

# JPSS and GOES-R programs and Active Fire Products at NOAA

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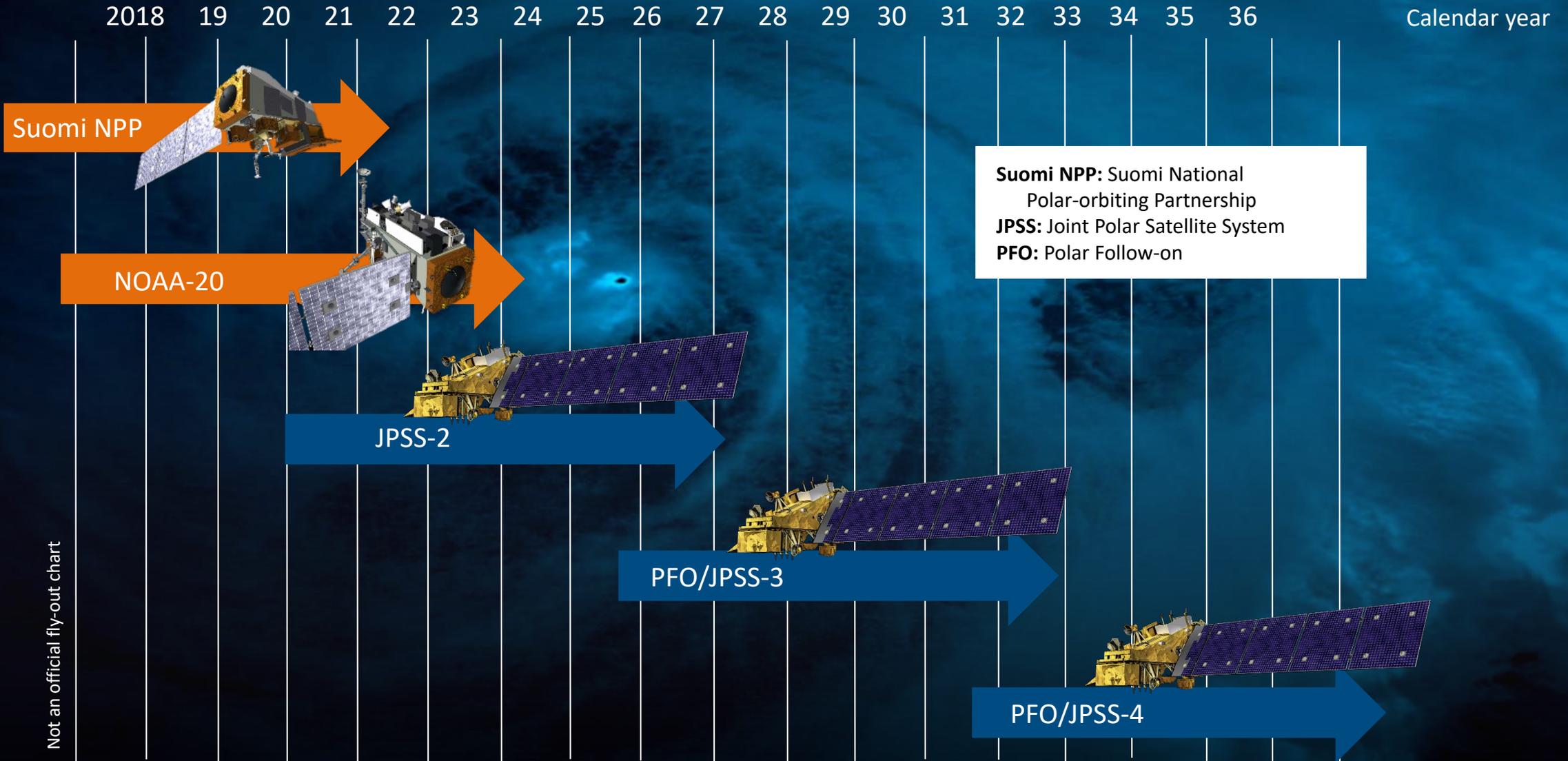
*I.M. Systems Group, Inc.*

*with material also from the JPSS and GOES-R program offices*





# JPSS Continuity of Operations





# NOAA-20 is Now Operational!



Launched into Low Earth Orbit—  
512 miles

**14x**

Orbits Earth 14 times  
pole-to-pole with Suomi NPP

**2x**

Images entire globe  
twice a day



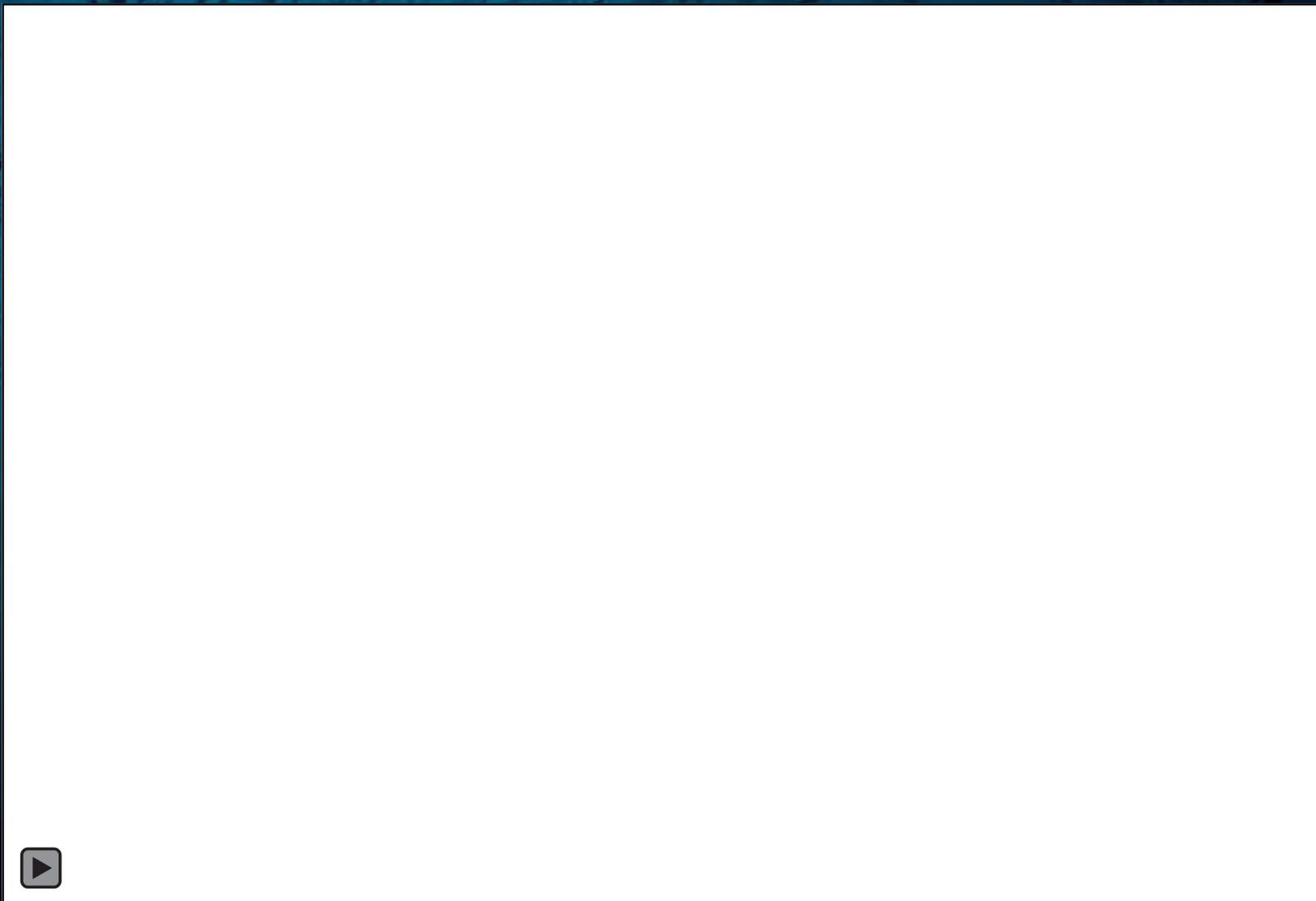
State of the art instrumentation to  
collect data on Earth's atmosphere,  
land surface, and oceans



Sends more than 2,000  
gigabytes of data to Earth  
every day

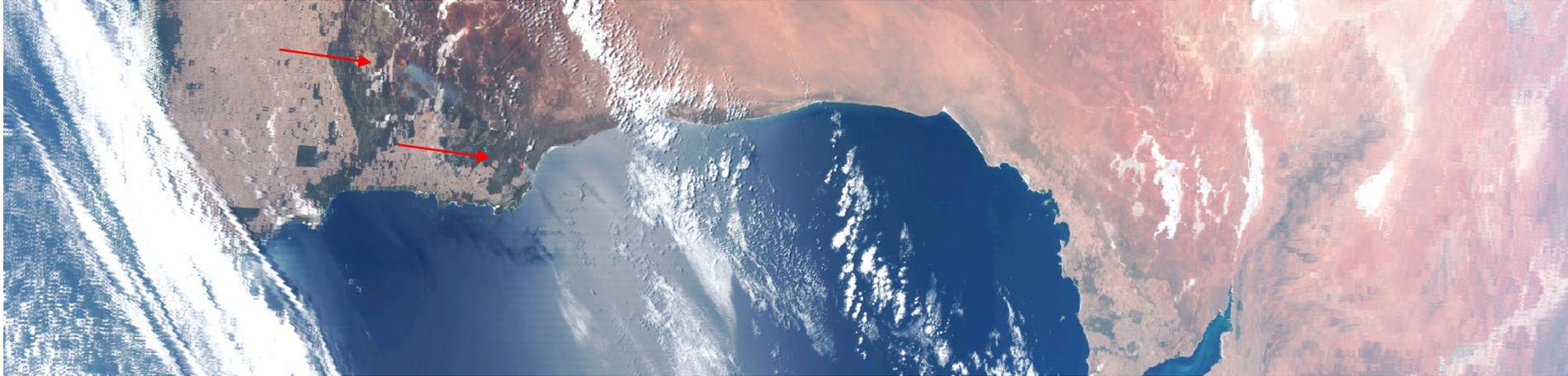


Flies in the same orbit as Suomi  
NPP, 50 minutes apart



**Suomi NPP 5:11 UTC**

***“First light” NOAA-20 fire image by the NOAA Science Team***

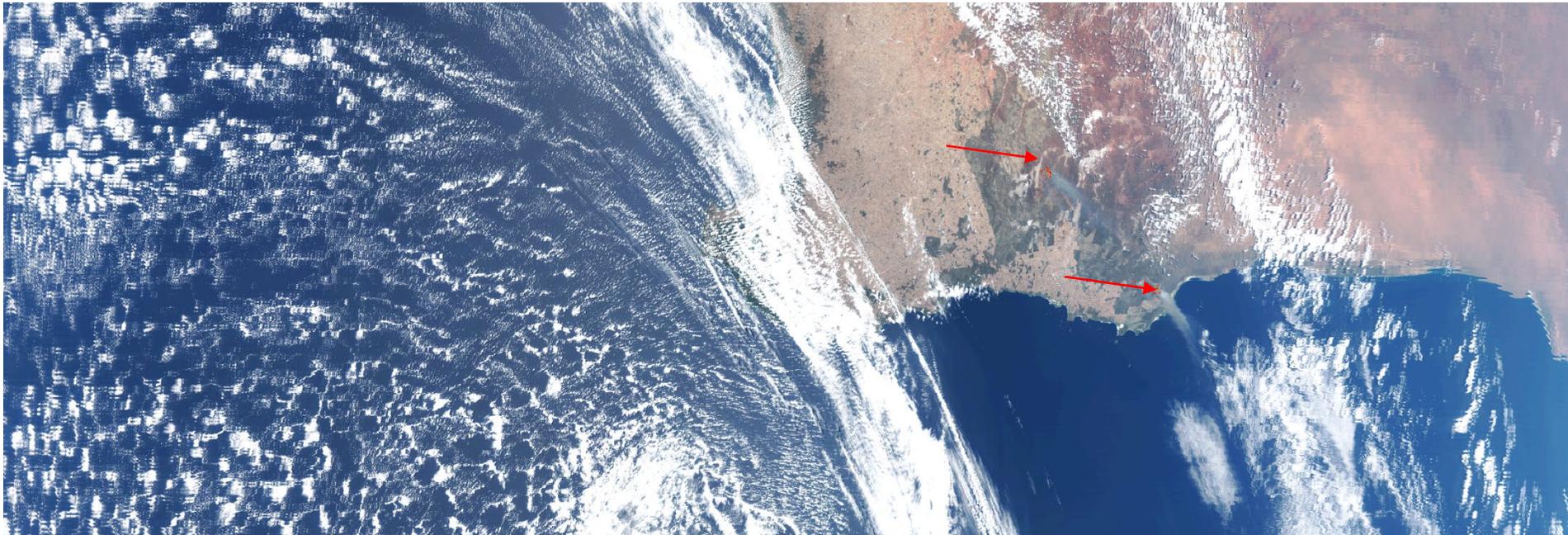


**VIIRS 750m  
Active fires on  
January 5, 2018**

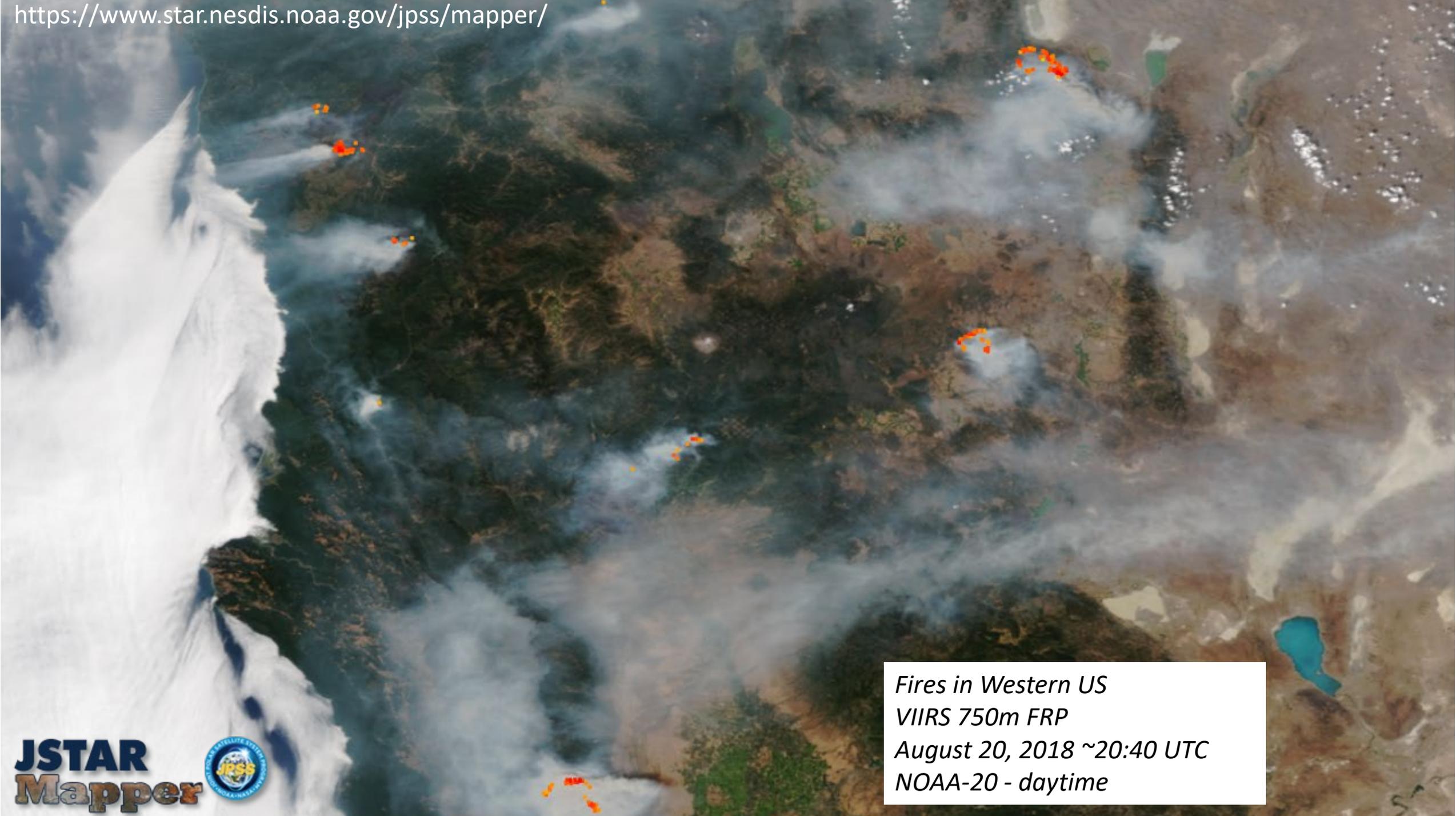
***Current production status***

Algorithm	Suomi NPP	NOAA-20
750m M-band	NDE Operational since March 15, 2016	NDE Operational since August 13, 2018
375m/750m I/M-band	STAR Systematic production since January 30, 2018	STAR Systematic production since February 5, 2018

