Active Fire product update

Presented by Ivan Csiszar (STAR)

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Marina Tsidulko, Valerie Mikles, Walter Wolf (STAR AIT)

August 27, 2015

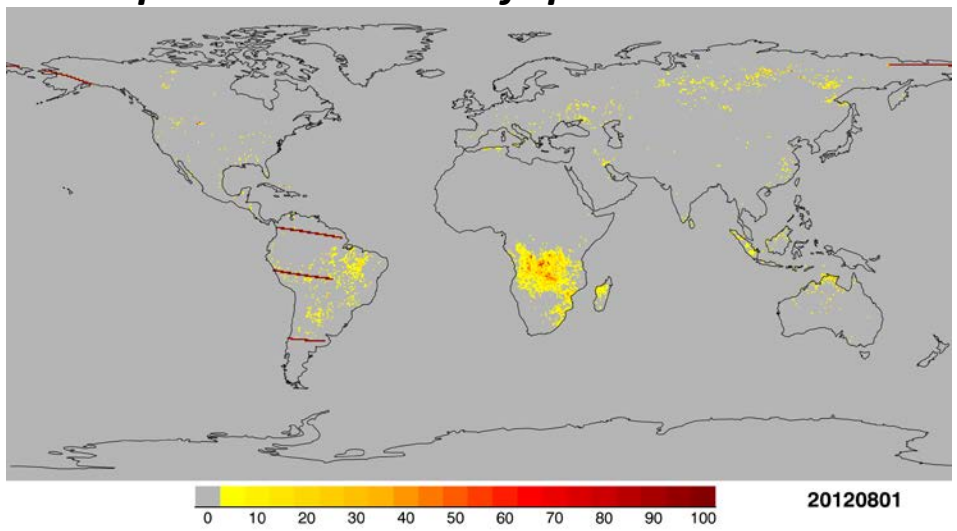
NOAA Operational Fire product status

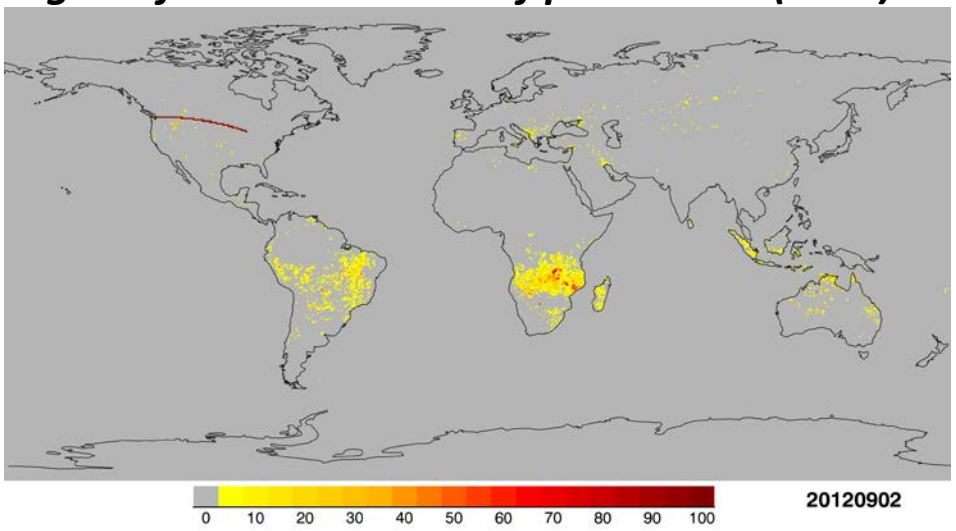
- **Current 750m operational product** in IDPS*
  - delivers a list of fire pixels
  - reached **Validated 1 maturity status** with an effectivity date (i.e. IDPS implementation) of **August 13, 2014**.
  - **declared NOAA Operational** product in September 2014
  - **long-term monitoring** and maintenance continues
- **Upcoming 750 NOAA operational product** in NDE**
  - the product is developed at UMD and is **tailored subset of the NASA science product** for real-time 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
  - Code **delivered to STAR AIT** and tailored for NDE processing
  - **Algorithm Readiness Review** held on June 18 2015
  - Currently in **NDE testing and integration** – operational later this year

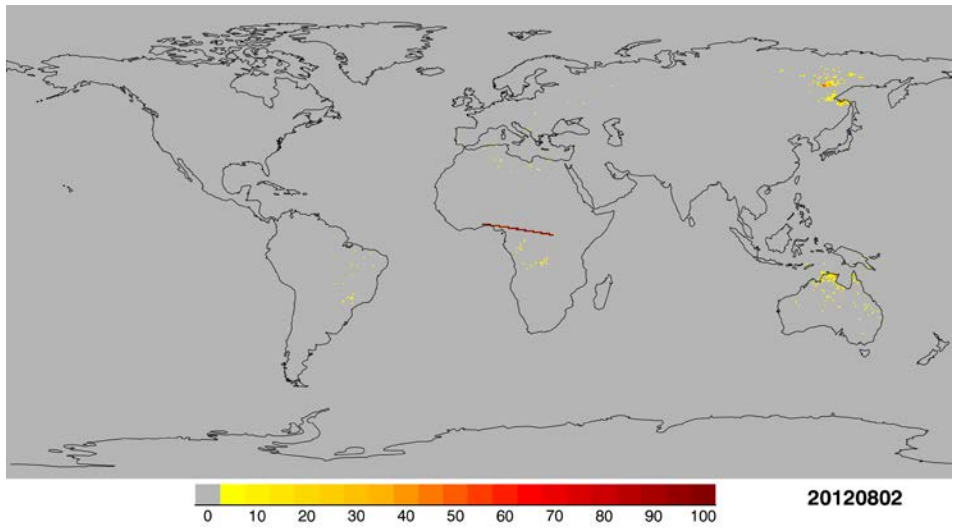
IDPS: Interface Data Processing Segment; **NDE: Suomi NPP Data Exploitation

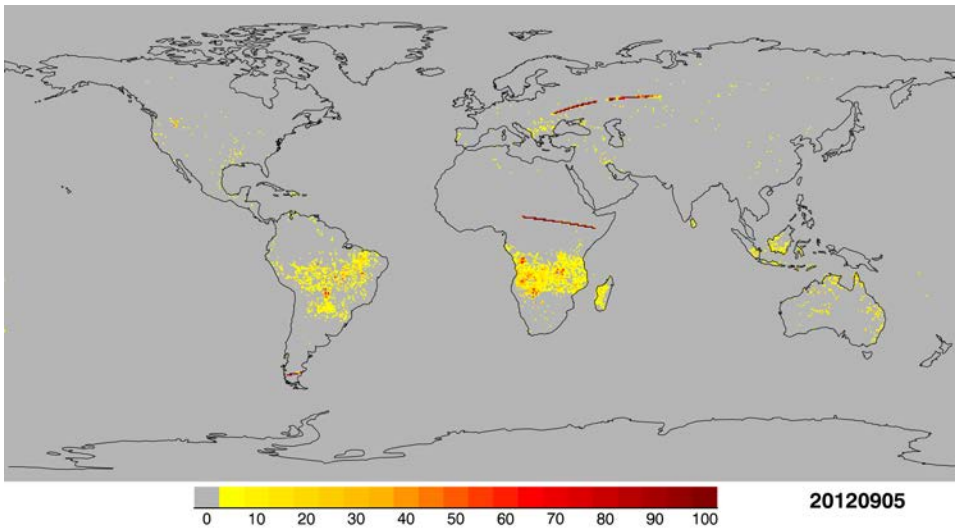
Examples of early IDPS product

Frequent occurrence of spurious scanlines during the first ~10 months of production (Beta)









Examples of the operational real-time IDPS product as archived in NOAA CLASS.
Not reprocessed; not to be used for science analysis. Product history demonstration only.

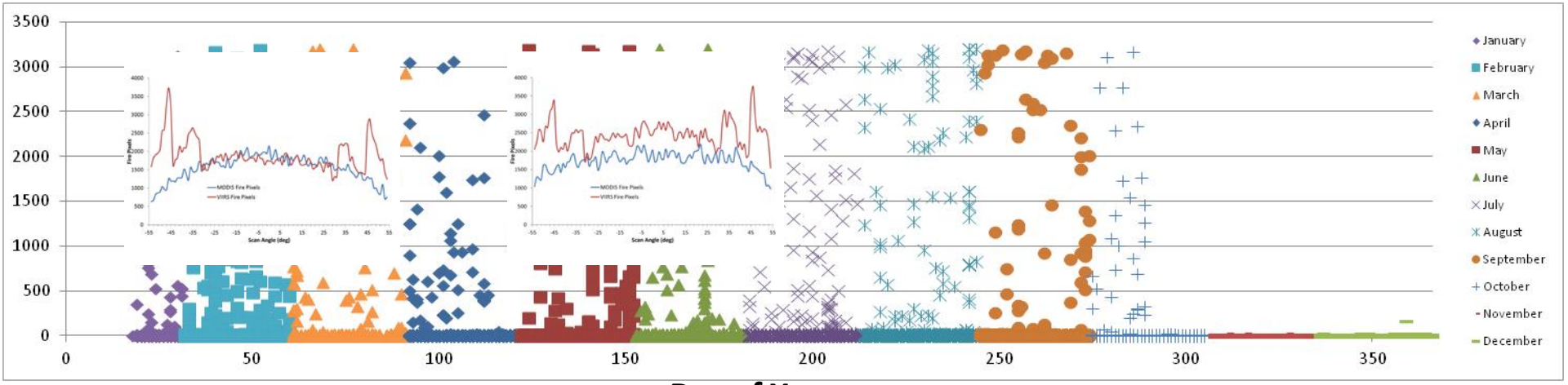
IDPS Suomi NPP Active Fire Product history: data anomalies and product maturity (2/1)

