JPSS AND GOES-R ACTIVITIES SUPPORTING 2013 FIRE OUTBREAKS

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and members of the NOAA, NASA, UMD and UW fire teams

Outline

- Introduction (Ivan Csiszar)
- SNPP/JPSS (Ivan Csiszar / Evan Ellicott)
  - VIIRS active fires
- Geostationary (Chris Schmidt)
  - GOES
  - GOES-R Activities
- Summary and conclusion

Critical relevant capability gaps

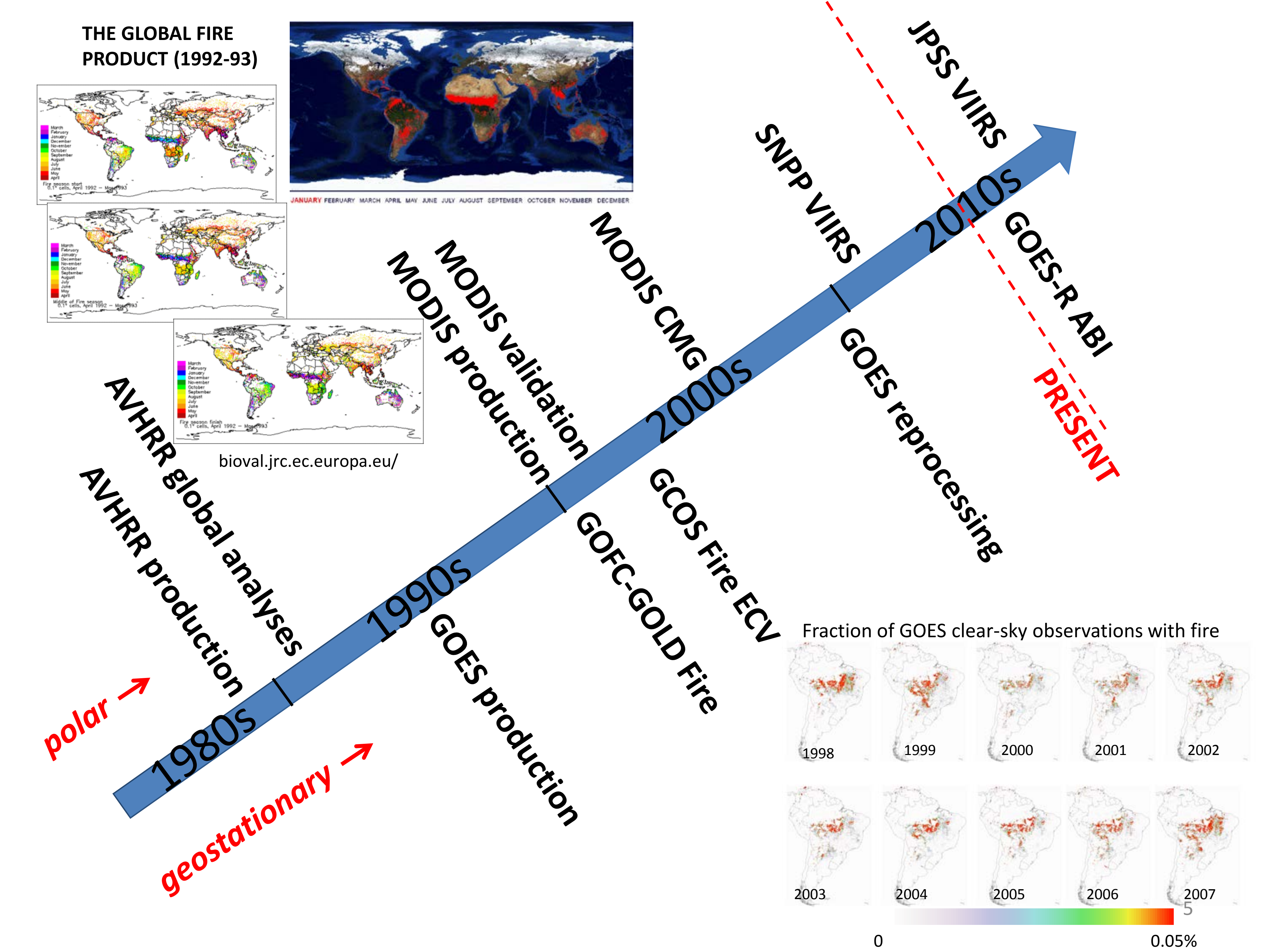
- “Sharing of information through multiple communication systems represents both a capability accomplishment and a continuing challenge for integration and management of information” (USDA FS)
- “Major uncertainties and data gaps are associated with fire activity data, plume injection height, and observational data/protocols for evaluating predictions from emissions and air quality models” (EPA)
- “Research to Operations (R2O) transformation challenges include fire weather and smoke modeling, research with and access to observation data, operational fire weather capabilities and services” (NWS)
- “Emerging needs of the land management agencies include improved fire weather forecasts (…)” (DOI, USDA FS)

COMMITTEE FOR ENVIRONMENTAL SERVICES, OPERATIONS, AND RESEARCH NEEDS (CESORN) WORKING GROUP FOR WILDLAND FIRE WEATHER (WG/WFW), March 13, 2014 ROA
http://www.ofcm.gov/wg-wfw/index.htm

National Weather Service: Information Gaps

- 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


THE GLOBAL FIRE PRODUCT (1992-93)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER
bioval.jrc.ec.europa.eu/
JPSS VIIRS
SNPP VIIRS
GOES-R ABI
PRESENT
2010s
MODIS CMG
MODIS validation
MODIS production
2000s
GOES reprocessing
GCOS Fire ECV
GOFC-GOLD Fire
1990s
AVHRR global analyses
AVHRR production
GOES production
1980s
polar
geostationary
Fraction of GOES clear-sky observations with fire
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
0
0.05%

http://www.ospo.noaa.gov/Products/land/hms.html

NOAA Hazard Mapping System

The Fire and Smoke Analysis is performed daily for the Continental US, Hawaii, Puerto Rico and Central America year round

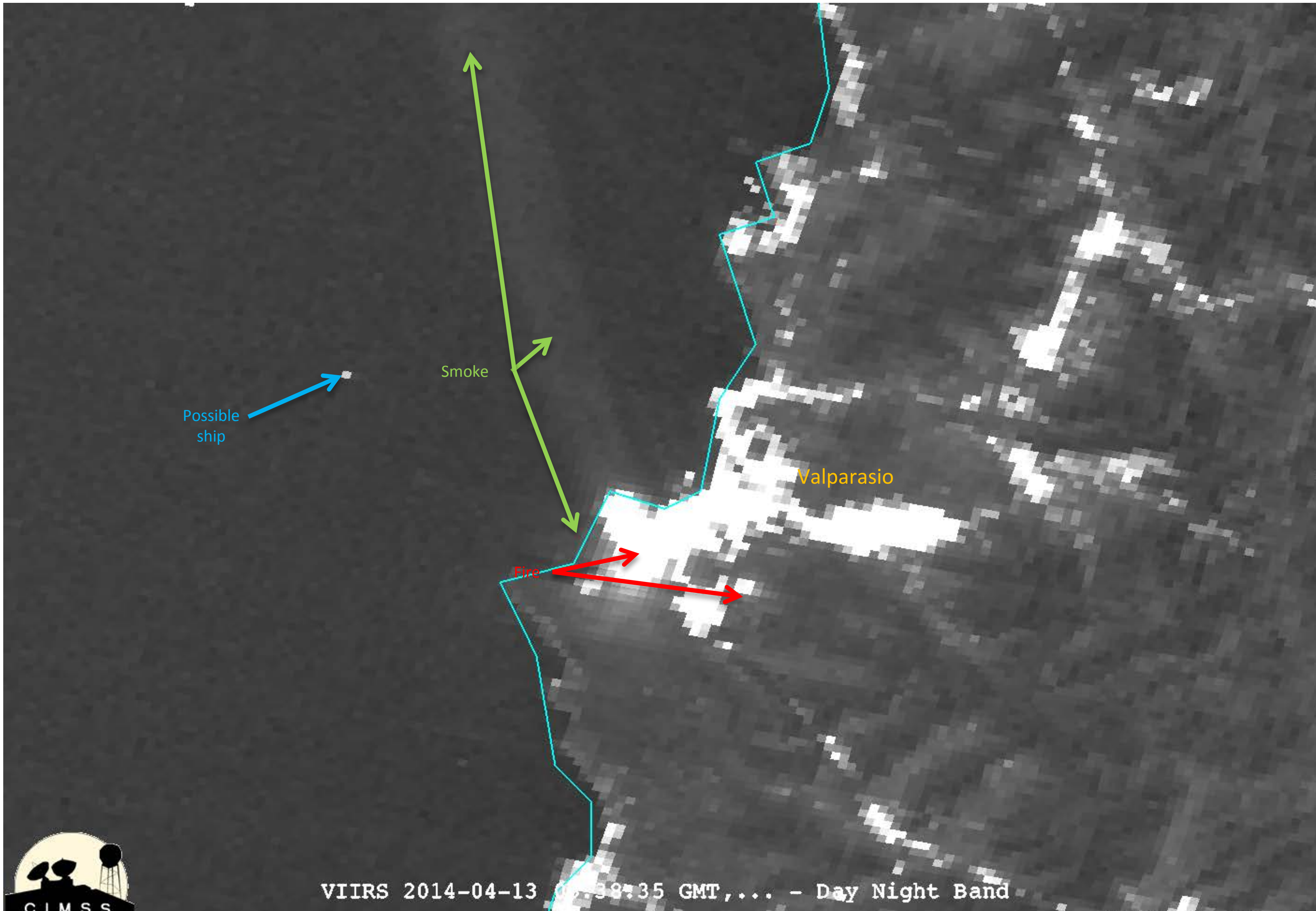
Seasonal analysis performed for Alaska and Canada from May through November

SNPP/JPSS STATUS AND ACTIVITIES

VIIRS Heritage: MODIS and AVHRR

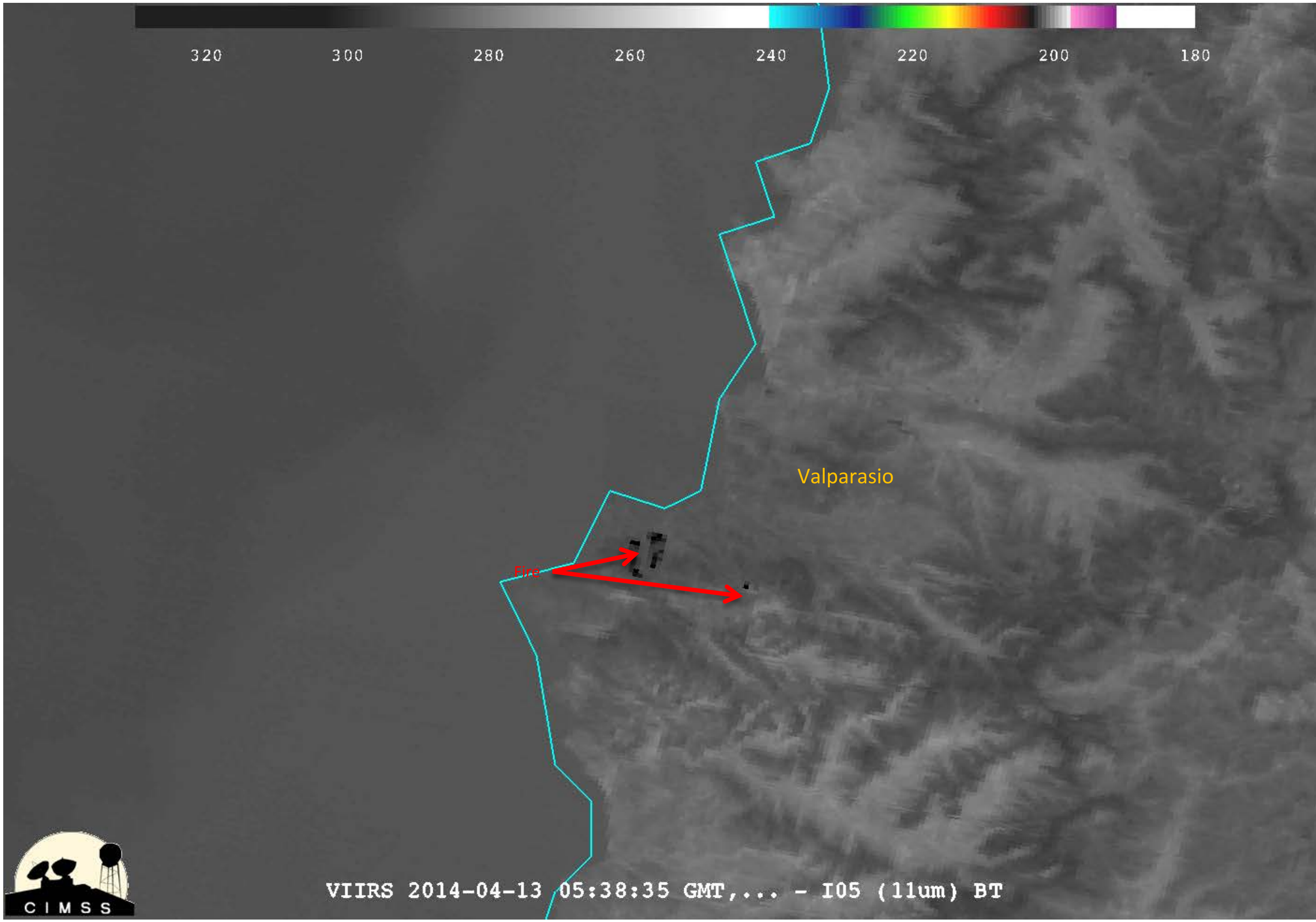
VIIRS			MODIS Equivalent			AVHRR-3 Equivalent			OLS Equivalent		
Band	Range (um)	HSR (m)	Band	Range	HSR	Band	Range	HSR	Band	Range	HSR
DNB	0.500 - 0.900								HRD PMT	0.580 - 0.910 0.510 - 0.860	550 2700
M1	0.402 - 0.422	750	8	0.405 - 0.420	1000						
M2	0.436 - 0.454	750	9	0.438 - 0.448	1000						
M3	0.478 - 0.498	750	3 10	0.459 - 0.479 0.483 - 0.493	500 1000						
M4	0.545 - 0.565	750	4 12	0.545 - 0.565 0.546 - 0.556	500 1000						
I1	0.600 - 0.680	375	1	0.620 - 0.670	250	1	0.572 - 0.703	1100			
M5	0.662 - 0.682	750	13 14	0.662 - 0.672 0.673 - 0.683	1000 1000	1	0.572 - 0.703	1100			
M6	0.739 - 0.754	750	15	0.743 - 0.753	1000						
I2	0.846 - 0.885	375	2	0.841 - 0.876	250	2	0.720 - 1.000	1100			
M7	0.846 - 0.885	750	16	0.862 - 0.877	1000	2	0.720 - 1.000	1100			
M8	1.230 - 1.250	750	5	SAME	500						
M9	1.371 - 1.386	750	26	1.360 - 1.390	1000						
I3	1.580 - 1.640	375	6	1.628 - 1.652	500						
M10	1.580 - 1.640	750	6	1.628 - 1.652	500	3a	SAME	1100			
M11	2.225 - 2.275	750	7	2.105 - 2.155	500						
I4	3.550 - 3.930	375	20	3.660 - 3.840	1000	3b	SAME	1100			
M12	3.660 - 3.840	750	20	SAME	1000	3b	3.550 - 3.930	1100			
M13	3.973 - 4.128	750	21 22 23	3.929 - 3.989 3.929 - 3.989 4.020 - 4.080	1000 1000 1000						
M14	8.400 - 8.700	750	29	SAME	1000						
M15	10.263 - 11.263	750	31	10.780 - 11.280	1000	4	10.300 - 11.300	1100			
I5	10.500 - 12.400	375	31 32	10.780 - 11.280 11.770 - 12.270	1000 1000	4 5	10.300 - 11.300 11.500 - 12.500	1100 1100	HRD	10.300 - 12.900	550
M16	11.538 - 12.488	750	32	11.770 - 12.270	1000	5	11.500 - 12.500	1100			