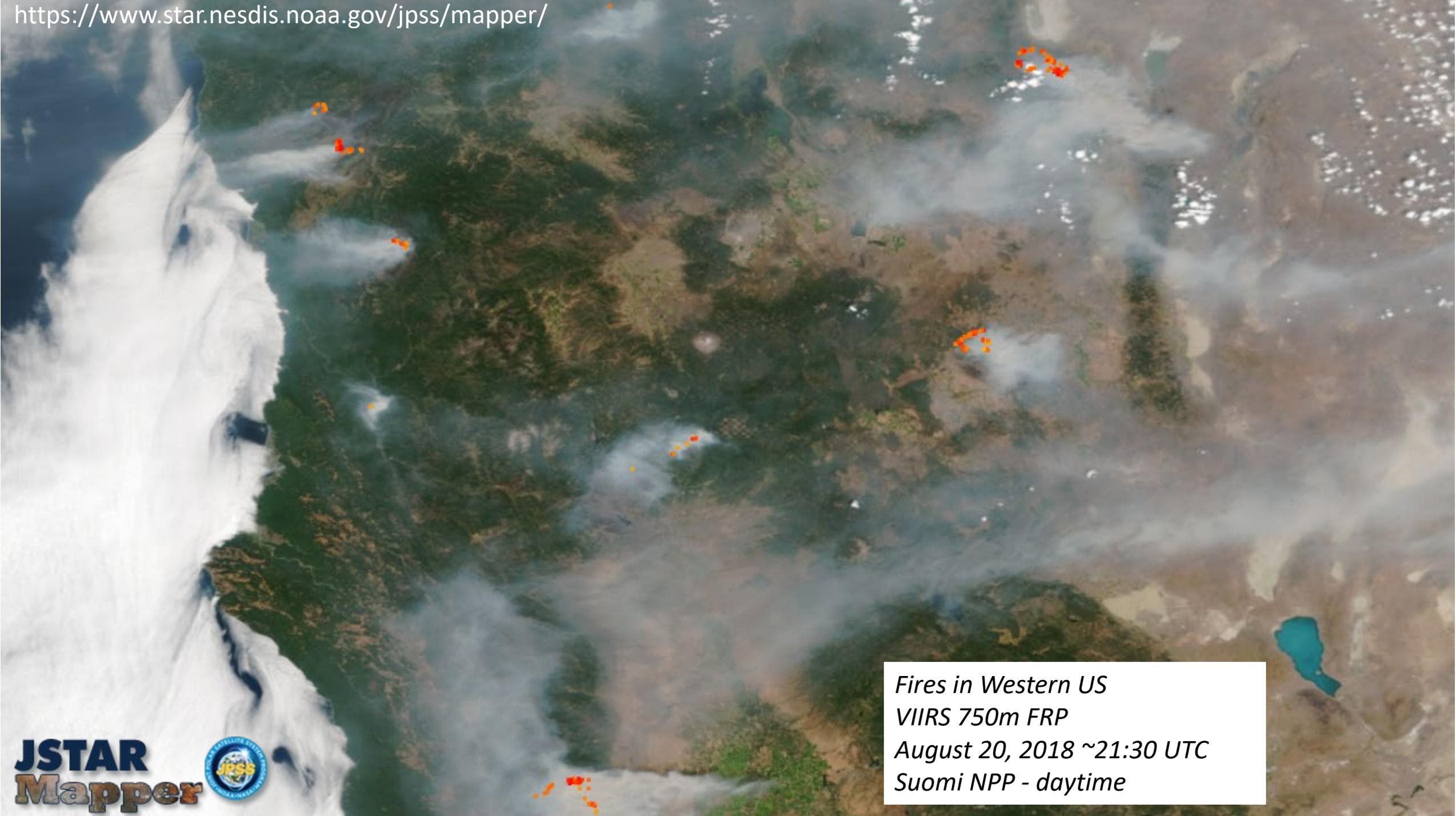
**NOAA-20 6:01 UTC**



***Algorithms are NOAA implementations of those also generated by NASA***

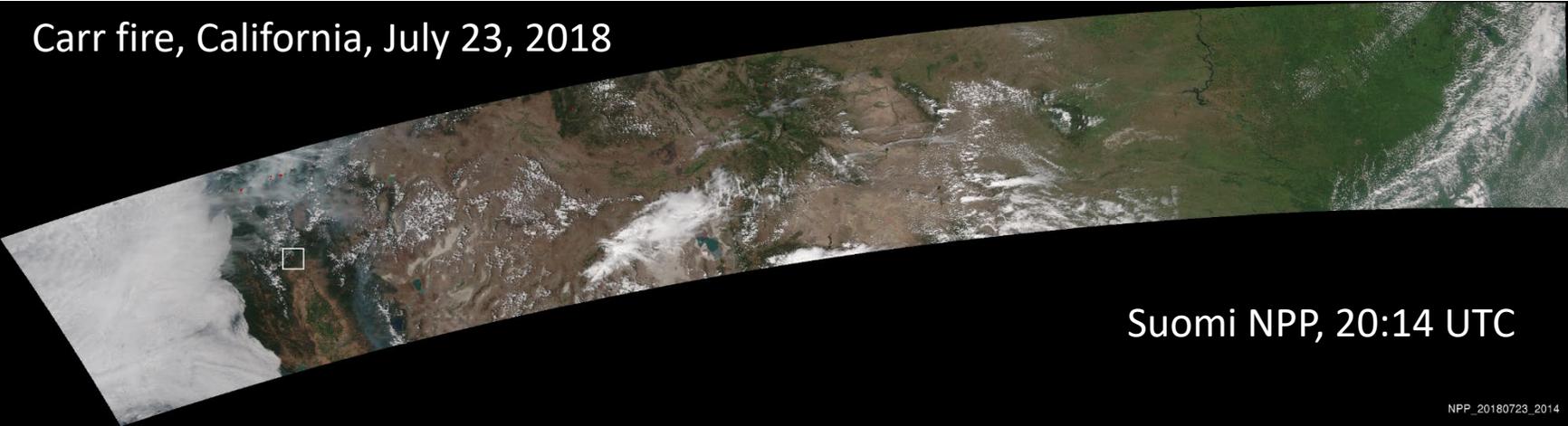


*Fires in Western US  
VIIRS 750m FRP  
August 20, 2018 ~20:40 UTC  
NOAA-20 - daytime*



*Fires in Western US  
VIIRS 750m FRP  
August 20, 2018 ~21:30 UTC  
Suomi NPP - daytime*