2012

April 3, 2012
IDPS Mx5.3

October 16, 2012
IDPS Mx6.3

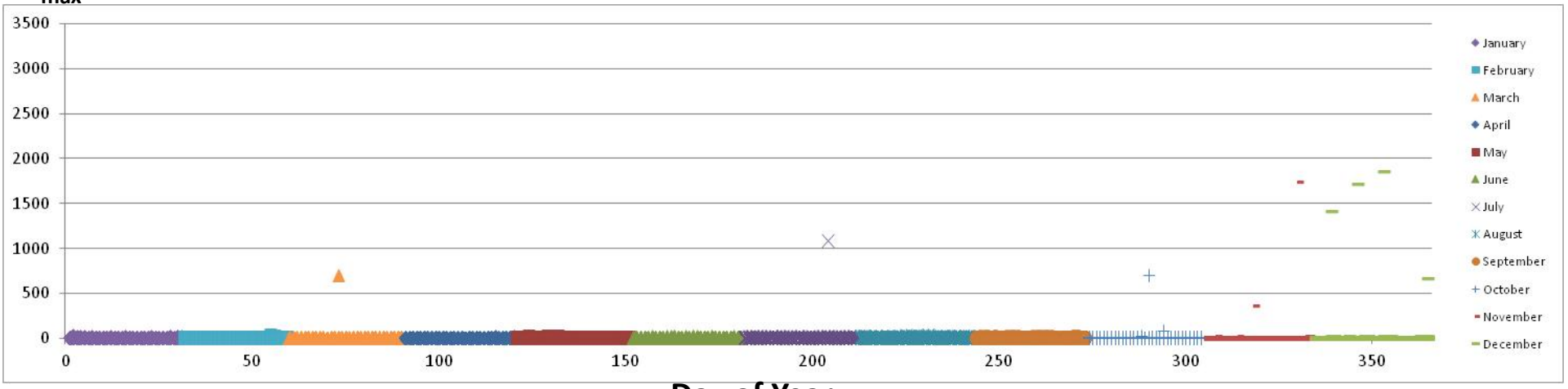
N_{max} ← *Pre-Beta* → *Beta* → *Provisional* →



Day of Year

2013

N_{max} ← *Provisional* →



Day of Year

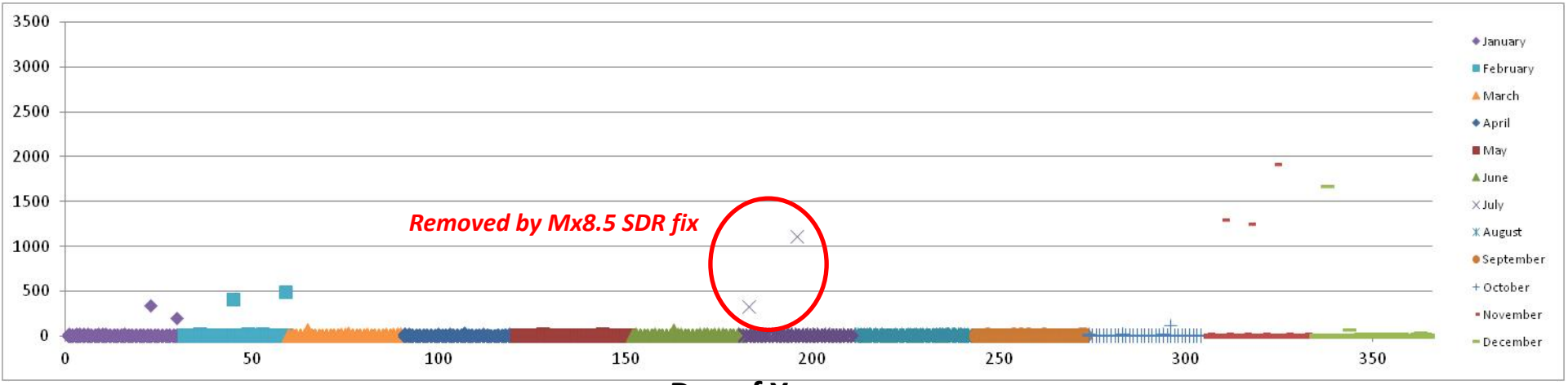
N_{max}: maximum number of detections within a scanline

IDPS Suomi NPP Active Fire Product history: data anomalies and product maturity (2/2)

2014

August 13, 2014
IDPS Mx8.5

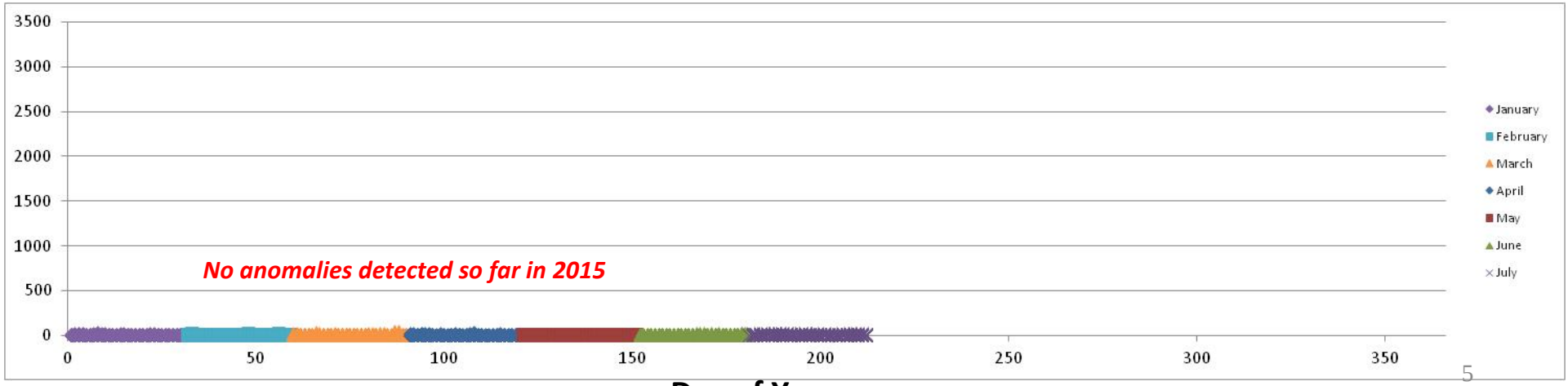
N_{max} ← *Provisional* → | ← *Validated stage 1* →



Day of Year

2015

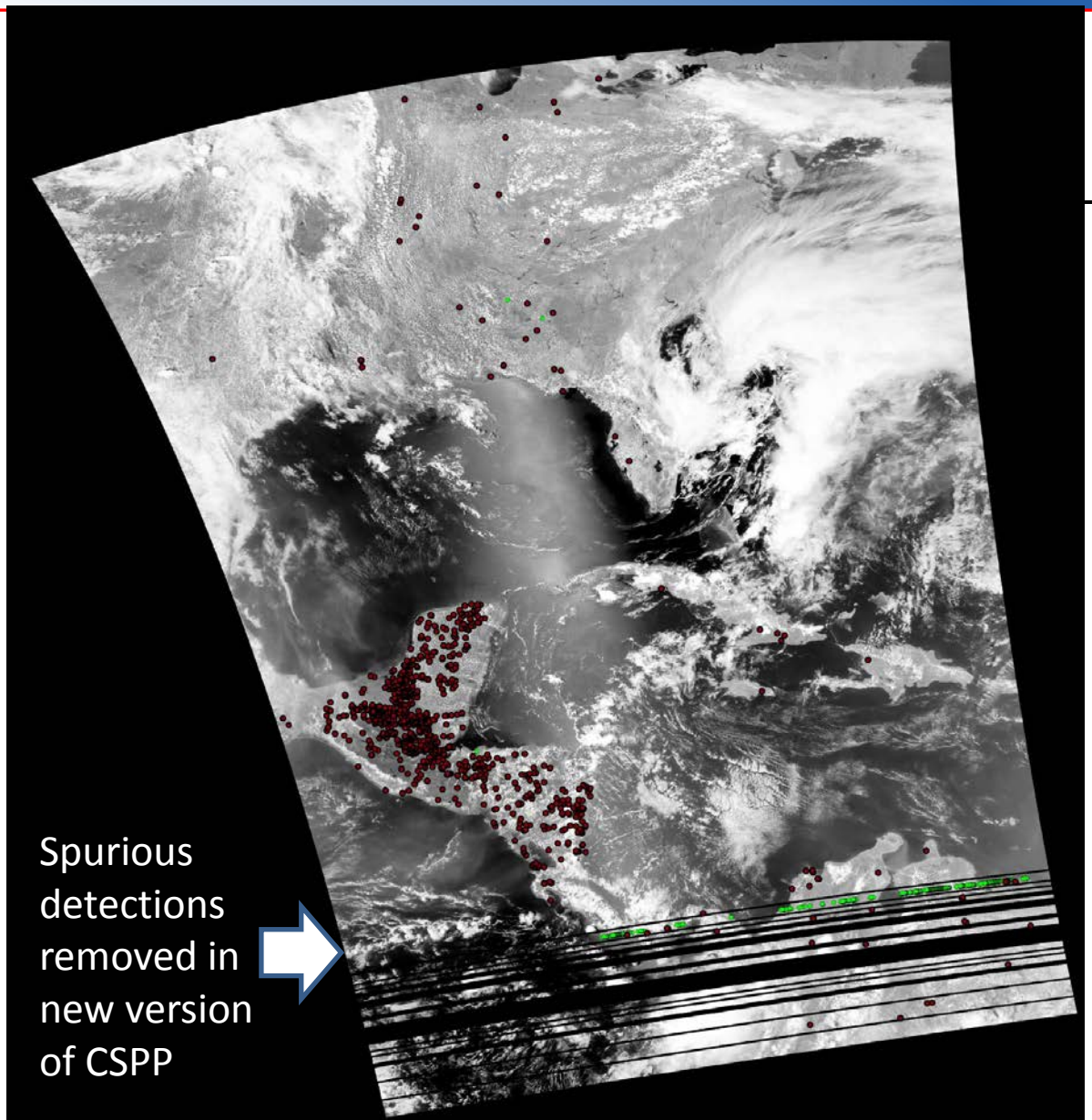
N_{max} ← *Validated stage 1* ------->



Day of Year

N_{max}: maximum number of detections within a scanline

Direct broadcast support



- *Missing / noisy data in Direct Broadcast transmission can result in incorrect SDR calibration and spurious detections.*
- *The frequency of DB data anomalies depend on the performance of the local DB processing system.*
- *Adjustments in the DB processing code are being implemented to improve SDR quality and spurious fire detections.*
- *Spurious detections can also be filtered by empirical techniques.*
- *Regular updates to include algorithm improvements is critical.*

CSPP V2.0 (SDR Mx8.4)
CSPP V2.1 (SDR Mx8.6)

