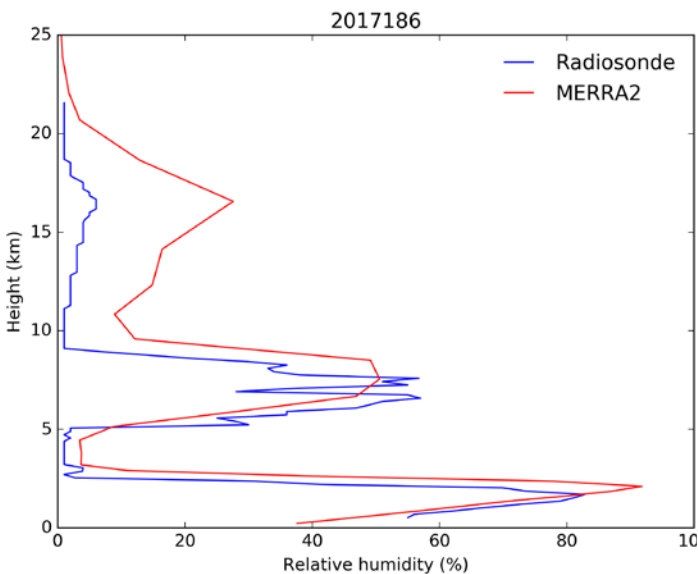
# Radiosonde x MERRA-2 Data Comparison



Calculated atmospheric transmittance:

Channel I4  
Radiosonde    MERRA-2  
**0.869**       **0.855**

Channel M13:  
Radiosonde    MERRA-2  
**0.723**       **0.727**

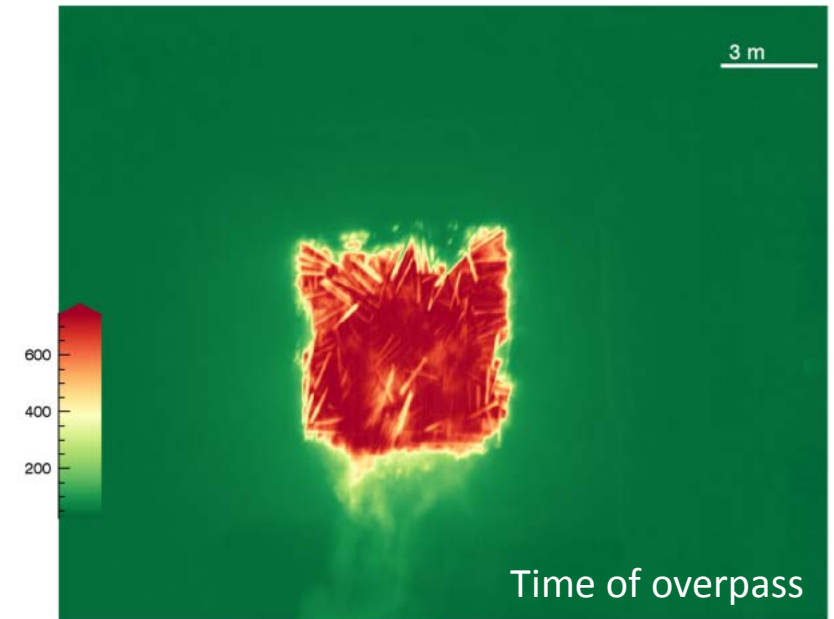
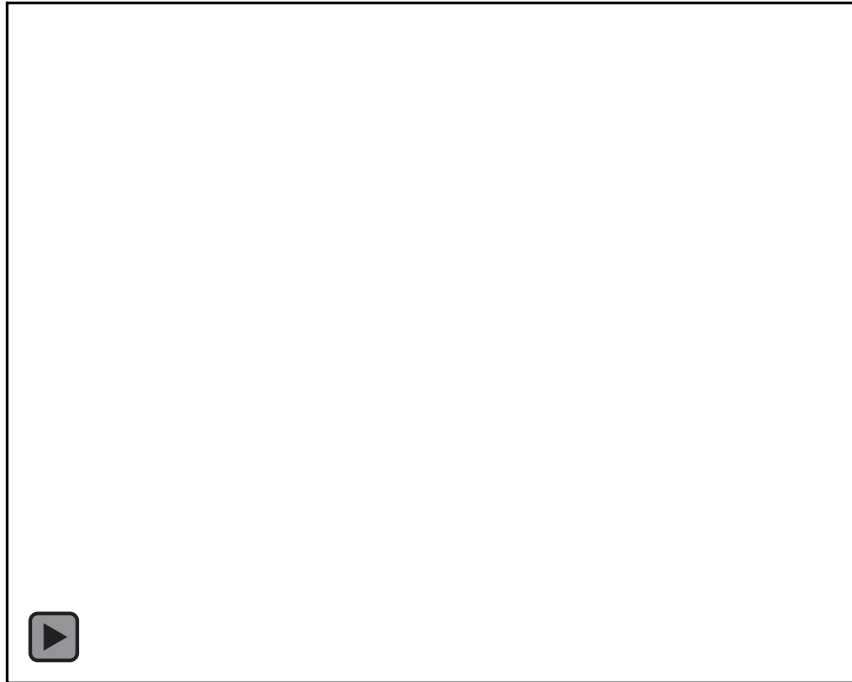