Carr fire, California, July 23, 2018

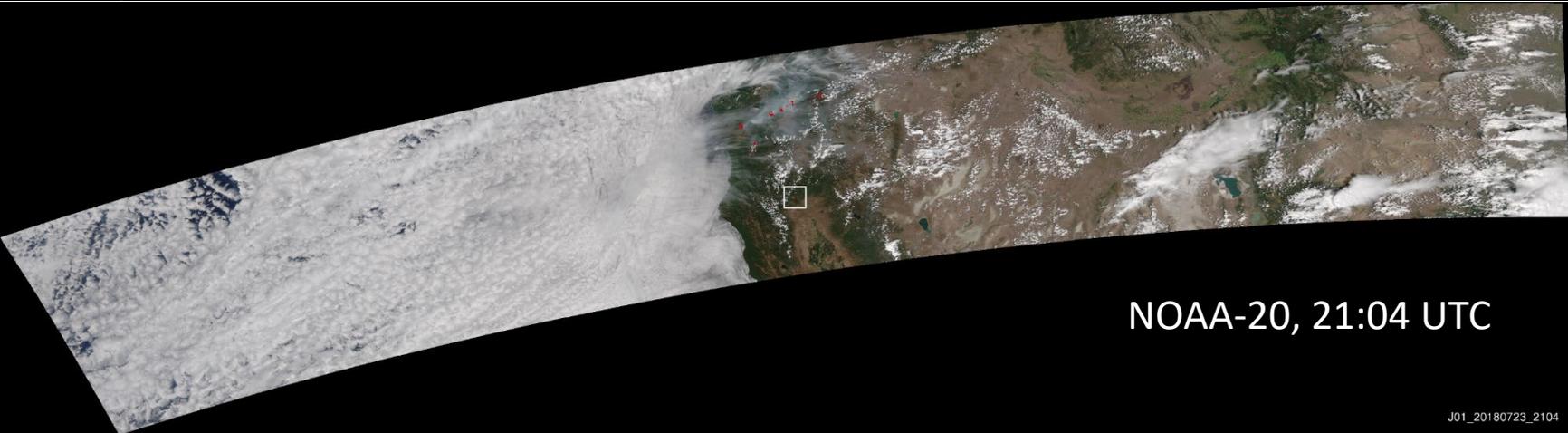


Suomi NPP, 20:14 UTC

NPP\_20180723\_2014



NPP\_20180723\_2014

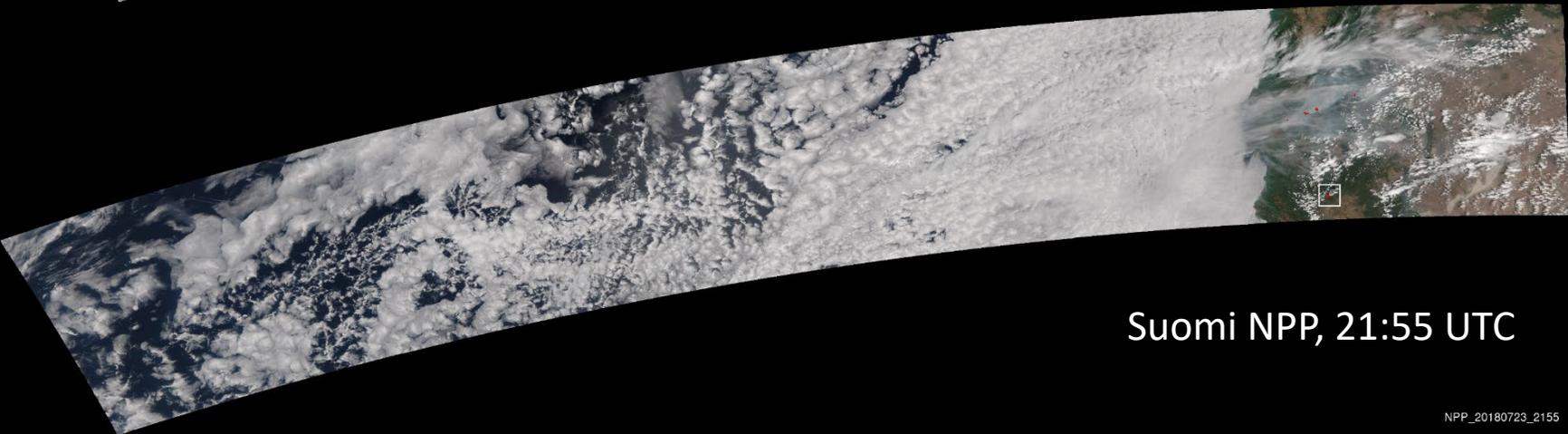


NOAA-20, 21:04 UTC

J01\_20180723\_2104



J01\_20180723\_2104



Suomi NPP, 21:55 UTC

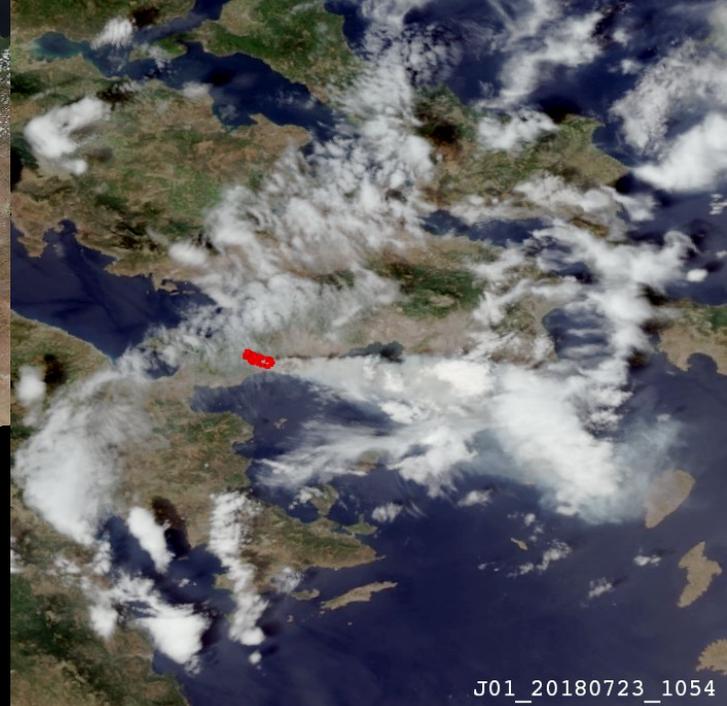
NPP\_20180723\_2155



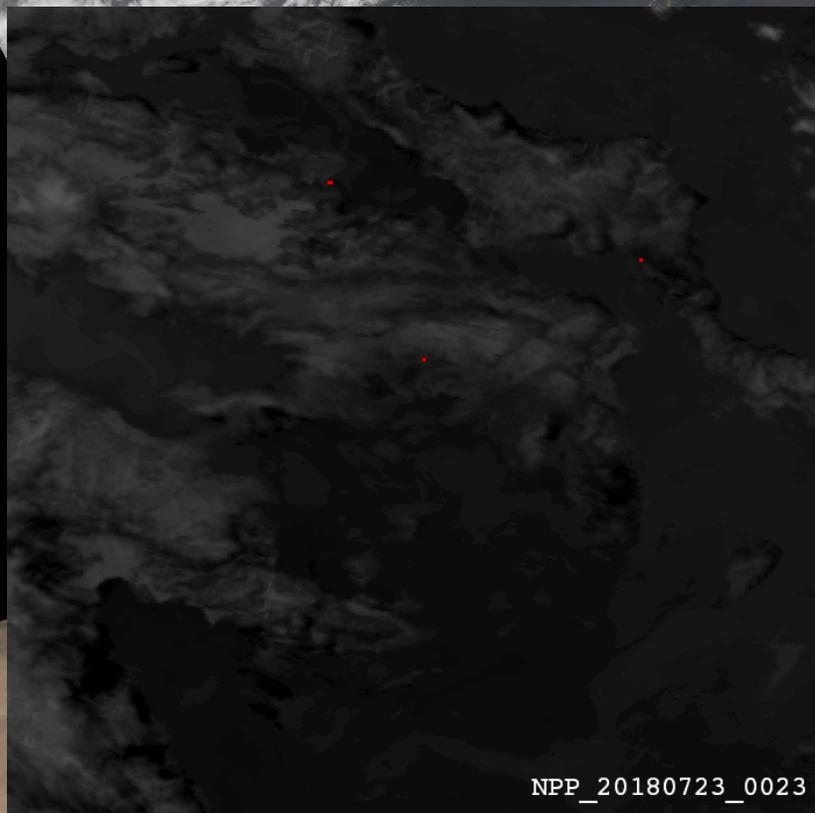
NPP\_20180723\_2155



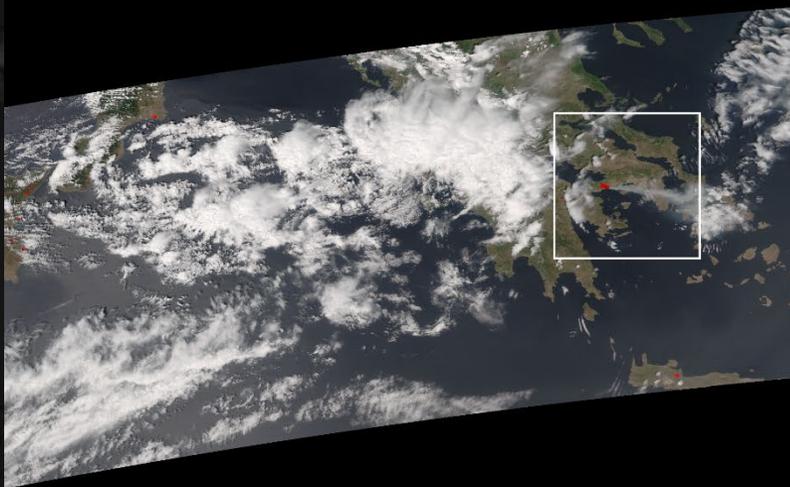
NOAA-20, 10:54 UTC



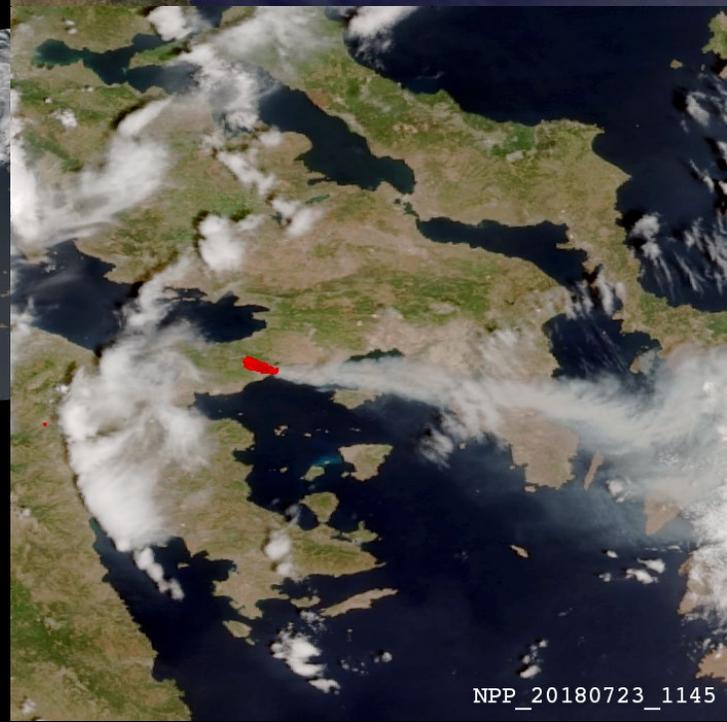
J01\_20180723\_1054



NPP\_20180723\_0023



Suomi NPP, 11:45 UTC



NPP\_20180723\_1145

July 23, 2018

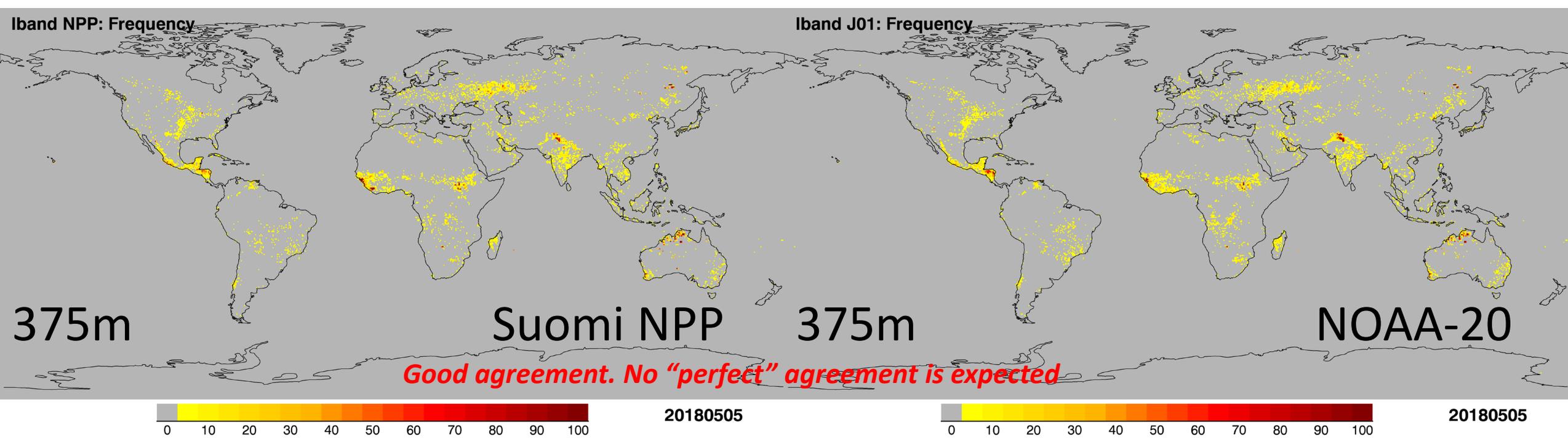
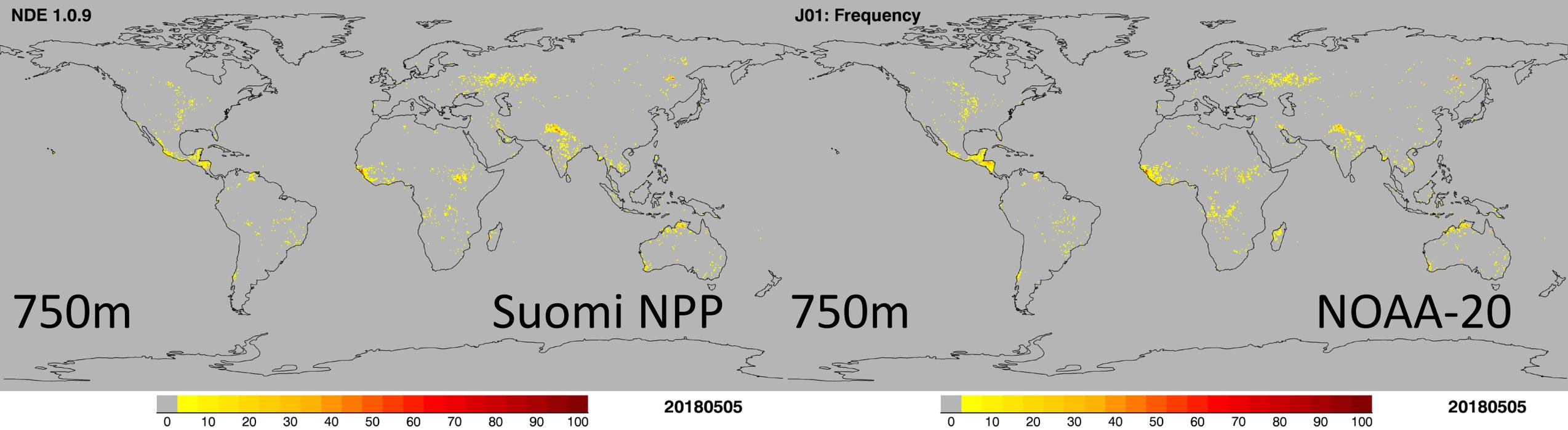
**VIIRS 375m product generated at STAR**

# 750m VIIRS NDE Product content

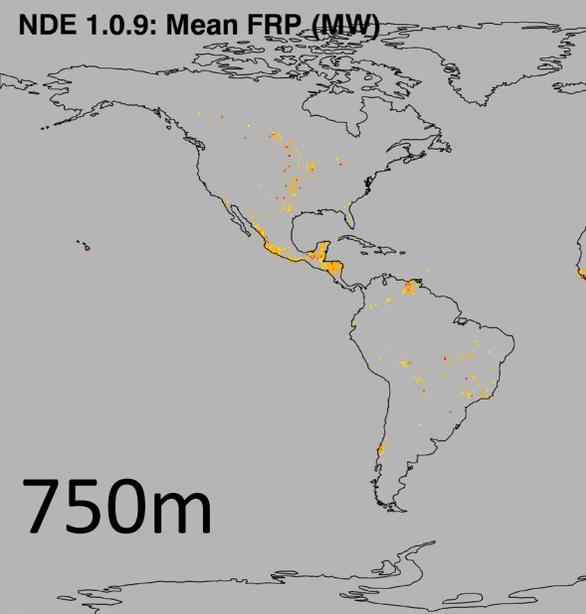
Output	Type	Description	
Fire Mask	8-bit unsigned integer 	Missing – 0	Missing input data
		Scan – 1	On-board bowtie deletion
		Other – 2	Not processed (obsolete)
		Water – 3	Pixel classified as non-fire water
		Cloud – 4	Pixel classified as cloudy
		No Fire – 5	Pixel classified as non-fire land
		Unknown – 6	Pixel with no valid background pixels
		Fire Low – 7	Fire pixel with confidence strictly less than 20% fire
		Fire Medium – 8	Fire pixel with confidence between 20% and 80%
		Fire High – 9	Fire pixel with confidence greater than or equal to 80%
Fire Algorithm QA Mask	32-bit unsigned integer	Details in Table 1-5	

Bits	Description
0-1	Surface Type (water=0, coastal=1, land=2)
2	EDR ground bowtie deletion zone (0=false, 1=true) 
3	Atmospheric correction performed (0=false, 1=true)
4	Day/Night (daytime = 1, nighttime = 0)
5	Potential fire (0=false, 1=true)
6	spare
7-10	Background window size parameter
11	Fire Test 1 valid (0 - No, 1 - Yes)
12	Fire Test 2 valid (0 - No, 1 - Yes)
13	Fire Test 3 valid (0 - No, 1 - Yes)
14	Fire Test 4 valid (0 - No, 1 - Yes)
15	Fire Test 5 valid (0 - No, 1 - Yes)
16	Fire Test 6 valid (0 - No, 1 - Yes)
17-19	spare
20	Adjacent clouds (0/1)
21	Adjacent water (0/1)
22-23	Sun Glint Level (0-3)
24	Sun Glint rejection
25	False Alarm (excessive rejection of legitimate background pixels)
26	False Alarm (rejection of land pixel due to water background)
27	Amazon forest-clearing rejection test
28	False alarm (rejection of water pixel due to land or coastal background)
29-31	spare

***New information has been added on bow tie deletion.***

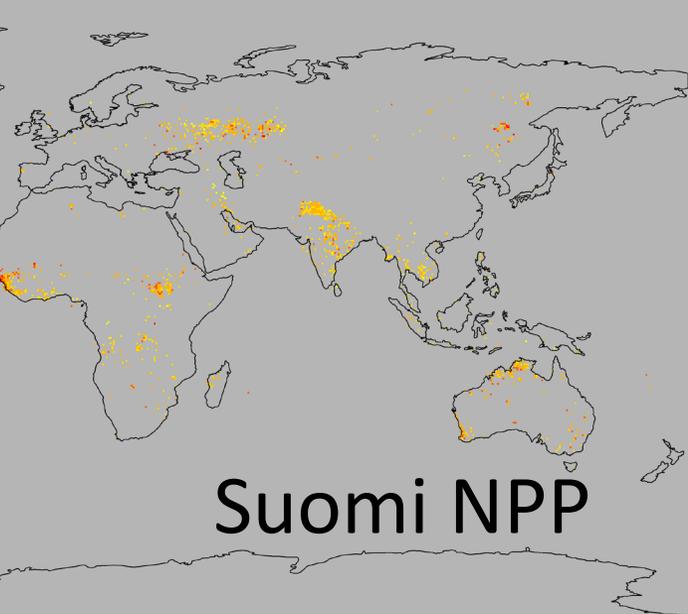


NDE 1.0.9: Mean FRP (MW)



750m

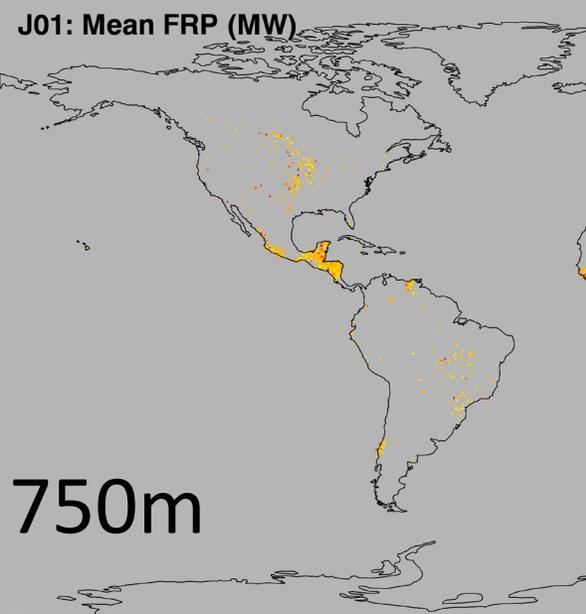
J01: Mean FRP (MW)



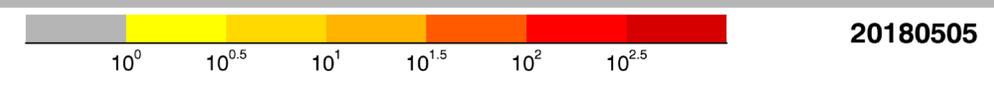
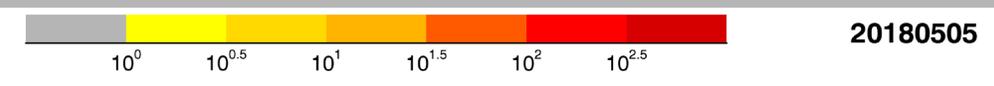
Suomi NPP

750m

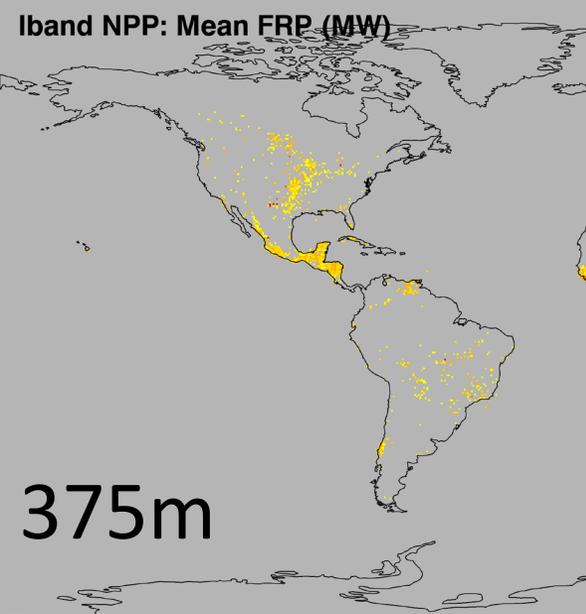
J01: Mean FRP (MW)



NOAA-20

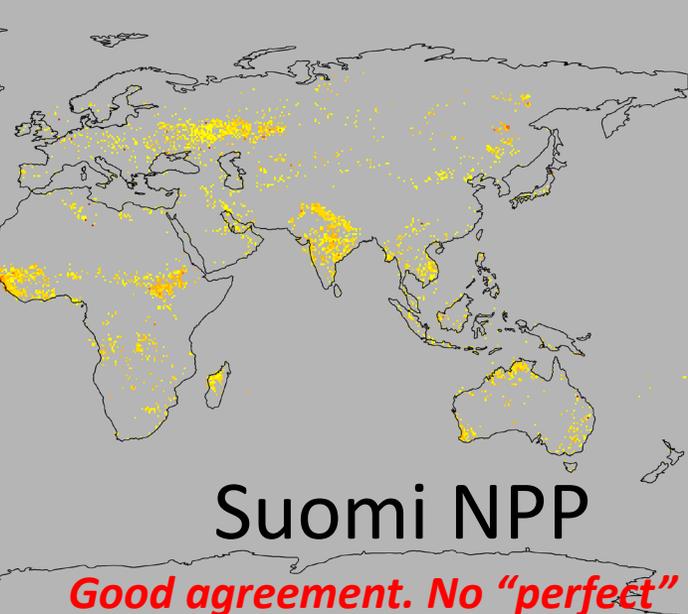


Iband NPP: Mean FRP (MW)



375m

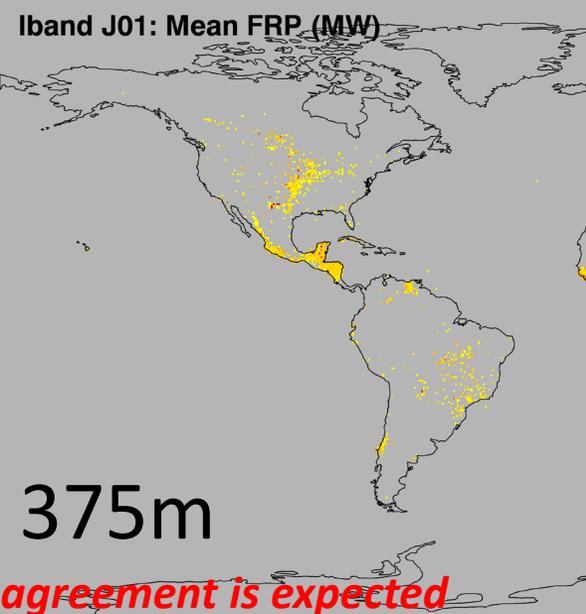
Iband J01: Mean FRP (MW)



Suomi NPP

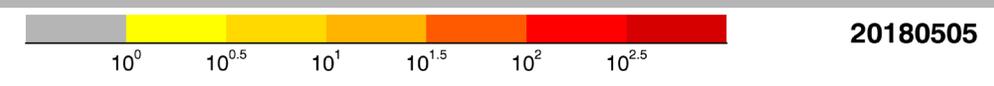
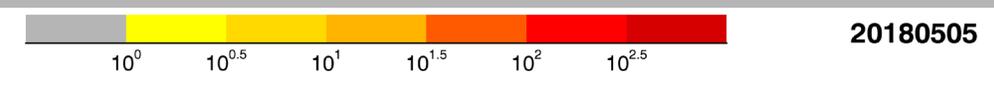
375m

Iband J01: Mean FRP (MW)

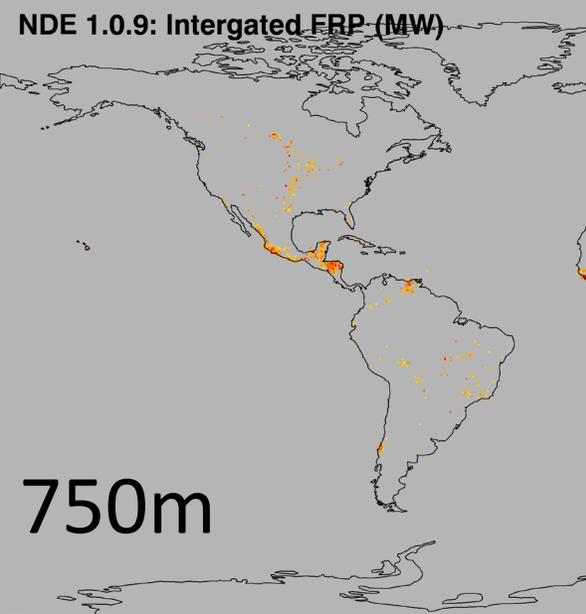


NOAA-20

*Good agreement. No "perfect" agreement is expected*

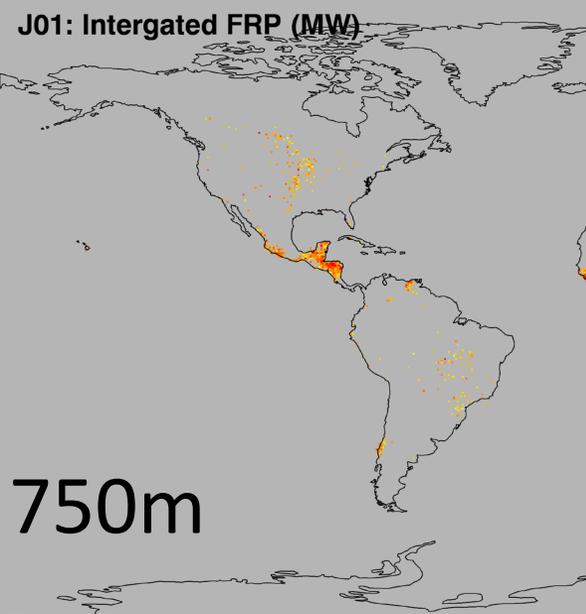


NDE 1.0.9: Intergated FRP (MW)