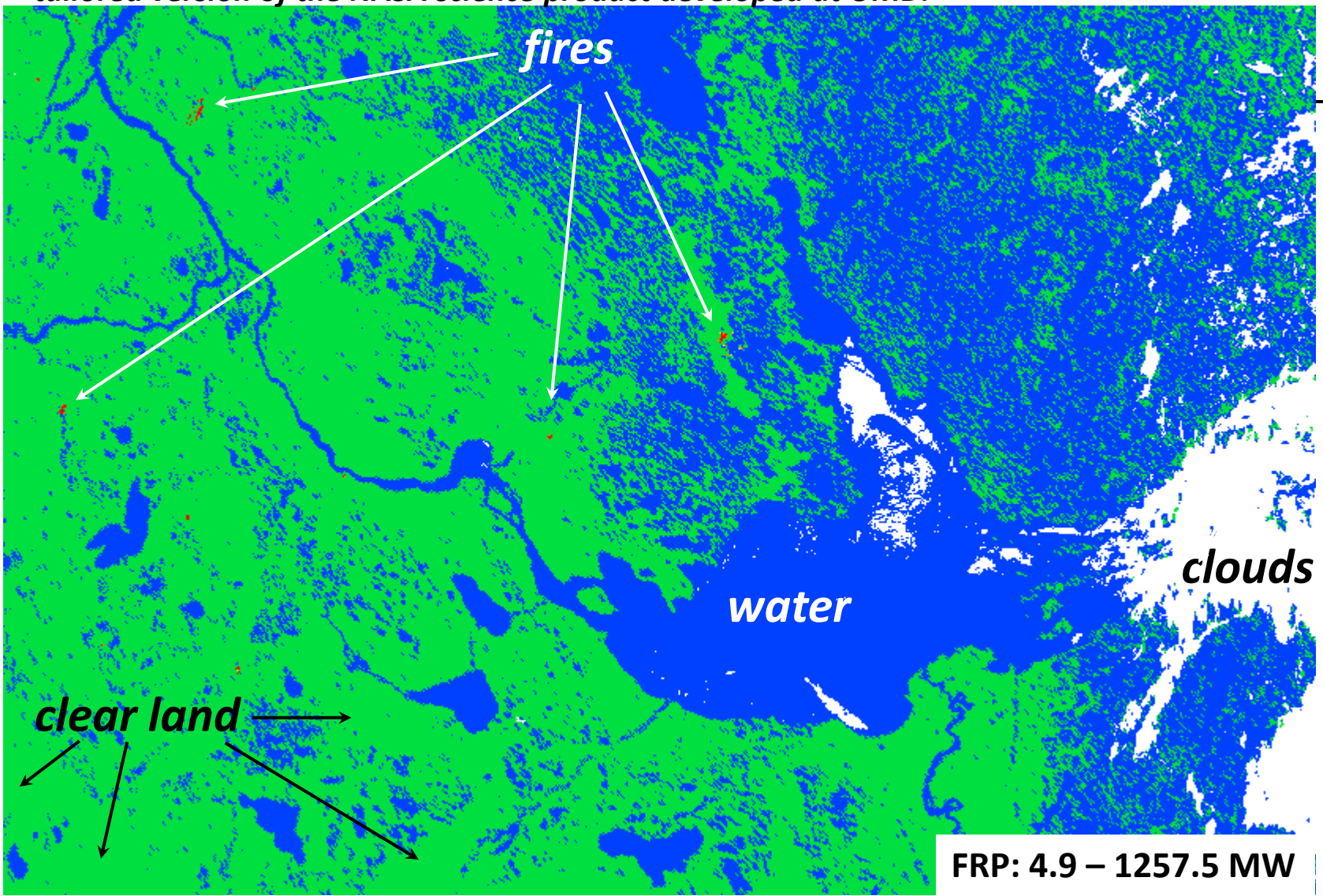
CSPP: Community Satellite Processing Package (UW-Madison)

Further fixes are needed to account for large data gaps – usually in DB – NASA DLR patch

Courtesy Isabel Cruz CONABIO, Mexico

NOAA NDE VIIRS Active Fire Product

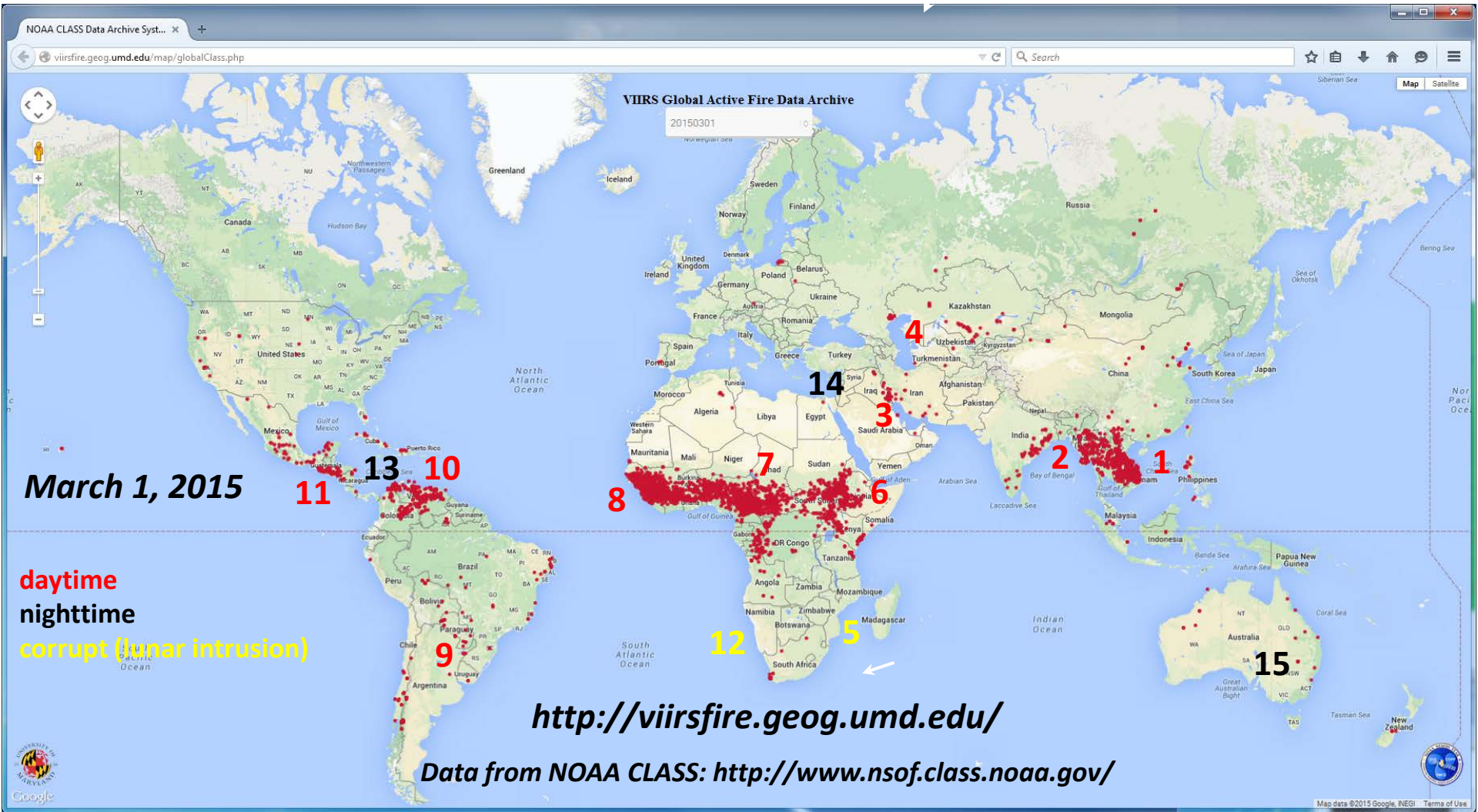
VIIRS fire mask generated at NOAA/NESDIS/STAR from IDPS input data. The NOAA Level-2 product is a tailored version of the NASA science product developed at UMD.



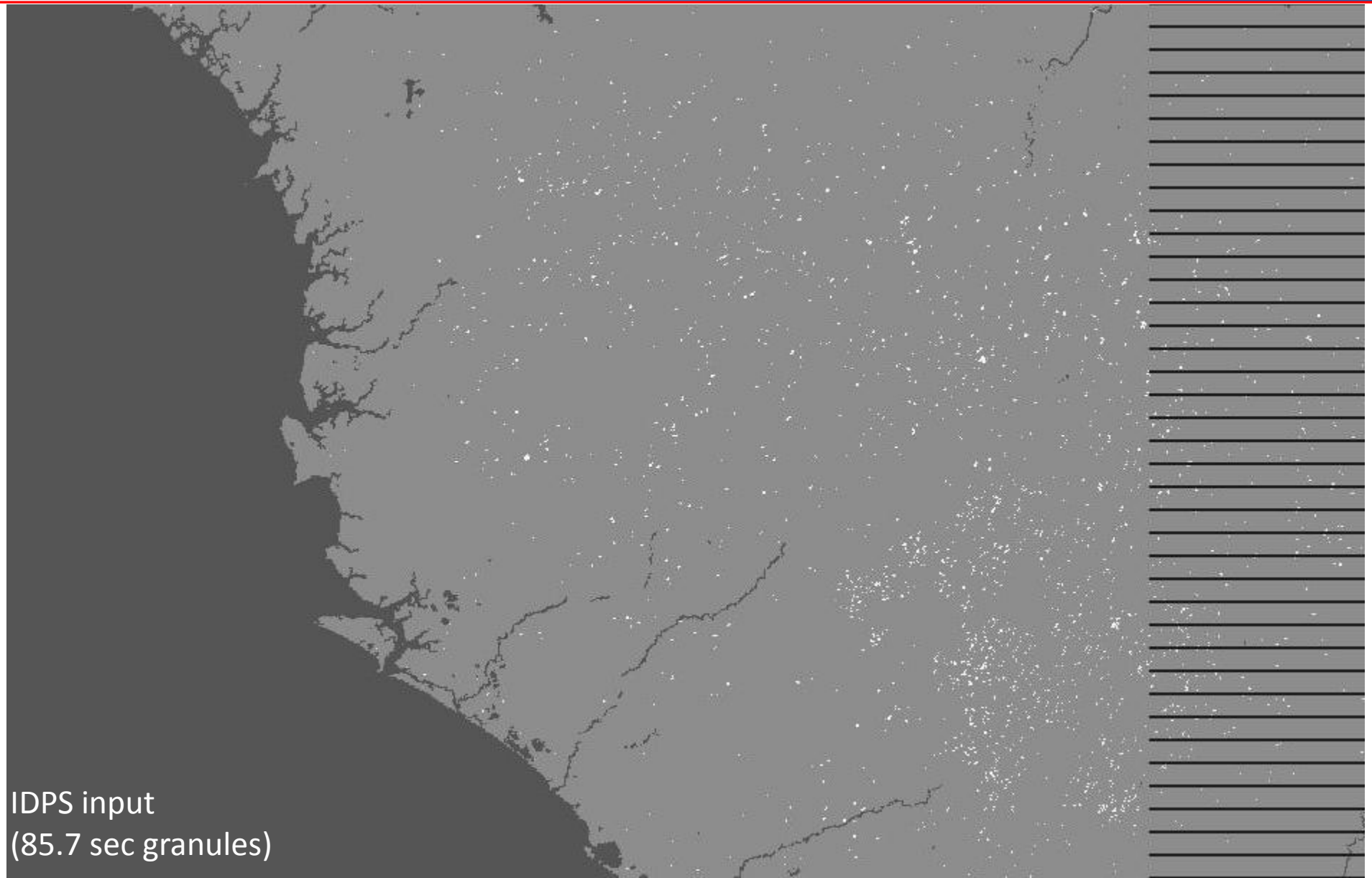
VIIRS fire mask over NW Canada 5/29/2015 20:06 UTC (daytime)