13 April 2014, 0538Z
Day Night Band



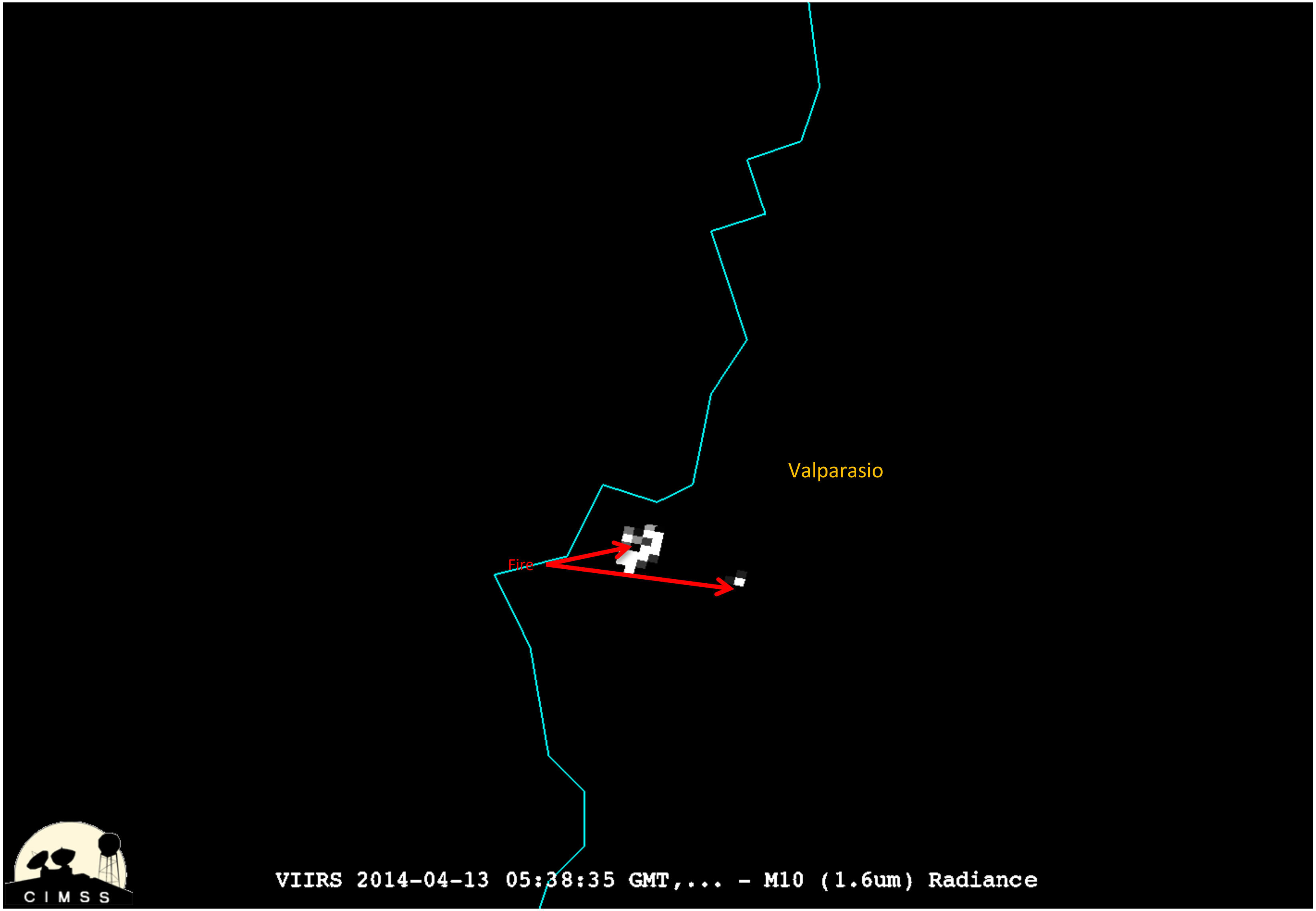
William Straka III, CIMSS

13 April 2014, 0538Z
I05 - 11μm



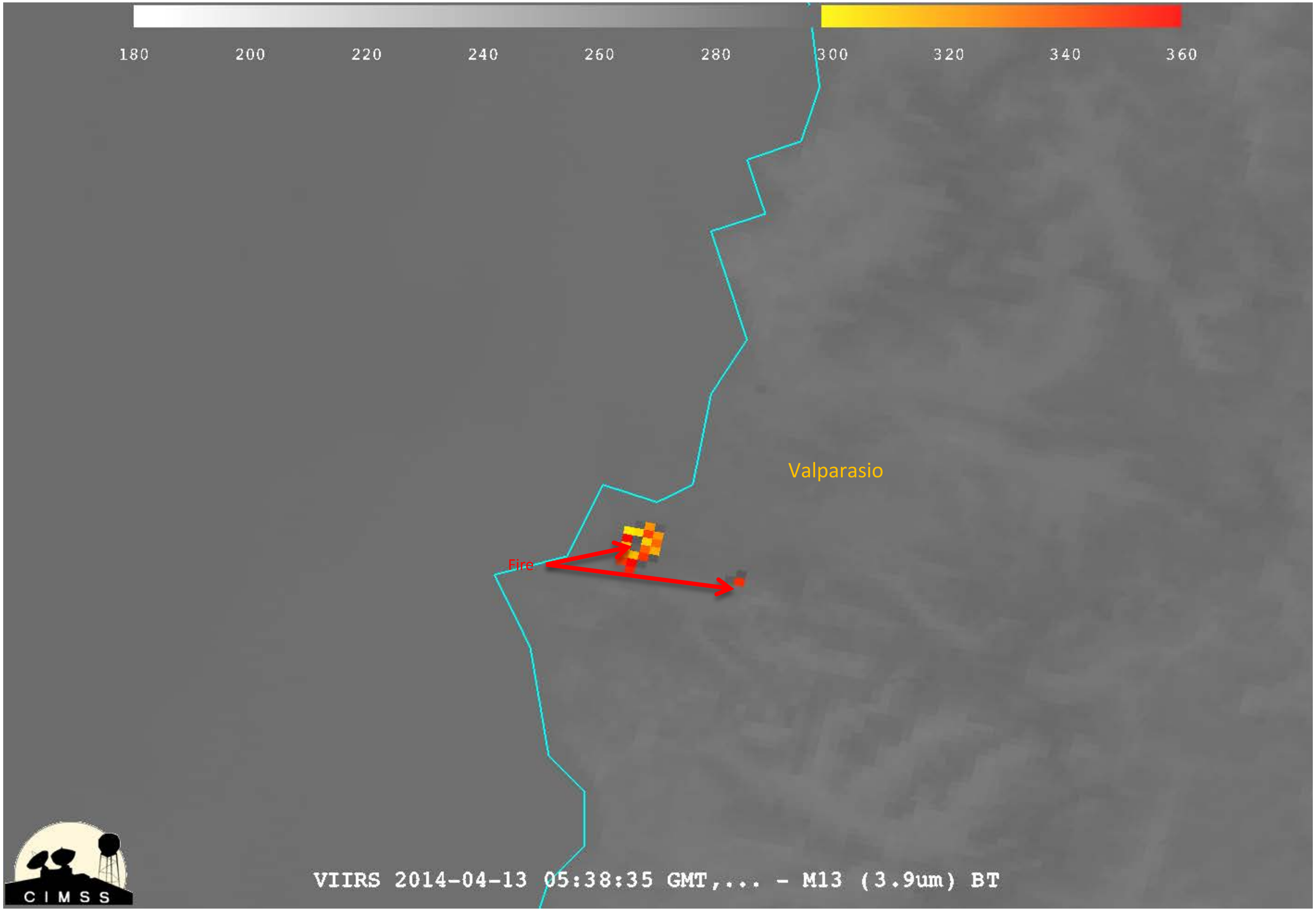
William Straka III, CIMSS

13 April 2014, 0538Z
M10 – 1.6μm



William Straka III, CIMSS

13 April 2014, 0538Z
M13 – 3.9μm



William Straka III, CIMSS

VIIRS active fire product development

NOAA: real-time NOAA operational applications

- Operational M-band product generated by IDPS (Interface Data Processing Segment)
- Part of integrated processing chain
- Low latency
- Detections only
- Locations only (no fire mask)

VIIRS Fire Team

Algorithm updates

Upstream processing updates

NASA: science, long-term continuity + added value NRT

- Experimental M-band MODIS continuity product at Land PEATE (Product Evaluation and Test Element)
- Detections, Fire Mask and Fire Radiative Power, CMG
- Spatially explicit fire mask
- Spatial and temporal aggregates – heritage deliver systems (RR, FIRMS)
- Experimental I-band product

