



# Active fire data from Suomi NPP VIIRS to serve end user applications

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# Suomi NPP VIIRS IDPS product status



- The **Suomi NPP Active Fire ARP was declared Operational** by the NESDIS Satellite Products and Services Review Board (SPSRB)
  - Primary use in NOAA'S Hazard Mapping System
- The Suomi NPP Active Fire product has reached **Validated 1 maturity status** with an effectivity date (i.e. IDPS implementation) of **August 13, 2014**.
  - The effectivity date corresponds to the Transition to Operations of IDPS Mx8.5, which includes the implementation SDR changes to address VIIRS Quality Flag and Calibration issues
  - Additional prior SDR changes also improved data quality
  - The team will continue systematic monitoring of product quality and will report any issues found immediately.



# Requirements: L1RD Supplement



Active Fires		
ATTRIBUTE	THRESHOLD	OBJECTIVE
<b>a. Horizontal Cell Size</b>		
1. Nadir	0.80 km	0.25 km
2. Worst case	1.6 km	
<b>b. Horizontal Reporting Interval</b>		
	HCS	
<b>c. Horizontal Coverage</b>		
	Global	Global
<b>d. Mapping Uncertainty, 3 sigma</b>		
	1.5 km	0.75 km
<b>e. Measurement Range</b>		
1. Fire Radiative Rower (FRP)	1.0 to 5.0 (10) <sup>3</sup> MW	1.0 to 1.0 (10) <sup>4</sup> MW
2. Sub-pixel Average Temperature of Active Fire	N/A	N/A
3. Sub-pixel Area of Active Fire	N/A	N/A
<b>f. Measurement Uncertainty</b>		
1. Fire Radiative Rower (FRP)	50%	20%
2. Sub-pixel Average Temperature of Active Fire	N/A	N/A
3. Sub-pixel Area of Active Fire	N/A	N/A
<b>g. Refresh</b>		
	At least 90% coverage of the globe every 12 hours (monthly average)	N/A

  : **Not required for S-NPP**

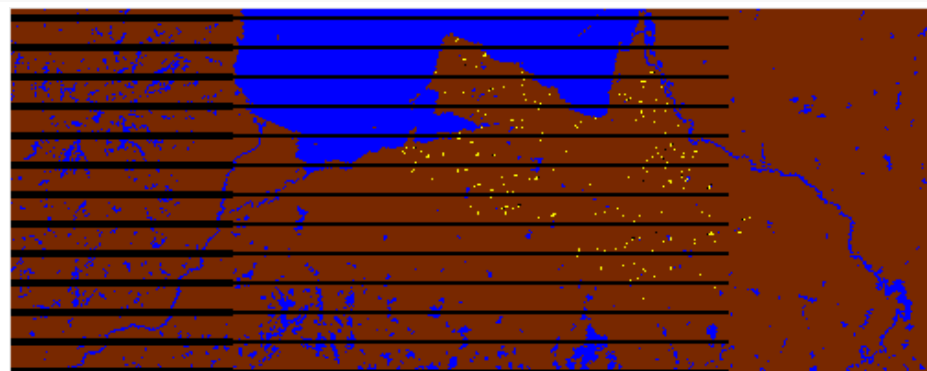
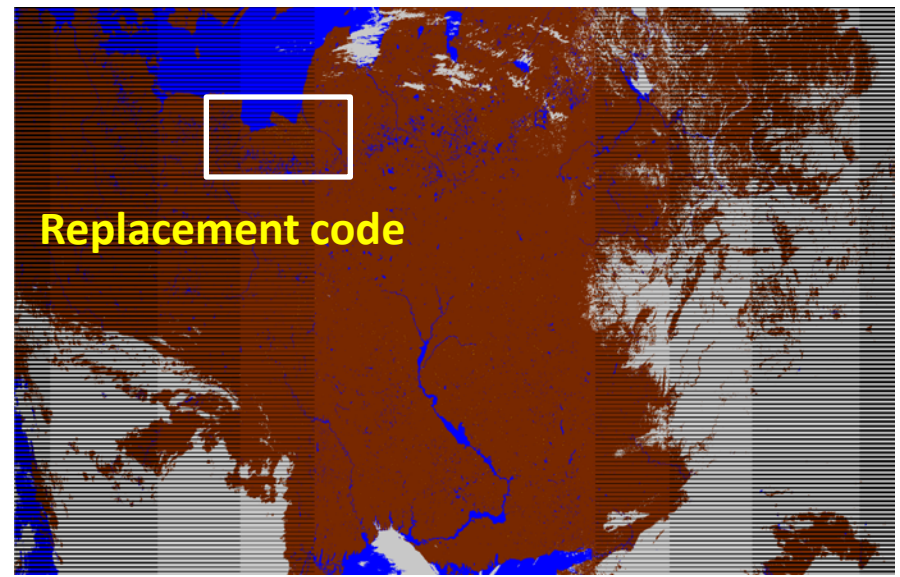
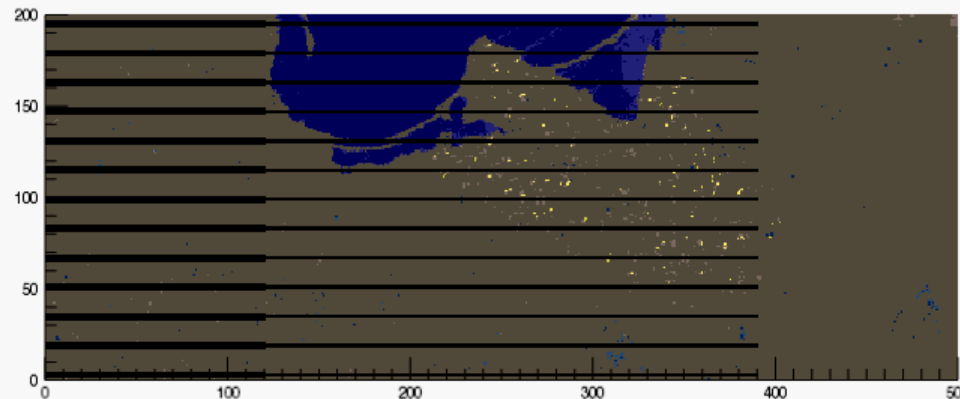
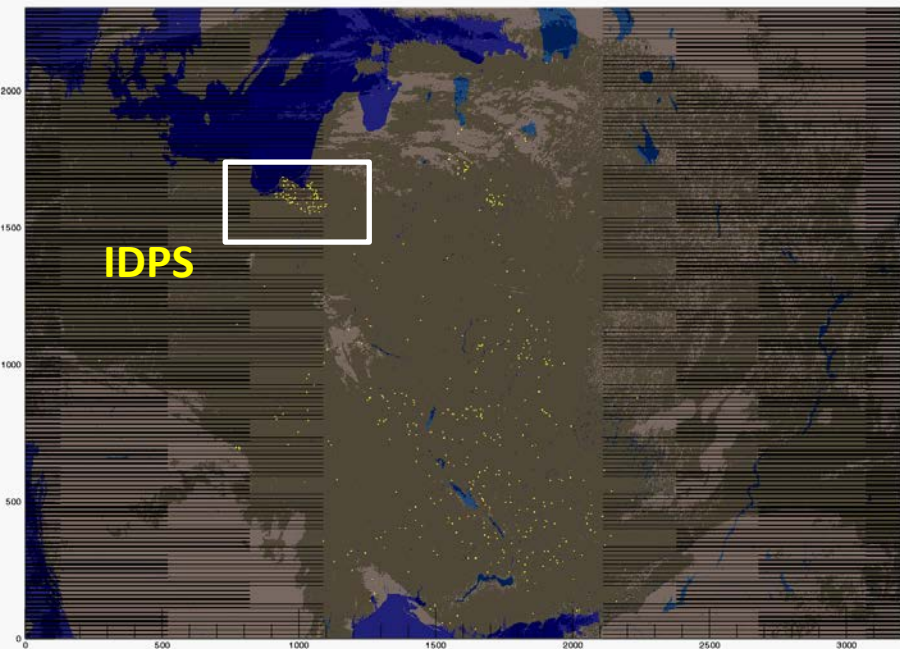
**Current IDP product was designed to meet heritage NPOESS requirements., which have been baselined according to L1RDS S-NPP Performance Exclusions (Appendix D). Spatially explicit fire mask and fire characterization are “uppers” in the JPSS L1RD for J1 and beyond.**



# IDPS vs. JPSS “replacement” code



March 10, 2014 10:36-10:40



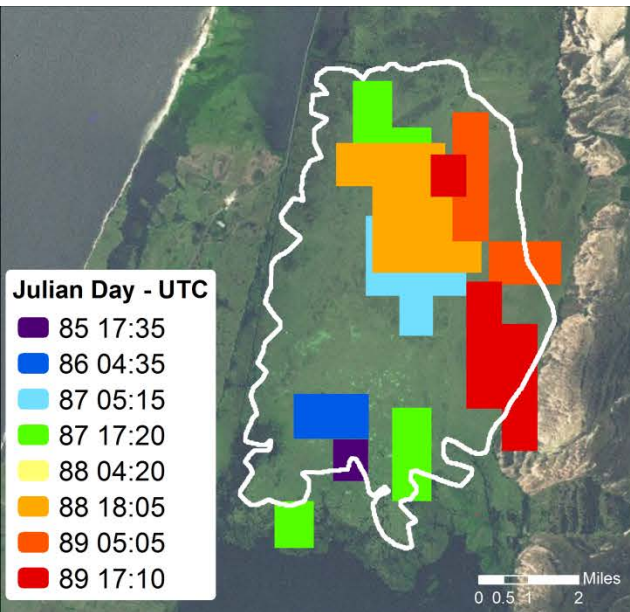
*The JPSS 1 “replacement” code has been delivered NOAA STAR Algorithm Implementation Team (AIT) for integration into NOAA operations. A Critical Design Review was held in December 2014.*



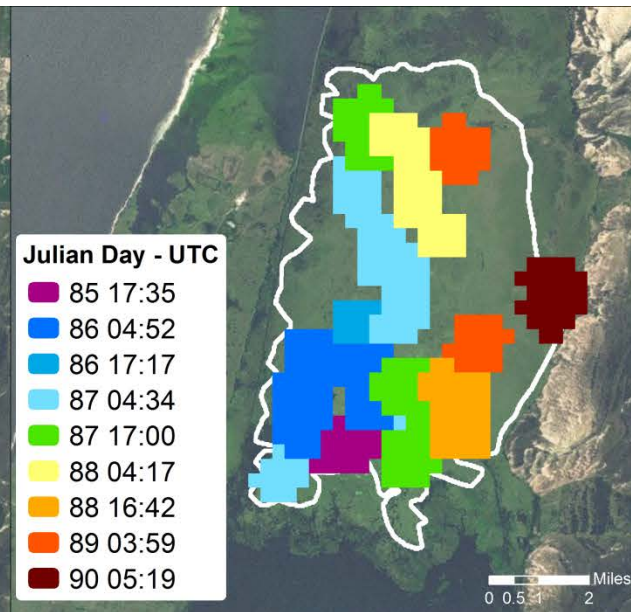
# Improved Satellite Mapping of Active Fires Achieved Using VIIRS I-bands



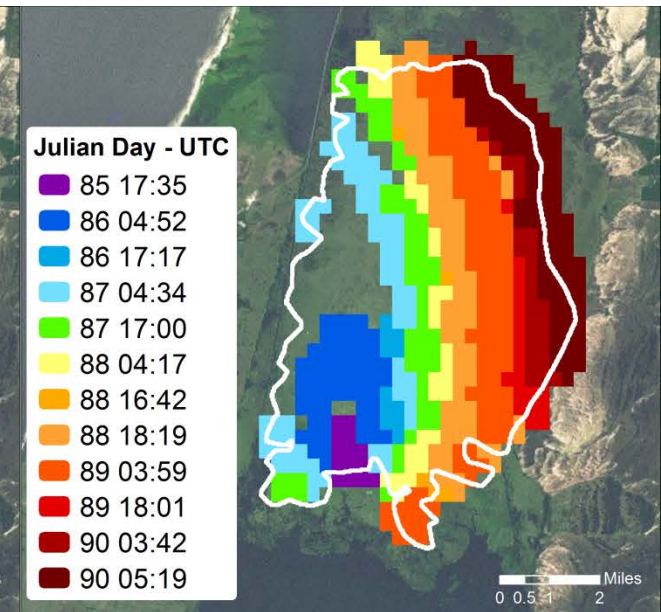
Wildfire in southern Brazil, March/2013



Aqua/MODIS 1 km



S-NPP/VIIRS 750 m



S-NPP/VIIRS 375 m

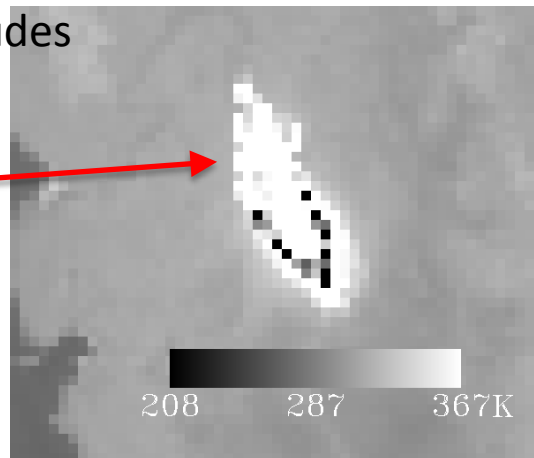
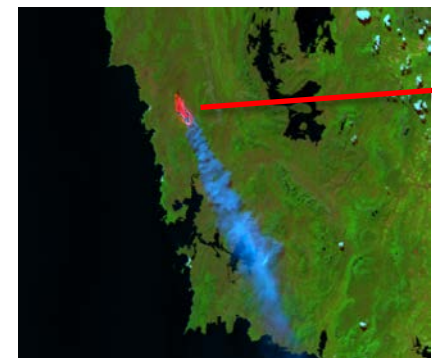
Spotty detection pixels and coverage gap at low latitudes

Spotty detection pixels

Improved fire line mapping

## Issues of VIIRS fire detection:

- Anomalous behavior at sensor saturation
- Inconsistent quality flags
- Unknown saturation of native resolution pixels prior to aggregation (single-gain bands)
- South Atlantic Magnetic Anomaly