NOAA NDE VIIRS Active Fire Product testing

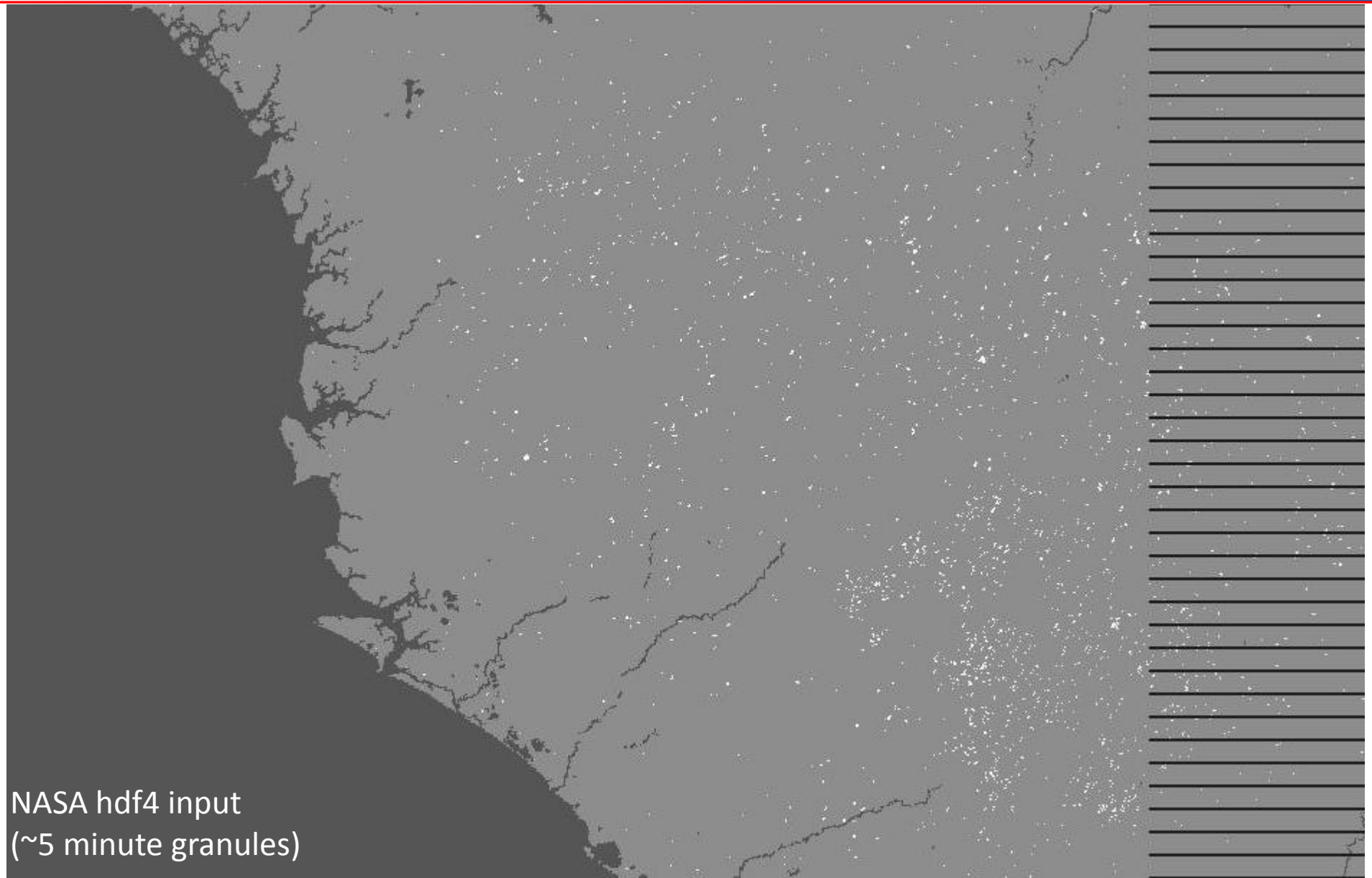
15 granules covering daytime (1-12), nighttime (13-15), land, water and corrupt (5,12) data were tested for overall performance and consistency between the NOAA and NASA output. The global map shown for reference is the current IDPS product.



NOAA STAR AIT output

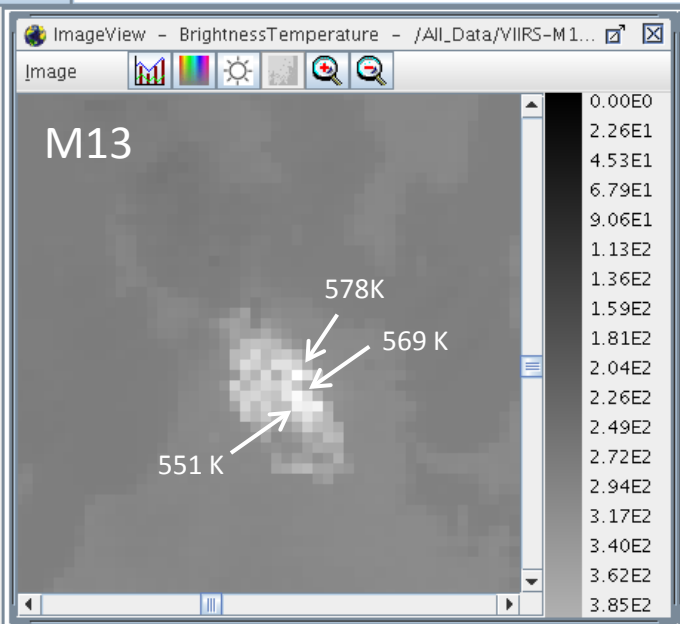


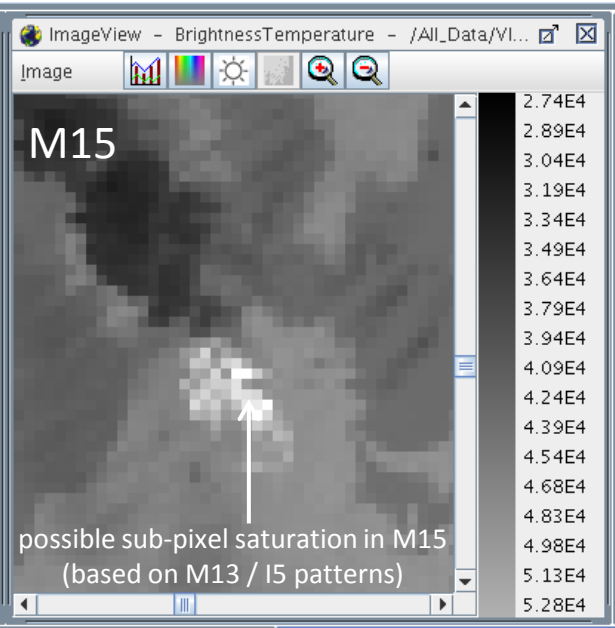
NASA Science Code output

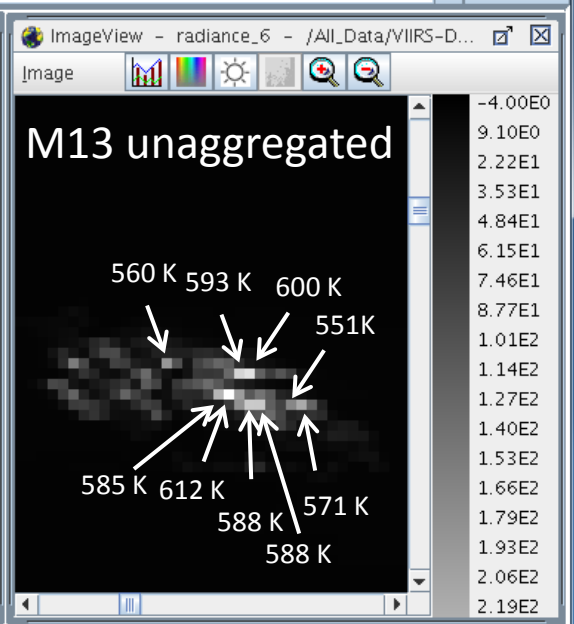


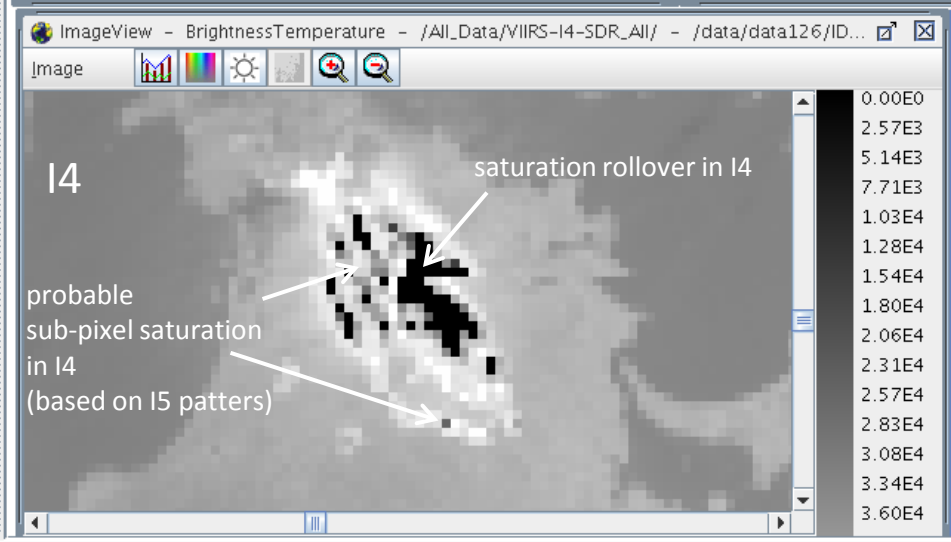
NASA hdf4 input
(~5 minute granules)