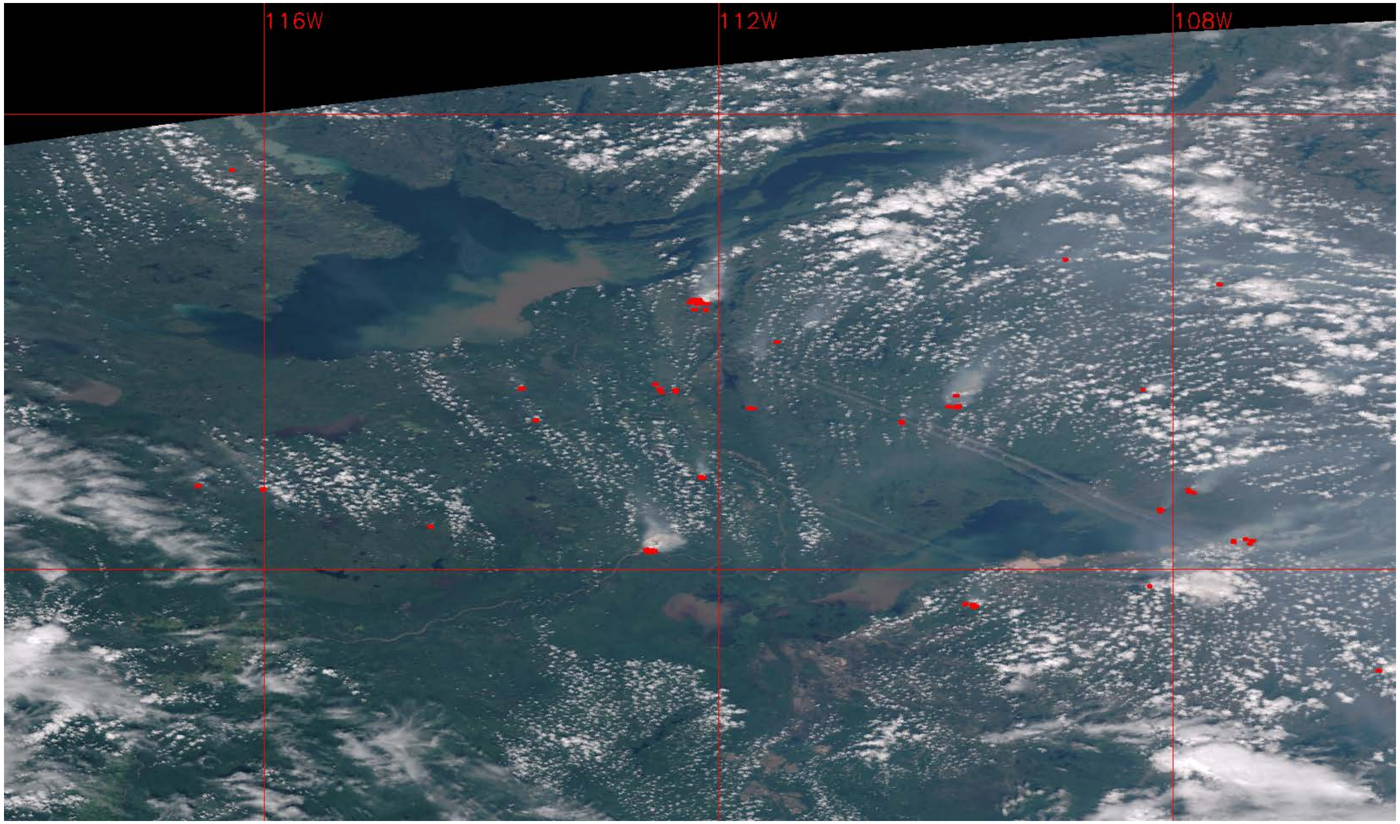
NOAA Proving Ground
NASA Applied Science
algorithm synchronization, end user feedback

DIRECT READOUT

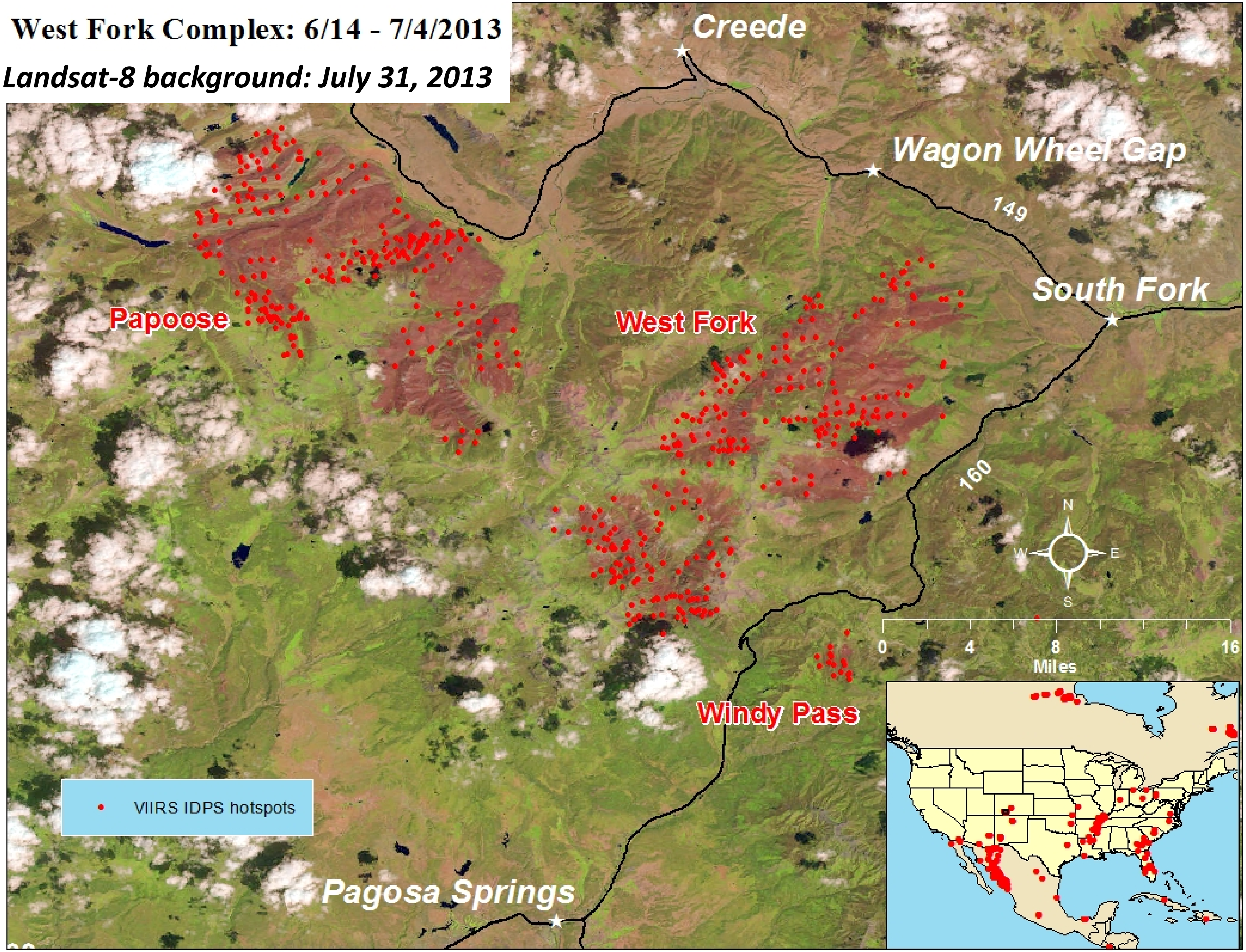
- **Can run IDPS, NASA or locally developed code**
- **Stand-alone**

Background of VIIRS IDPS Active Fire Product

- Represents **continuity** with NASA EOS **MODIS** and NOAA POES **AVHRR** fire detection (and also international missions such as (A)ATSR
- VIIRS **design allows for radiometric measurements** to detect and characterize active fires over a wide range of observing and environmental conditions
- Product is expected to be used by **real-time resource and disaster management; air quality monitoring; ecosystem monitoring; climate studies** etc.

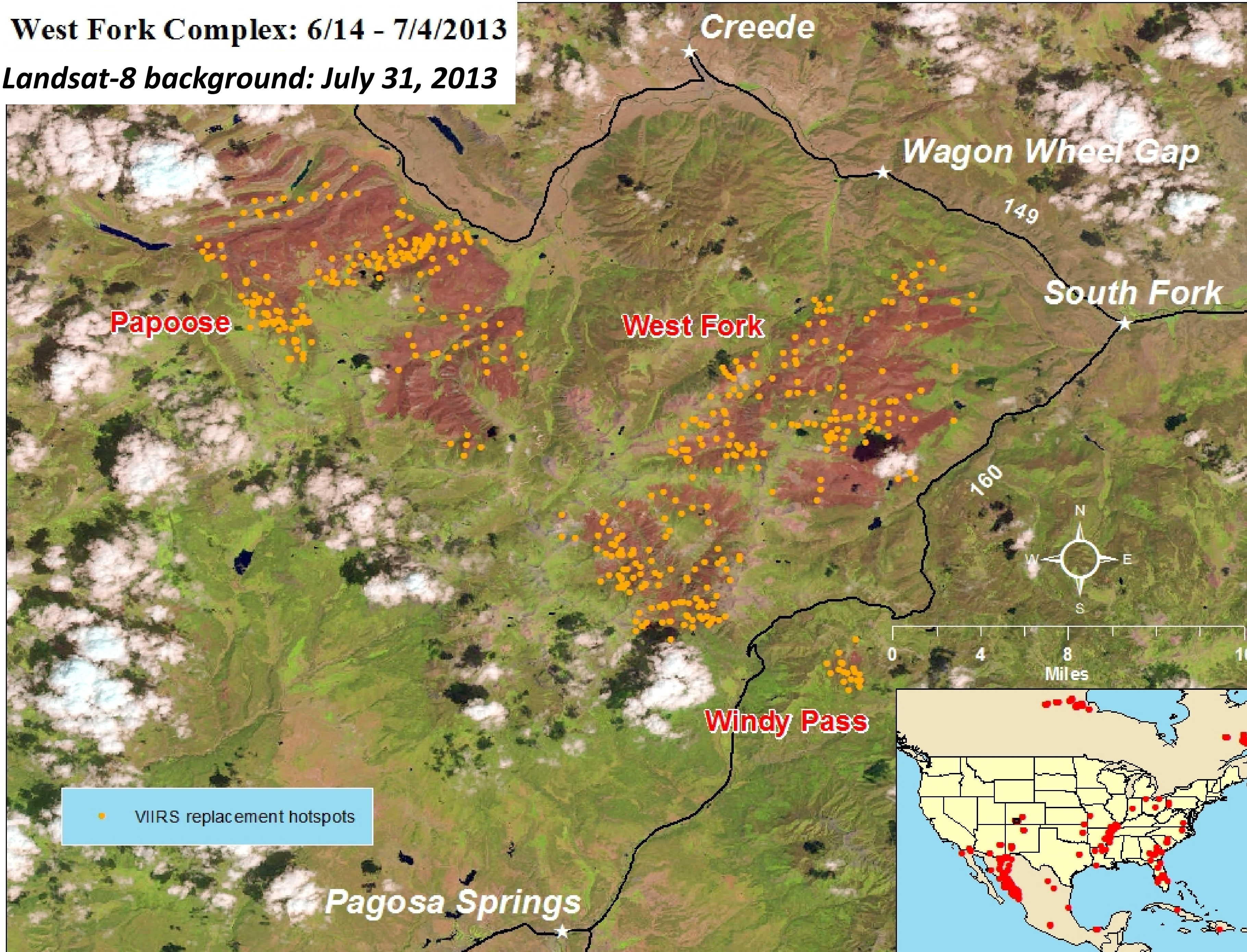


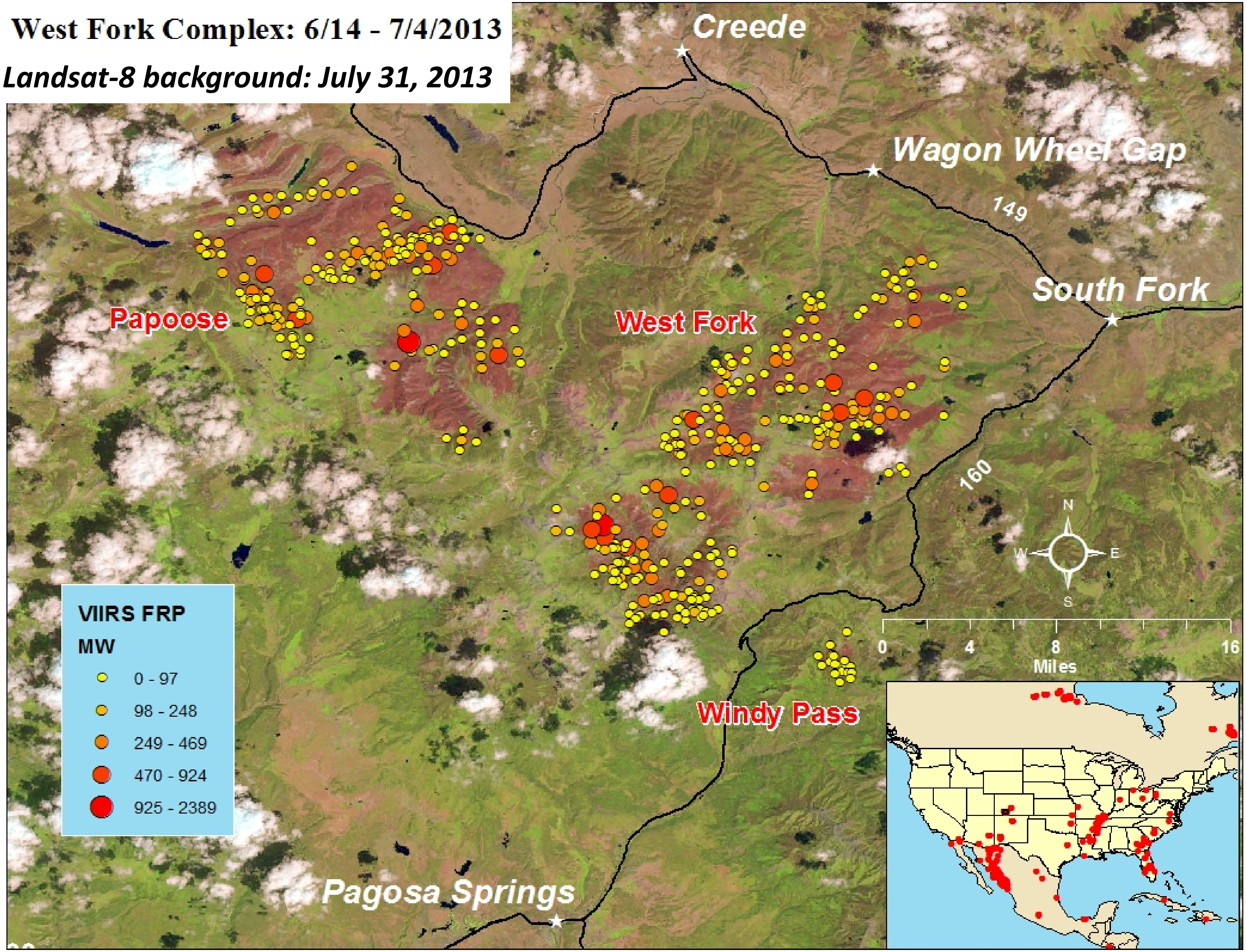
NW Canada
07 July 2013
20:14:55-20:20:34 UTC