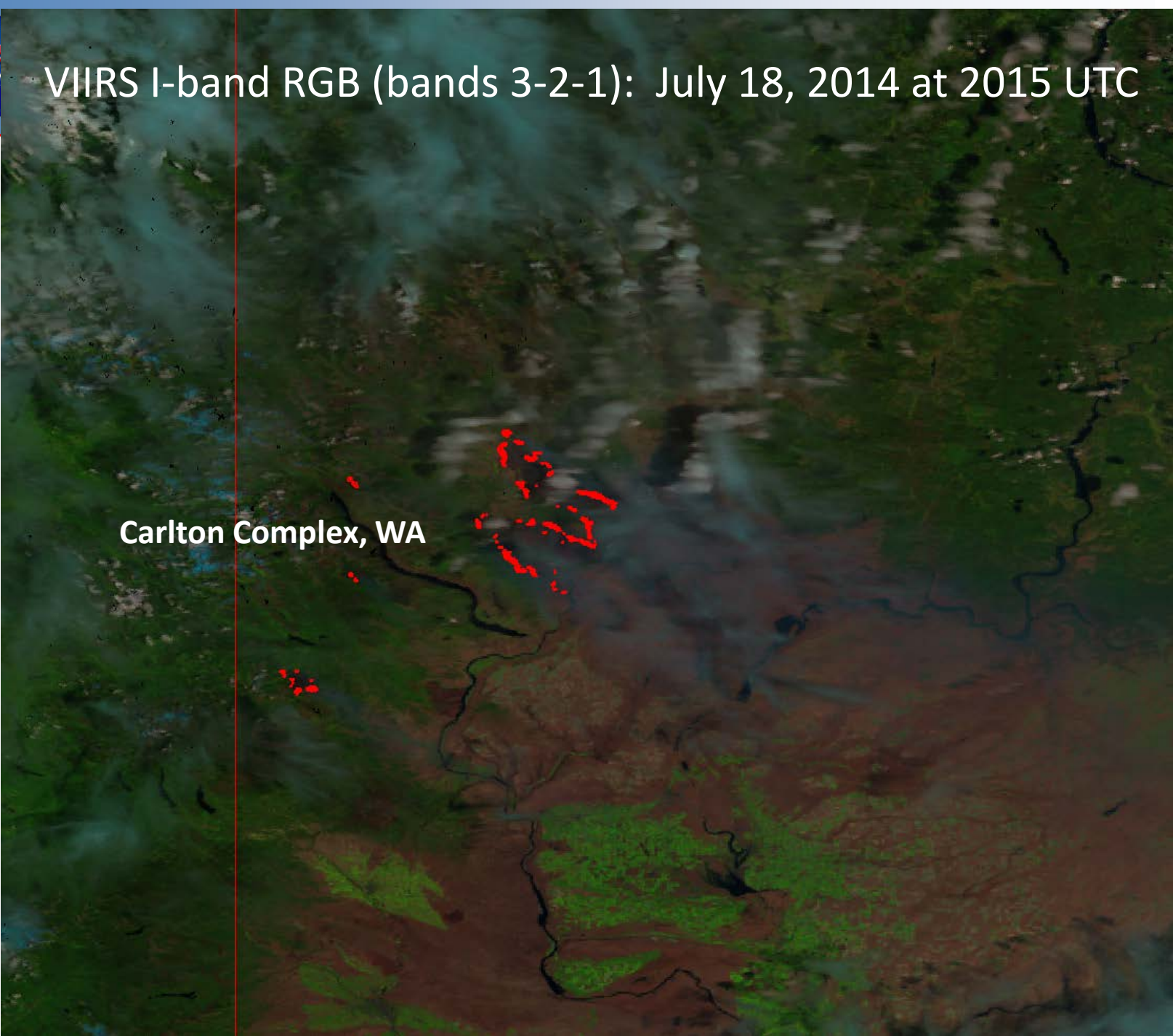




# VIIRS I-band RGB (bands 3-2-1): July 18, 2014 at 2015 UTC



Carlton Complex, WA



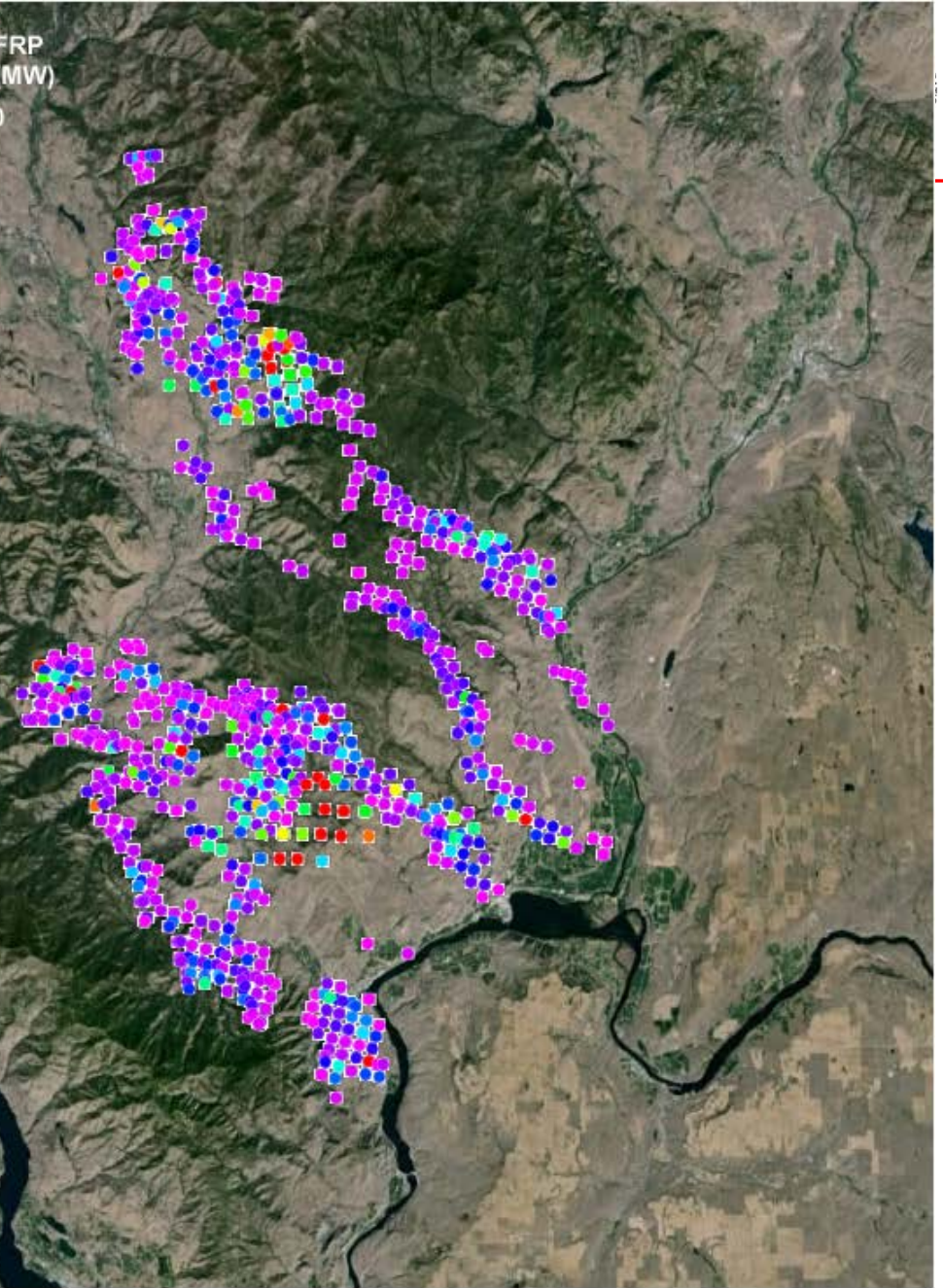


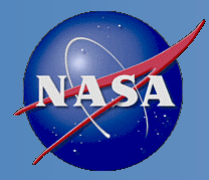
**CONUS VIIRS-AF 750m Fire Detections and Fire Radiative Power**

This KML displays VIIRS fire detections, derived using the VIIRS-AF algorithm, at a spatial resolution of 750m and associated fire radiative power measurements in megawatts (MW) for fire detections occurring in the past 6 hours, 6-12 hours, 12-24 hours and the previous 6 day period. Each 750m VIIRS fire detection and its associated FRP measure is depicted as a point representing the centroid of the 750m VIIRS pixel where the fire is detected. The 750m footprint of the VIIRS pixel for each detection is also displayed.

Data current as of **18-Jul-2014; 2345 Mountain Time (19-Jul-2014; 0545 UTC)**.  
 KML file generated by the USDA Forest Service Active Fire Mapping Program.  
 Please see <http://activefiremaps.fs.fed.us> for additional fire mapping products and information.

Disclaimer: Although these data have been used by the USDA Forest Service, the USDA Forest Service shall not be held liable for improper or incorrect use of the data described and/or contained herein. The information contained in these data is dynamic and is continually updated. This disclaimer applies both to individual use of the data and aggregate use with other data. The USDA Forest Service reserves the right to correct, update or modify this data and related materials without notification.

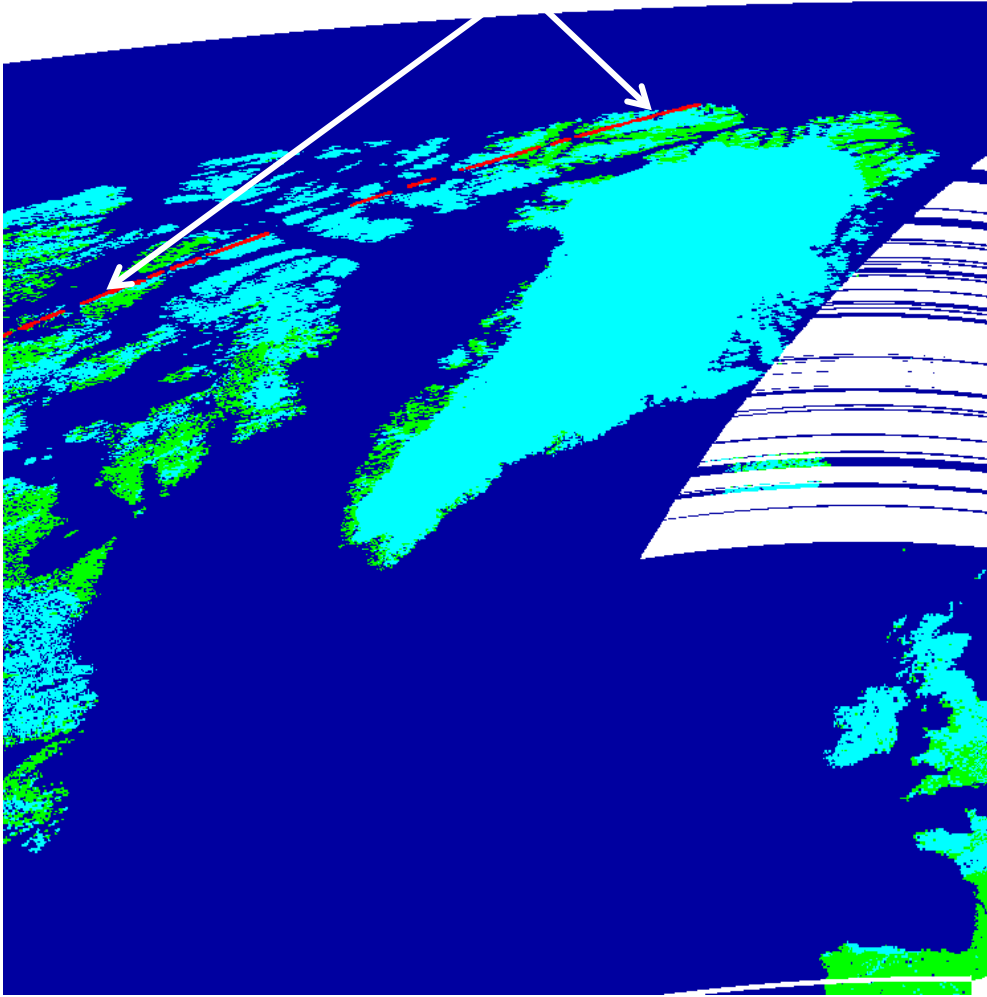




# Primary quality issue: bad scan lines



July 15 2014 14:33:19 UTC



*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.*

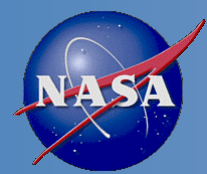
*Over time the **frequency** of spurious scanlines **decreased** as a result of IDPS SDR algorithm changes*

*Currently most spurious scanlines in the core ground segment data (**Stored Mission Data**) appear in the **Arctic**.*

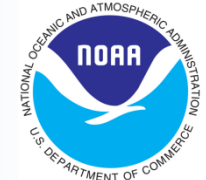
*Anomalies in **direct broadcast** data may occur **anywhere** .*

**NPP\_VAFIP\_L2(Active Fire IP) on 2014196, LPEATE (AS3001)**





# Example of spurious detections: Mx8.4: July 2, 2014 case



HDFView - /data/data126/SCDR/SVM13\_npp\_d20140702\_11336187\_e1337429\_b13878\_c20140702195820942070\_noaa\_ops\_h5

Recent Files

TableView - BrightnessTemperature - /AI/Data/VIIRS-M13-SDR\_AI/ - /data/data126/SCDR/SVM... **M13 TB**