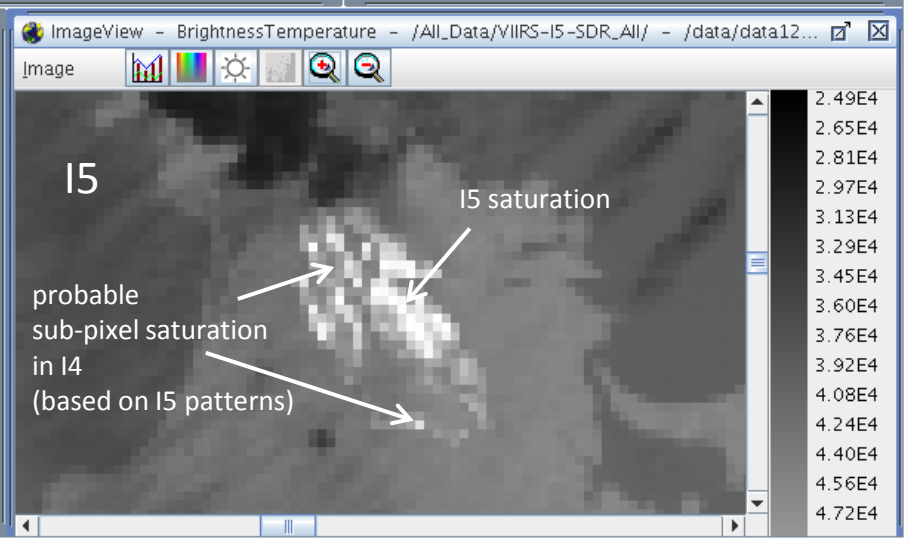
Example of SDR output for large / intense fires







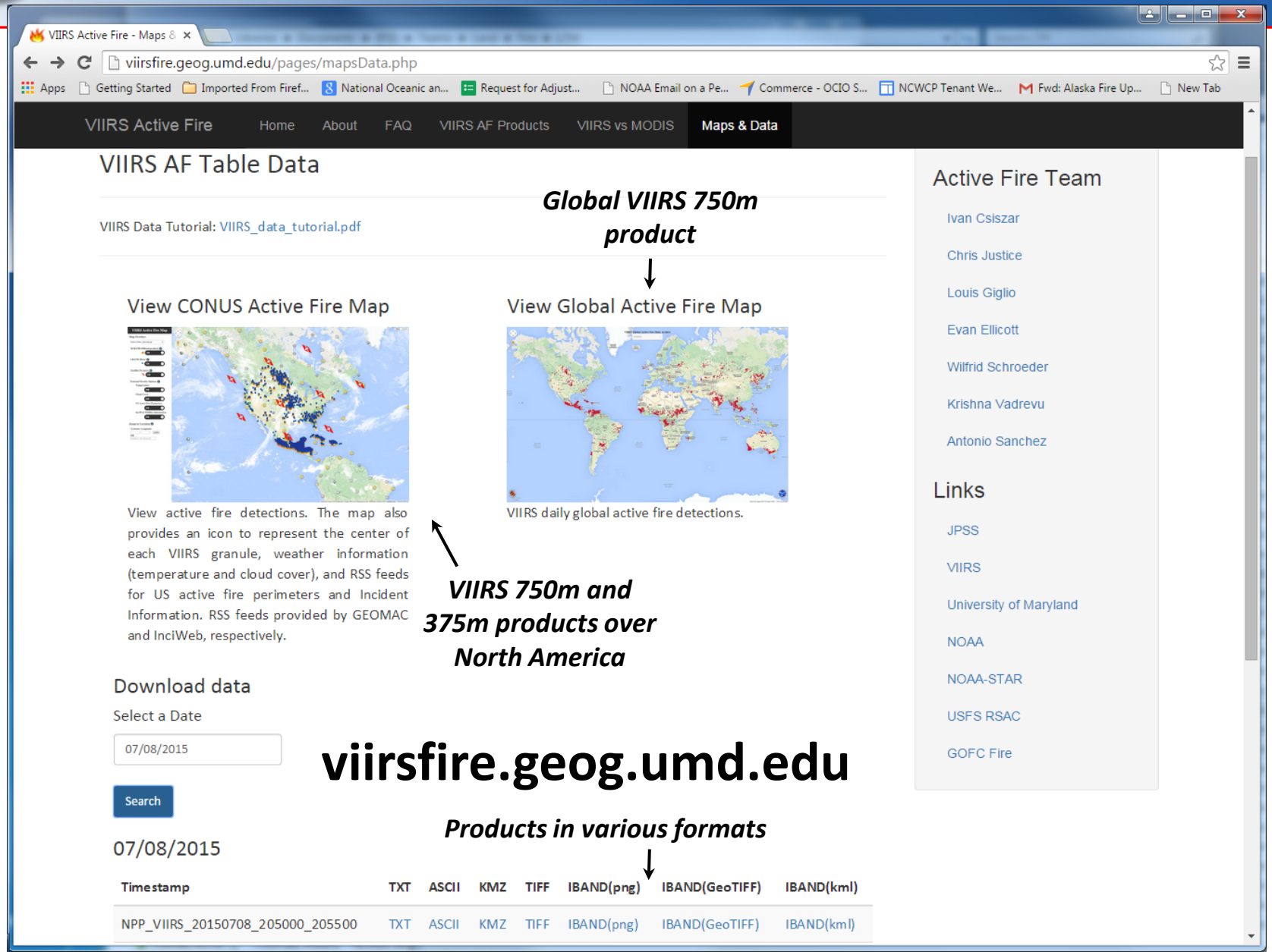




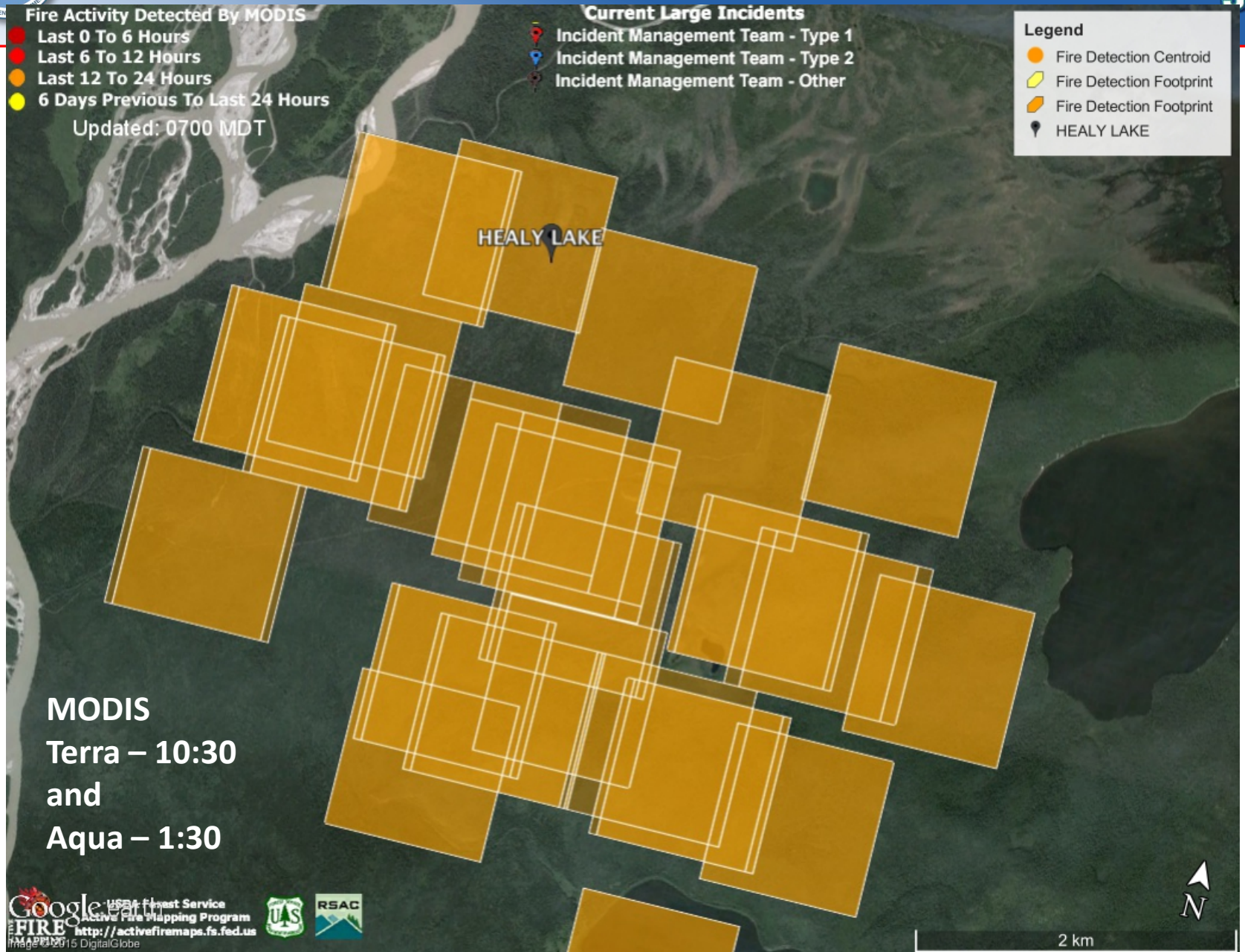
January 4 2013 4:22 UTC

greyscale images of scaled radiance or brightness temperature output for the purpose of displaying relative patterns of SDR output