West Fork Complex: 6/14 - 7/4/2013
Landsat-8 background: July 31, 2013
Creede
Wagon Wheel Gap
149
South Fork
Papoose
West Fork
160
N
W
E
S
0
4
8
16
Miles
Windy Pass
VIIRS IDPS hotspots
Pagosa Springs

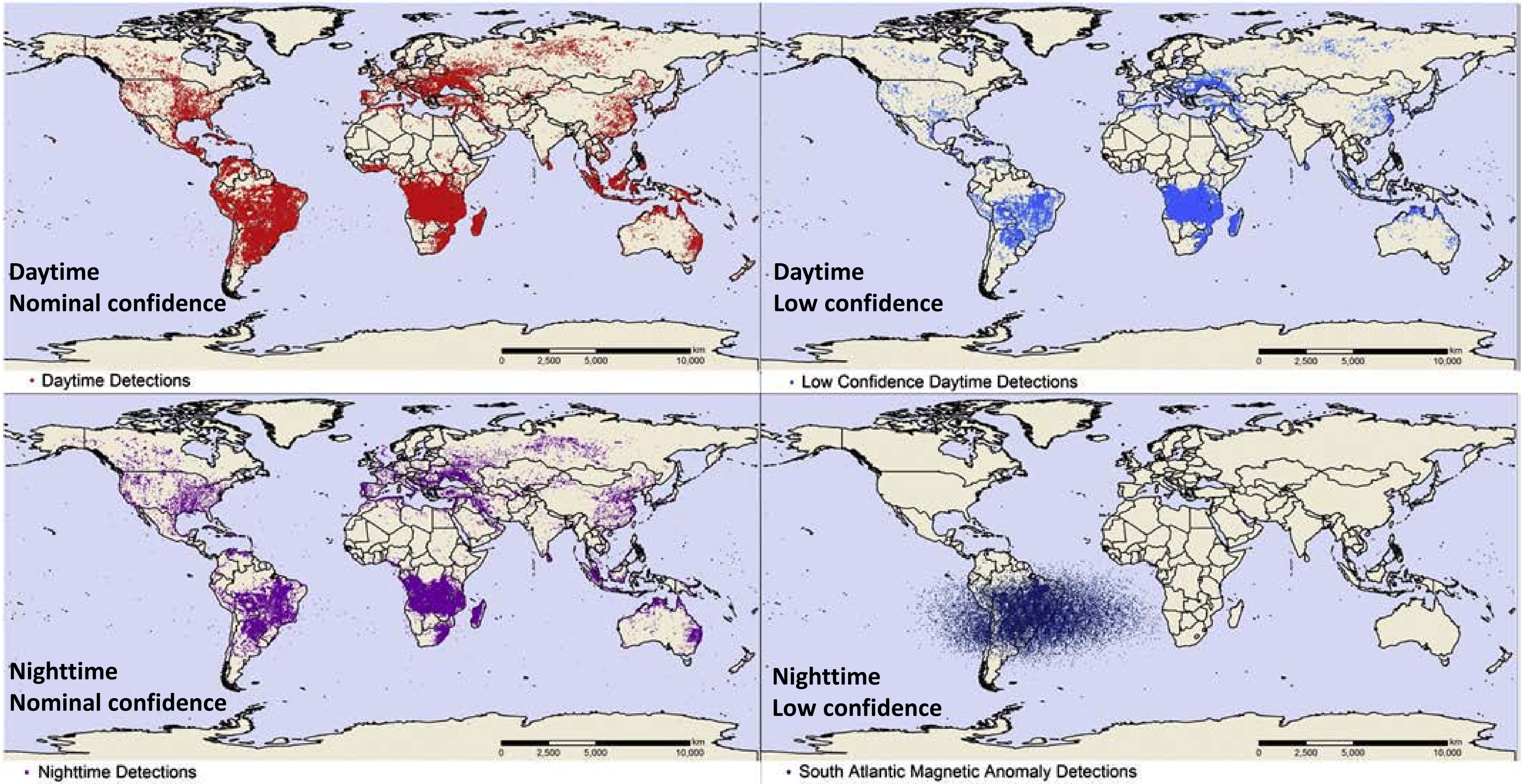
West Fork Complex: 6/14 - 7/4/2013

Landsat-8 background: July 31, 2013




West Fork Complex: 6/14 - 7/4/2013
Landsat-8 background: July 31, 2013
Creede
Wagon Wheel Gap
149
South Fork
160
Papoose
West Fork
Windy Pass
Pagosa Springs
N
W
E
S
0
4
8
16
Miles
VIIRS FRP
MW
0 - 97
98 - 248
249 - 469
470 - 924
925 - 2389

Global fires from I-band data

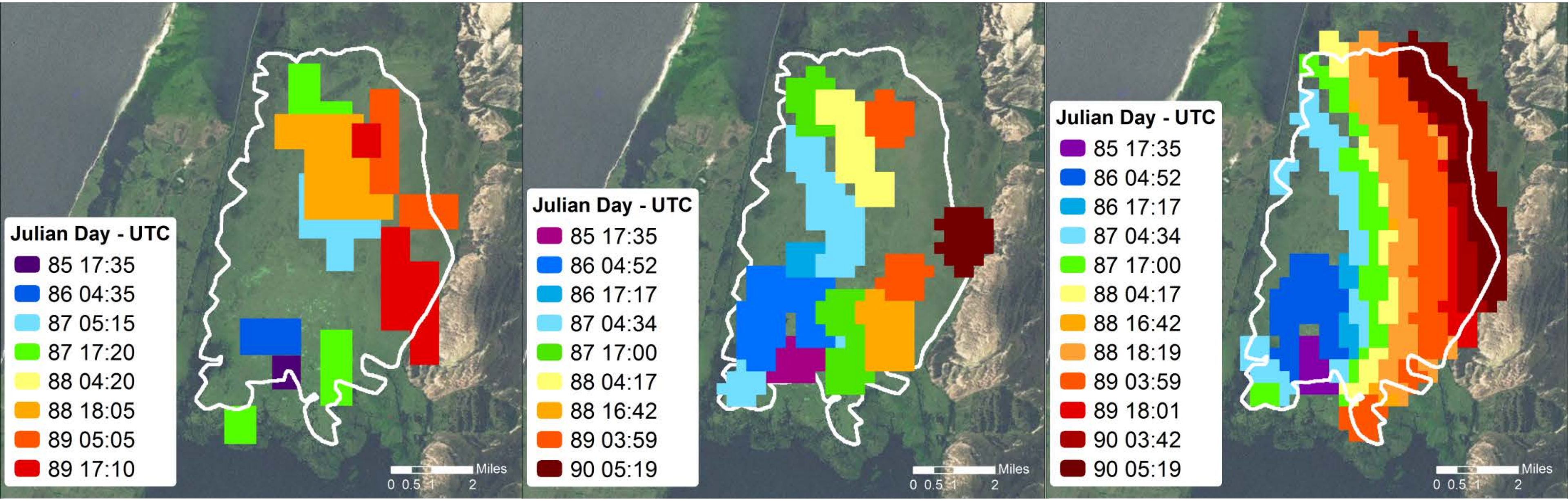


VIIRS 375 m fire algorithm output showing the accumulated daytime nominal confidence fire pixels (upper left), low confidence daytime pixels (upper right), nighttime fire pixels (purple; lower left), and SAMA-related low confidence nighttime pixels (dark blue; lower right) during 1–30 August 2013.

Wilfrid Schroeder, Patricia Oliva, Louis Giglio, Ivan 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.

Development of Spatially Refined Satellite Fire Products Enabling Improved Fire Mapping

Grass fire in Southern Brazil, 26-31 March 2013



Aqua/MODIS 1 km Spotty detection pixels and coverage gap at low latitudes	S-NPP/VIIRS 750 m Spotty detection pixels	S-NPP/VIIRS 375 m Improved fire line mapping

Credit: Wilfrid Schroeder (UMD)
See for example: Schroeder et al., 2014 [doi:10.1016/j.rse.2013.12.008]

Using S-NPP/VIIRS 375 m Fire Perimeters to Initialize and Evaluate Coupled Weather-Wildfire Model (CAWFE)

Yarnell Fire simulation
initialized using
S-NPP/VIIRS 375m fire data

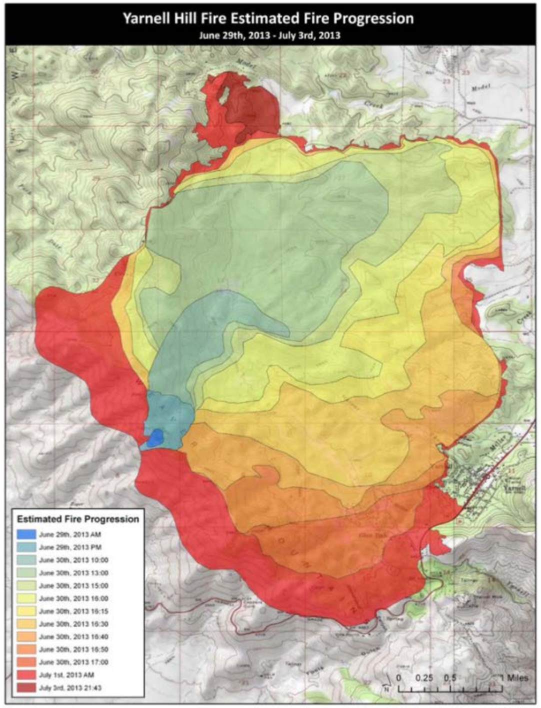


Figure 22. Yarnell Hill Fire Progression Map, June 29 through July 3, 2013.

Credit: Janice Coen (NCAR)
See for example Coen and Schroeder, 2013
[doi: 10.1002/2013GL057868]

Proving Ground & Risk Reduction

- The goals of VIIRS AF data proving ground project is the development of a near-real-time enhanced VIIRS AF product delivery system to NOAA end users.

To be demonstrated:

- **VIIRS active fire algorithm improvement and evaluation**
- **Near real-time data visualization and evaluation**

Multi agency team

- Ivan Csiszar – *NOAA/NESDIS/STAR*
- Evan Ellicott, Louis Giglio, Krishna Vadrevu, Wilfrid Schroeder, Christopher O. Justice – *Geographical Sciences, UMD*
- Brad Quayle – *RSAC*
- Peter Roohr – *NOAA NWS Office of Science and Technology*

Outreach

Presentations

- AMS 2013 & 2014
- IMET workshop 2013
- USFS/NASA Tactical Fire Remote Sensing Advisory Committee (TFRSAC) 2011, 2012, 2013
- NOAA Satellite Conference 2013
- NOAA Science Week Virtual 2013
- NASA Applied Remote SEnsing Training (ARSET) 2013:
  - *Introduction to Remote Sensing for Air Quality Applications*

The role of IMETs

What we offer:

- We provide insight and expert knowledge of the VIIRS and MODIS products
- Data availability in easy to use formats
- Continue to develop tools and data based on IMET input and feedback