	0	1	2	3	4	5	6	7
0	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
1	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
2	268.81265	268.81262	269.14615	268.81262	268.81262	268.13126	268.8126	268.13126
3	270.98325	269.60553	269.4475	269.28842	268.9672	268.14478	267.97684	267.63748
4	269.90936	269.90936	268.58844	267.89978	266.8282	265.70575	267.19077	267.89975
5	267.88638	268.05386	266.856	266.14337	266.14337	268.5494	270.58652	270.13132
6	266.1578	265.39532	265.58826	265.58826	266.3446	266.3446	265.20078	265.58826
7	265.43475	264.28345	264.28345	264.47934	264.47934	264.08594	262.6539	261.7936
8	263.807	264.22437	264.22437	263.5955	262.50775	263.16656	262.7295	263.80704
9	263.2511	263.6589	264.45352	263.86008	263.2511	265.41013	266.86392	267.89853
10	265.00272	266.71182	267.07532	267.4334	268.98154	268.81436	268.81436	269.47614
11	269.66672	270.43436	269.51022	269.3527	269.03455	269.19412	268.22037	267.88678
12	268.8741	268.7058	268.70578	268.19382	268.02066	268.02066	268.02066	267.84622
13	267.74014	267.0524	267.0524	266.16373	267.22623	267.909	267.7401	267.7401
14	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
15	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
16	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
17	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
18	457.1118	457.27	457.89975	457.5853	456.7938	458.21246	459.4528	460.67413
19	462.46375	463.08267	464.15475	464.0023	465.51285	466.10925	466.1091	466.55374
20	462.66895	463.5636	462.51868	462.36823	462.3681	462.0664	461.91513	461.45972
21	464.39508	463.94907	464.0979	463.65027	463.35037	463.50027	463.50015	463.35
22	464.44675	463.97507	463.97495	462.70392	463.5004	464.28925	464.13196	464.289
23	459.17206	458.26727	456.89653	456.426	457.81064	458.115	458.11487	458.72025
24	460.31262	457.85273	456.93155	455.40838	455.0979	455.5602	455.40622	459.36874
25	458.13098	457.85273	456.93155	455.40838	455.0979	455.5602	455.40622	456.17227
26	462.85095	463.0135	463.49948	462.52432	463.01312	463.6605	464.14255	464.62195
27	460.0732	459.9135	459.2715	458.78665	460.07278	462.27542	462.43033	461.80823
28	455.89658	455.56494	454.89758	454.7298	455.73062	457.20837	458.0175	458.0174
29	458.06073	458.706	458.86642	458.5449	458.06036	458.38354	458.5446	458.5445
30	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
31	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
32	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
33	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
34	268.6455	268.30487	266.33914	264.7994	264.9975	265.38876	265.58194	266.15213
35	266.4113	266.7686	266.94522	266.4113	266.5906	267.12054	267.8091	267.67824
36	265.1252	265.32083	264.12192	263.28677	265.70712	267.72586	267.54935	266.94815
37	264.6512	263.86694	262.84778	263.26093	264.4576	266.85736	267.03226	267.37817
38	264.40735	265.00595	265.20215	264.80807	264.60864	265.20215	265.00595	265.00595
39	265.24814	266.71146	266.71146	266.53342	266.5334	266.88815	265.99112	265.80753
40	264.43158	265.0385	266.3963	267.13855	266.95514	267.13852	266.20712	265.82397
41	264.64938	266.14963	266.68842	266.68842	267.04092	267.3883	267.04092	266.51013
42	265.58774	266.89575	267.4348	266.89572	265.58774	265.58774	266.5293	266.89572

missing data (bow tie deletion)

incorrect data (bad calibration)

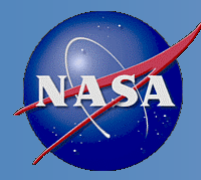
TableView - QF1\_VIIRSBANDSDR - /AI/Data/VIIRS-M13-SDR\_AI/ - /data/data126/SCDR/SVM13... **M13 TB QF1**

	0	1	2	3	4	5	6	7
0	2	2	2	2	2	2	2	2
1	2	2	2	2	2	2	2	2
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	2	2	2	2	2	2	2	2
15	2	2	2	2	2	2	2	2
16	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	2	2
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	2	2	2	2	2	2	2	2
31	2	2	2	2	2	2	2	2
32	2	2	2	2	2	2	2	2
33	2	2	2	2	2	2	2	2
34	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0

"no calibration"

"good"

QF1\_VIIRSBANDSDR (19691488)  
8-bit unsigned character, 768 x 3200  
Number of attributes = 0



# Example of spurious detections: July 2: Mx8.4 vs. Mx8.5 M13 TB



HDFView

File Window Tools Help

Recent Files: /data/data126/SCDR/SVM13\_npp\_d20140702\_t1336187\_e1337429\_b13878\_c20140702195820942070\_noaa\_ops.h5

SVM13\_npp\_d20140702...

**Mx8.4 M13 TB**

	0	1	2	3	4	5	6	7
0	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
1	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
2	268.81265	268.81262	269.14615	268.81262	268.81262	268.13126	268.8126	268.13126
3	270.98325	269.60553	269.4475	269.28842	268.9672	268.14478	267.97684	267.6374
4	269.90936	269.90936	268.58844	267.89978	266.8282	265.70575	267.19077	267.89975
5	267.88638	268.05386	266.856	266.14337	266.14337	268.5494	270.58652	270.13132
6	266.1578	265.39532	265.58826	265.58826	266.3446	266.3446	265.20078	265.58826
7	265.43475	264.28345	264.28345	264.47934	264.47934	264.08594	262.6539	261.7936
8	263.807	264.22437	264.22437	263.5955	262.50775	263.16656	262.7295	263.80704
9	263.2511	263.6589	264.45352	263.86008	263.2511	265.41013	266.86392	267.89853
10	265.00272	266.71182	267.07532	267.4334	268.98154	268.81436	269.4766	269.4766
11	269.66672	270.43436	269.51022	269.3527	269.03455	268.81436	268.22037	267.88678
12	268.8741	268.7058	268.70578	268.19382	268.02066	268.02066	268.02066	267.84622
13	267.74014	267.0524	267.0524	266.16373	267.22623	267.909	267.7401	267.7401
14	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
15	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
16	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
17	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
18	457.1118	457.27	457.89975	457.5853	456.7938	458.21246	459.4528	460.6741
19	462.46375	463.08267	464.15475	464.0023	465.51285	466.10925	466.1091	466.5537
20	462.66895	463.5636	462.51868	462.36823	462.3681	462.0664	461.91513	461.4597
21	464.39508	463.94907	464.0979	463.65027	463.35037	463.50027	463.50015	463.35
22	464.44675	463.97507	463.97495	462.70392	463.5004	464.28925	464.13196	464.289
23	459.17206	458.26727	456.89053	456.427	457.91064	459.115	458.11487	458.7202
24	460.87067	460.70067	463.33033	462.2127	463.33033	463.33033	463.33033	463.33033
25	458.13098	457.85273	456.93153	455.40336	455.0979	455.5802	455.40622	456.1722
26	462.85095	463.0135	463.49948	462.52432	463.01312	463.6605	464.14255	464.6213
27	460.0732	459.9135	459.2715	458.78665	460.07278	462.27542	462.43033	461.80882
28	455.89658	455.56494	454.89758	454.7298	455.73062	457.20837	458.0175	458.0174
29	458.06073	458.706	458.86642	458.5449	458.06036	458.38354	458.5446	458.5445
30	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
31	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
32	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
33	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
34	268.6455	268.30487	266.33914	264.7994	264.9975	265.38876	265.58194	266.15213
35	266.4113	266.7686	266.94522	266.4113	266.5906	267.12054	267.8091	267.97824
36	265.1252	265.32083	264.12192	263.28677	265.70712	267.72586	267.54935	266.64615
37	264.6512	263.86694	262.84778	263.26093	264.4576	266.85736	267.03226	267.37817
38	264.40735	265.00595	265.20215	264.80807	264.60864	265.20215	265.00595	265.00595
39	265.24814	266.71146	266.71146	266.53342	266.5334	266.88815	265.99112	265.80753
40	264.43158	265.0385	266.3963	267.13855	266.95514	267.13852	266.20712	265.82397
41	264.64938	266.14963	266.68842	266.68842	267.04092	267.3883	267.04092	266.51013
42	265.58774	266.89575	267.4348	266.89572	265.58774	265.58774	266.5293	266.89572

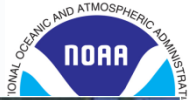
**Mx8.5 M13 TB**

	0	1	2	3	4	5	6	7
0	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
1	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
2	268.81265	268.81262	269.14615	268.81262	268.81262	268.13126	268.8126	268.13126
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4	269.90936	269.90936	268.58844	267.89978	266.8282	265.70575	267.19077	267.89975
5	267.88638	268.05386	266.856	266.14337	266.14337	268.5494	270.58652	270.13132
6	266.1578	265.39532	265.58826	265.58826	266.3446	266.3446	265.20078	265.58826
7	265.43475	264.28345	264.28345	264.47934	264.47934	264.08594	262.6539	261.7936
8	263.807	264.22437	264.22437	263.5955	262.50775	263.16656	262.7295	263.80704
9	263.2511	263.6589	264.45352	263.86008	263.2511	265.41013	266.86392	267.89853
10	265.00272	266.71182	267.07532	267.4334	268.98154	268.81436	269.4766	269.4766
11	269.66672	270.43436	269.51022	269.3527	269.03455	268.81436	268.22037	267.88678
12	268.8741	268.7058	268.70578	268.19382	268.02066	268.02066	268.02066	267.84622
13	267.74014	267.0524	267.0524	266.16373	267.22623	267.909	267.7401	267.7401
14	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
15	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
16	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
17	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
18	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
19	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
20	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
21	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
22	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
23	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
24	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
25	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
26	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
27	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
28	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
29	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5	-999.5
30	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
31	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
32	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
33	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7	-999.7
34	268.6455	268.30487	266.33914	264.7994	264.9975	265.38876	265.58194	266.15213
35	266.4113	266.7686	266.94522	266.4113	266.5906	267.12054	267.8091	267.97824
36	265.1252	265.32083	264.12192	263.28677	265.70712	267.72586	267.54935	266.64615
37	264.6512	263.86694	262.84778	263.26093	264.4576	266.85736	267.03226	267.37817
38	264.40735	265.00595	265.20215	264.80807	264.60864	265.20215	265.00595	265.00595
39	265.24814	266.71146	266.71146	266.53342	266.5334	266.88815	265.99112	265.80753
40	264.43158	265.0385	266.3963	267.13855	266.95514	267.13852	266.20712	265.82397
41	264.64938	266.14963	266.68842	266.68842	267.04092	267.3883	267.04092	266.51013
42	265.58774	266.89575	267.4348	266.89572	265.58774	265.58774	266.5293	266.89572

BrightnessTemperature (9840768)  
32-bit floating-point, 768 x 3200  
Number of attributes = 0

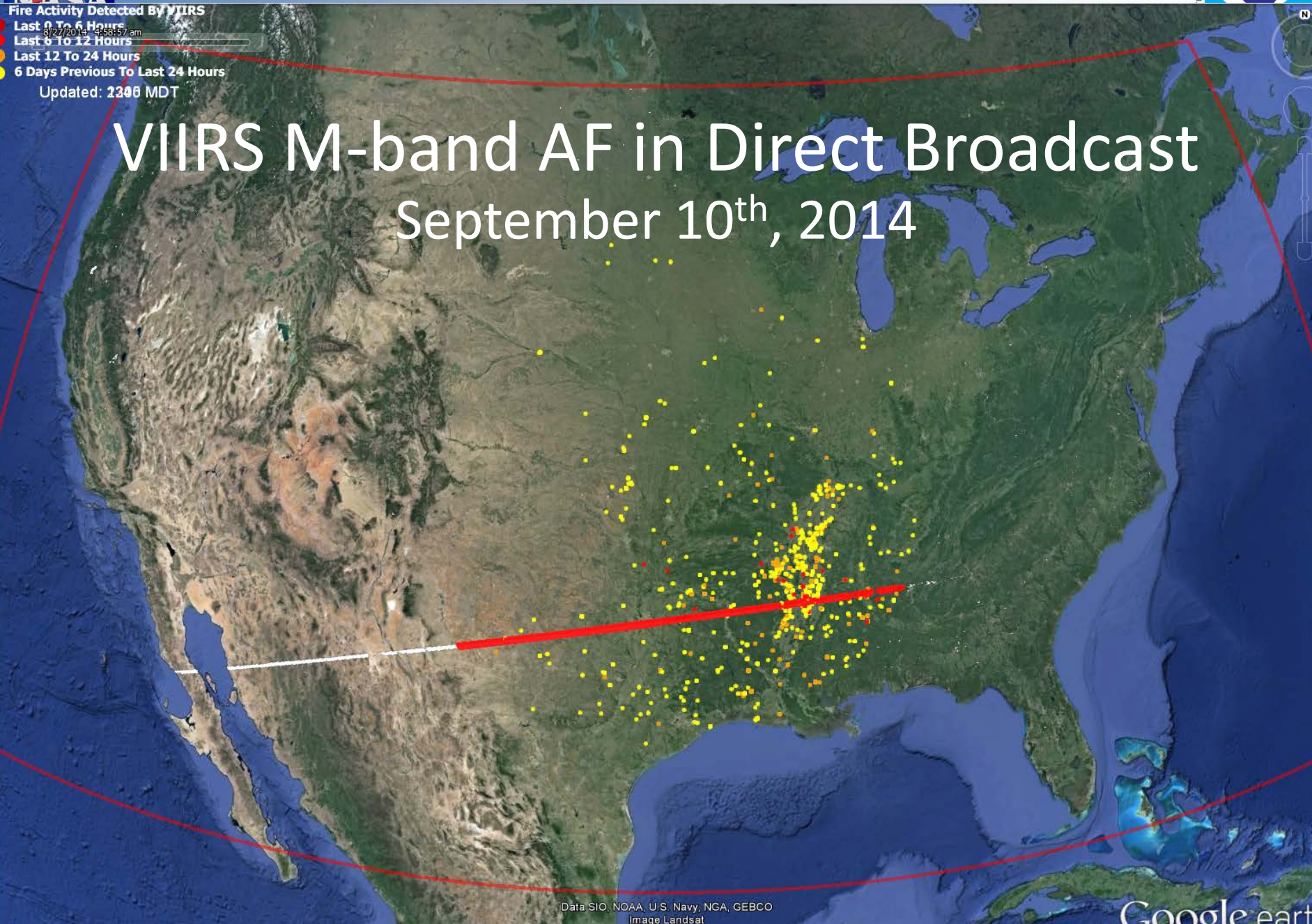
incorrect data (bad calibration)

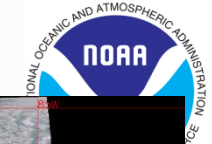
missing data



Fire Activity Detected By VIIRS  
 Last 0 To 6 Hours  
 Last 6 To 12 Hours  
 Last 12 To 24 Hours  
 6 Days Previous To Last 24 Hours  
 Updated: 2308 MDT