Calculated atmospheric transmittance:

Channel I4  
Radiosonde    MERRA-2  
**0.814**       **0.798**

Channel M13:  
Radiosonde    MERRA-2  
**0.660**       **0.657**

# S-NPP/VIIRS - 04 Jul 2017 16:33:30UTC



Scan angle:  $10.8^\circ$

Sky: clear

Fire detection: **no**

Fire area:  $54 \text{ m}^2$

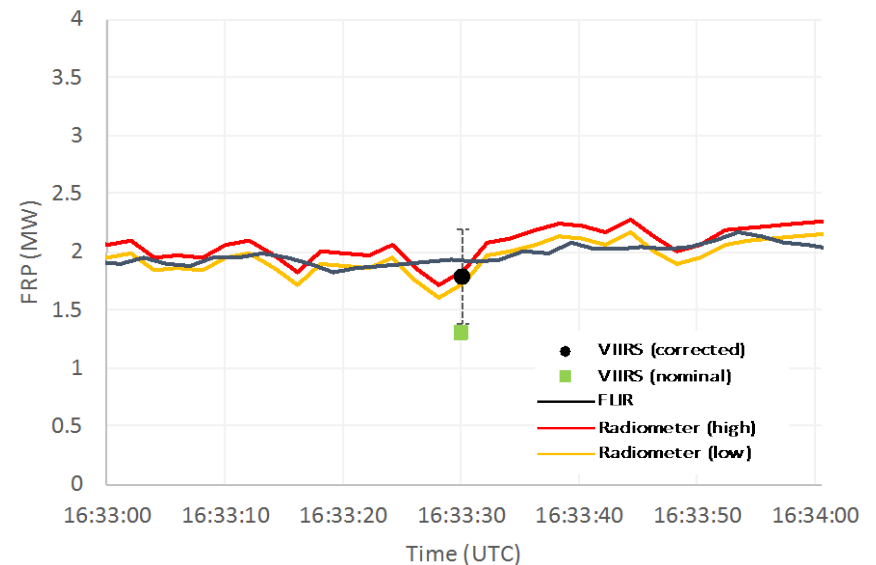
Adjusted fire area:  $43 \text{ m}^2$

Pixel size:  $401 \times 368 \text{ m}$

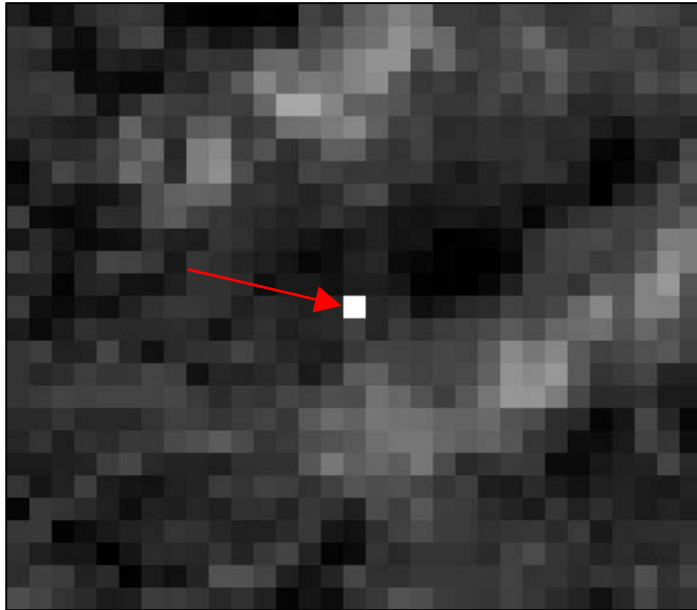
Pixel fraction: 0.036%

Estimated fire temp: 876 K

Fire ID#1

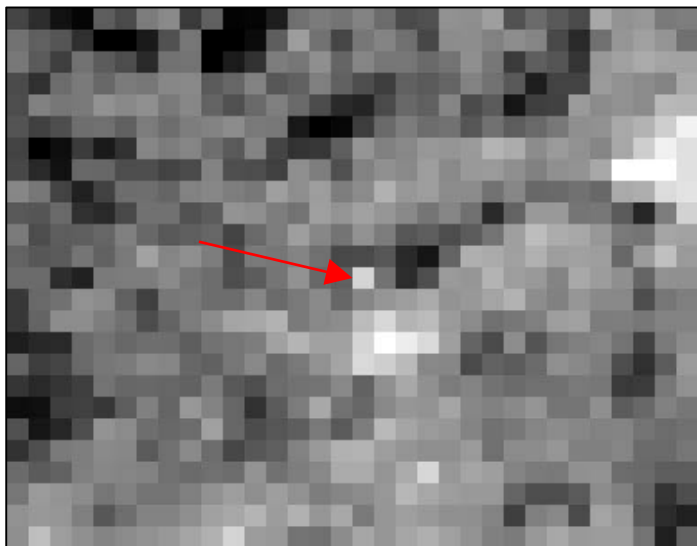






***375m data***

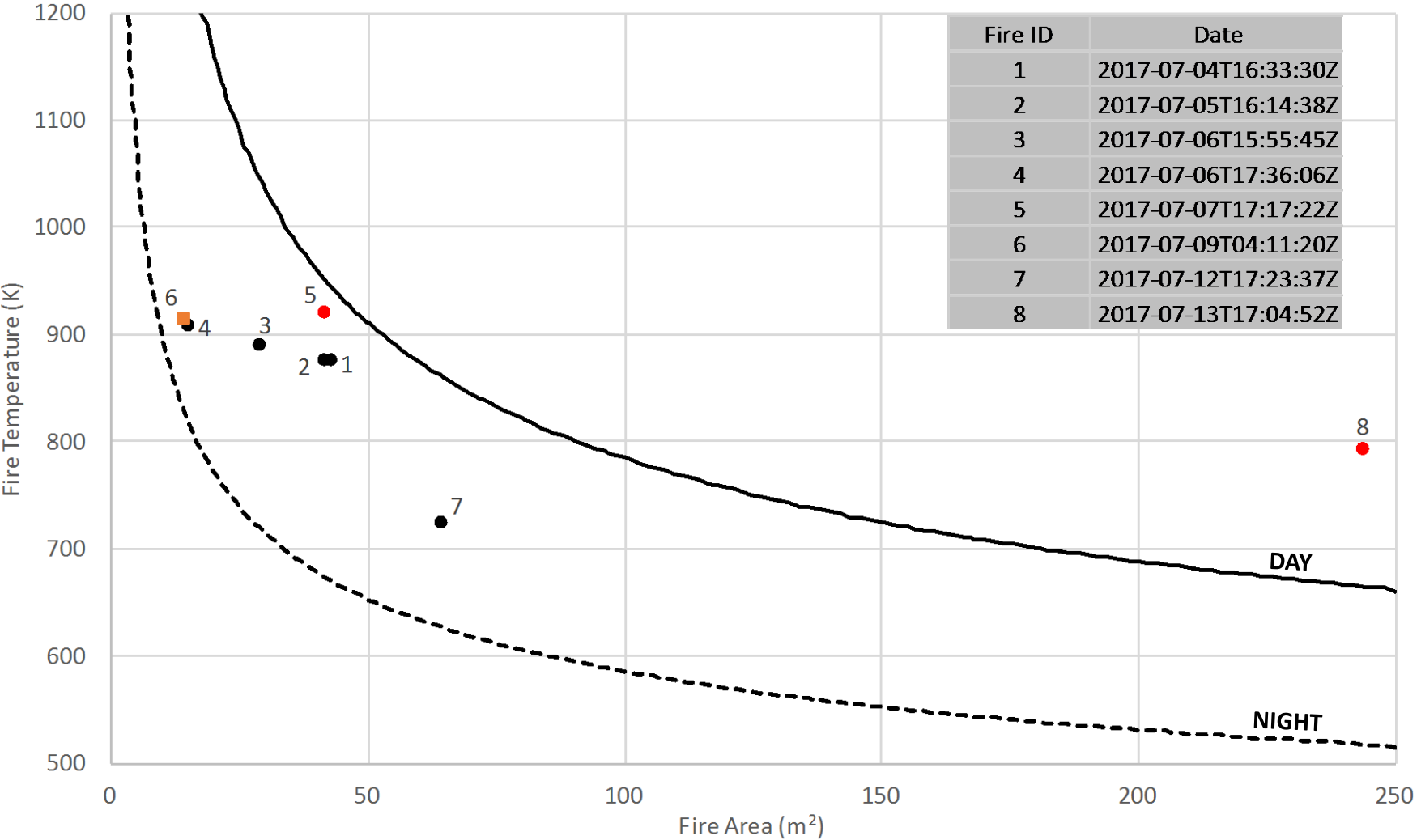