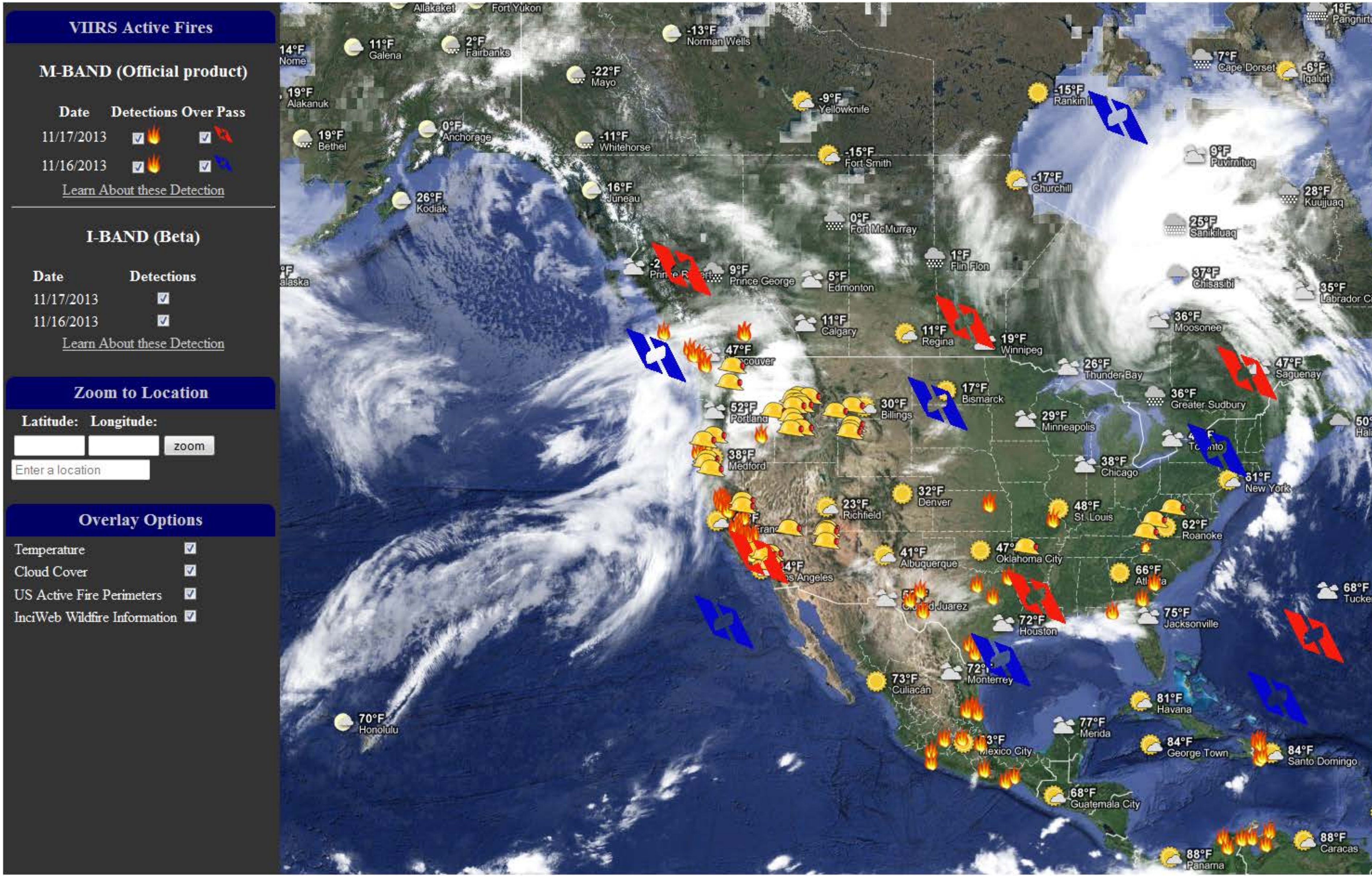
In return we hope that IMETs will…

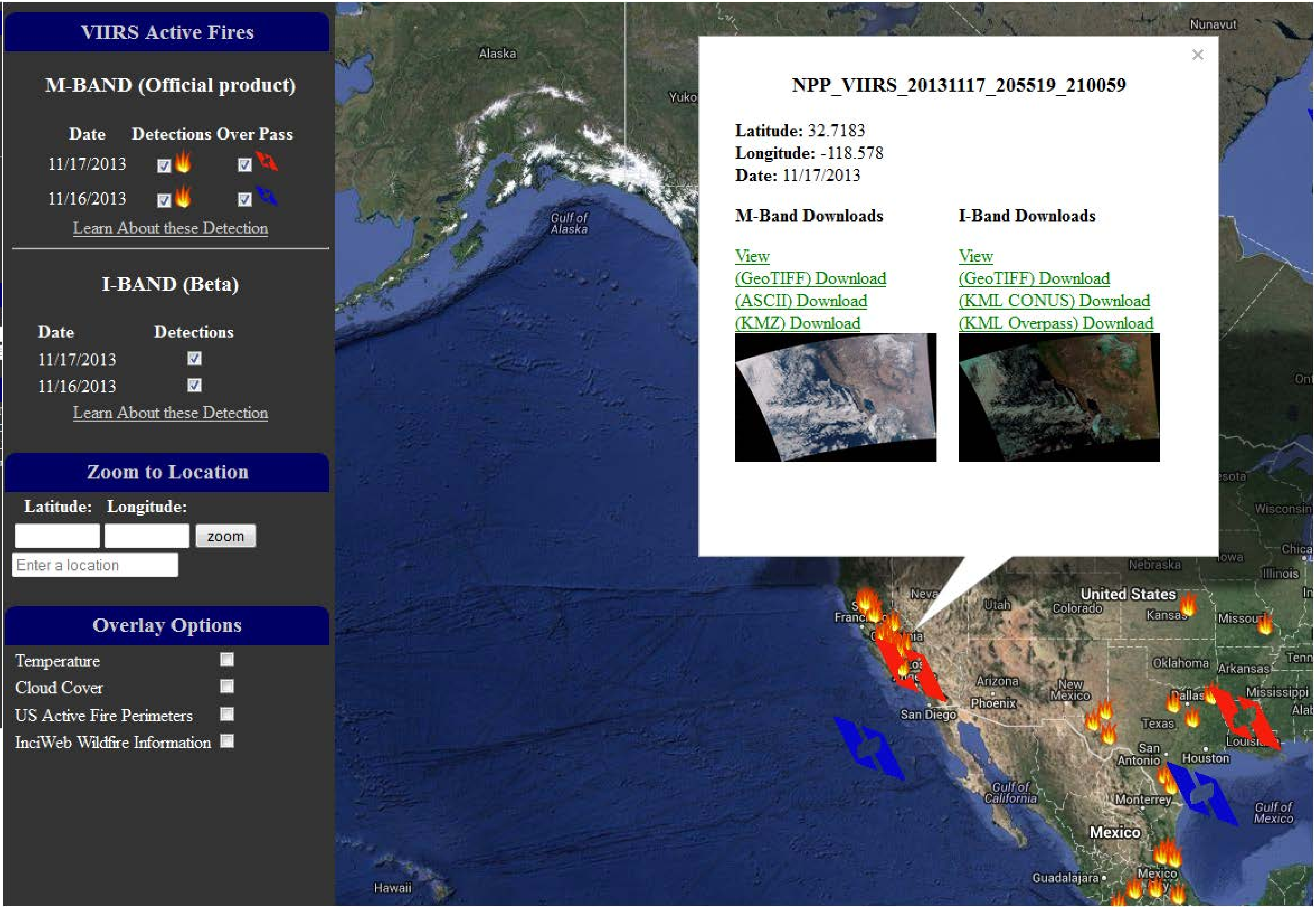
- Aid us in evaluating the VIIRS fire product
  - Absolute and Relative (to MODIS) accuracy
  - Insight into fire behavior and how/when the VIIRS product is helpful and what value-added characteristics would be useful (e.g. FRP)

Proving Ground & Risk Reduction

- Developed a website to provide background information, data for CONUS, VIIRS-MODIS comparisons to aid product evaluation, and contact page to leave feedback.
- The system is also a *test-bed* for evaluating enhanced and experimental algorithms

http://viirsfire.geog.umd.edu


VIIRS Active Fires
M-BAND (Official product)
Date Detections Over Pass
11/17/2013
11/16/2013
Learn About these Detection
I-BAND (Beta)
Date Detections
11/17/2013
11/16/2013
Learn About these Detection
Zoom to Location
Latitude: Longitude:
zoom
Enter a location
Overlay Options
Temperature
Cloud Cover
US Active Fire Perimeters
InciWeb Wildfire Information
11°F Galena
2°F Fairbanks
-13°F Norman Wells
-22°F Mayo
19°F Alakanuk
19°F Bethel
0°F Anchorage
-11°F Whitehorse
-9°F Yellowknife
-15°F Fort Smith
26°F Kodiak
16°F Juneau
0°F Fort McMurray
9°F Prince George
5°F Edmonton
11°F Calgary
11°F Regina
19°F Winnipeg
52°F Portland
30°F Billings
17°F Bismarck
38°F Medford
23°F Richfield
32°F Denver
41°F Albuquerque
29°F Minneapolis
38°F Chicago
48°F St. Louis
62°F Roanoke
61°F New York
66°F Atlanta
75°F Jacksonville
72°F Houston
73°F Culiacán
70°F Honolulu
81°F Havana
77°F Merida
84°F George Town
84°F Santo Domingo
68°F Guatemala City
88°F Panama
88°F Caracas
7°F Cape Dorset
-6°F Iqaluit
-15°F Rankin In
9°F Puvirnituq
-17°F Churchill
28°F Kuujjuaq
25°F Sanikiluaq
37°F Chisasibi
35°F Labrador City
36°F Moosonee
26°F Thunder Bay
36°F Greater Sudbury
47°F Saguenay
50°F Halifax
68°F Tucker's