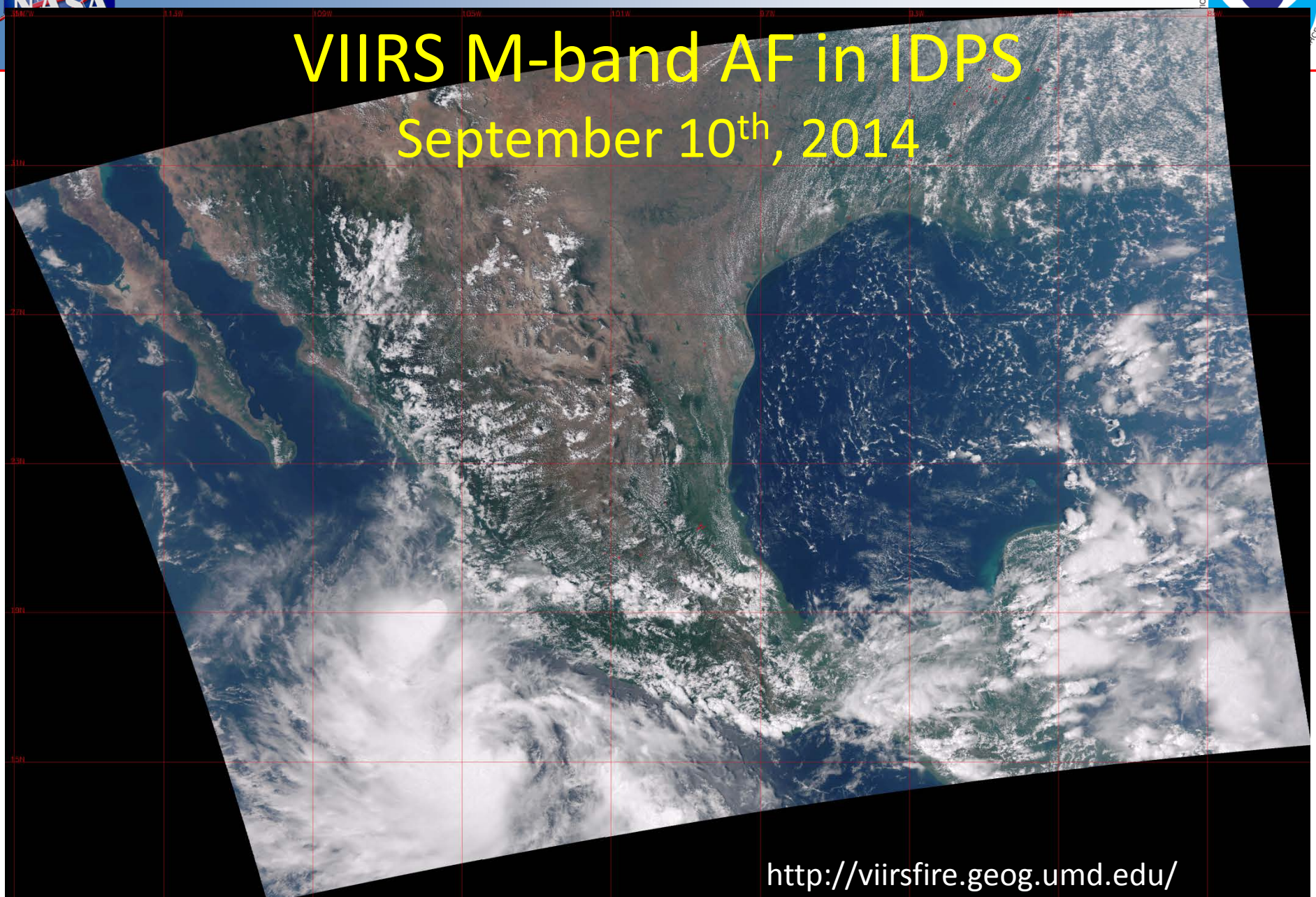
# VIIRS M-band AF in Direct Broadcast September 10<sup>th</sup>, 2014





# VIIRS M-band AF in IDPS

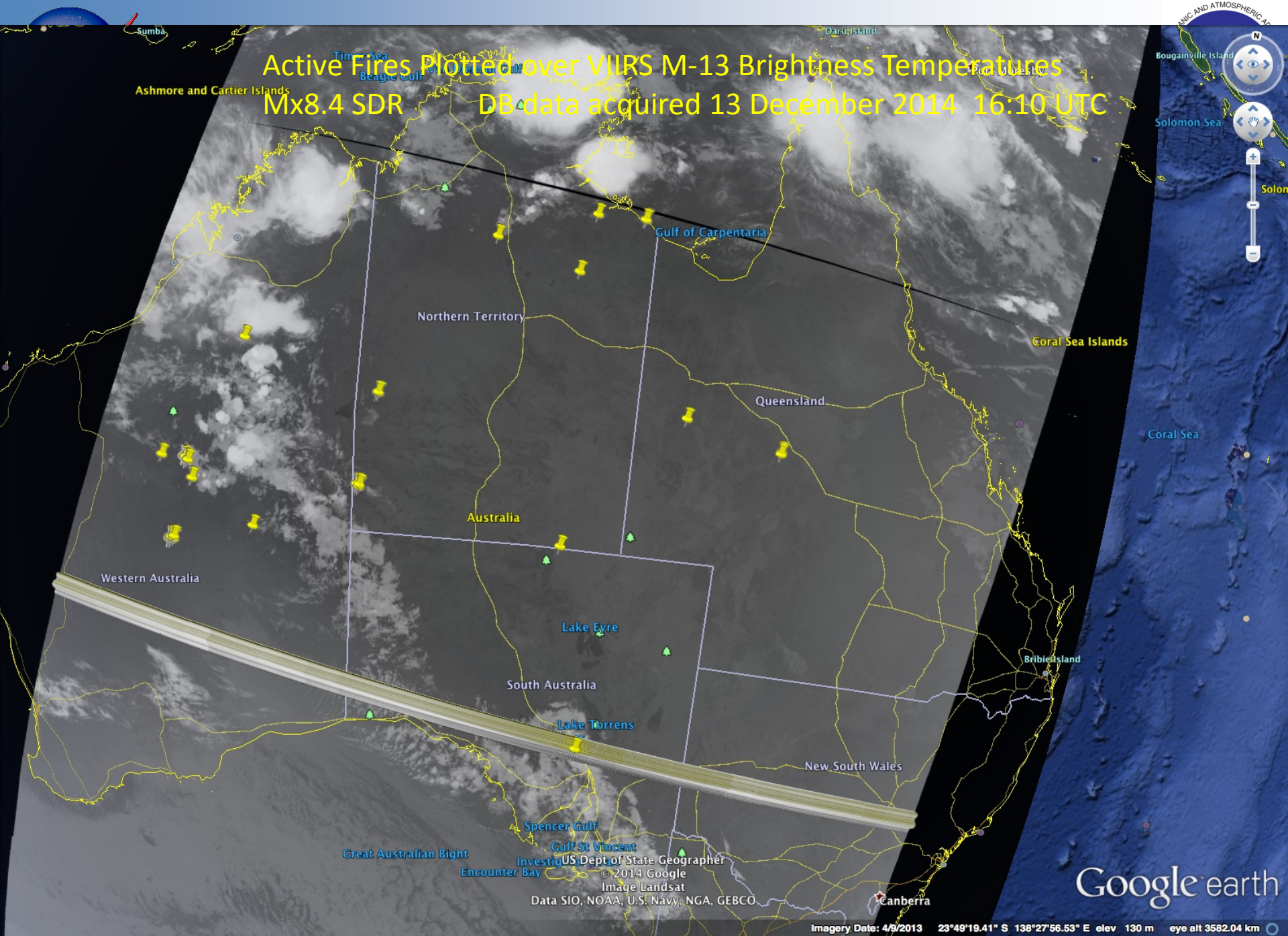
## September 10<sup>th</sup>, 2014



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

# Active Fires Plotted over VIIRS M-13 Brightness Temperatures

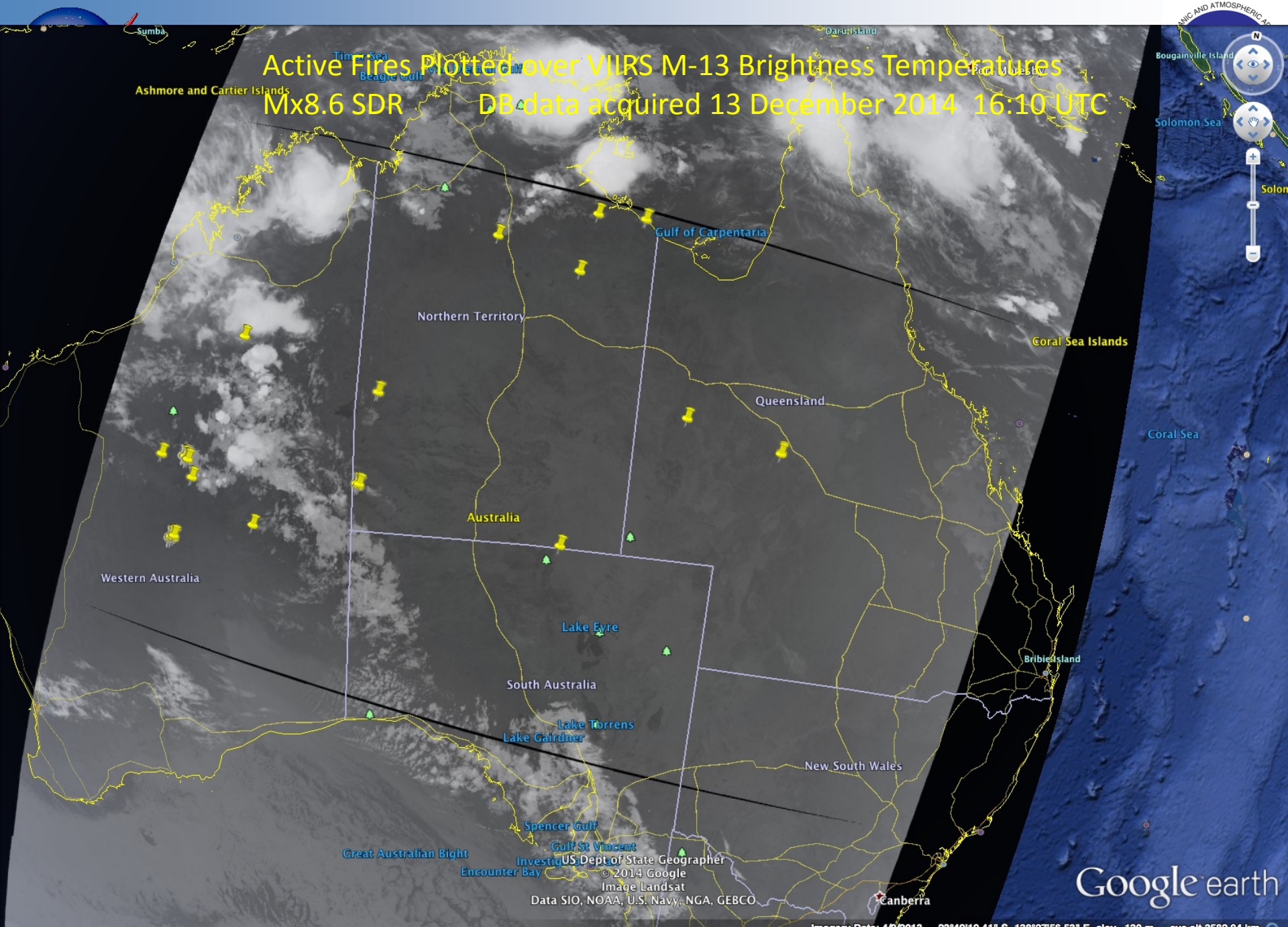
Mx8.4 SDR DB data acquired 13 December 2014 16:10 UTC



Credit: Lan-Wei Wang (Geoscience Australia) / Kathleen Strabala (University of Wisconsin – Madison)

# Active Fires Plotted over VIIRS M-13 Brightness Temperatures

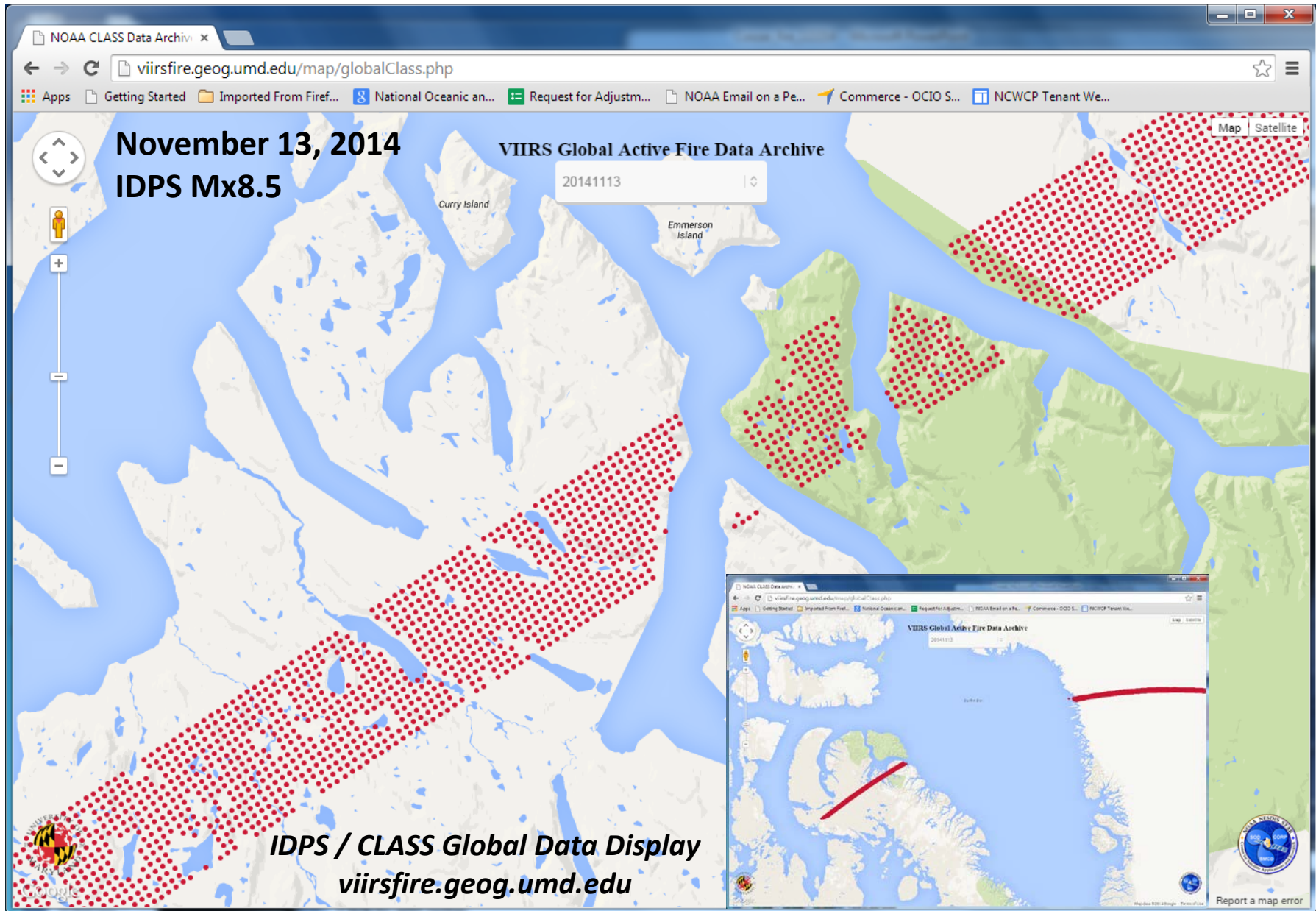
Mx8.6 SDR DB data acquired 13 December 2014 16:10 UTC