750m

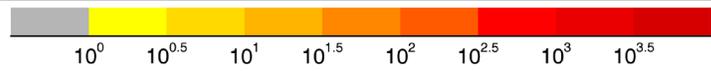
J01: Intergated FRP (MW)



750m

Suomi NPP

NOAA-20

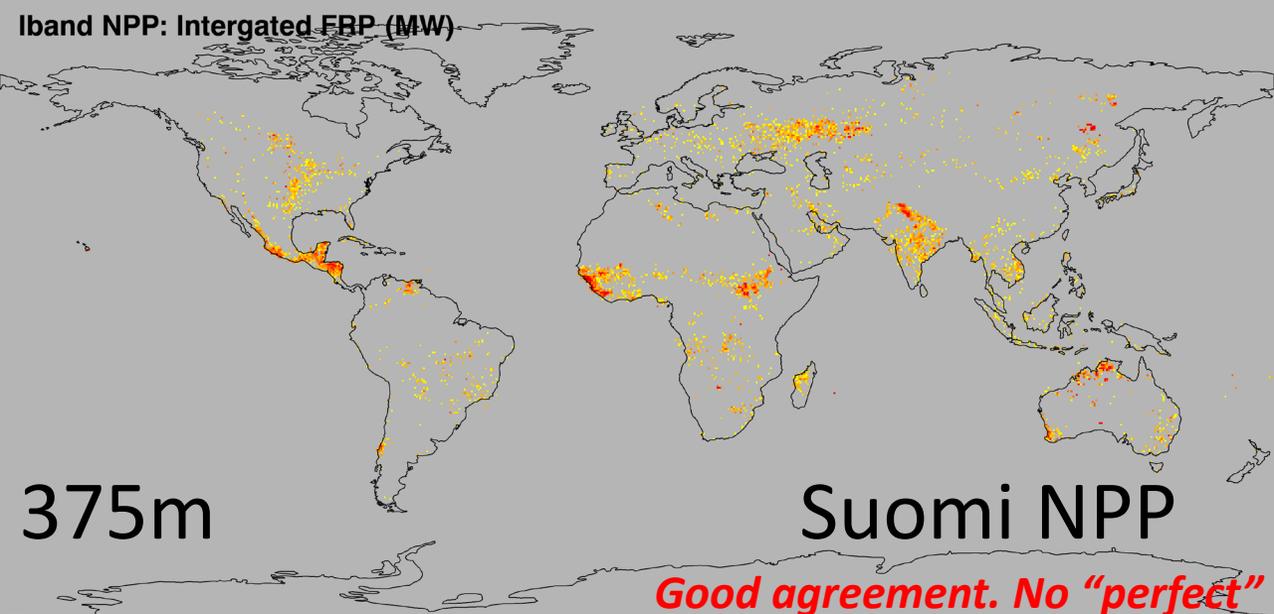


20180505



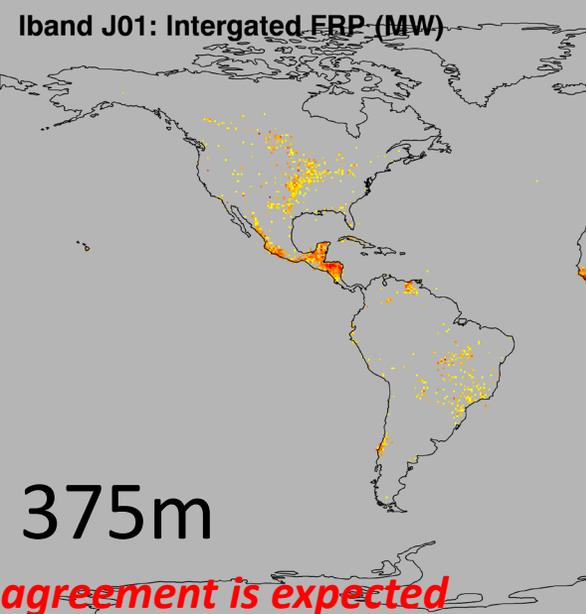
20180505

Iband NPP: Intergated FRP (MW)



375m

Iband J01: Intergated FRP (MW)

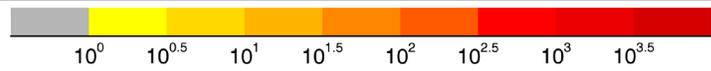


375m

Suomi NPP

NOAA-20

*Good agreement. No "perfect" agreement is expected*

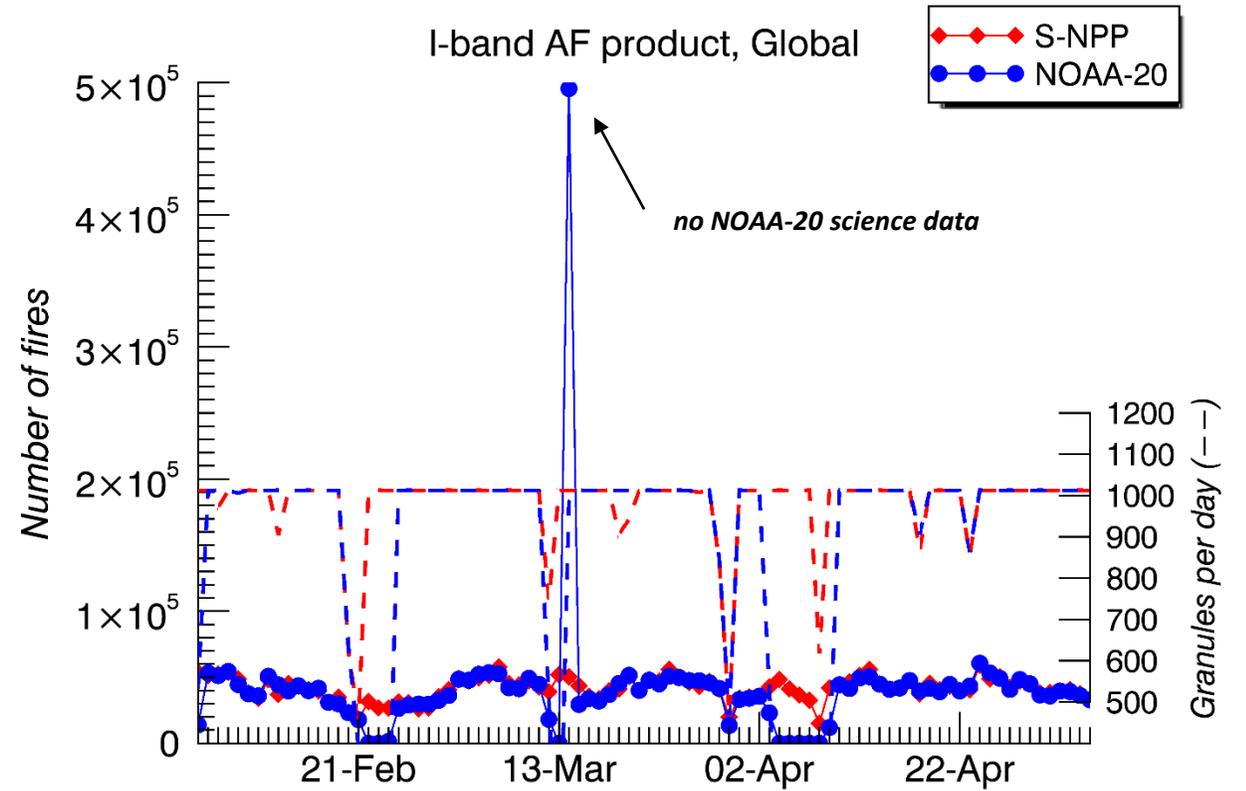
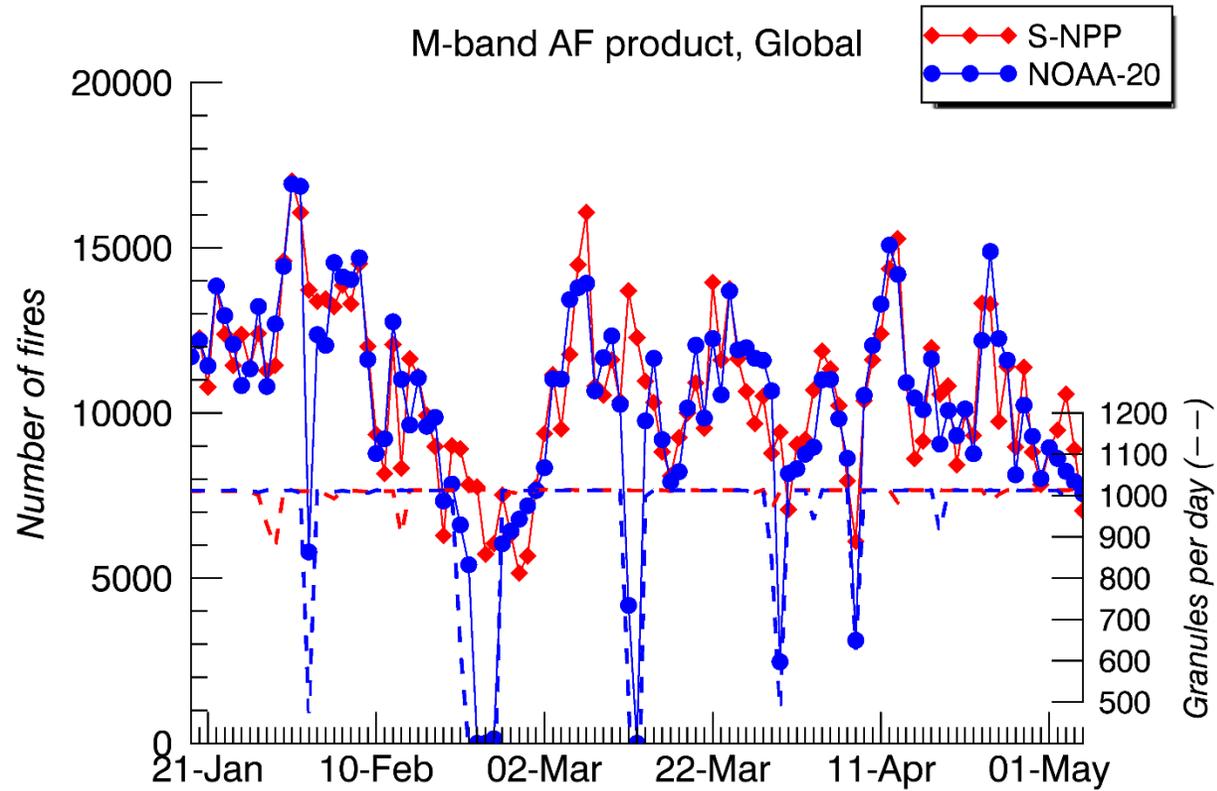


20180505



20180505

# Suomi NPP vs. NOAA-20 global fire statistics

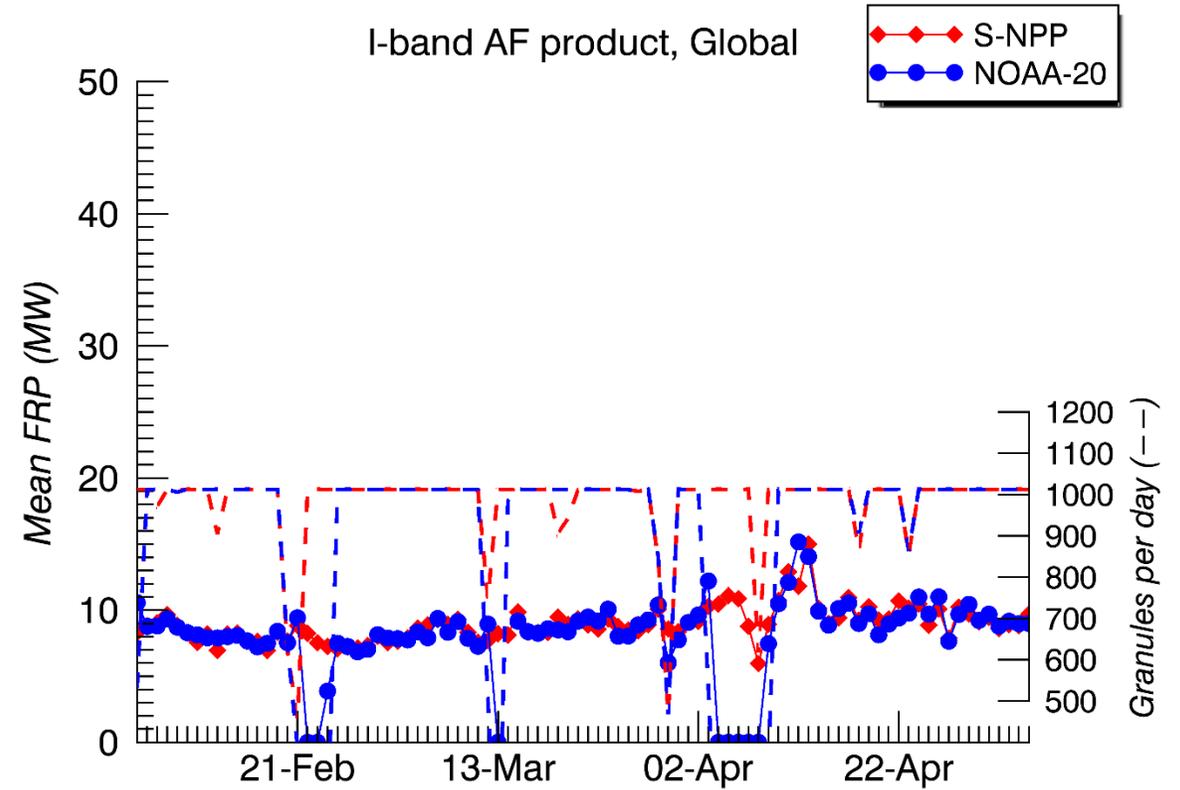
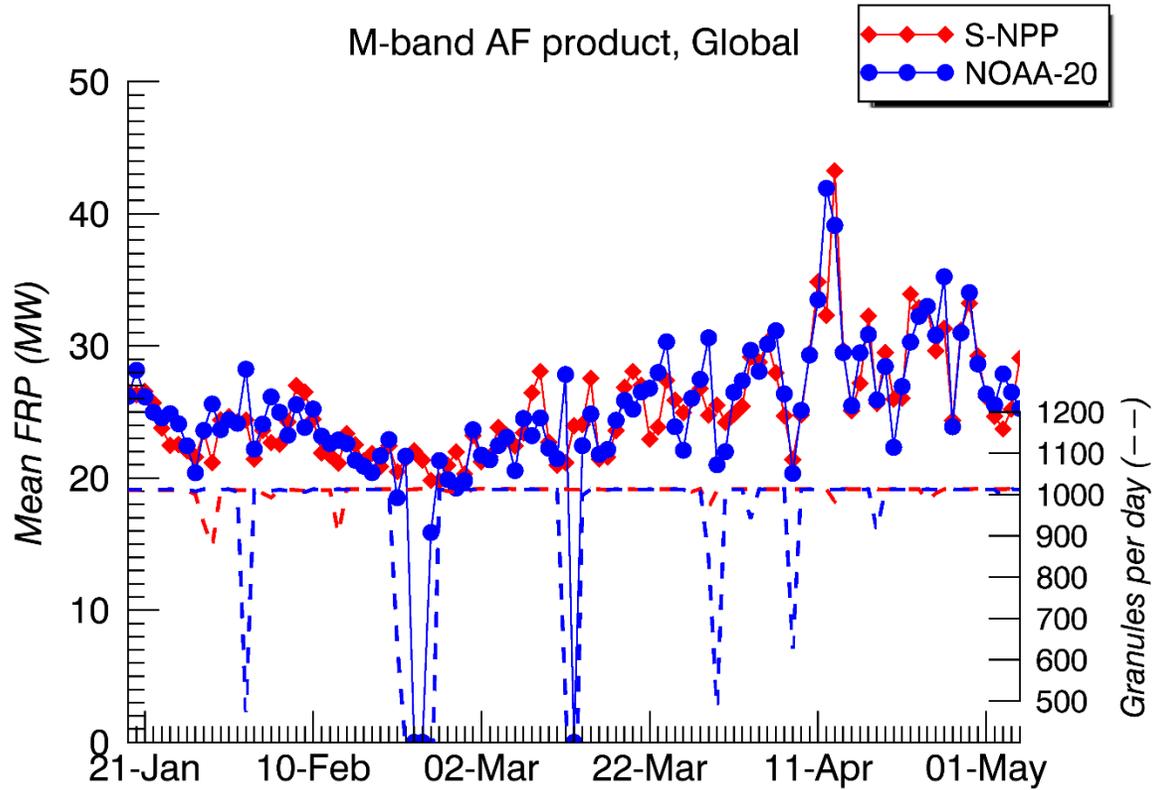