VIIRS Active Fires
M-BAND (Official product)
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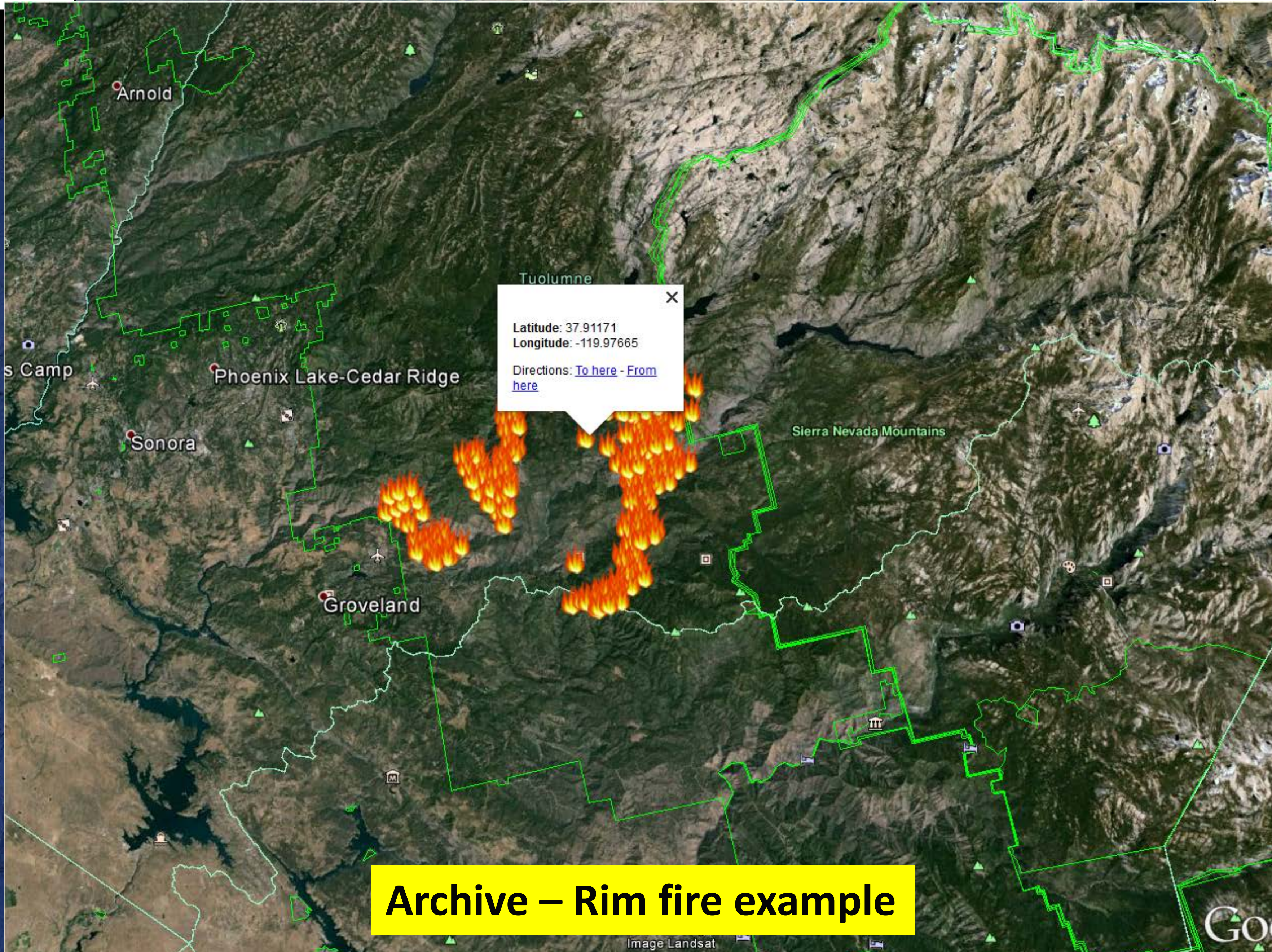
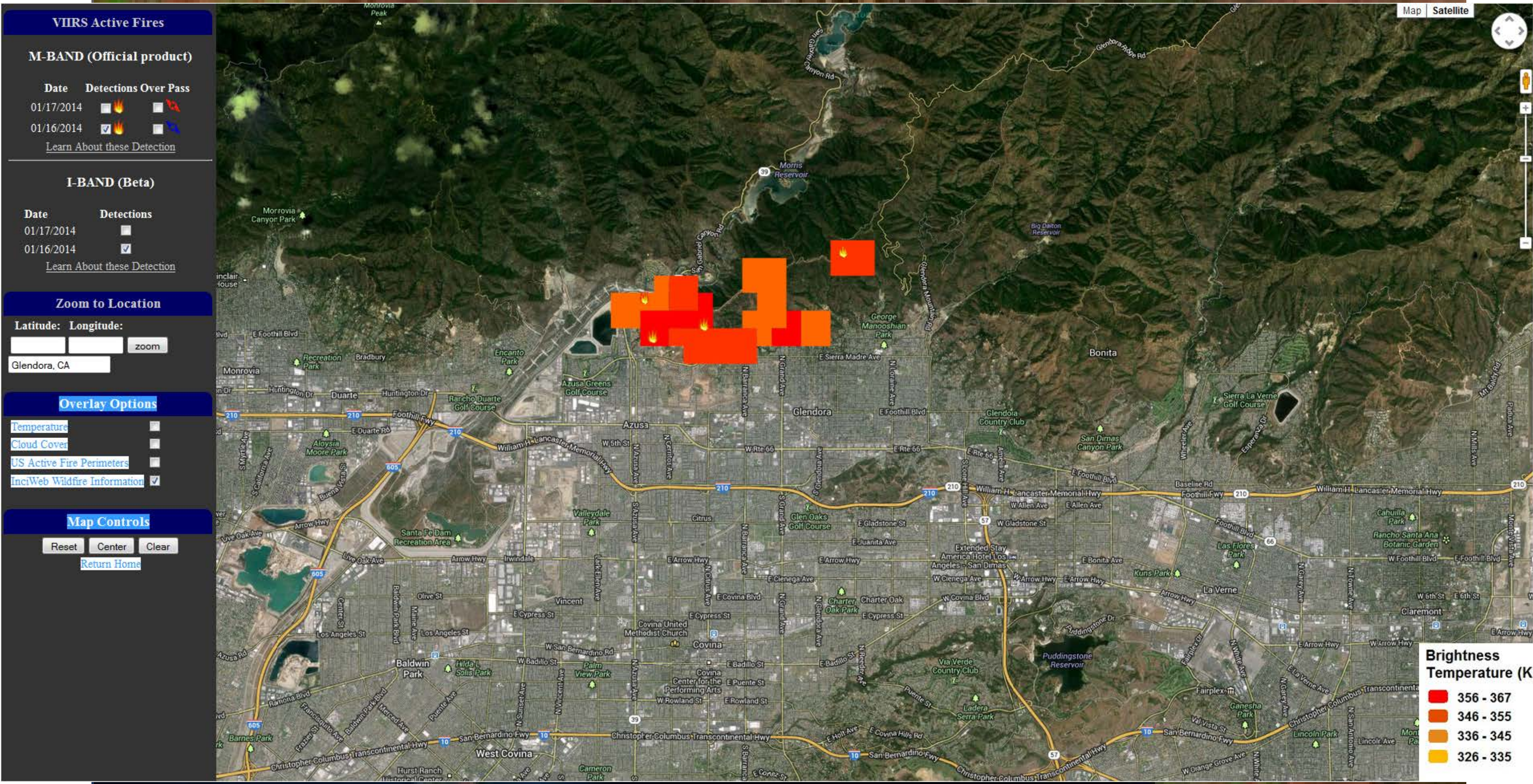
11/17/2013
11/16/2013
Learn About these Detection
Zoom to Location
Latitude: Longitude:
zoom
Enter a location
Overlay Options
Temperature
Cloud Cover
US Active Fire Perimeters
InciWeb Wildfire Information
NPP_VIIRS_20131117_205519_210059
Latitude: 32.7183
Longitude: -118.578
Date: 11/17/2013
M-Band Downloads
View
(GeoTIFF) Download
(ASCII) Download
(KMZ) Download
I-Band Downloads
View
(GeoTIFF) Download
(KML CONUS) Download
(KML Overpass) Download
Alaska
Gulf of Alaska
Nunavut
United States
Colorado
Kansas
Utah
Oklahoma
Arkansas
Arizona
New Mexico
Phoenix
San Diego
Texas
Dallas
San Antonio
Houston
Mississippi
Gulf of California
Monterrey
Gulf of Mexico
Mexico
Guadalajara
Hawaii
Nebraska
Iowa
Illinois
Wisconsin

Archive – Rim fire example

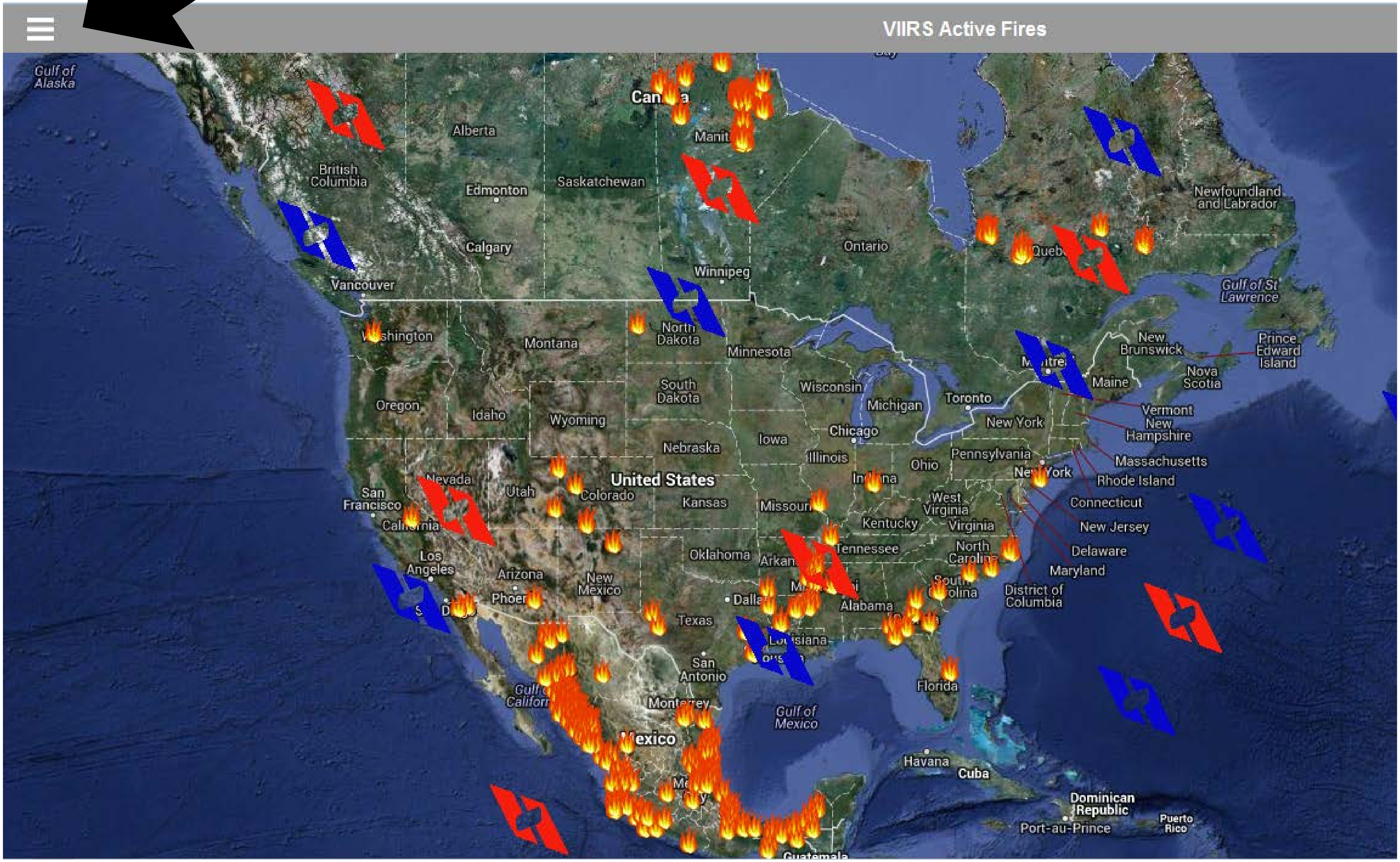


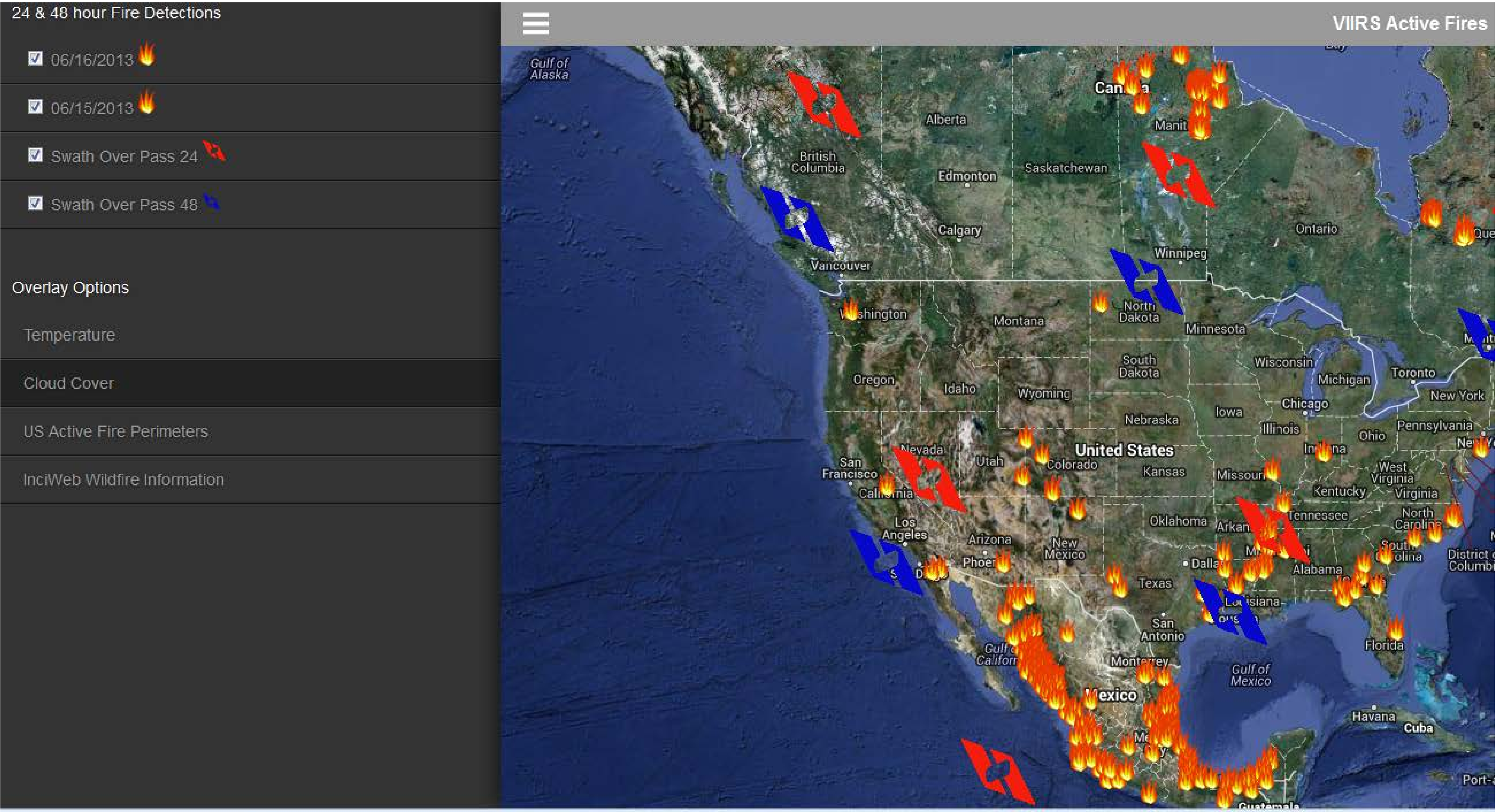
Colby fire, Glendora, CA: 1/16/2014



- The Colby Incident started Thursday January 16th, 2014 at approximately 06:00 AM PST in the vicinity of Glendora Mountain Road and the Colby Trail.
- As of 1/17 it had burned 1,863 acres.