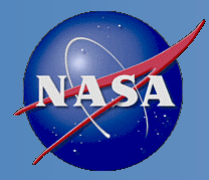


Credit: Lan-Wei Wang (Geoscience Australia) / Kathleen Strabala (University of Wisconsin – Madison)



# Remaining data anomalies in IDPS

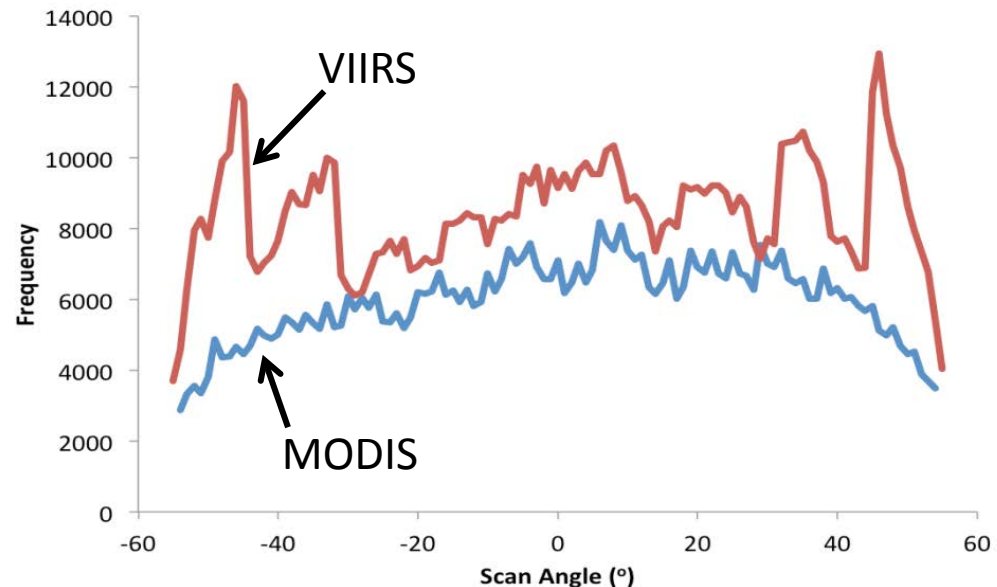
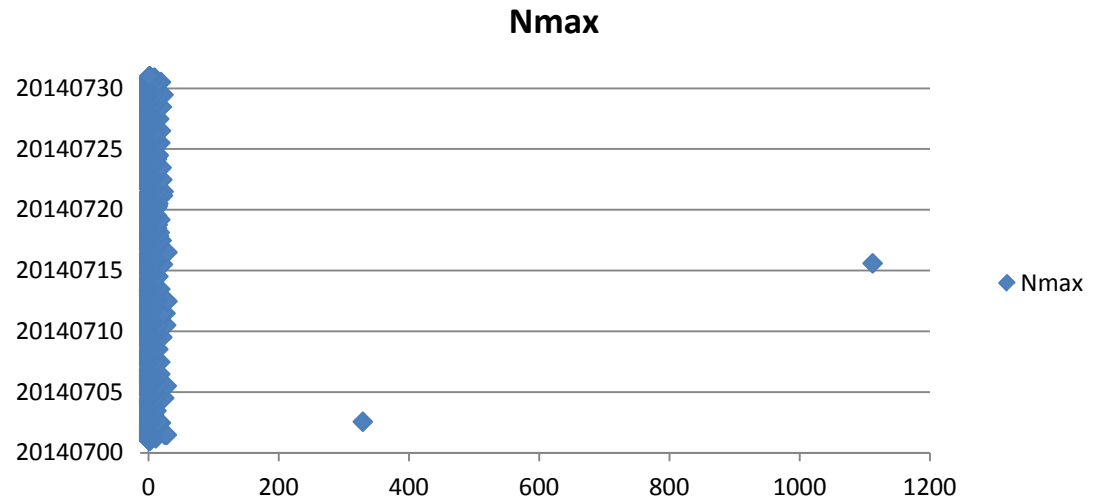




# Monitoring Methods/Strategies



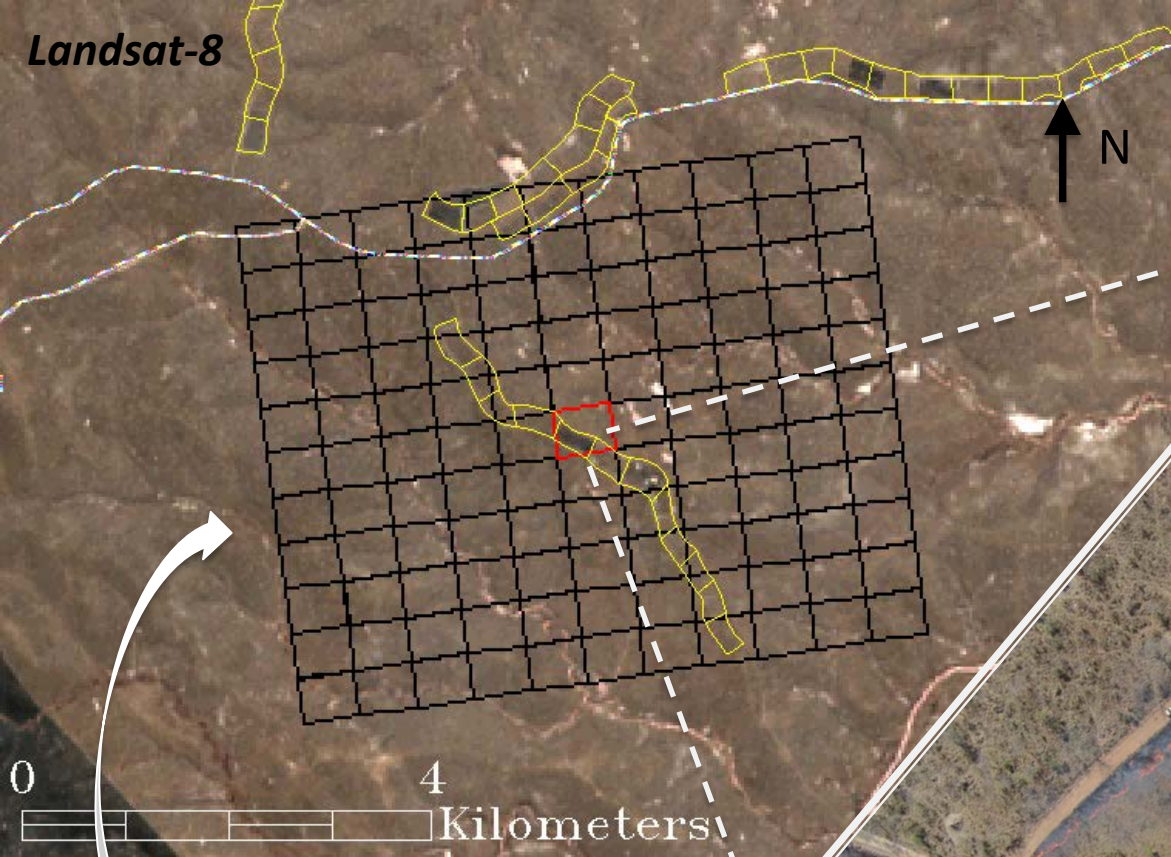
- Identification of data anomalies: spurious fire detections
  - Typically long segments of scan lines
- Monitoring key QFs
  - Input SDR quality
  - Detection confidence statistics
- Comparison with Aqua MODIS
  - Consistency; close match not expected due to differences in detection capabilities
- No in-situ data are available for systematic monitoring



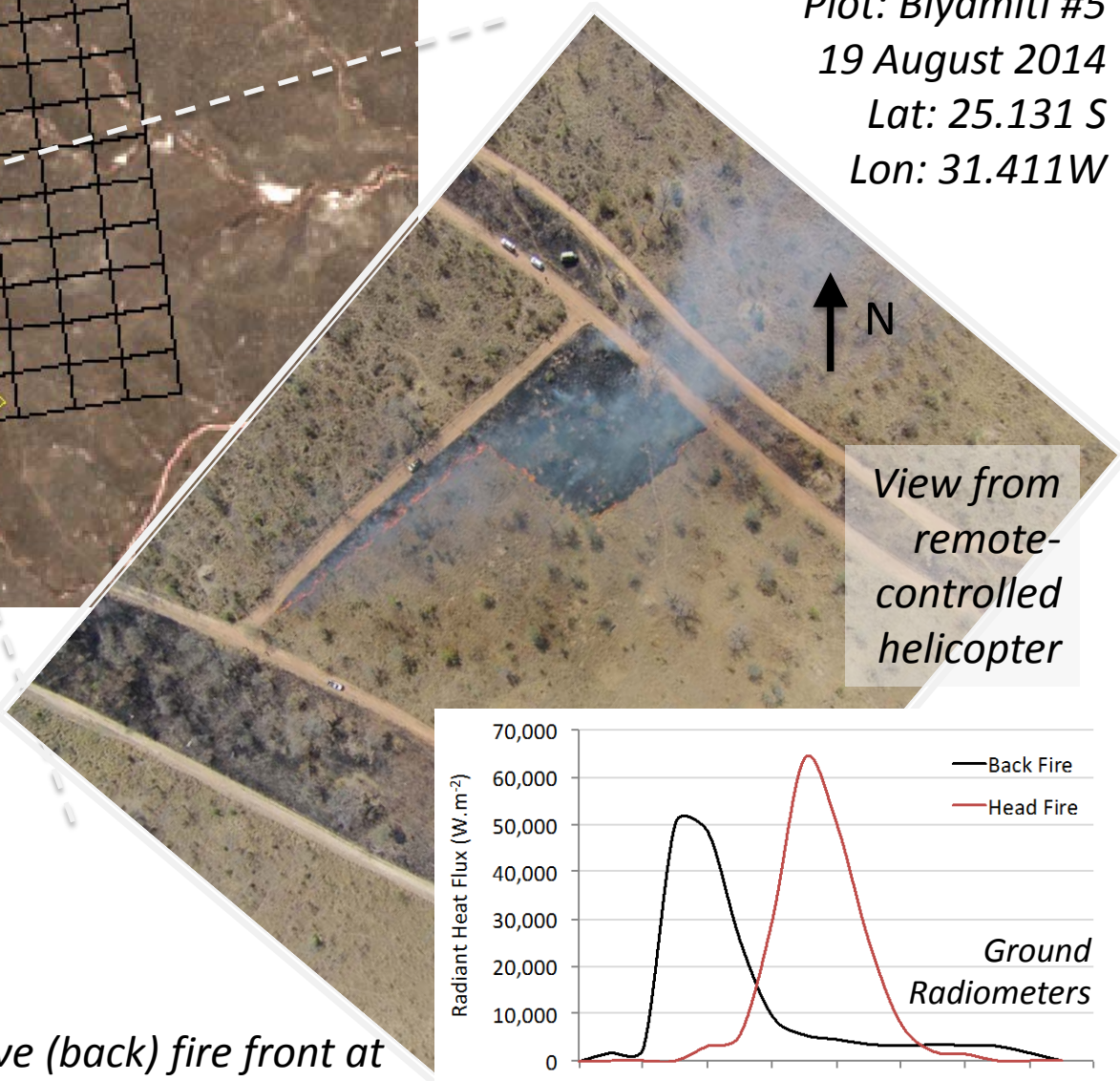
Feb - Jun 2013



Landsat-8



Plot: Biyamiti #5  
 19 August 2014  
 Lat: 25.131 S  
 Lon: 31.411W



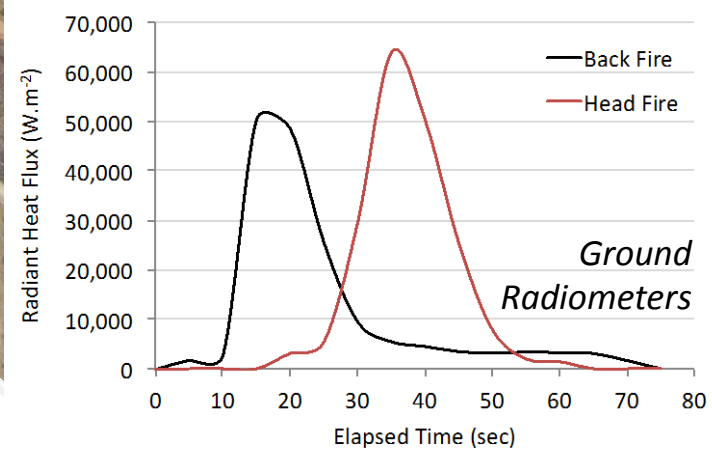
View from  
 remote-  
 controlled  
 helicopter

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

Surface-leaving FRP (VIIRS):  
 $4.4 \pm 0.2 \text{ MW}$   
 @ 13:24:26 h local time