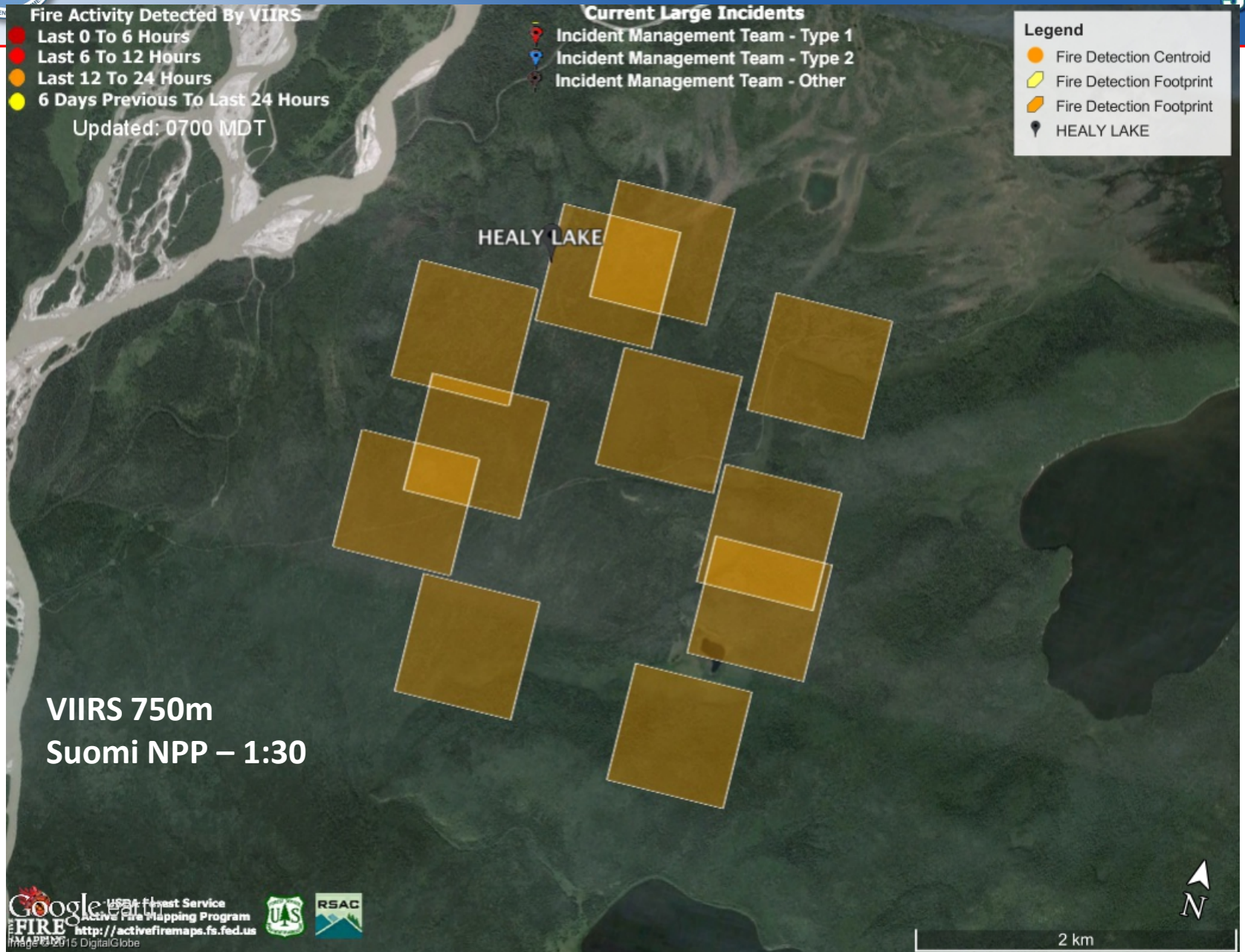
VIIRS Fire Data and Evaluation Portal



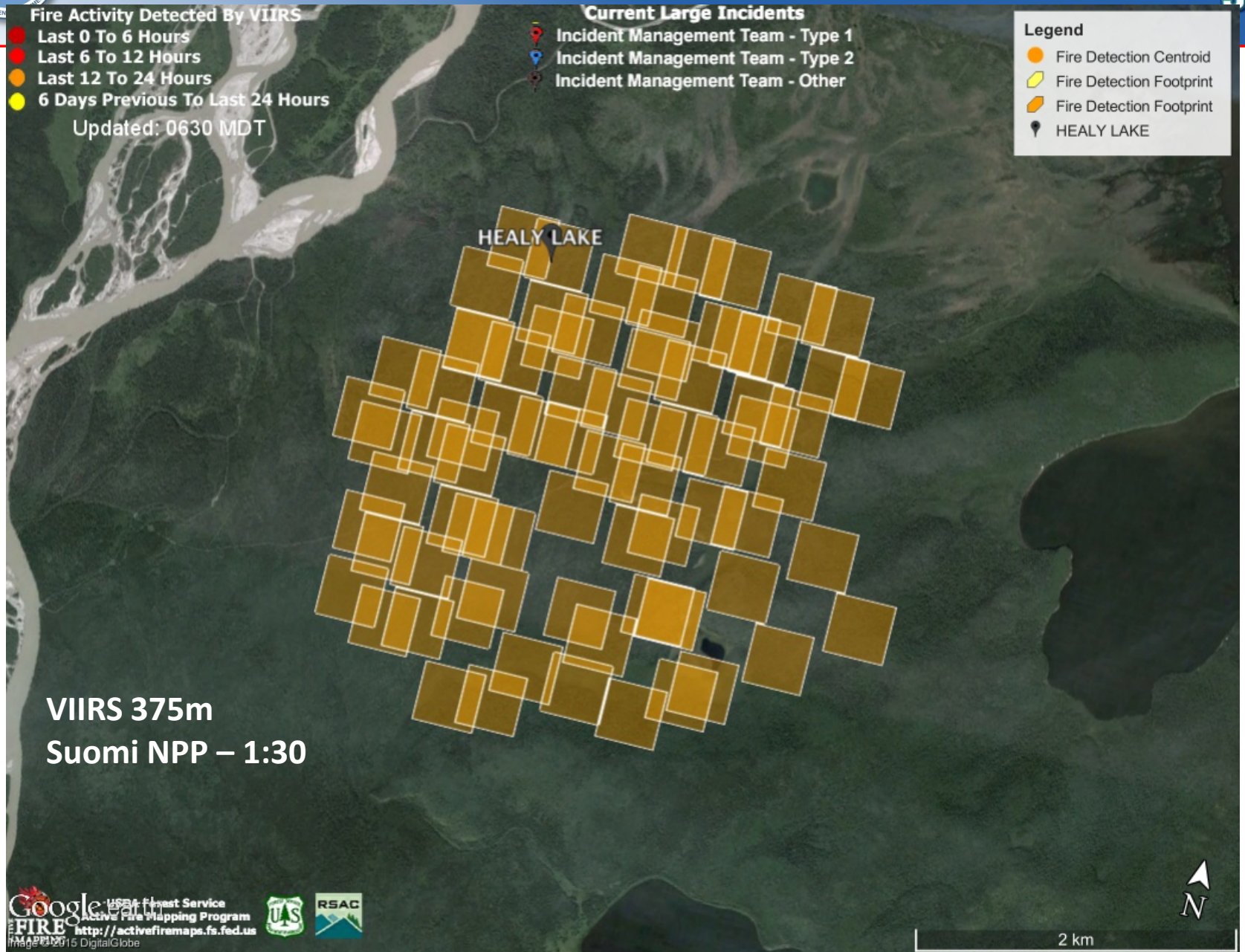
Healy Lake Fire (Alaska)



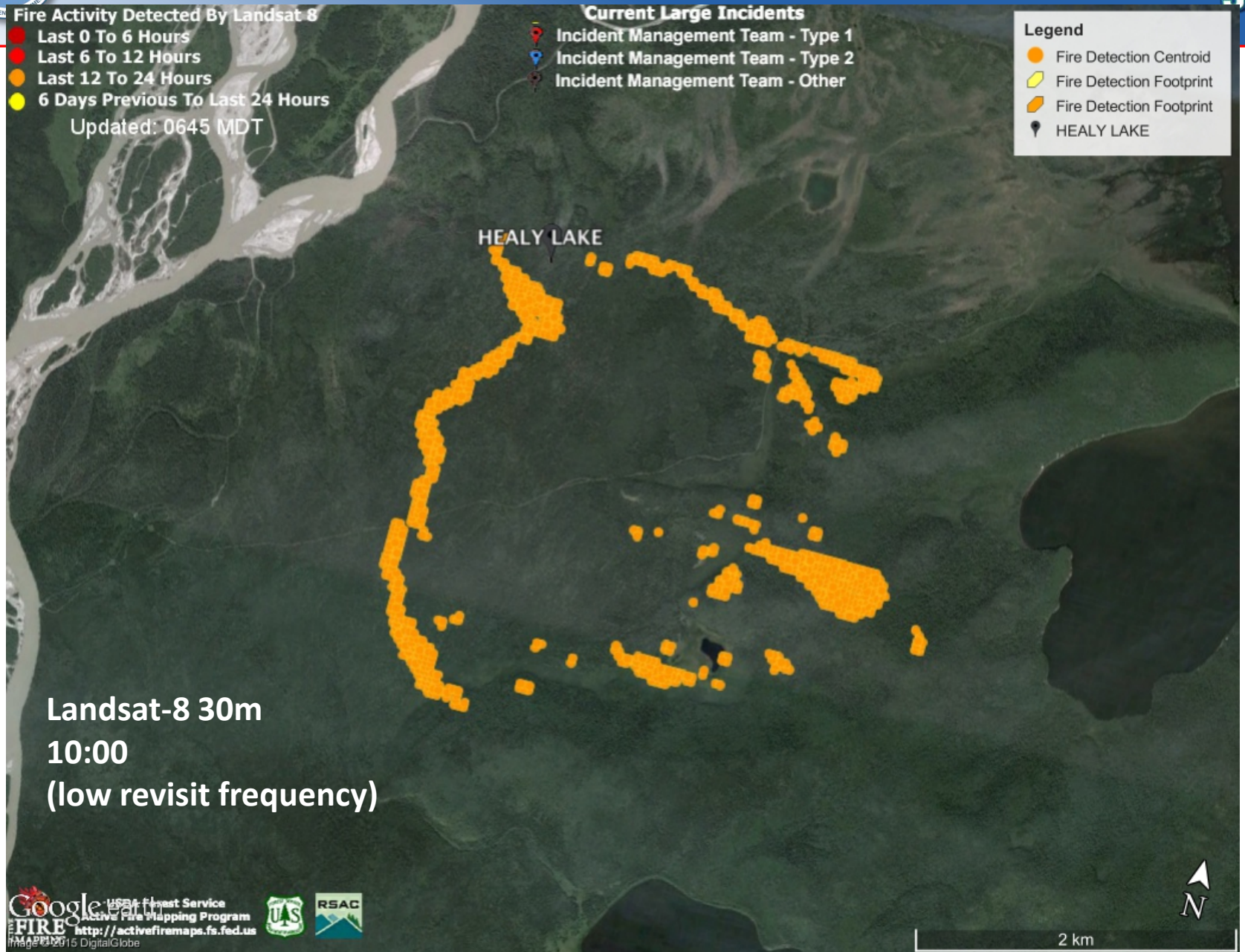
Healy Lake Fire (Alaska)



Healy Lake Fire (Alaska)