Mobile “friendly”. Click here to see map options




24 & 48 hour Fire Detections
06/16/2013
06/15/2013
Swath Over Pass 24
Swath Over Pass 48
Overlay Options
Temperature
Cloud Cover
US Active Fire Perimeters
InciWeb Wildfire Information
VIIRS Active Fires
Gulf of Alaska
Alberta
British Columbia
Edmonton
Saskatchewan
Calgary
Vancouver
Winnipeg
Ontario
Montana
North Dakota
Minnesota
South Dakota
Oregon
Idaho
Wyoming
Wisconsin
Michigan
Toronto
New York
Chicago
Iowa
Nebraska
Illinois
Ohio
Pennsylvania
Nevada
Utah
United States
Colorado
San Francisco
Kansas
Kentucky
West Virginia
Virginia
Tennessee
North Carolina
Oklahoma
Los Angeles
Arizona
New Mexico
Alabama
Texas
San Antonio
Florida
Gulf of Mexico
Havana
Cuba

VIIRS fire data access

Screen shot of the data delivery interface on the VIIRS Active Fire website

Downloading VIIRS Active Fire Data

Updated 25 January 2013

The user community will find five primary options available to download Suomi-NPP VIIRS (Visible Infrared Imager Radiometer Suite) Active Fire data. The diagram on page 2 should help individuals choose their preferred method to access the data. Step-by-step instructions are provided in the next pages. Users should find similar – if not identical – data content regardless of the provider accessed. All distributed products listed below are based on the algorithm and processing code within the NOAA/NESDIS Interface Data Processing Segment (IDPS), therefore at this moment the NOAA/CLASS Data Archive System represents the official VIIRS data source. Small differences may exist among files downloaded from different sources due to unique processing systems, software sub-versions, and data formats (e.g., 84sec versus 5min orbit segments) used. The range of selectable data acquisition dates will also vary depending on the data provider of your choice.

The baseline VIIRS active fire product is currently composed of vectors (1D) containing the list of latitude/longitude and corresponding image element (line/sample) values of individual fire pixels detected. The data are distributed in HDF5 or HDF4 file formats. Users are encouraged to find the most appropriate software packages to open/read those files based on their own needs. Further enhancements to the VIIRS active fire detection product are being developed, including a fire detection mask (2D array) and radiative power (FRP) retrieval, mimicking the NASA MODIS *Fire and Thermal Anomalies* (MOD14/MYD14) product. Future updates to this document will be released as the new data sets become available.

The VIIRS active fire product maturity status is currently "*Beta*". In short, the data are public however they are not science/application-ready and may contain errors. The main intent is to allow users to become familiar with VIIRS data format and characteristics. Please see the following URL for more information on individual maturity levels and what they entail:

http://www.jpss.noaa.gov/science-maturity-level.html

Additional information on the Beta status of the Active Fires product is available in the "readme" document on NOAA's CLASS website:

http://www.class.ngdc.noaa.gov/notification/pdfs/VIIRS_Active%20Fire%20ARP_Release_Readme_final.pdf

Users are referred to the VIIRS Active Fire Science Team dedicated URL for more information involving the active fire data set:

http://blaze.umd.edu/

Option 1: NOAA CLASS Data Archive System (Web)

This should be your preferred option along with *Option 2* when downloading data that must intersect a given spatial and temporal window and therefore requires user input. Files are delivered exclusively as **~5min** tiles in **HDF5** file format.

Step-by-step procedure:

(1) Open an internet browser and go to http://www.class.noaa.gov/

(2) First, you must register (first-time users) by clicking on the "*Register*" button near the top of the page. Enter your information and create a new user account

(3) Login using your account information

(4) Click on the drop-down bar labeled:
"*Please select a product to search*"
and select:
"*NPP Visible/Infrared Imager/Radiometer Suite (VIIRS)*"
then click on:
"*Go*"

(5) Choose spatial & temporal domains of interest

(6) On "Node", select:
"*Ascending*" for daytime data
"*Descending*" for nighttime data
"*Either*" for both

(7) On "Satellite", select:
"*NPP*"

(8) On "Datatype", under "Application Related Product" select:
"*VIIRS Active Fires ARP (public 05/03/2012)*"

(9) Click "*Search*"

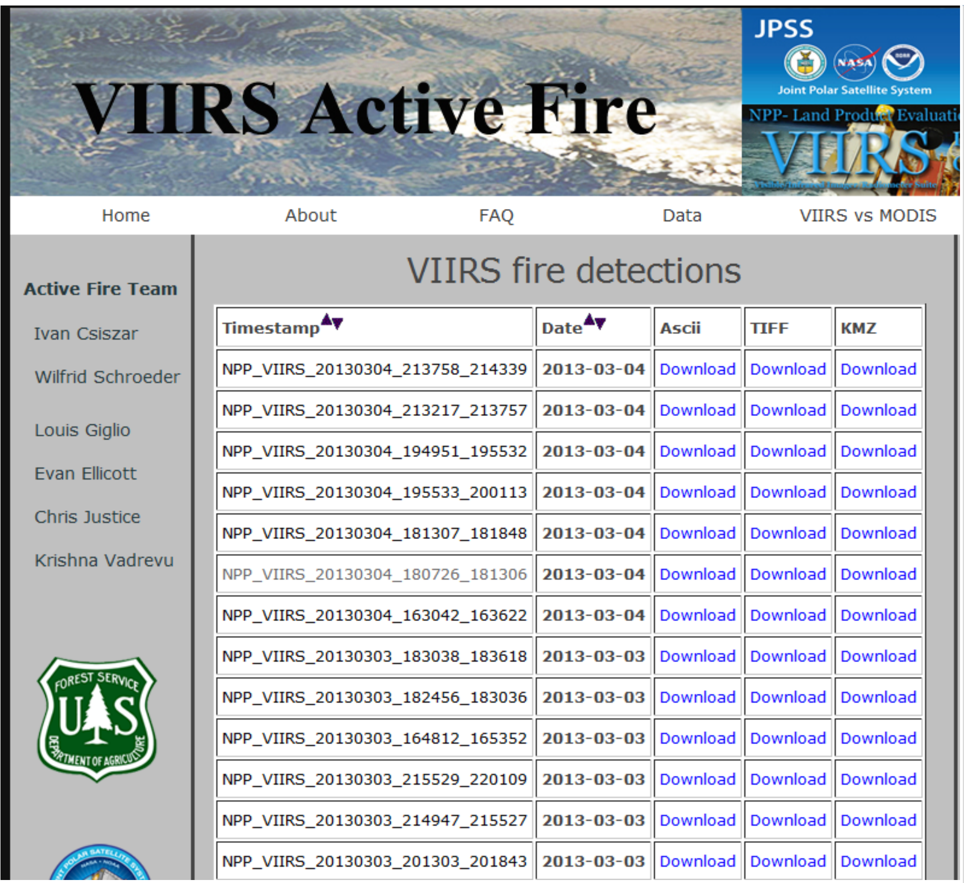
(10) On the new window containing the search results in tabular format, check the boxes in the "Shopping Cart" column containing the files of interest or alternatively click the "*Select All*" button above the table, and then click the "*Update*" button also located above the table. Note that you won't be automatically redirected. In order to see you shopping cart, click on the "*Goto Cart*" button above the table.

(11) In the shopping cart window, all selected files will be listed. By clicking on "Advanced Options" you will find additional options. Note that these do not apply to the Active Fire product but you may find it useful when

3

Data Availability

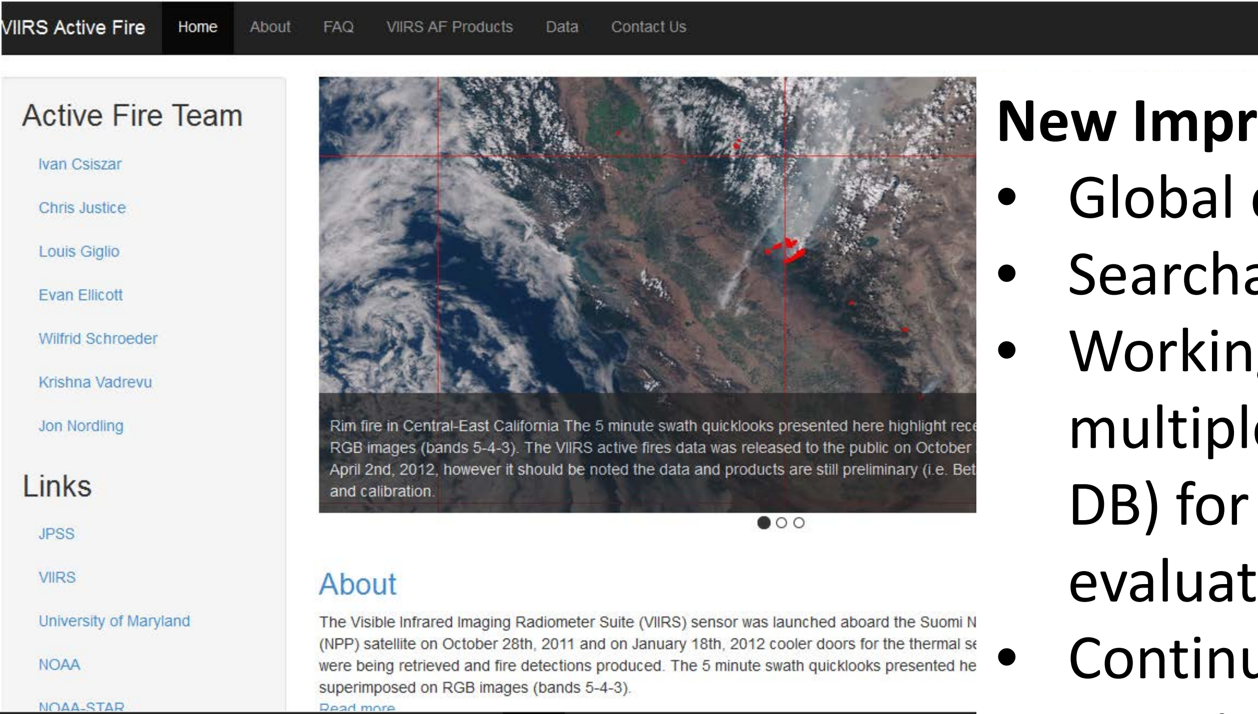
http://viirsfire.geog.umd.edu/Documents/VIIRS_data_tutorial.pdf



Global VIIRS fire data access

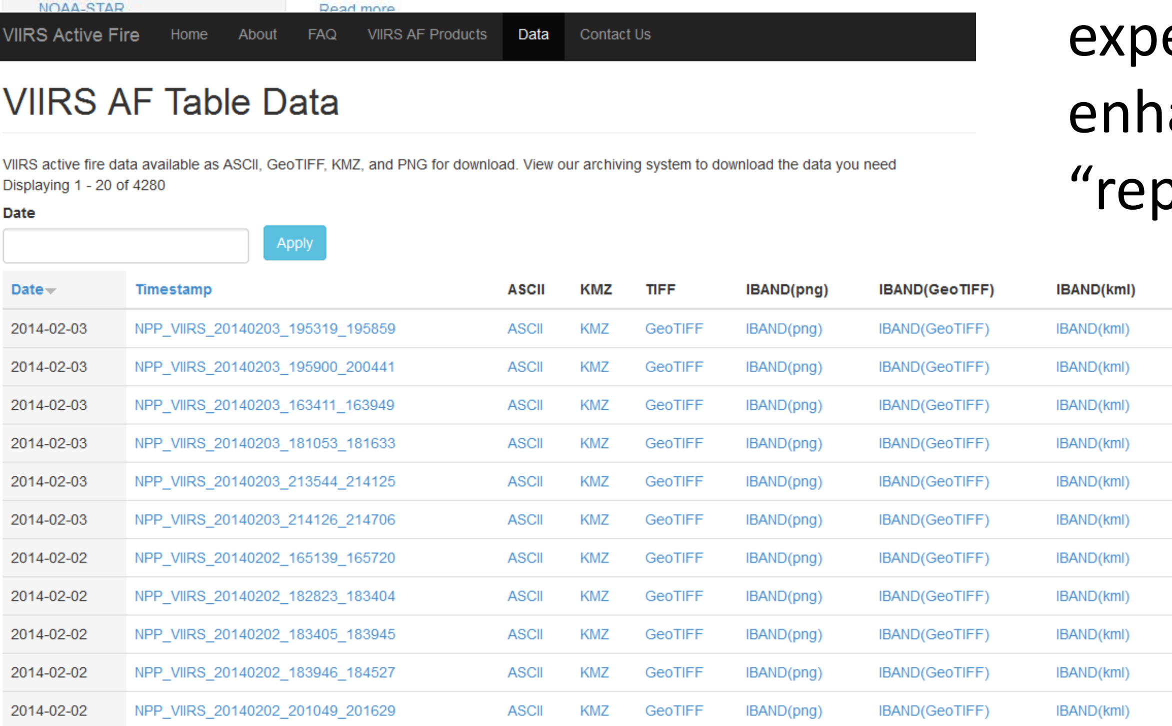
- Options:
  - NOAA CLASS Web
    - www.class.noaa.gov
  - NASA LAADS Web
    - ladsweb.nascom.nasa.gov/data/search.html
  - NOAA CLASS ftp (anonymous)
    - ftp-npp.class.ngcd.noaa.gov
  - NASA LAADS ftp (anonymous)
    - ladsweb.nascom.nasa.gov
- Detailed instructions:

  viirsfire.geog.umd.edu/Documents/VIIRS_data_tutorial.pdf



New Improved Website:

- Global detections
- Searchable archive of data
- Working towards ingesting multiple sources of data (IDPS, DB) for comparison and evaluation
- Continue to provide new, experimental (I-band) and enhanced products (M-band “replacement”)