←  
←  
↑  
↗  
↘  
*Unprocessed granules*

←  
↑  
↗  
↘  
*Unprocessed granules*

***Good agreement. No "perfect" agreement is expected***

# Suomi NPP vs. NOAA-20 global fire statistics

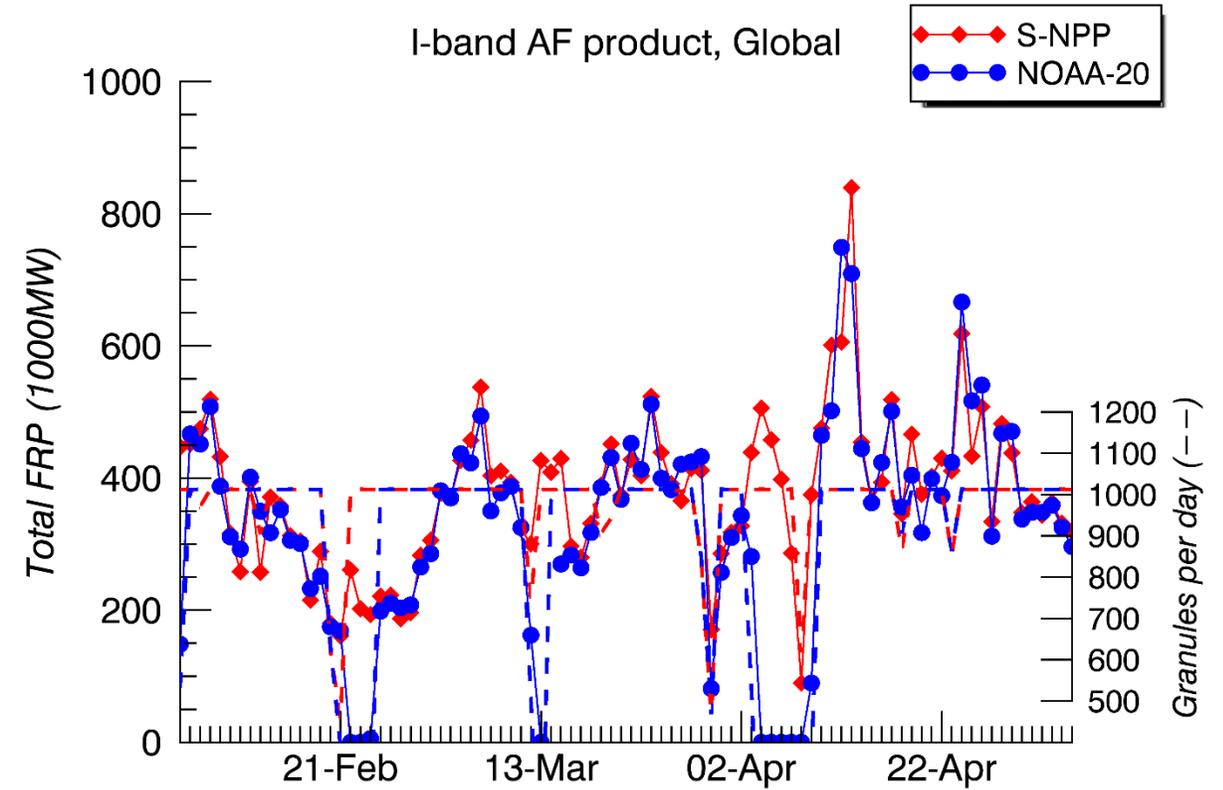
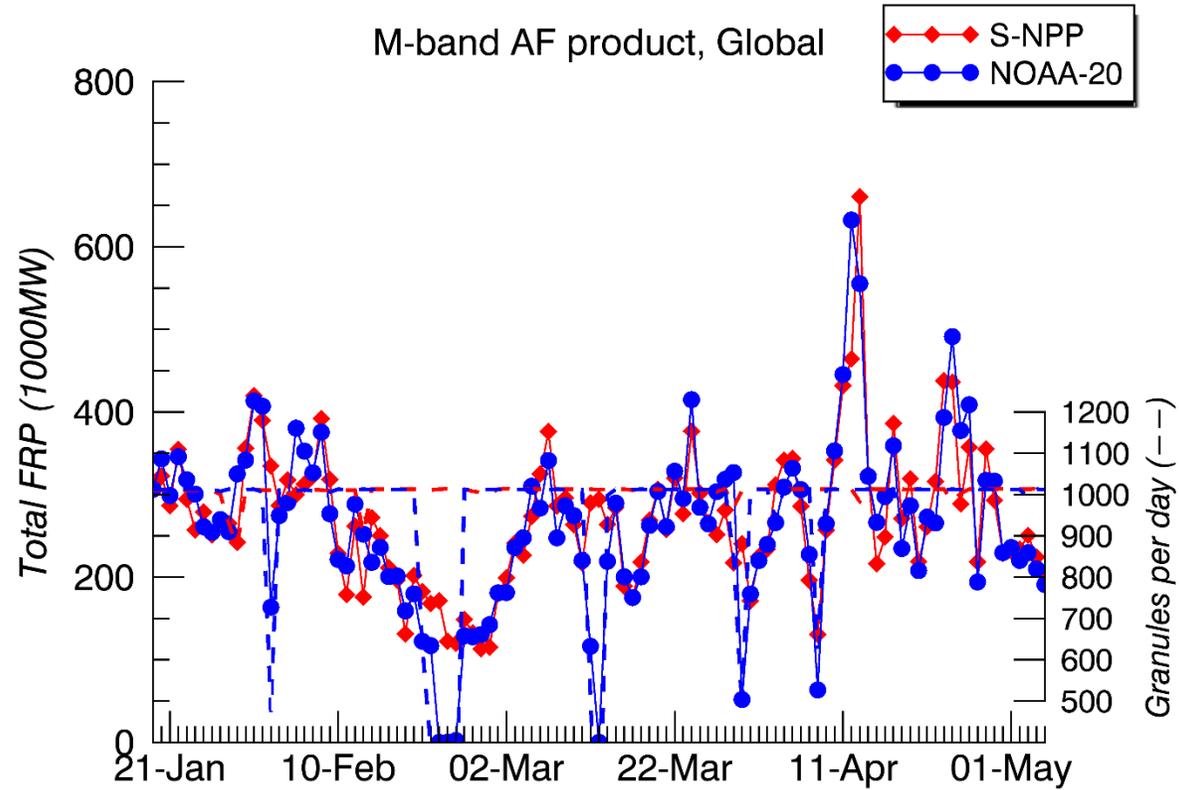


Unprocessed granules

Unprocessed granules

**Good agreement. No "perfect" agreement is expected**

# Suomi NPP vs. NOAA-20 global fire statistics

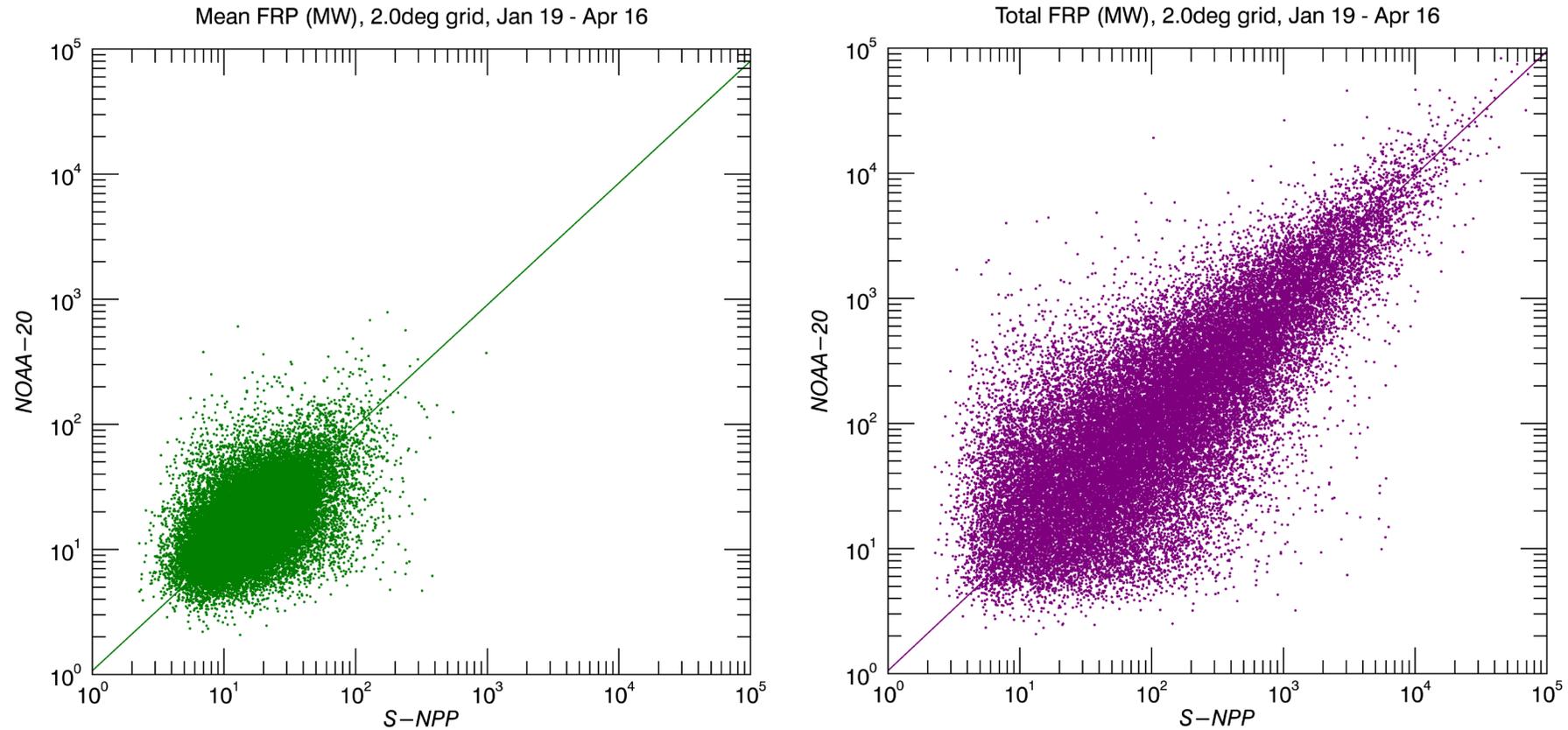


← ↑ ↗ ↘  
*Unprocessed granules*

← ↑ ↗ ↘  
*Unprocessed granules*

***Good agreement. No "perfect" agreement is expected***

# Suomi NPP vs. NOAA-20: 750m

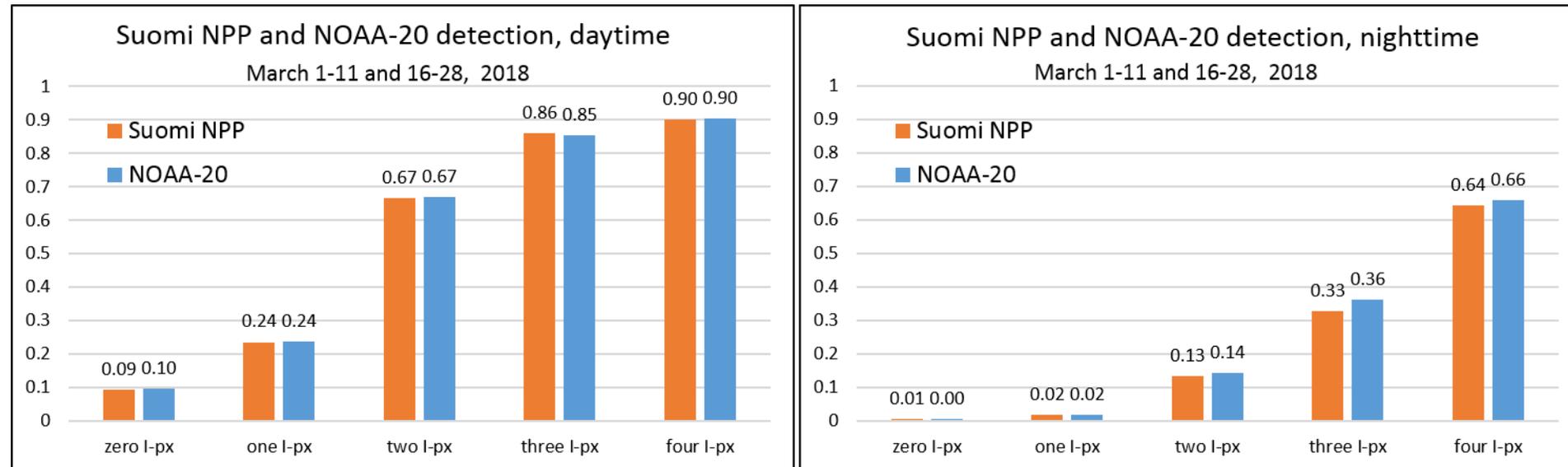


***Good agreement. No "perfect" agreement is expected***

# M-band vs. I-band detection rates

- Detection rates relative to the experimental 375m I/M “hybrid” product as a function of the number of I-band resolution detections within the M-band pixel footprint
- Frequency of M-band detections without a single I-band detection were used as a proxy for commission errors
- Increase of detection rates with increasing number of I-band detections
- Good consistency of detection rates between Suomi NPP and NOAA-20
- Significant differences between daytime and nighttime detection rates, indicating a more conservative performance of the nighttime M-band algorithm

*Daytime (left) and nighttime (right) relative detection performance between the operational 750m M-band and the experimental 375m I/M-band VIIRS active fire products*