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





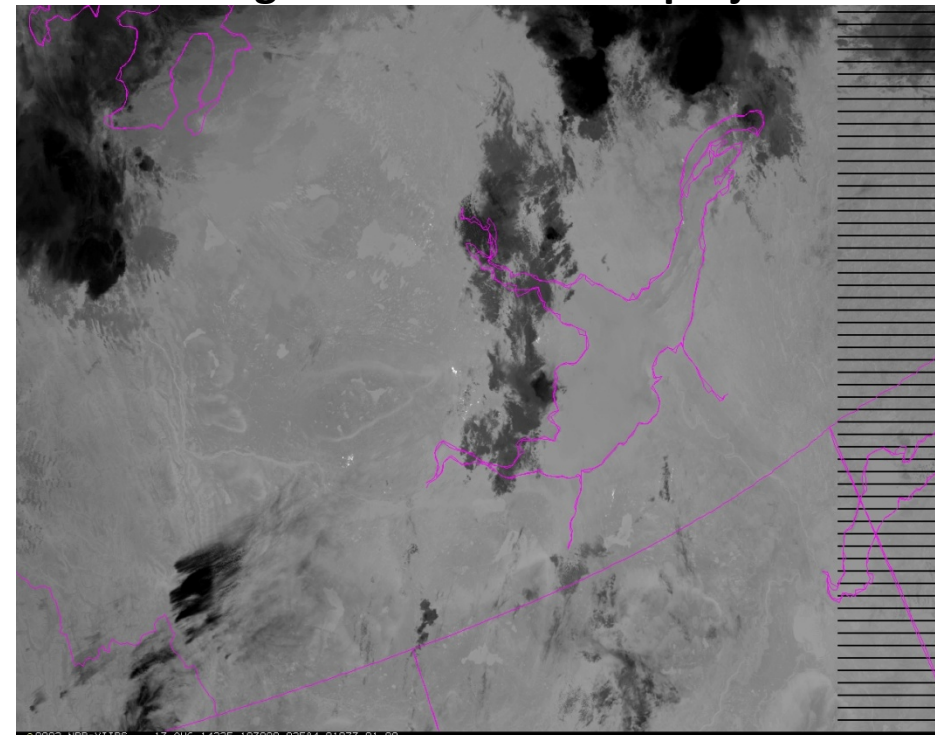
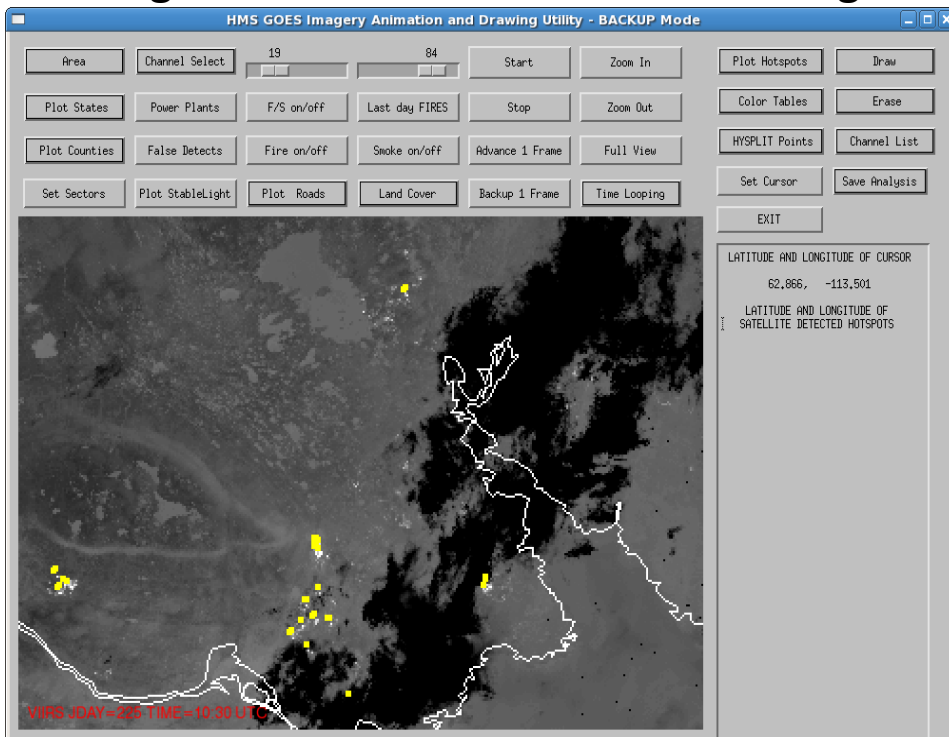
# VIIRS Fire in the NOAA Hazard Mapping System (HMS)



- **VIIRS Active Fire is incorporated** with detected fires from numerous other satellite sources (GOES, POES and MODIS) and undergoes **additional manual quality control** before being merged into a unified daily fire analysis product for North America.
- The AFP also provides an additional **data source as input for initializing the daily National Weather Service Air Quality smoke forecast.**

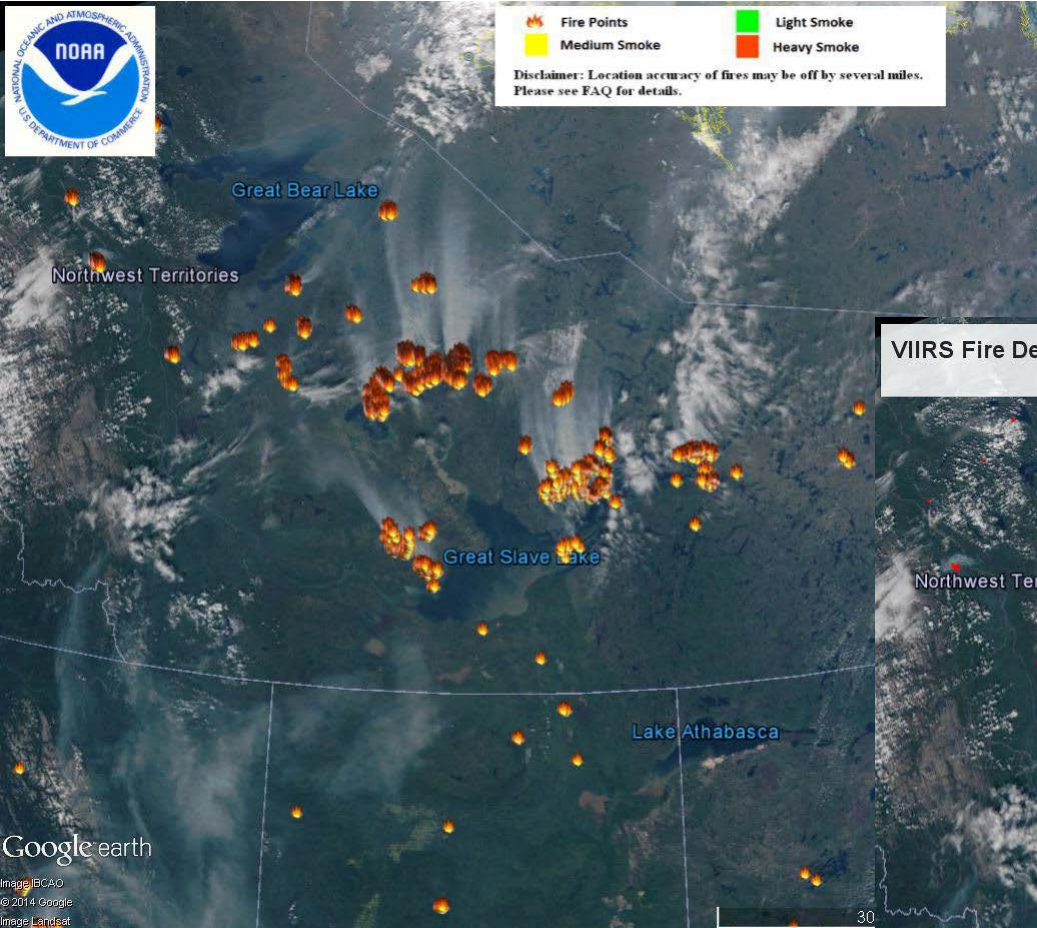
VIIRS AFP from 13 August 0850Z and 1030Z images over VIIRS M13 SDR 1030Z image

McIDAS display of 13 August 1030Z M13 SDR image in native satellite projection



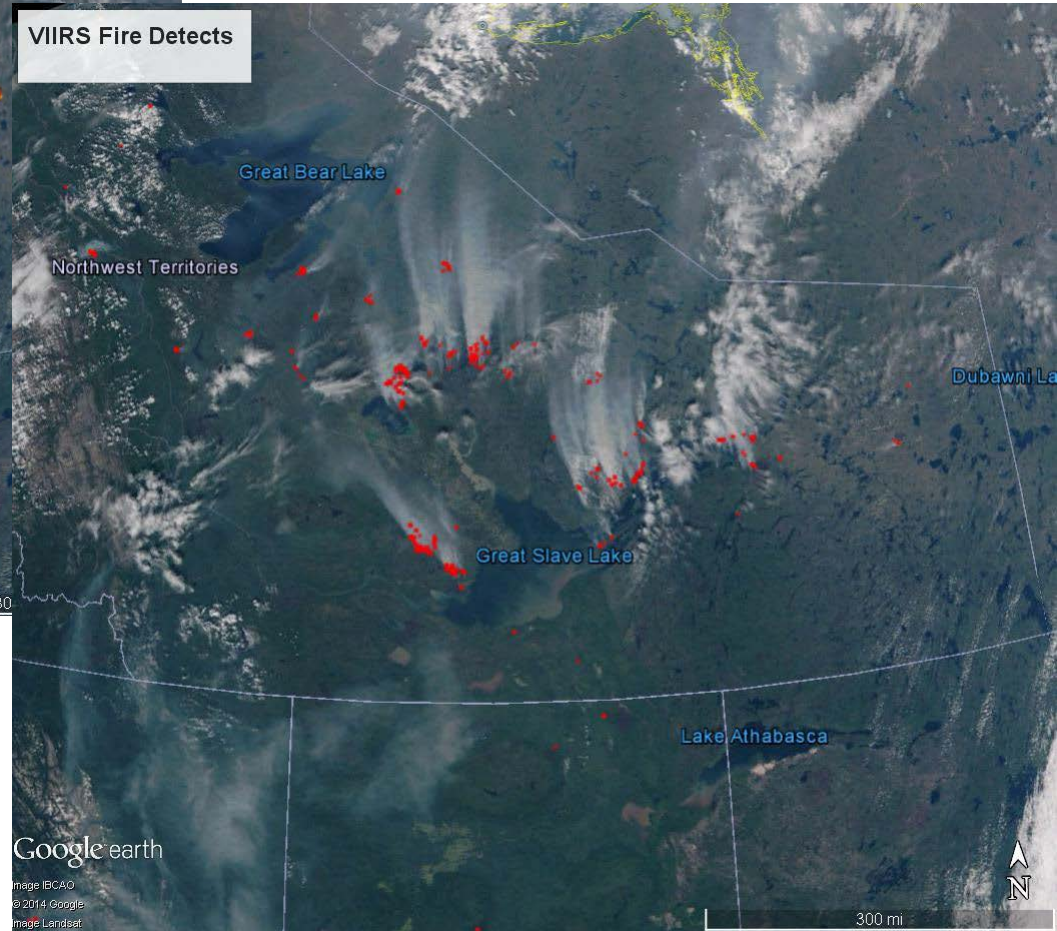


# VIIRS Fire in the NOAA Hazard Mapping System (HMS)



*The relative contribution of VIIRS data is being evaluated, including needs for operational redundancy.*

**IDPS VIIRS fire product**



**HMS multi-sensor analysis**

July 13, 2014, NW Canada

*Full operational implementation in early 2015.*

Google earth

Image: IBCAO  
© 2014 Google  
Image: Landsat

Google earth

Image: IBCAO  
© 2014 Google  
Image: Landsat

300 mi



# Fire and Smoke

## Initiative Objectives



- Organize a forum to allow stakeholder supporting Fire and Smoke detection and forecasting to interact
- Encourage participation of the stakeholder organizations with current responsibilities in Fire and Smoke detection and forecasting.
- Understand the current use of geostationary and polar orbiting satellite capabilities in support of Fire and Smoke detection and forecasting mission
- Identify current SNPP/JPSS and new GOES-R data and capabilities with the potential to improve support to this mission
- Establish methodologies and procedures for the operational demonstrations of these capabilities
- Following these operational demonstrations, identify the satellite capabilities whose operational impacts are sufficient to warrant transition from research to operations
- Determine required actions for an effective transition of these capabilities to operations



# VIIRS active fire data portal



VIIRS AF Table Data | VIIRS x


viirsfire.geog.umd.edu/viirs-af-table-data

Apps Getting Started Imported From Firef... National Oceanic an... Request for Adjustm... NOAA Email on a Pe... Commerce - OCIO S... NCWCP Tenant We...

VIIRS Active Fire Home About FAQ VIIRS AF Products VIIRS vs MODIS **Maps & Data** Contact Us


## VIIRS AF Table Data <http://viirsfire.geog.umd.edu/>

### View CONUS Active Fire Map



View active fire detections. The map also provides an icon to represent the center of each VIIRS granule, weather information (temperature and cloud cover), and RSS feeds for US active fire perimeters and Incident Information. RSS feeds provided by GEOMAC and InciWeb, respectively.

### View Global Active Fire Map



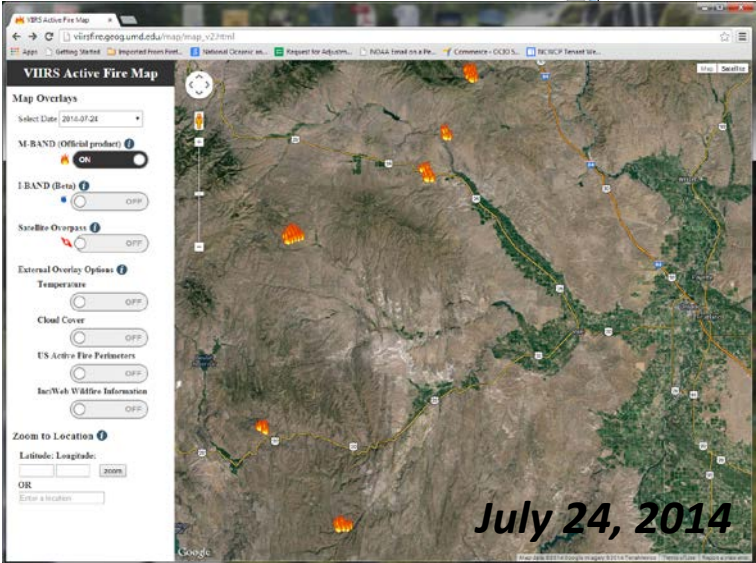
VIIRS daily global active fire detections

### Data Archive

Displaying 1 - 20 of 6395

Date

Date	Timestamp	ASCII	KMZ	TIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2015-01-01	NDD_VIIRS_00150101_165500_170000	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)



VIIRS Active Fire Map

Map Overlays

Select Date: 2015.07.24

M-BAND (Official product)  ON

1BAND (Beta)  OFF

Satellite Overpass  OFF

External Overlay Options

Temperature  OFF

Cloud Cover  OFF

US Active Fire Perimeters  OFF

InciWeb Wildfire Information  OFF

Zoom to Location

Latitude, Longitude:

OR

Enter a location

July 24, 2014



# VIIRS active fire data portal



VIIRS Active Fire Map

viirsfire.geog.umd.edu/map/map\_v2.html

Map Overlays

Select Date: 2015-01-04

M-BAND (Official product) **ON**

I-BAND (Beta) **ON**

Satellite Overpass **ON**

External Overlay Options

Temperature **OFF**

Cloud Cover **OFF**

US Active Fire Perimeters **OFF**

InciWeb Wildfire Information **OFF**

Zoom to Location

Latitude: Longitude:

**NPP\_VIIRS\_20150104\_201500\_202000**

Latitude: 27.7405  
Longitude: -106.143  
Date: 01/04/2015

M-Band Downloads

[View](#)  
[\(GeoTIFF\) Download](#)  
[\(ASCII\) Download](#)  
[\(KMZ\) Download](#)