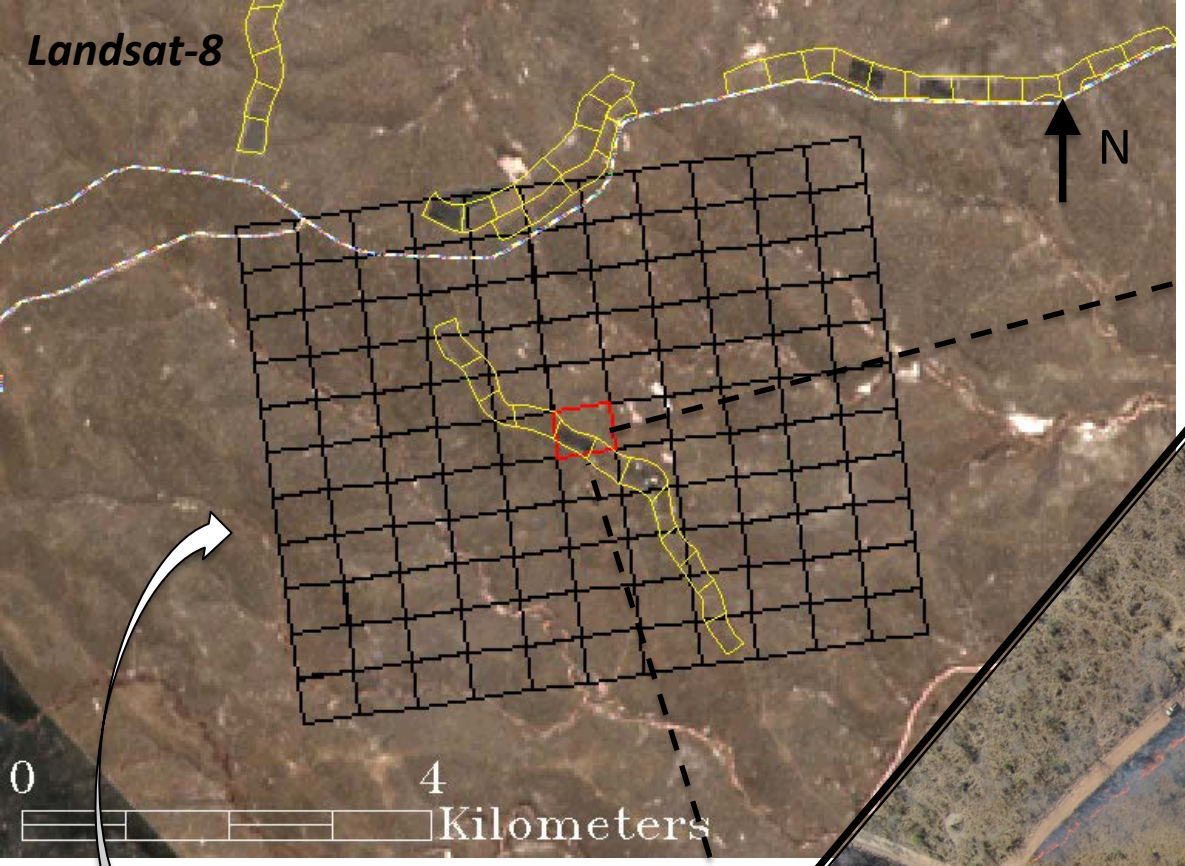
Healy Lake Fire (Alaska)



Active Fire Data Validation

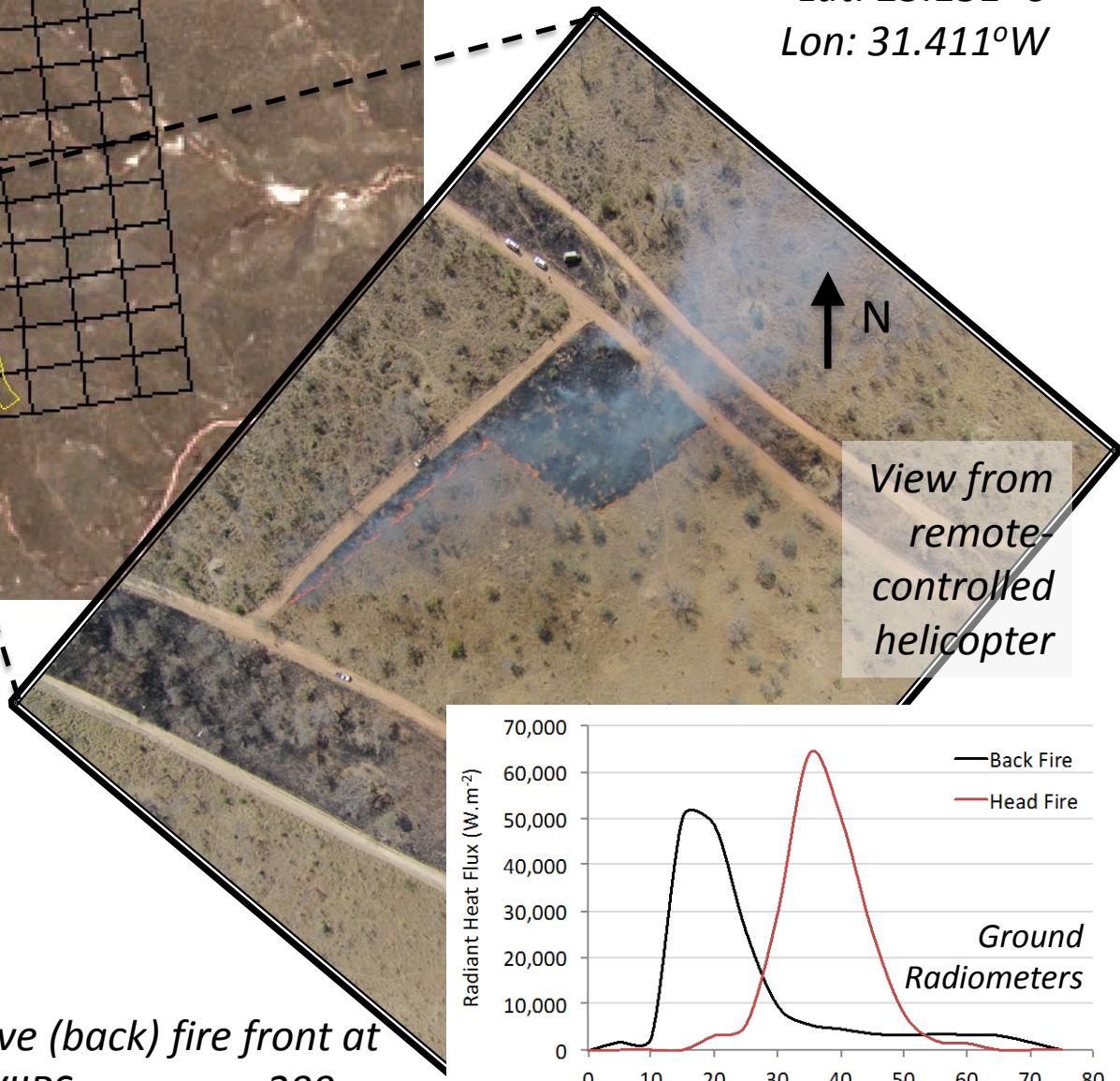
- *Use of Landsat-class data to validate VIIRS is **not an option** due to prohibitively large time separation between same-day acquisitions*
  - *We won't match the MODIS validation status for VIIRS (≤ stage 2)*
- *Use of **prescribed fires** (easy/accessible)*
- ***Coincident** ground, airborne, spaceborne data acquisitions*
- ***Community-organized** (reduce spending, maximize output)*





Kruger National Park
19 August 2014
Lat: 25.131° S
Lon: 31.411°W

Subset of VIIRS 375 m pixel grid (fire detection in red)