# Carr Fire in California as seen by Suomi NPP VIIRS and GOES-16 ABI

First detection by Suomi NPP VIIRS at 20:14 UTC

First detection by GOES-16 at 20:37 UTC

GOES-16 filled in the gap and detection the fast  
growth of the fire

NOAA-20 VIIRS detected again at 21:04 UTC as a  
larger fire

GOES-16 continued monitoring the growth of  
the fire complex

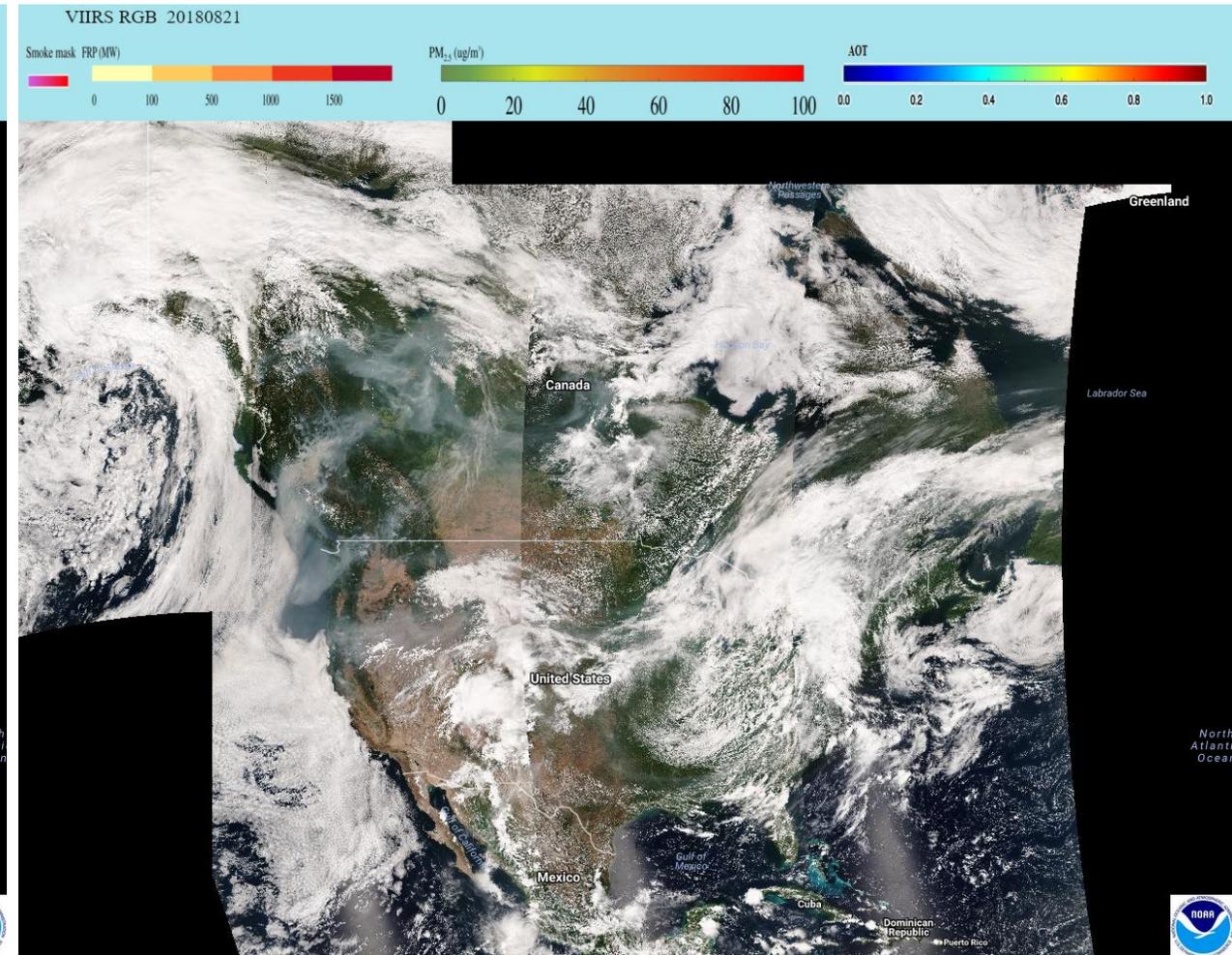
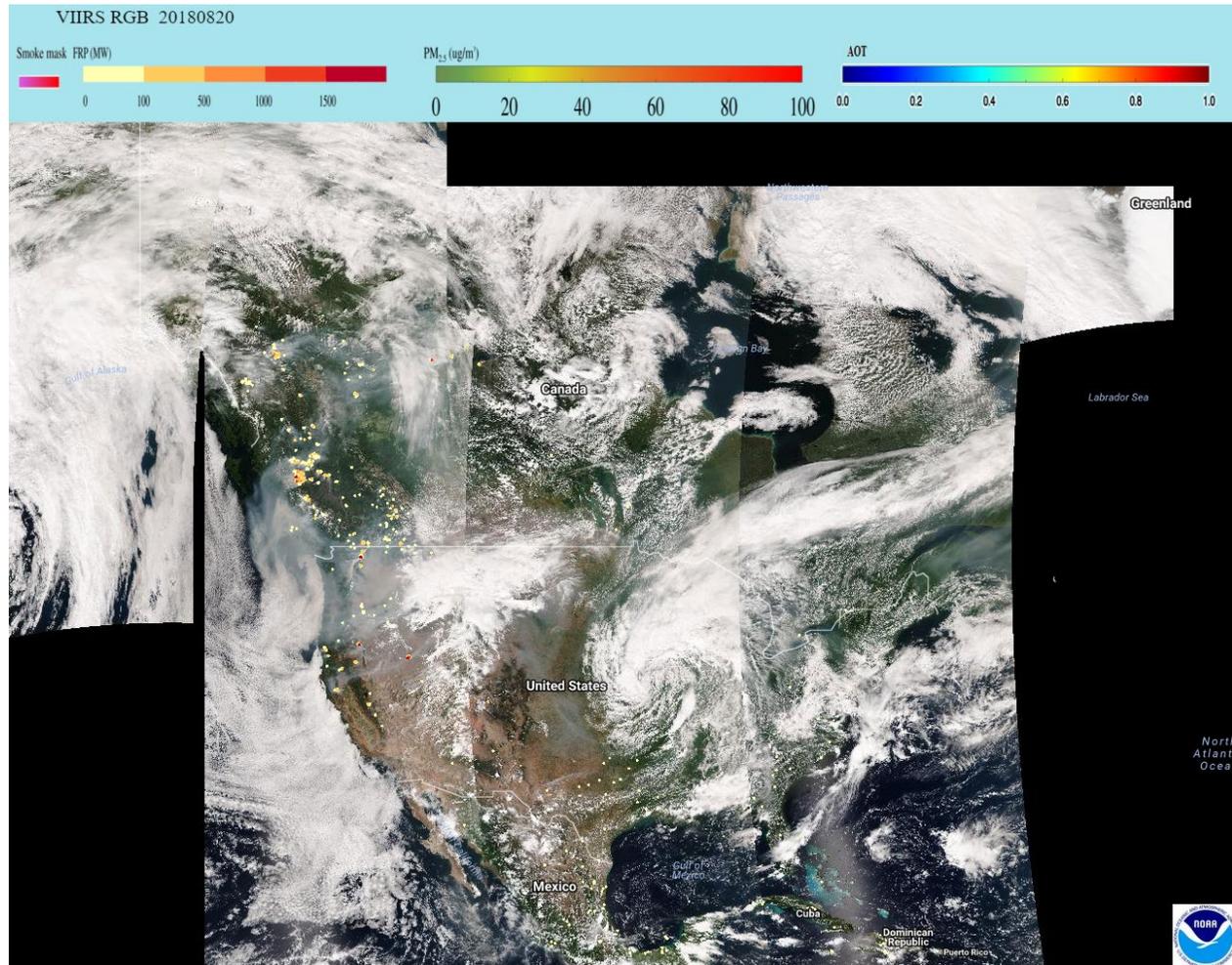
Suomi NPP detected again at 21:55 UTC



G16\_20180723\_2002

# VIIRS FRP in eIDEA

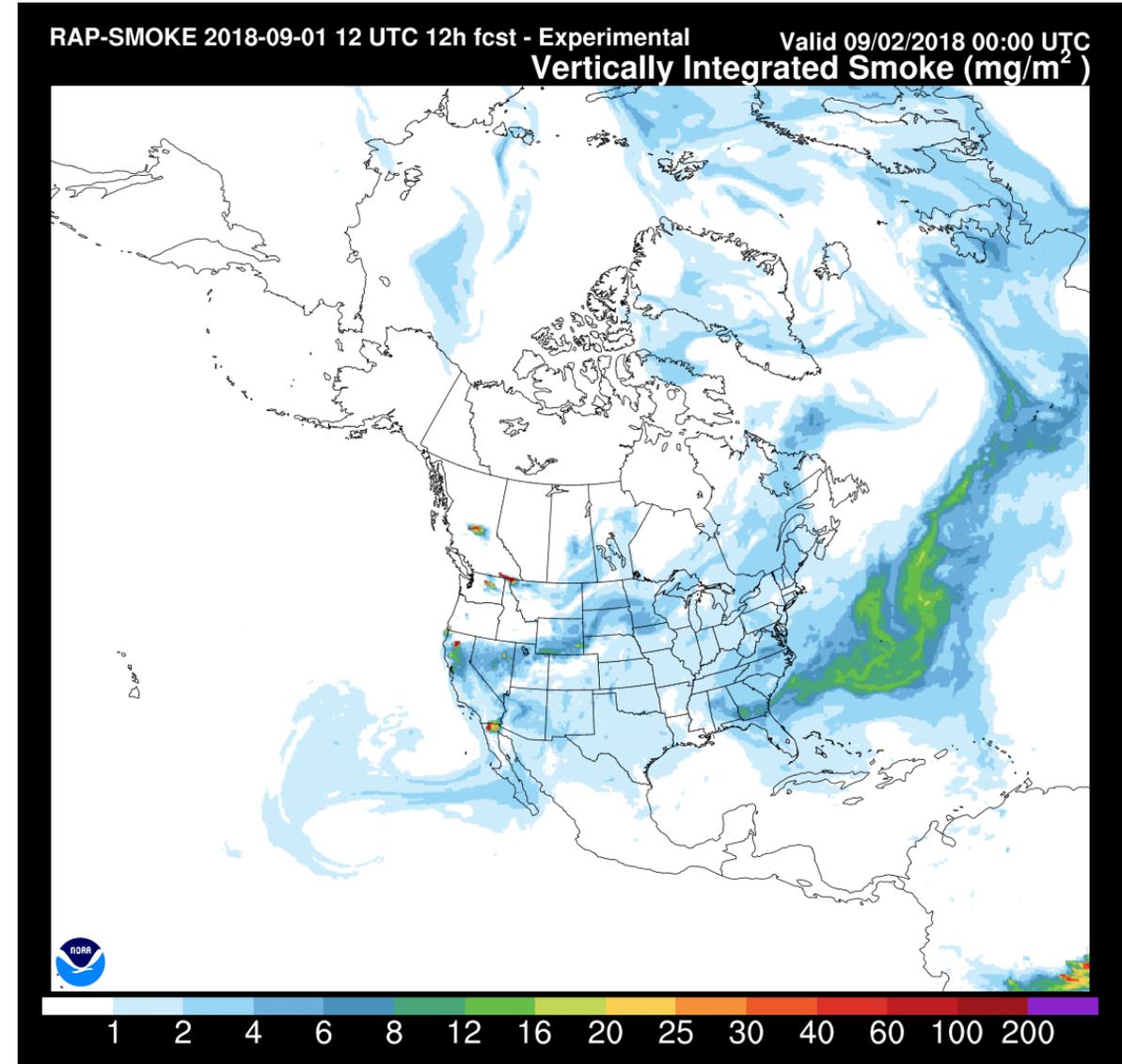
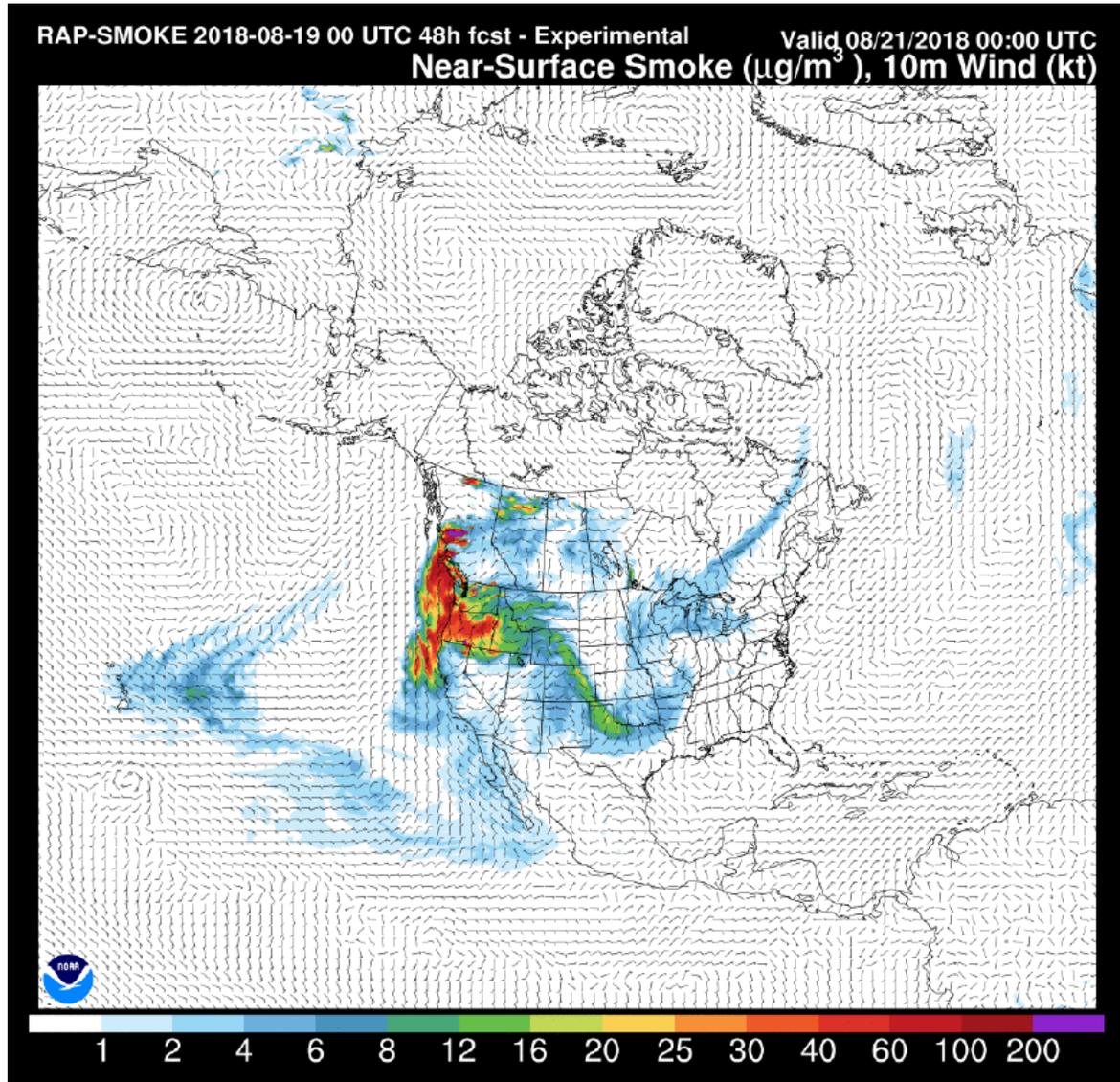
<https://www.star.nesdis.noaa.gov/smcd/spb/aq/eidea/>



eIDEA: enhanced Infusing satellite Data into Environmental Applications

# VIIRS FRP in Rapid Refresh (RAP) - Smoke

<https://rapidrefresh.noaa.gov/RAPsmoke/>

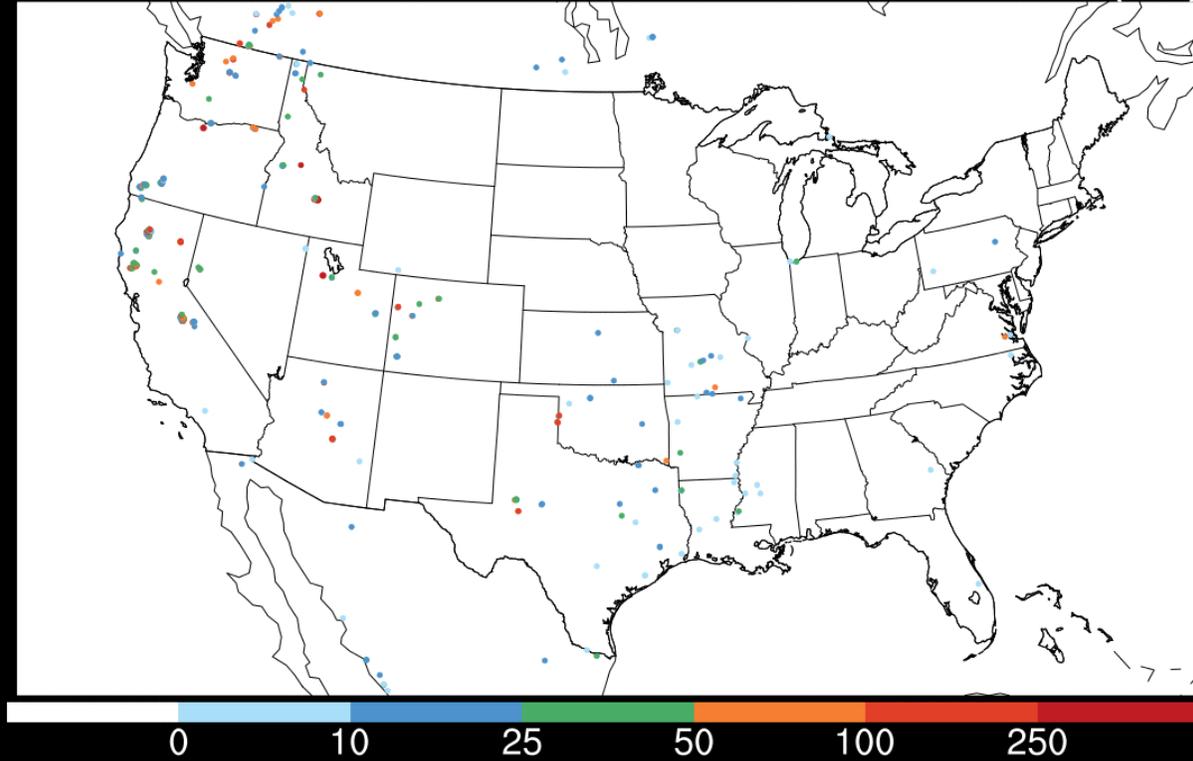


# High Resolution Rapid Refresh(HRRR) - Smoke

<https://rapidrefresh.noaa.gov/hrrr/HRRRsmoke/>

HRRR-SMOKE 2018-08-02 00 UTC - EXPERIMENTAL

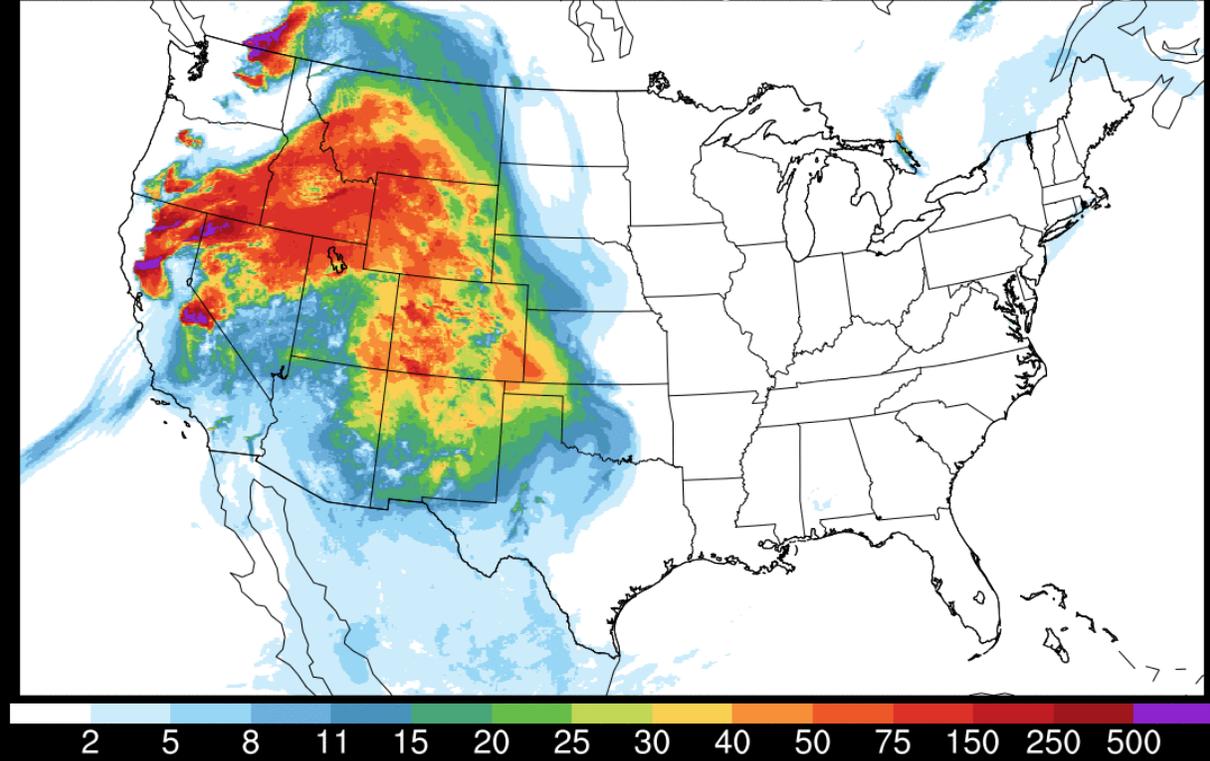
Fire Radiative Power (MW)