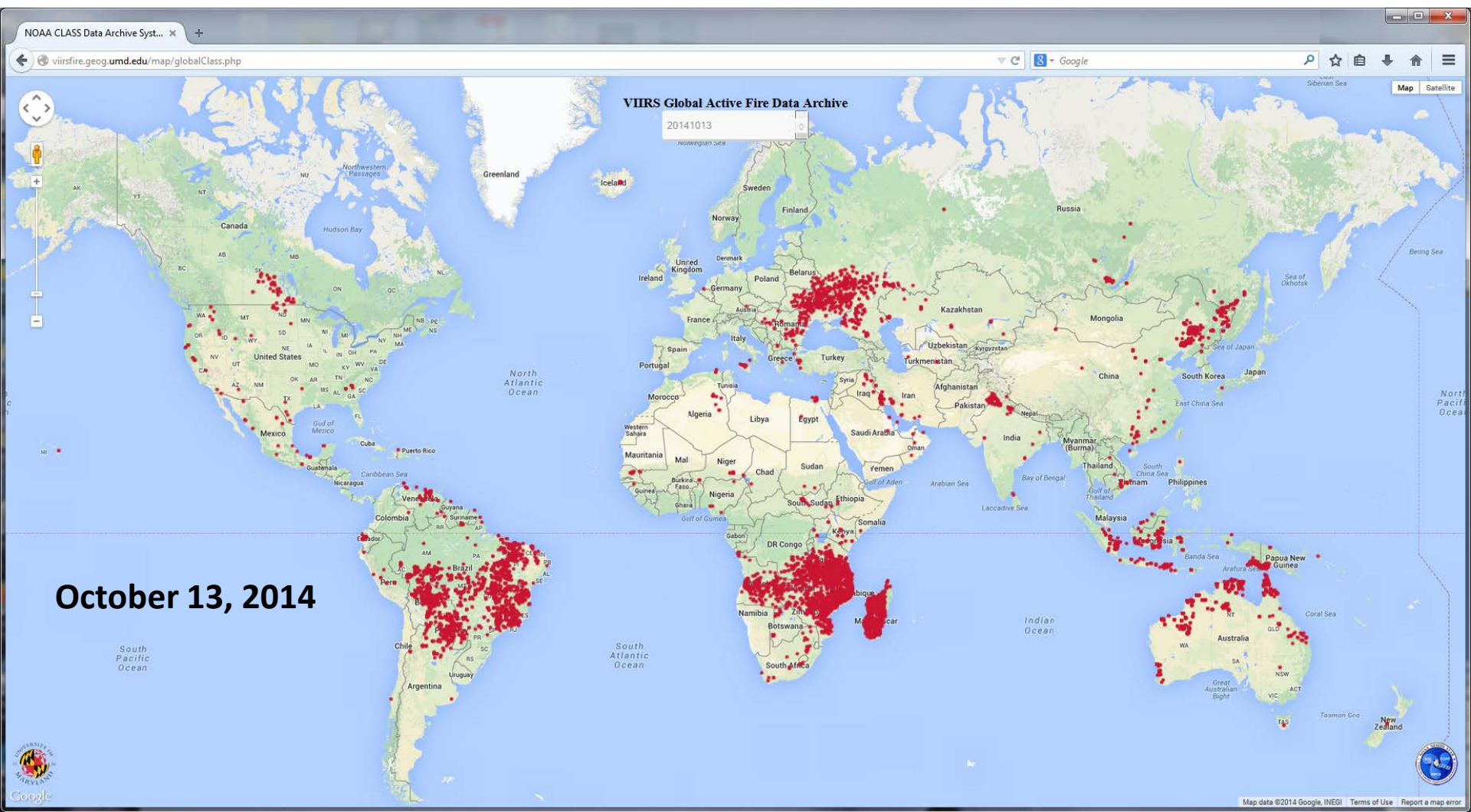
I-Band Downloads

[View](#)  
[\(GeoTIFF\) Download](#)  
[\(KML CONUS\) Download](#)  
[\(KML Overpass\) Download](#)

The screenshot displays the VIIRS Active Fire Map web application. The main map shows North America with various fire data overlays. A popup window is open, providing detailed information for a specific fire event: NPP\_VIIRS\_20150104\_201500\_202000. The popup includes the fire's latitude (27.7405), longitude (-106.143), and date (01/04/2015). It also offers download options for M-Band and I-Band data in various formats (GeoTIFF, ASCII, KMZ, KML). Two satellite images are shown side-by-side, illustrating the fire's location and the satellite overpass. The left sidebar contains controls for map overlays, including date selection, M-Band and I-Band toggles, and external overlay options like Temperature, Cloud Cover, US Active Fire Perimeters, and InciWeb Wildfire Information. The bottom of the page features a zoom-to-location input field.



# VIIRS active fire data portal



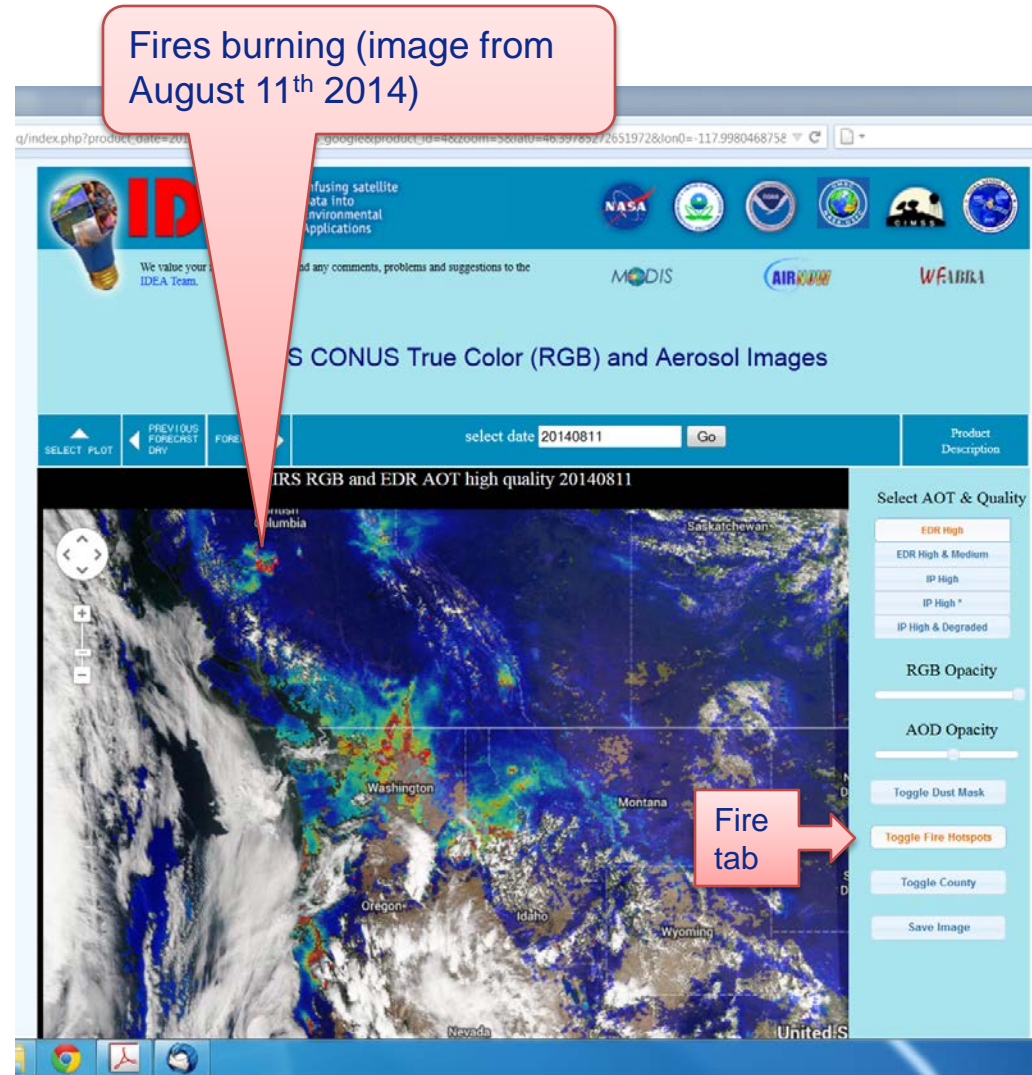
**<http://viirsfire.geog.umd.edu/>**  
**[Data from NOAA CLASS: http://www.nsof.class.noaa.gov/](http://www.nsof.class.noaa.gov/)**



# VIIRS Fire in STAR Smoke Analysis system (IDEA)



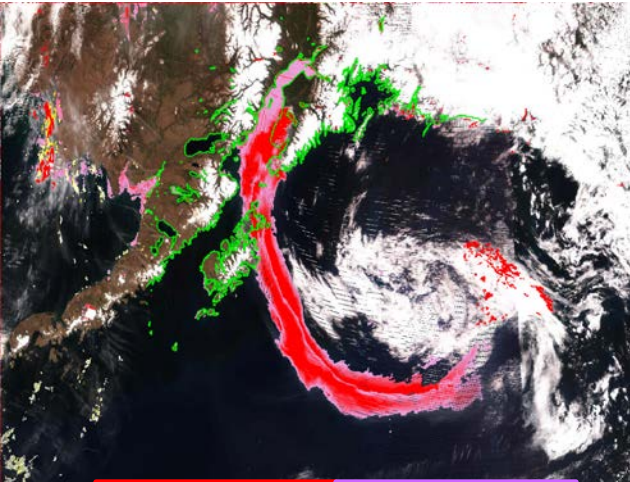
- IDEA (Infusing satellite Data into Environmental Applications) system and ASDA (Automated Smoke Detection and tracking Algorithm) have been using **VIIRS hot spots** generated from DB data since March 2013. NDE products will also be used when available operationally.
- GBBEPx (Global Biomass Burning Emissions Product – Extended) will also use the product when **FRP** becomes available along with fire detection
- Air quality forecasters use the IDEA system in their daily forecasting. *This website gets more than one million hits each year.*
- NWS Alaska and Western regions will use ASDA smoke plumes for incident monitoring and containment activities. *Through new fire and smoke initiative*
- GBBEPx using fire detection and FRP will generate emissions that will be used by NCEP's global aerosol model



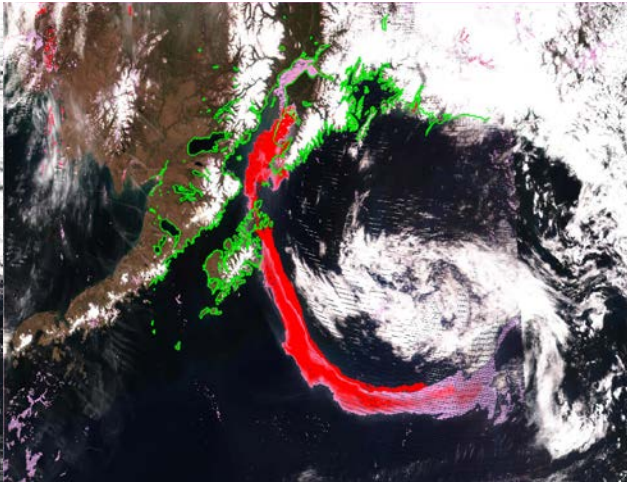
<http://www.star.nesdis.noaa.gov/smcd/spb/aq/>



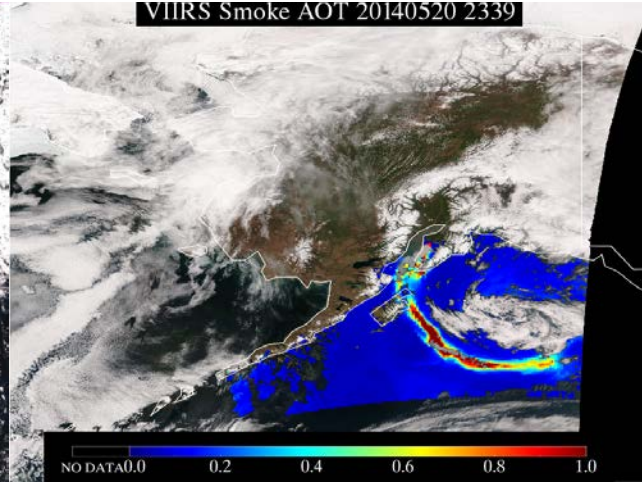
JPSS RR Algorithm



GOES-R ABI algorithm



ASDA Algorithm



Thick Smoke

Thin Smoke

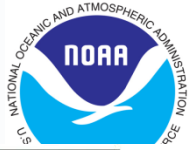
*Funny River Fire Southern Alaska on 05/20/2014*

- Smoke event nicely captured by VIIRS
  - Qualitative smoke detection has some data artifacts: false dust detection, false smoke detection in between clouds. But this smoke was mixed in with clouds quite a bit so hard to tell if smoke near clouds is true or not. Need to evaluate further.
  - ASDA “smoke AOD” product is quantitative but has a higher latency due to run time of the ASDA algorithm
- Question to users: which product do you prefer? A qualitative product generated with lower latency or a quantitative product with higher latency



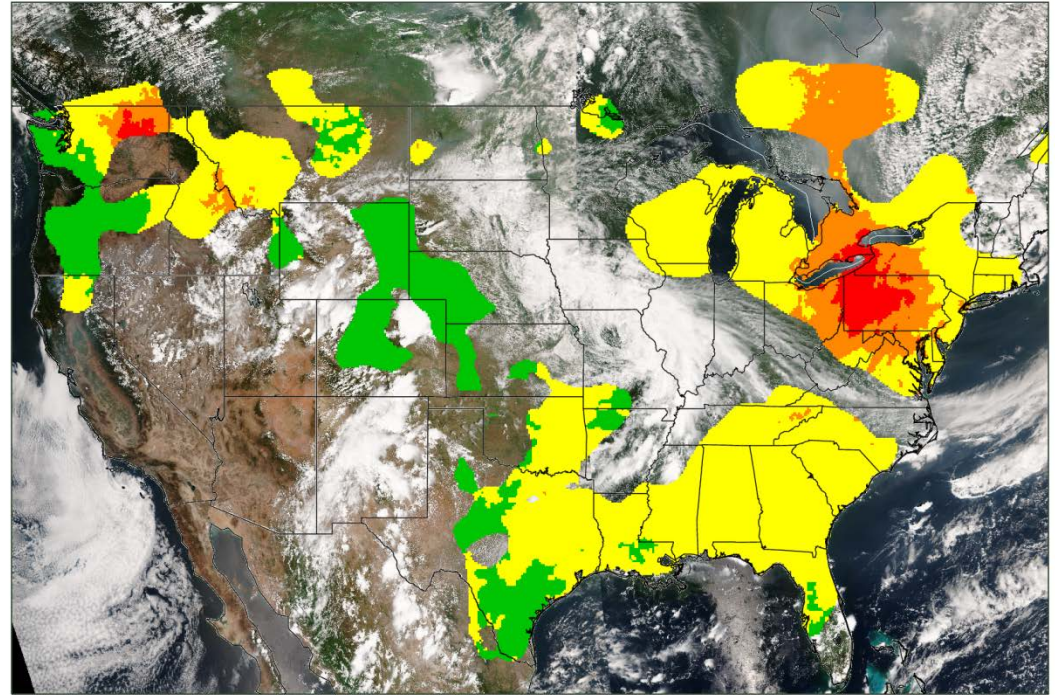
# Air Quality and Public Health

## Air Quality Index (AQI) for August 7, 2014 from SNPP VIIRS



Aerosols from natural (**fires**, volcanic eruptions, dust storms) and man-made (cars, industry) sources are harmful to human health. **More than 3 million premature deaths globally per year\***.