| BT I04 |      |        |        |        |
|--------|------|--------|--------|--------|
|        |      | Sample |        |        |
|        |      | 3602   | 3603   | 3604   |
| Line   | 3792 | 293.82 | 295.02 | 295.08 |
|        | 3793 | 296.15 | 323.05 | 296.04 |
|        | 3794 | 296.20 | 299.10 | 295.88 |



***750m data***

| BT M13 |      |        |        |        |
|--------|------|--------|--------|--------|
|        |      | Sample |        |        |
|        |      | 1800   | 1801   | 1802   |
| Line   | 1895 | 289.52 | 289.59 | 290.02 |
|        | 1896 | 290.40 | 295.15 | 291.11 |
|        | 1897 | 290.68 | 291.96 | 292.56 |

# VIIRS 375m Theoretical Detection Envelope



# Final Remarks

- S-NPP/VIIRS 375m and 750m Level-2 (swath) fire products publicly available through NASA and NOAA, including near real-time access
- Continuation (NASA) proposal being reviewed. Main objectives:
  - Algorithm refinements (e.g., additional tuning, atmospheric correction of FRP retrievals)
  - Expand data validation
  - Level 3 & 4 data generation
- JPSS-1 successfully launched on 18 November 2017!!
  - Phased orbit ( $180^\circ$ ), approx 50min apart (more near-nadir views)