Fire Radiative Power from Suomi NPP VIIRS

HRRR-SMOKE 2018-08-02 00 UTC 0h fcst - EXPERIMENTAL Valid 08/02/2018 00:00 UTC

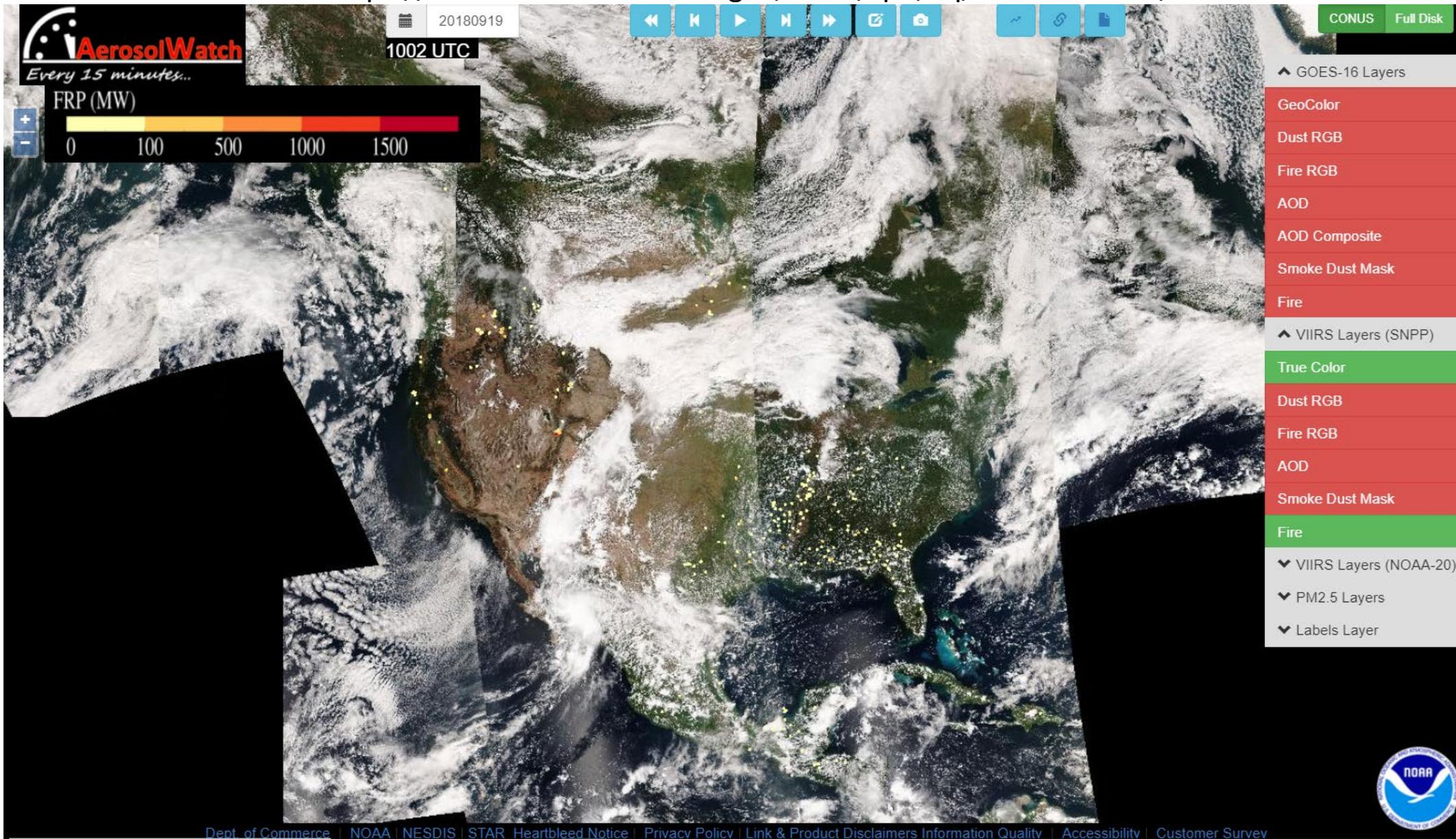
Vertically Integrated Smoke (mg/m<sup>2</sup>)



Vertically Integrated Smoke

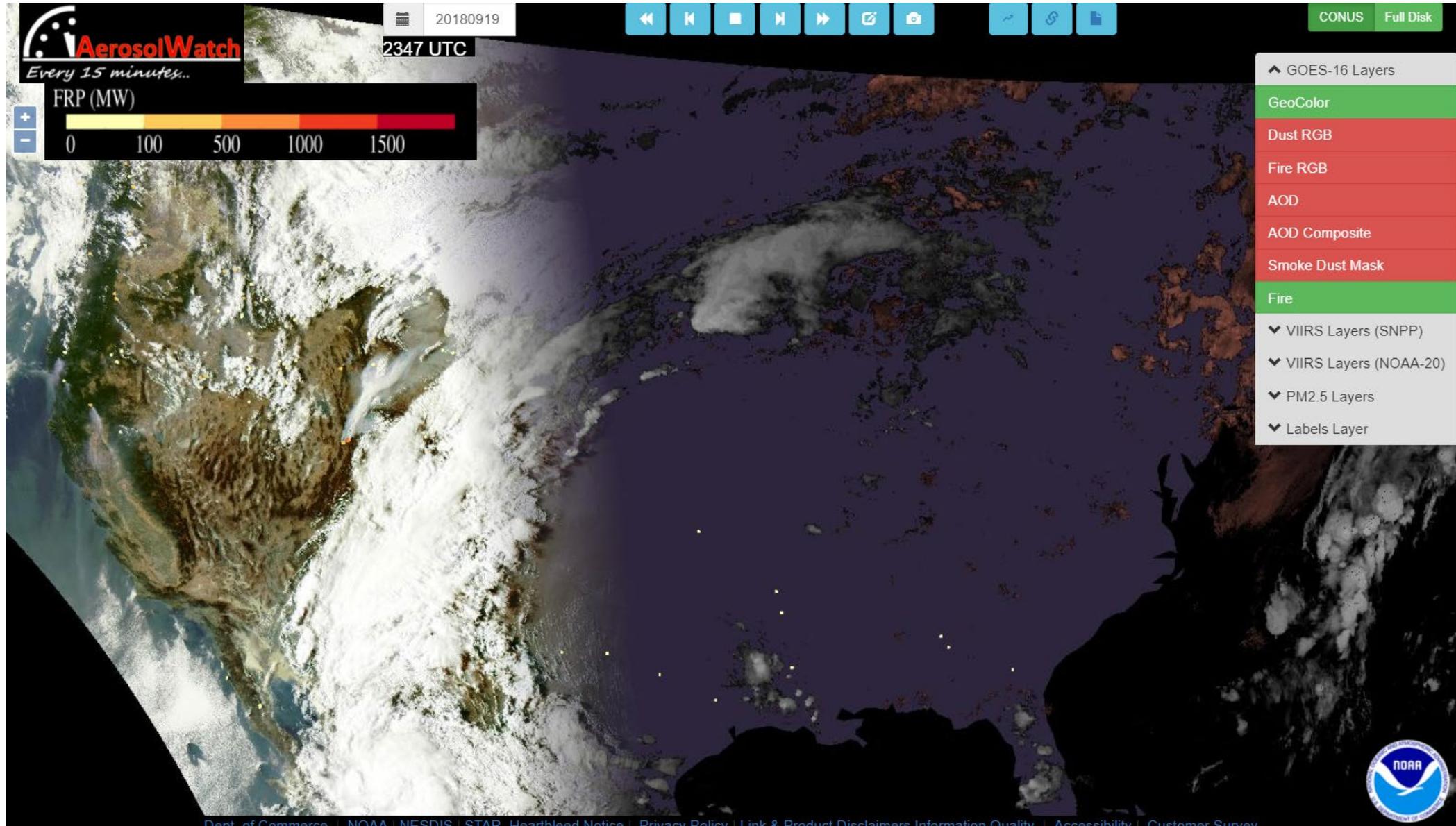
# VIIRS FRP in AerosolWatch

<https://www.star.nesdis.noaa.gov/smcd/spb/aq/AerosolWatch/>



# GOES-16 FRP in AerosolWatch

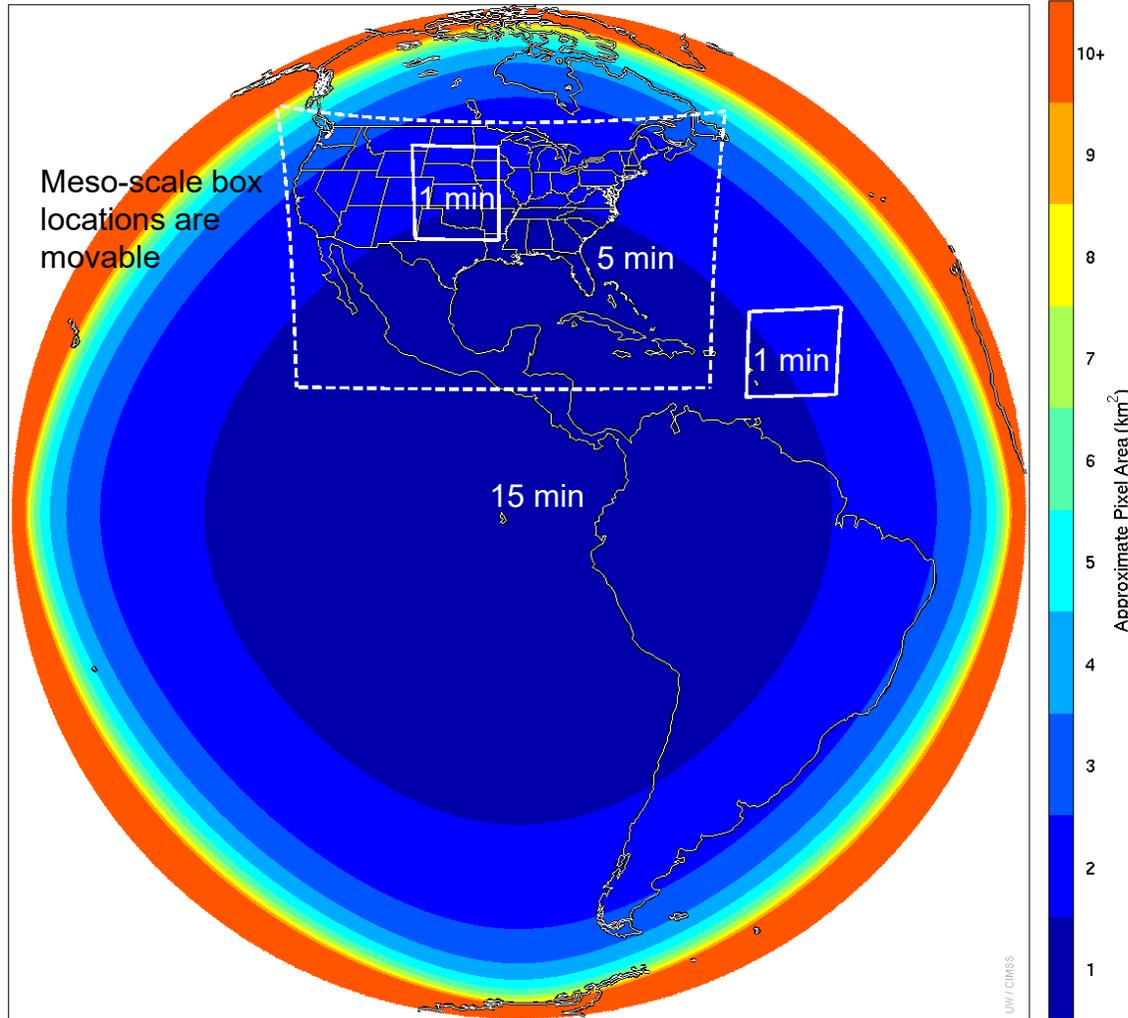
<https://www.star.nesdis.noaa.gov/smcd/spb/aq/AerosolWatch/>





# GOES-R ABI

Approximate Pixel Area (Nominally 1km at Nadir) from -89.5 West



## Default Operational Mode:

Full Disk 15 min

CONUS 5 min

Mesoscale 1 min

Proposed mode to be consistent with AHI

Full Disk 10 min

Tim Schmit, NOAA

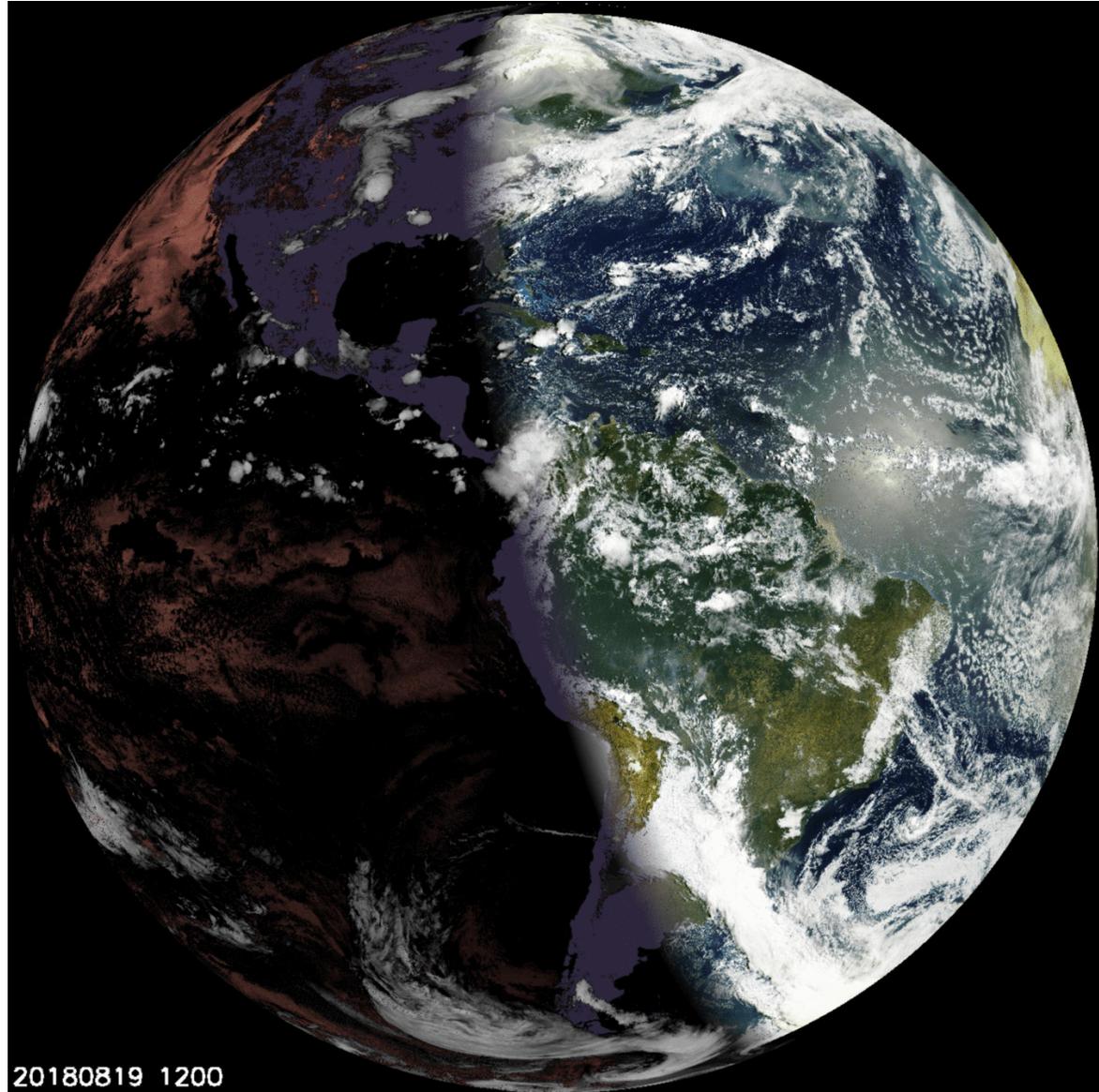


# GOES-R ABI New Capabilities: 0.5 km Visible band every 5 minutes

Smoke from several small plumes blend together and become one large plume.