EPA ground monitors not dense enough to provide monitoring and warnings for 40 million people living in rural areas in the US. Satellite data help fill the spatial gaps



NESDIS satellite-derived air quality products used in Environmental Protection Agency (EPA) Air Quality Index (AQI) forecasts. Currently using Aqua/Terra MODIS with plans to transition to SNPP VIIRS. *AQI derived for August 7, 2014 using SNPP VIIRS aerosol optical thickness is shown above as an example.*

\*Global Disease Burden project by Lim et al., The Lancet, 2012

Courtesy of S. Kondragunta (STAR) and H. Zhang (IMSG)



# Global Observation of Forest and Land Cover Dynamics Fire Implementation Team Meeting



*Primary forum for international outreach and coordination*



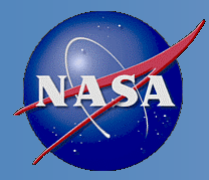
***NOAA Center for Weather and Climate Prediction, College Park, MD, July 29-31 2014***



# Summary and conclusions



- The **IDPS Suomi NPP product** is stable
  - Validated Stage 1 science maturity and NOAA Operational status
- Some **data anomalies** in Direct Broadcast and high latitudes remain
- A processing code is available to generate a product that meets the **JPSS 1 requirements** is available
  - Developed as part of a NASA Science Team effort
  - Implemented at STAR
- An automated **long-term monitoring system** is being set up at STAR for quality monitoring and reactive maintenance of the Suomi NPP Active Fire product
- Continuing efforts towards rigorous **validation** using **independent reference data**
- Domestic and international **partnerships and user outreach** are ongoing as part of Proving Ground / Fire and Smoke and GOFC-GOLD initiatives



# For more information



- **NOAA JPSS**

[www.jpss.noaa.gov](http://www.jpss.noaa.gov)

- **NOAA STAR JPSS**

[www.star.nesdis.noaa.gov/jpss](http://www.star.nesdis.noaa.gov/jpss)

- **VIIRS Fire Evaluation and Data Portal**

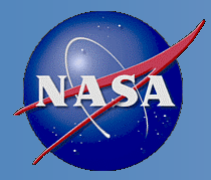
[viirsfire.geog.umd.edu](http://viirsfire.geog.umd.edu)

- **STAR JPSS 2014 Annual Science Team Meeting**

[www.star.nesdis.noaa.gov/star/meeting\\_2014JPSSAnnual\\_agenda.php](http://www.star.nesdis.noaa.gov/star/meeting_2014JPSSAnnual_agenda.php)

- 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>



# Backup slides



- Limited observations and measurements near fires
- Real-time detection of fires
- Improved high-res model forecast guidance
- Fine-scale coupled model (sub 1-km, hourly)
- Improved Red Flag ID, lead time, indexing
- No coupled smoke behavior prediction less than 4 km res
- Intra-seasonal prediction of fires
- IMET capability improvements (training, customer interface)
- Tool for debris flow prediction
- Social science evaluation

*Eli Jacks, Supervisory Meteorologist, Fire and Public Weather Services*

*Peter Roohr, Meteorologist, Science Plans Branch*

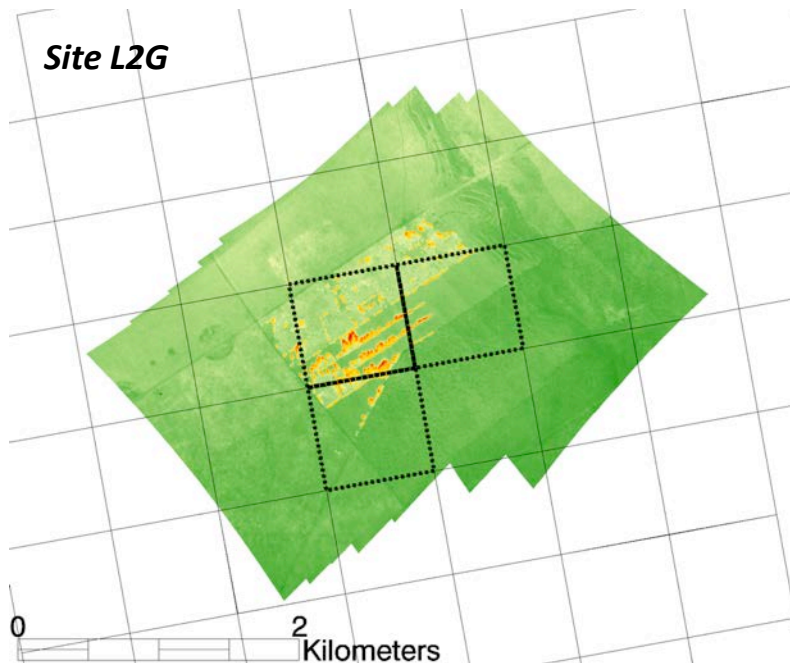
*Heath Hockenberry, Meteorologist, Fire and Public Weather Services*



# VIIRS Fire Product Validation: Preliminary Results



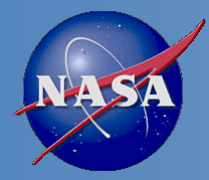
Prescribed Fire Combustion and Atmospheric Dynamics Research (RxCadre) experiment in Eglin Air Force Base, FL Nov 2012.



VIIRS (750 m) mapping of 2012 prescribed fire in Florida using airborne reference data (WASP sensor)

Satellite	Fire	FRP (MW)			Cloud	Time (UTC)		Diff (s)
		WASP	MODIS	Diff		WASP	MODIS	
MODIS	L1G	148	143	5	Yes	19:19:47	19:18:58	49
	L2G	111	167	-55	No	18:42:26	18:42:01	25
	L2F	119	199	-79	No	19:25:56	19:25:05	51
	Mean (SD)			-43 (44)				
VIIRS	L1G	414	158	256	Yes	18:59:24	18:59:54	30
	L2G	152	151	1	No	18:49:08	18:47:22	106
	L2F	487	237	250	Yes	18:29:47	18:28:34	73
	Mean (SD)			169 (146)				

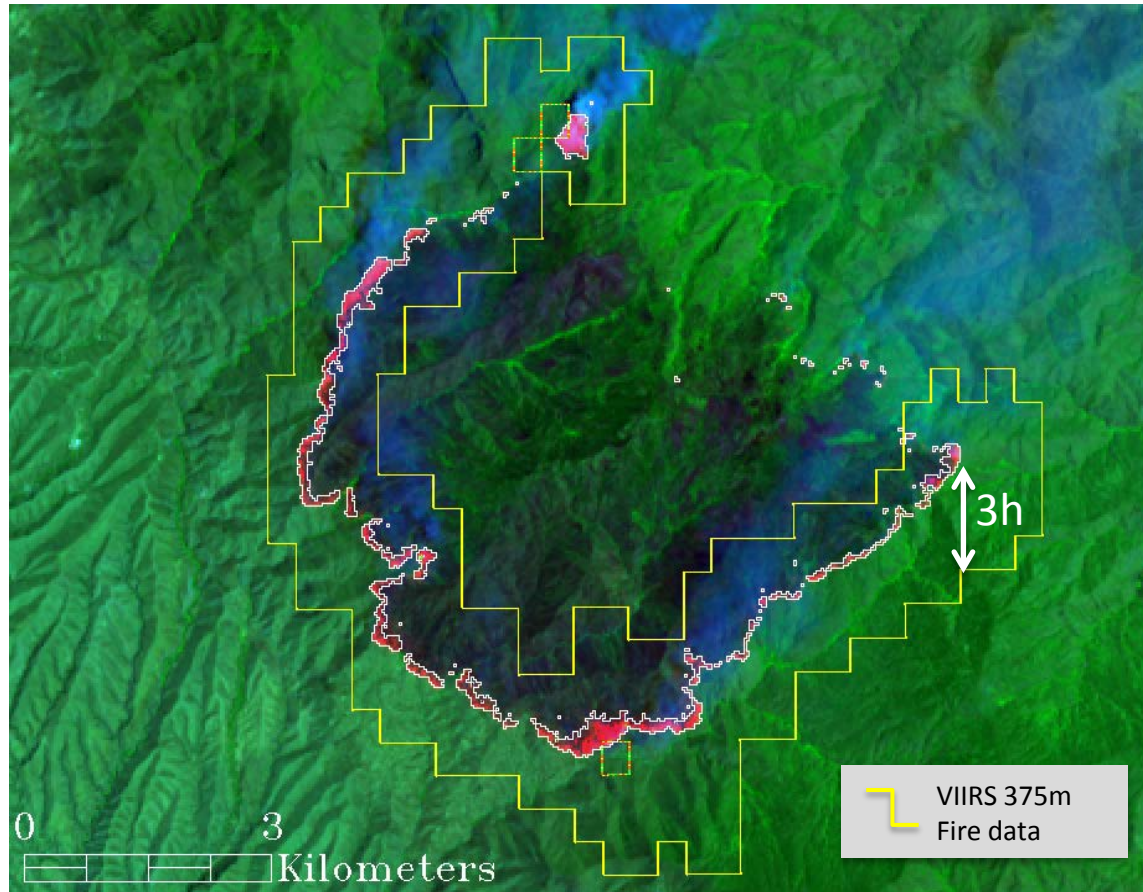




# Landsat-8 30 m Active Fire Data

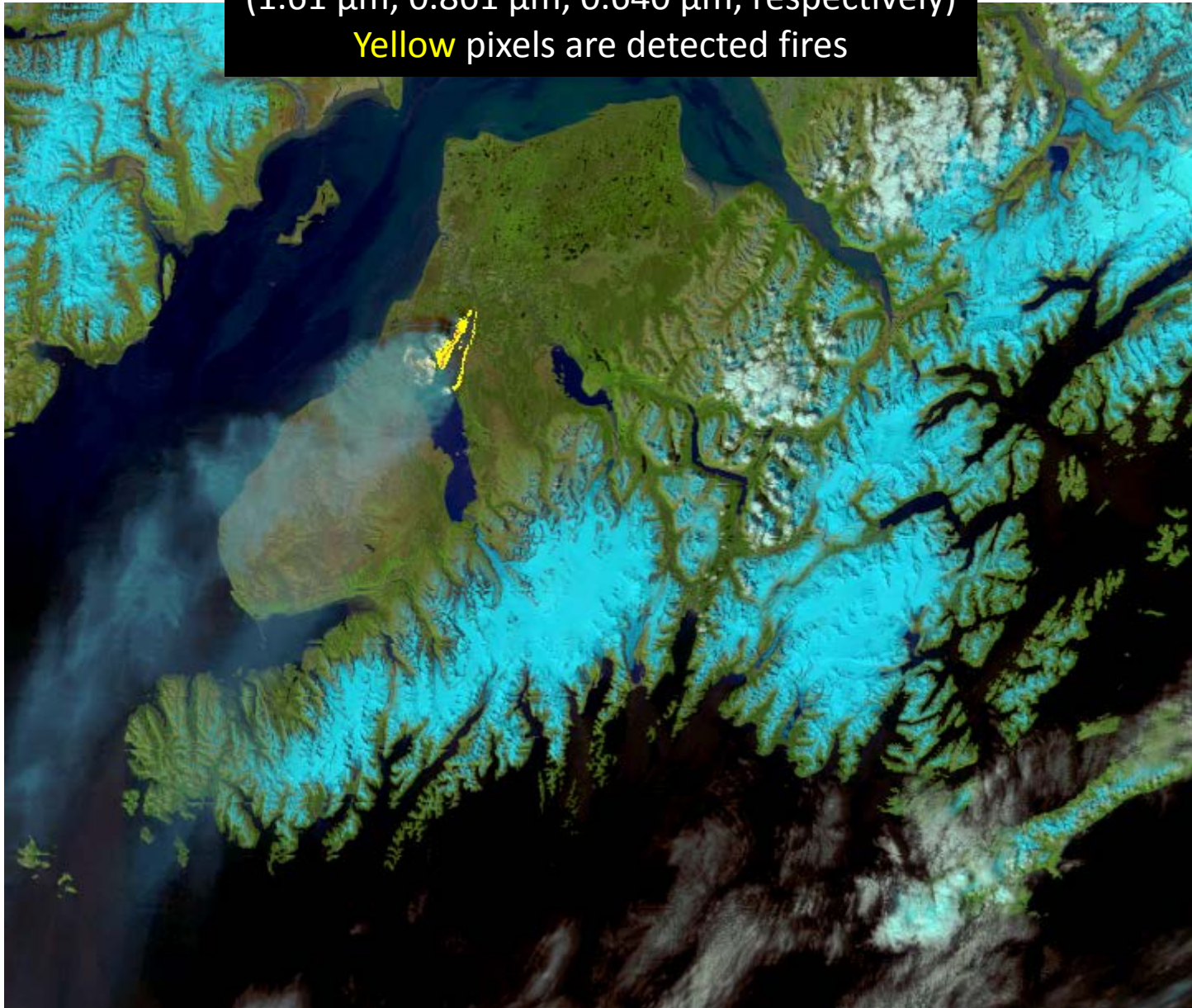


Built on proven ASTER/Landsat (5&7) fire algorithms [Giglio *et al.*, 2008; Schroeder *et al.*, 2008]  
Day & nighttime detections 16/8-day revisit (day/&night)  
Spatial resolution providing detailed fire perimeter information (plus area estimate)





I-band false color "RGB" using bands 3-2-1  
(1.61  $\mu\text{m}$ , 0.861  $\mu\text{m}$ , 0.640  $\mu\text{m}$ , respectively)  
**Yellow** pixels are detected fires





# High Resolution Aerosol Optical Thickness (AOT) product from SNPP VIIRS provides forecast guidance to operational air quality forecasters



Pixel level AOT clearly shows smoke plumes from different fires including the small ones.

The smoke plumes in the EDR AOT are pixelated and not very obvious