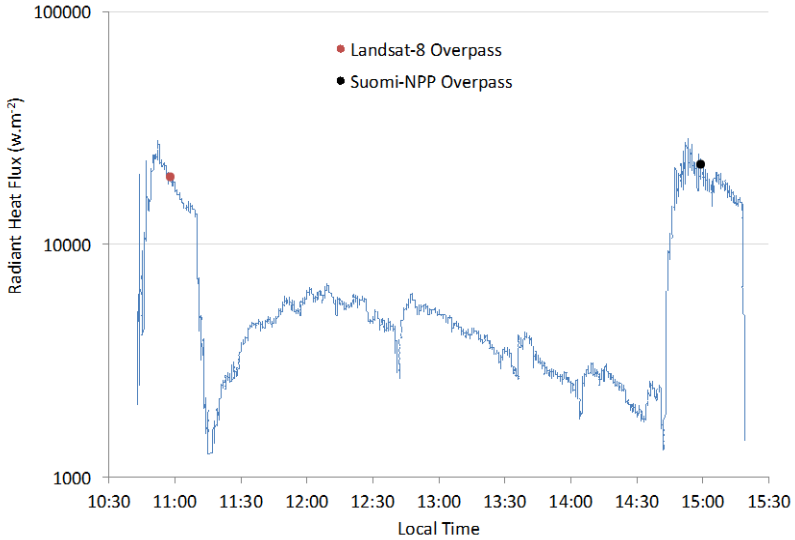
View from remote-controlled helicopter

Surface-leaving FRP (VIIRS): 4.4±0.2MW @ 13:24:26 h local time

Length of active (back) fire front at time of VIIRS overpass: 200 m

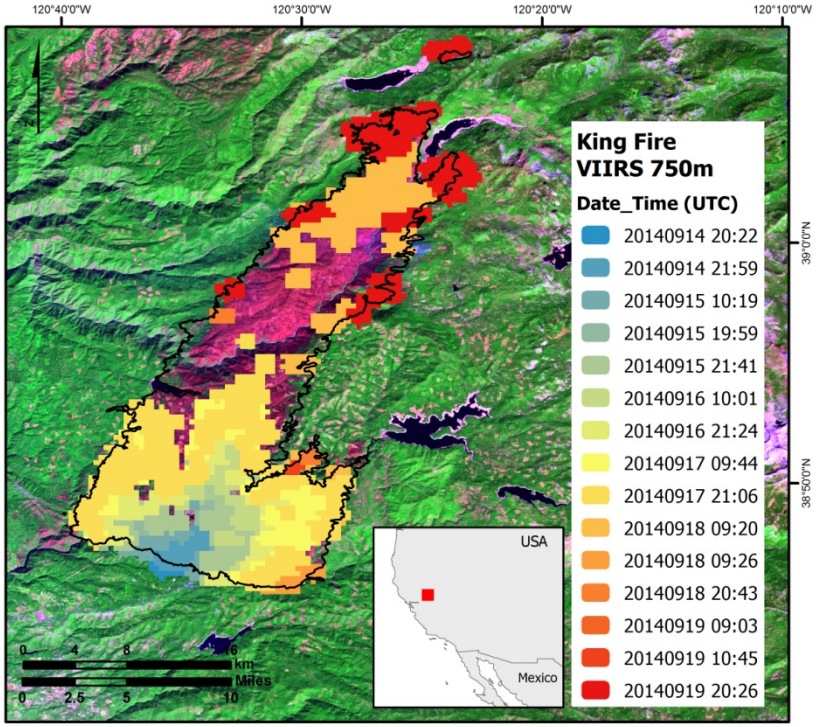
Active Fire Data Validation

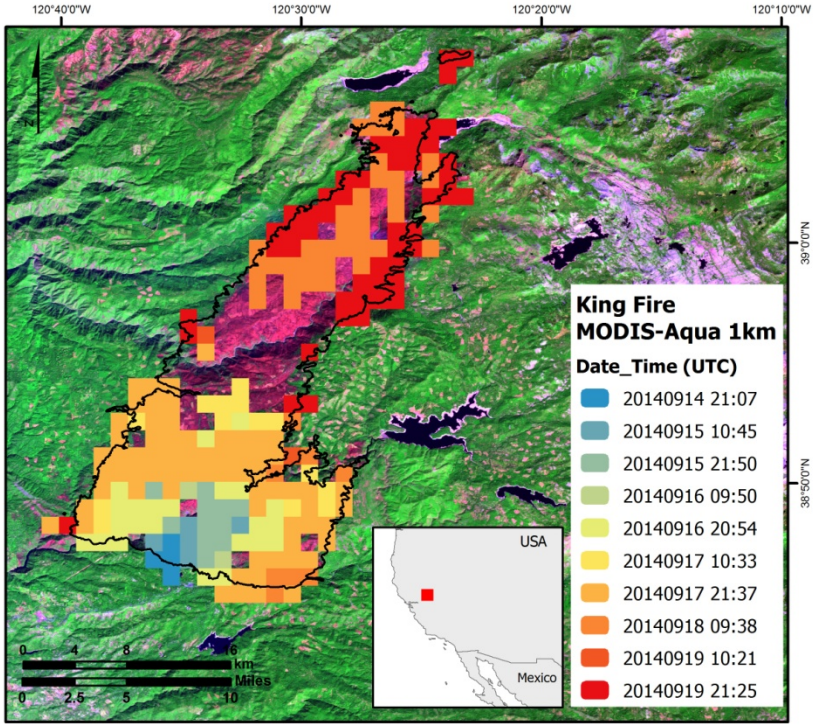




Small experimental fire implemented for the validation of same-day Landsat-8 and Suomi-NPP/VIIRS fire detection data in Brazil, Jan/2015. Tower-mounted radiometers provided 1Hz fire radiant flux data coincident with satellite overpasses.

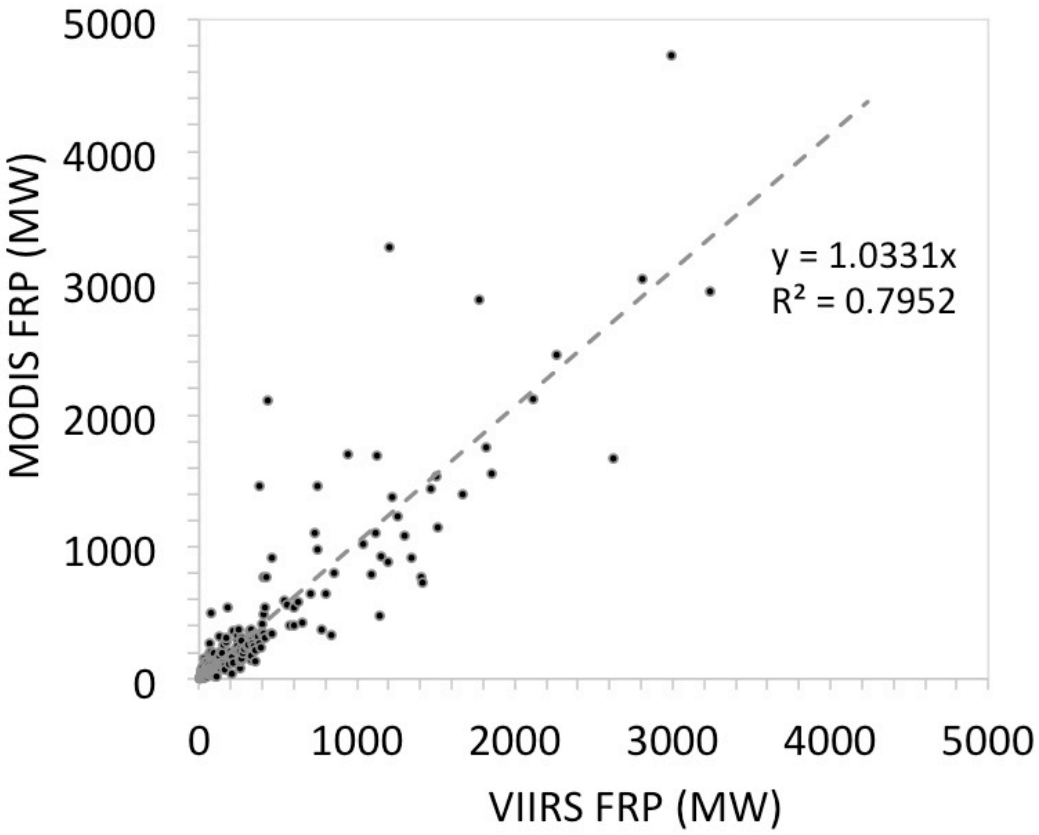
VIIRS vs. MODIS active fire





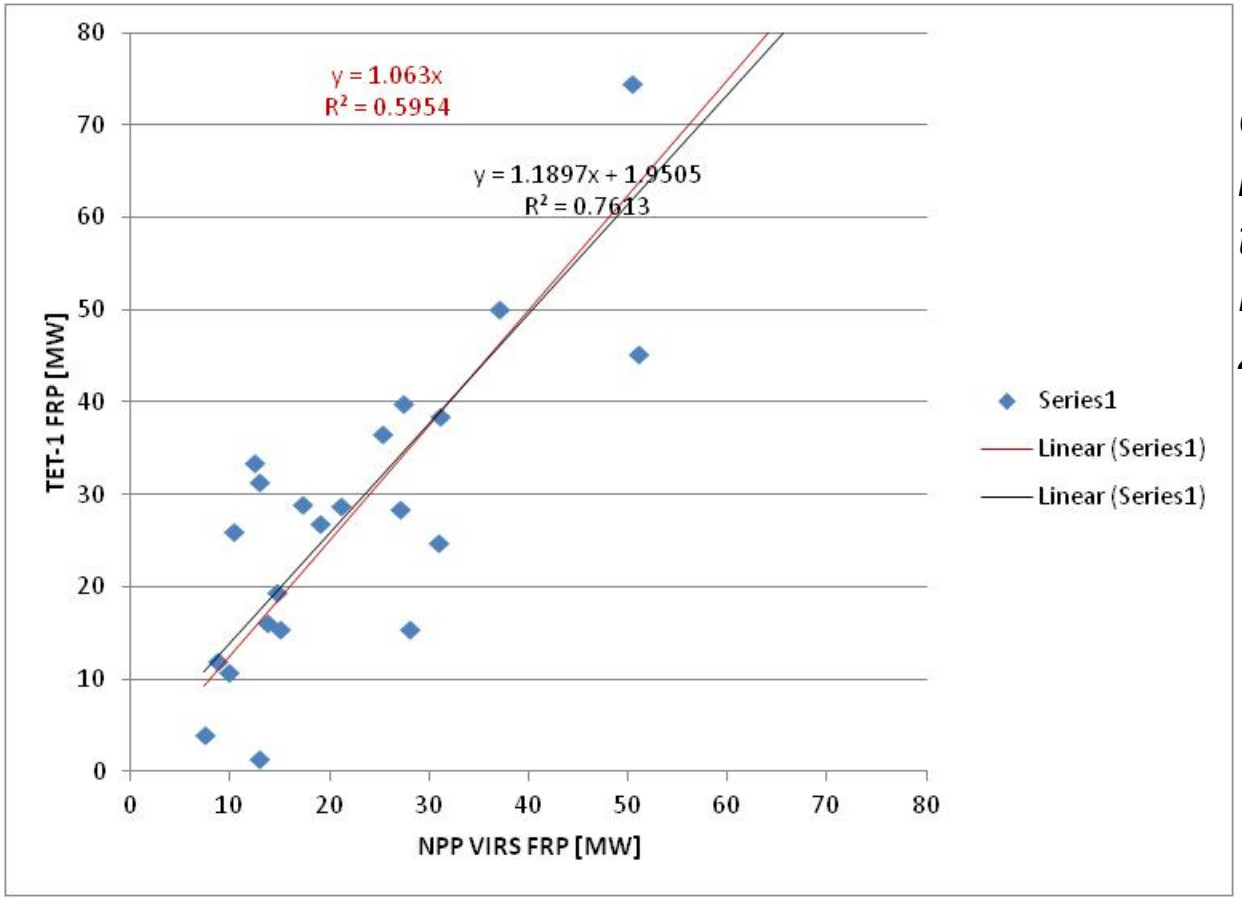
Suomi NPP/VIIRS AF and Aqua/MODIS MYD14 fire detection data produced for the King fire/California on 14-19 September 2014

FRP evaluation using MODIS



MODIS/VIIRS gridded data (0.5 degree) of near-coincident fires (<1km from each other) over different parts of the globe including atmospheric correction of both data sets.

FRP evaluation using DRL TET-1



Comparison of FRP retrievals of gas flares in the Middle East on May 9, 12, 15, 18, 24 2015

TET-1: Technology Experiment Carrier-1by German Aerospace Agency DRL; dedicated 185m unsaturated measurements for hotspot characterization

Summary

- 750m M-band product
  - the **IDPS Suomi NPP product** is stable
  - **new NDE product** that meets the **JPSS 1 requirements** is transitioning to NOAA operations
    - consistent NRT algorithm with NASA science product within Land SIPS
  - **long-term monitoring system** is set up at STAR
- 375m I-band product
  - **next generation** product towards operations
  - already in **systematic use** to support fire management and modeling
- Need thorough assessment of potential for **NOAA Enterprise and non-NOAA data processing**
- Continuing efforts towards rigorous **validation**
- Preparation for **JPSS-1** (and beyond) is ongoing
  - Calibration / validation plan
  - Sensor evaluation
  - Pre-launch algorithm testing
- Extensive **user outreach** and support
  - NOAA JPSS Proving Ground and Risk Reduction - Fire and Smoke Initiative
    - NOAA HRRR, HMS, NWS, IMETs, Alaska DB etc.
  - NASA Applied Sciences – Wildfires
    - USDA Forest Service RSAC, NCAR modeling, State of Colorado etc.