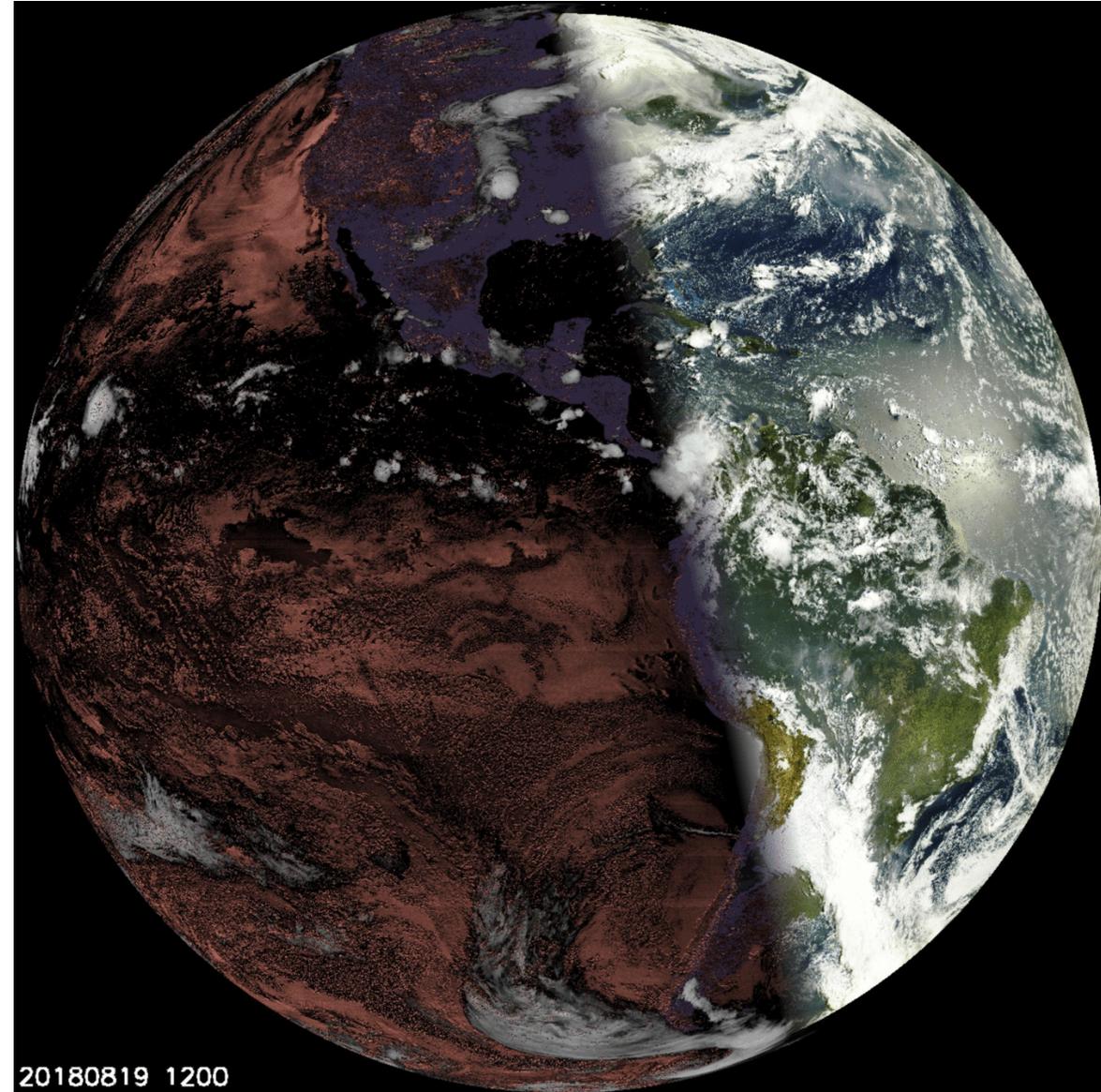


GOES-16



20180819 1200

GOES-17

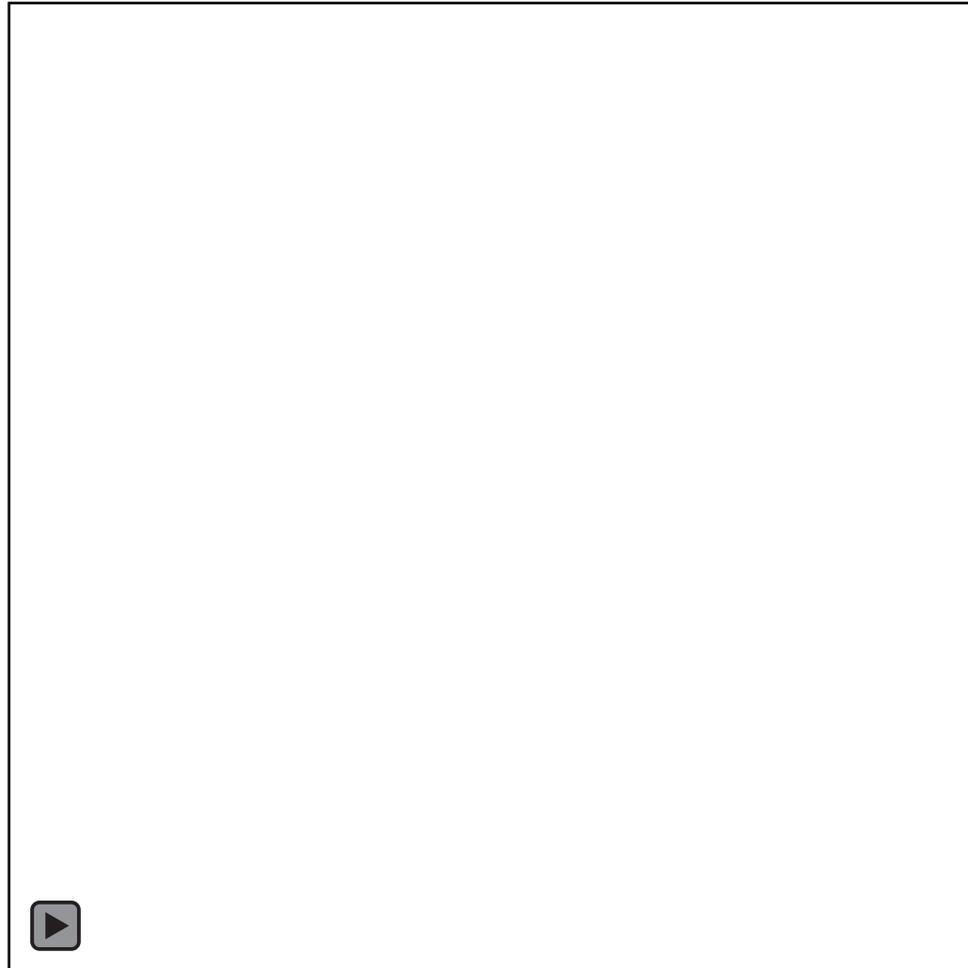


20180819 1200

***GOES-17 Preliminary, Non-Operational Data***

# The Tubbs Fire

Recorded start time: 9:45 PDT on October 8, 2017  
Loop is from 8:07 PDT to 18:07 PDT (3:07 – 13:37 UTC)



Fire Legend

- Processed Fire
- High Possibility Fire
- Saturated Pixel
- Medium Possibility Fire
- Cloudy Fire
- Low Possibility Fire

# Real-Time Wildland Fire Notifications for Impact-Based Decision Support Services

Potential Prototype for a Future Red Flag Warning Paradigm

**T. Todd Lindley**

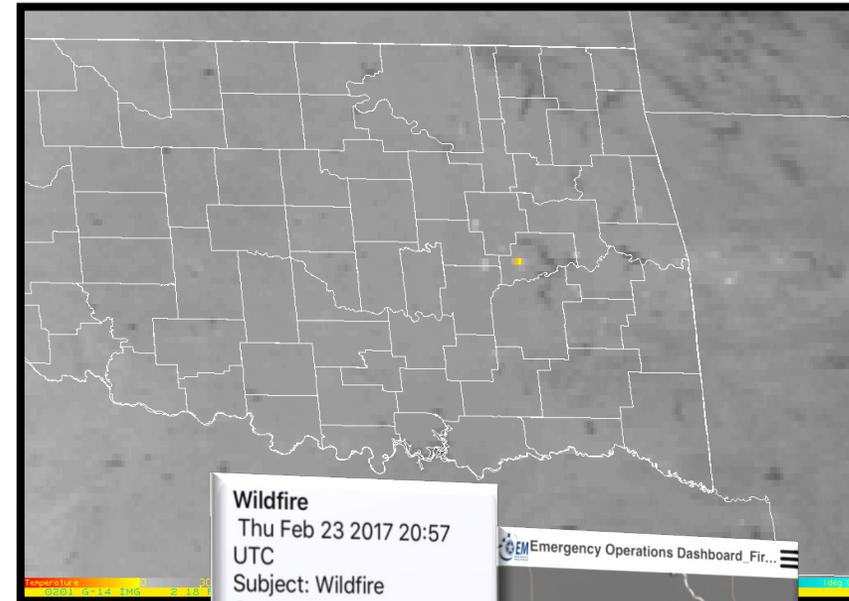
Science & Operations Officer  
NOAA/NWS Norman, OK

**Dr. Chad Gravelle**

Chief Scientist  
NOAA/NWS-OU/CIMMS  
Operations Proving Ground  
Kansas City, MO

Contributors:

Vivek Mahale, Aaron Anderson, Scott Curl, Steve Piltz,  
James Frederick, Robyn Heffernan, Drew Daily, Daniel Piltz  
& Zach Stanford



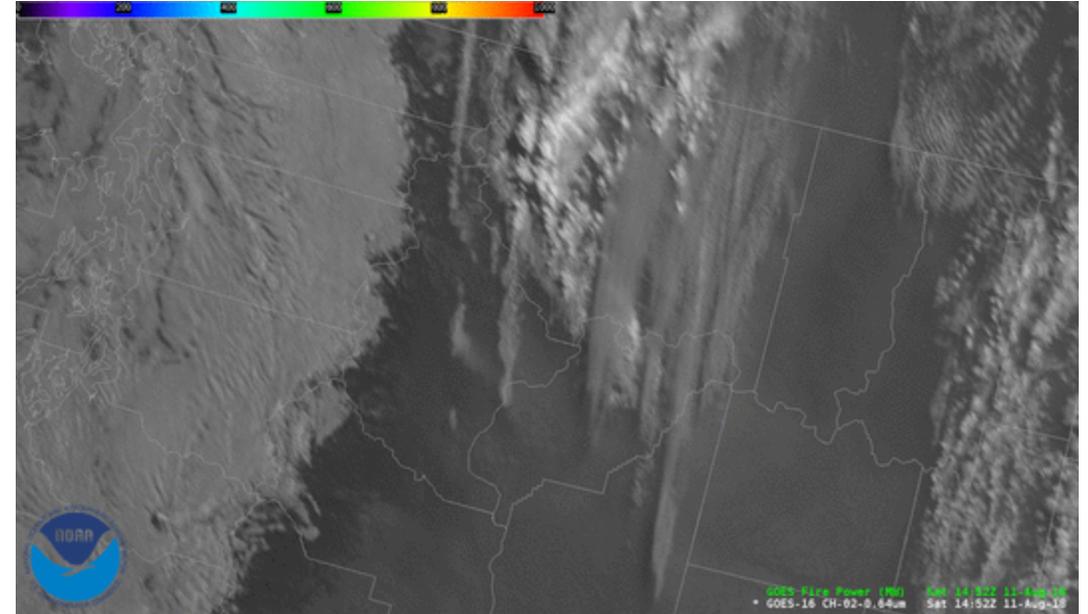
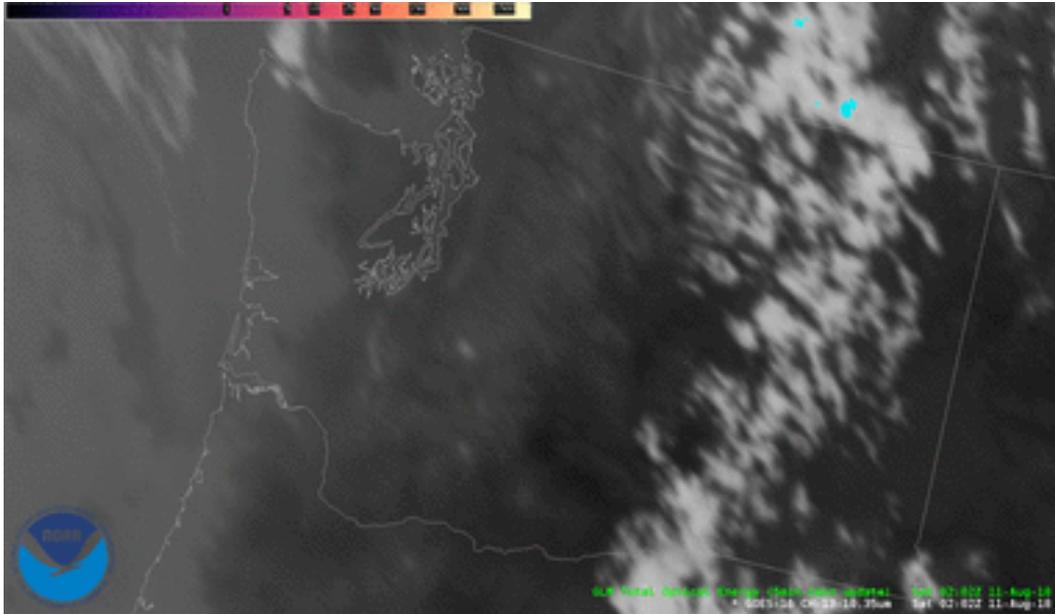
**Wildfire**  
Thu Feb 23 2017 20:57 UTC  
Subject: Wildfire  
County: Woodward, OK  
Fire Weather Level: Extreme  
Detection Method: Satellite  
- 5min  
Mesonet: WOOD T:85F RH:  
9% WDIR:247 WSPD:26  
WGST:41  
Comments: 5 NW  
Mooreland.  
Lat: 36.506  
Lon: -99.252  
Thanks.



Thanks!  
Lon: -99.252  
Lat: 36.506  
Mooreland

# GOES-16 GLM and ABI Fire

August 11-12, 2018



*GLM: Geostationary Lightning Mapper*  
*ABI: Advanced Baseline Imager*

**Scott Rudloski, NOAA/NESDIS/STAR**

# GOES-17 Cooling System Issue

<https://www.goes-r.gov/users/transitionToOperations17.html> (as of 9/28/2018)

- “The loop heat pipe (LHP) subsystem, which transfers heat from the ABI electronics to the radiator, is not operating at its designed capacity
- During nighttime hours, the sun heats up the ABI detectors faster than they can be cooled
- The detectors become warmer than they’re designed to operate, and they begin to radiate at temperatures closer to the wavelengths they’re attempting to detect from the Earth
- Eventually, local emissions and dark current noise overwhelm the signal from the Earth, and the channels saturate, meaning a useful signal is not available
- Channel availability will also fluctuate seasonally depending on the amount of solar radiation absorbed by the instrument
- A great deal of progress has been made to optimize the performance of the GOES-17 data and the instrument is currently projected to deliver 97% of the data it was intended to provide”

# FDCA Current Status

- Currently considered Provisional, however users who have a high sensitivity to false alarms and/or composite multiple time periods have reported false alarm problems during the Northern Hemisphere's summer
- An update will soon be implemented that decreases the algorithm's sensitivity and makes other changes that substantially reduce the false alarm rate but will also remove some legitimate fires
- Users who track specific fire incidents have reported fewer problems

# FDCA data availability

- Provisional FDCA GOES-16 L2 data is available now
- GOES-17 FDCA is not yet available
- Currently will be produced from the Ground System (GS) for Full Disk (FD) and CONUS sectors
- It is **not** produced by the GS for MESO sectors
- Fire weather is in the priority list for calling MESO sectors

# Summary and conclusions

- JPSS
  - Both Suomi NPP and NOAA-20 750m VIIRS active fire products are operational
  - Testing / evaluation / transition to operations of the 375m I/M-band product is ongoing
  - The two-satellite configuration provides improved coverage
  - The VIIRS active fire product has been used successfully in particular for smoke and air quality monitoring and forecasting
- GOES-R
  - GOES-16 operational and Provisional
  - GOES-17 in testing and evaluation
  - GOES-17 loop heat pipe anomaly mitigation and impact evaluation is ongoing
- Multi-sensor integrated observing system
  - Synergistic use of JPSS and GOES-R data
  - Enterprise algorithms for consistency and improved processing efficiency
  - Sentinel-3 SLSTR and EPS-SG METImage are critical for mid-morning polar observations

# For more information visit

- NOAA JPSS at <https://www.jpss.noaa.gov/>
- STAR JPSS at <https://www.star.nesdis.noaa.gov/jpss/>
- Active Fire product info at <https://www.star.nesdis.noaa.gov/jpss/fires.php>
- NOAA's Comprehensive Large Array-data Stewardship System (CLASS) at <https://www.bou.class.noaa.gov/saa/products/welcome>
- VIIRS Active Fire science team at <http://viirsfire.geog.umd.edu/>
- GOES-R Program, Products etc. <https://www.goes-r.gov/>