VIIRS Active Fire | Home | About | FAQ | VIIRS AF Products | Data | Contact Us

VIIRS AF Table Data

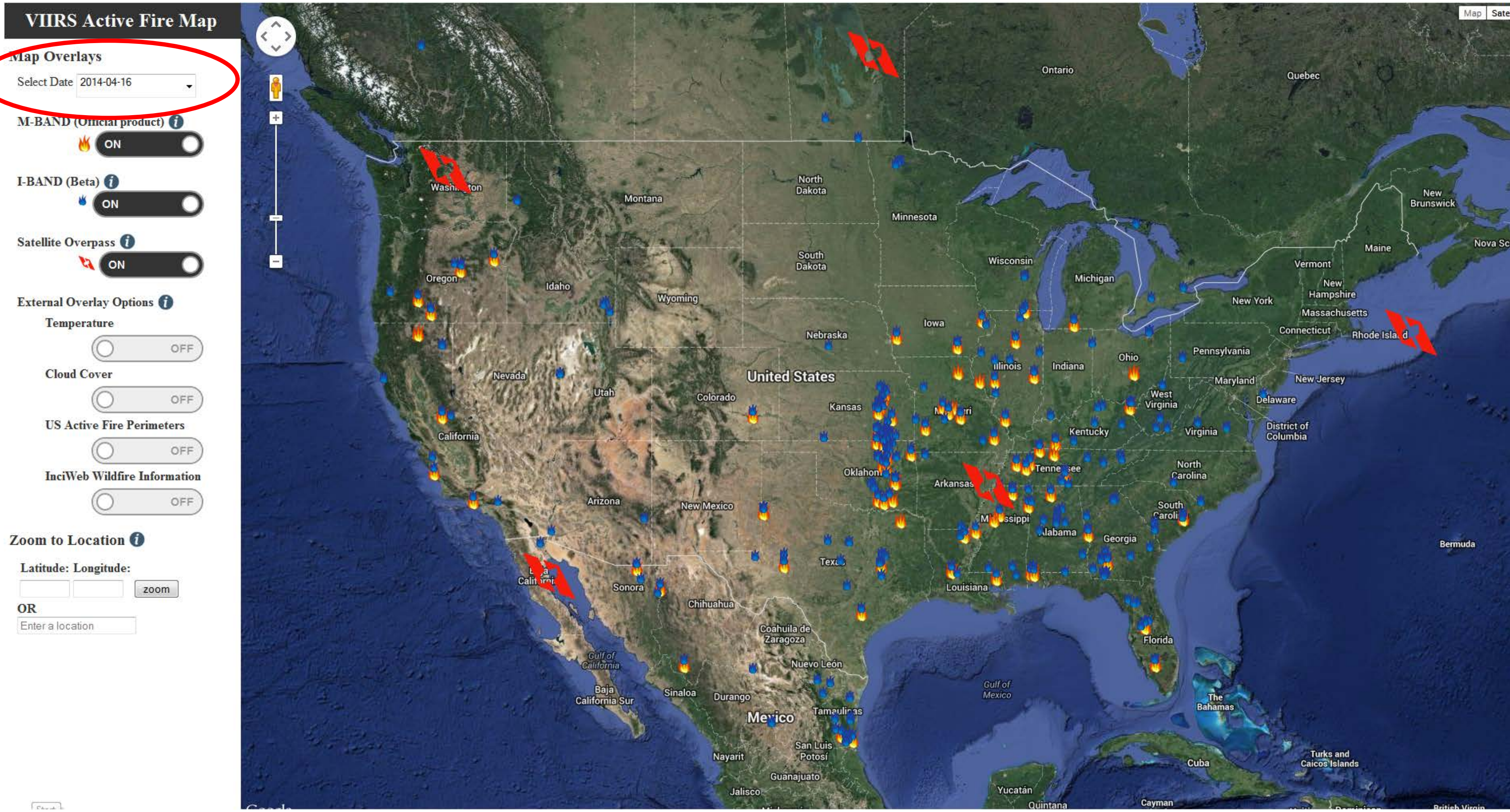
VIIRS active fire data available as ASCII, GeoTIFF, KMZ, and PNG for download. View our archiving system to download the data you need

Displaying 1 - 20 of 4280

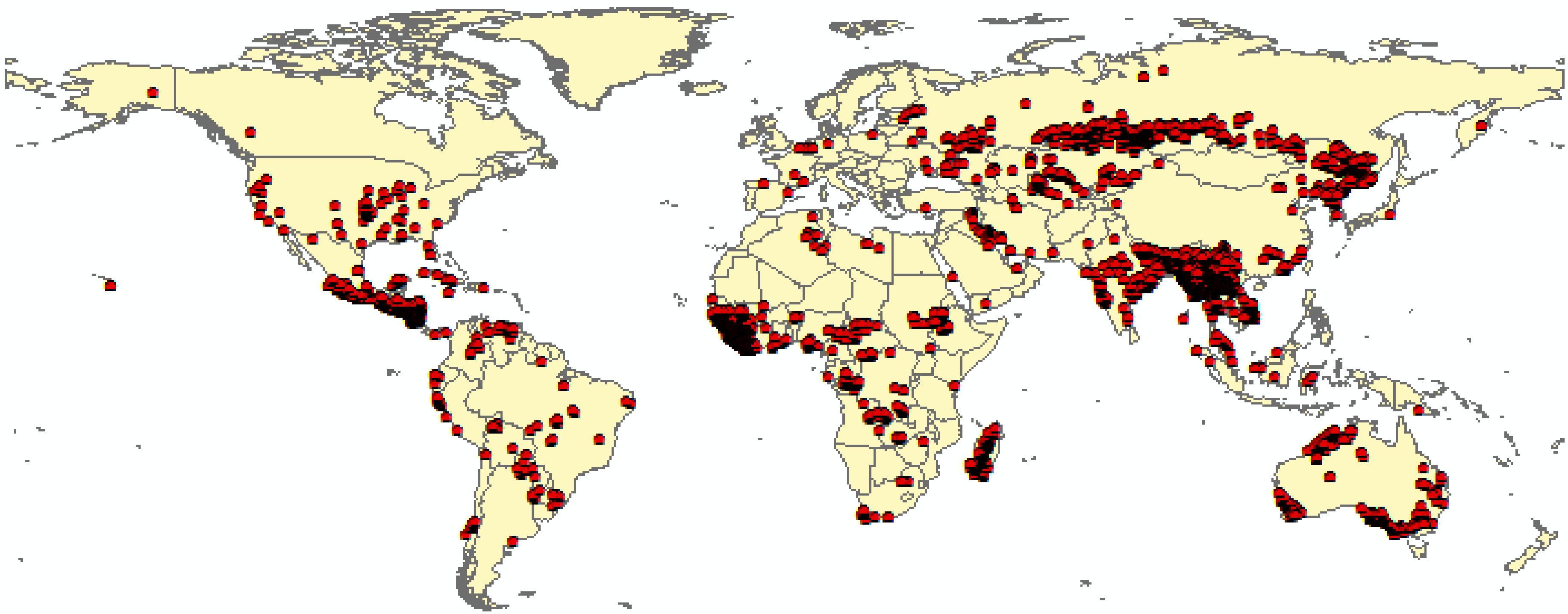
Date

Apply

Date	Timestamp	ASCII	KMZ	TIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_195319_195859	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_195900_200441	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_163411_163949	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_181053_181633	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_213544_214125	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-03	NPP_VIIRS_20140203_214126_214706	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-02	NPP_VIIRS_20140202_165139_165720	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-02	NPP_VIIRS_20140202_182823_183404	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-02	NPP_VIIRS_20140202_183405_183945	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-02	NPP_VIIRS_20140202_183946_184527	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)
2014-02-02	NPP_VIIRS_20140202_201049_201629	ASCII	KMZ	GeoTIFF	IBAND(png)	IBAND(GeoTIFF)	IBAND(kml)


VIIRS Active Fire Map
Map Overlays
Select Date 2014-04-16
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:
zoom
OR
Enter a location
Map
Satellite
Ontario
Quebec
North Dakota
Montana
Minnesota
South Dakota
Wisconsin
Michigan
Oregon
Idaho
Wyoming
Iowa
Nebraska
Illinois
Indiana
Ohio
Pennsylvania
New York
Vermont
New Hampshire
Massachusetts
Connecticut
Maine
New Brunswick
Nova Scotia
New Jersey
Maryland
Delaware
District of Columbia
West Virginia
Virginia
Kentucky
North Carolina
South Carolina
Georgia
Alabama
Arkansas
Oklahoma
Kansas
Colorado
Utah
Nevada
California
United States
Arizona
New Mexico
Texas
Louisiana
Florida
Sonora
Chihuahua
Coahuila de Zaragoza
Nuevo León
Gulf of California
Baja California Sur
Sinaloa
Durango
Mexico
Tamaulipas
San Luis Potosí
Nayarit
Guanajuato
Jalisco
Gulf of Mexico
The Bahamas
Cuba
Yucatán
Turks and Caicos Islands
Bermuda

Global VIIRS detections

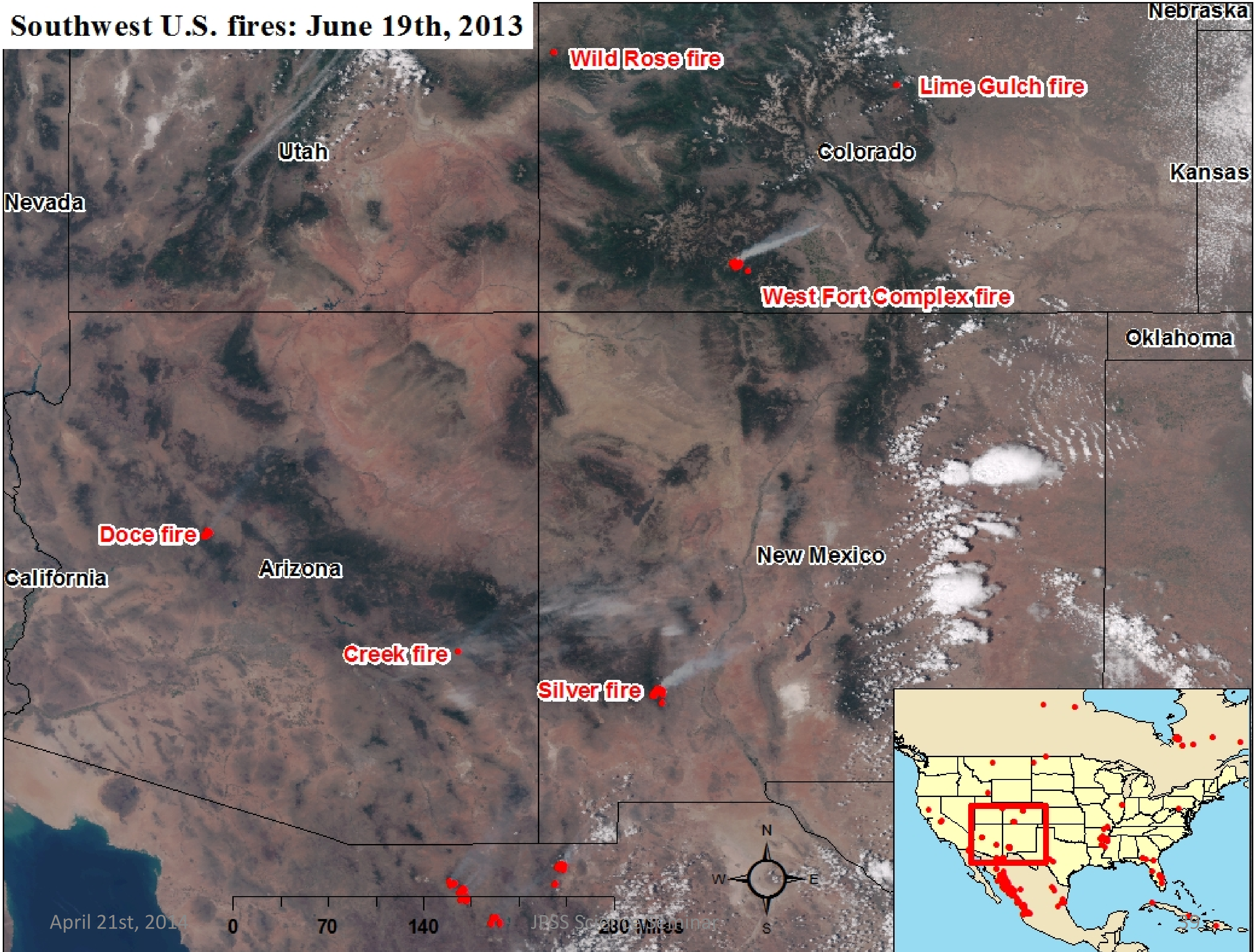


Outreach

Teleconferences

- Over the past 2 years teleconferences have facilitated a dialogue between PGRR project investigators and members of the user community, such as NWS Incident Meteorologists (**IMETs**) on topics such as VIIRS data and information dissemination, latency of the delivery system, and user community needs and wants.
- From these conference calls, and follow-on discussions among team members, we came to the realization that to best understand what the end-users are dealing with at a wildfire incident <u>**we needed to visit them – on the ground**</u>**.**

Southwest U.S. fires: June 19th, 2013



West Fork Complex

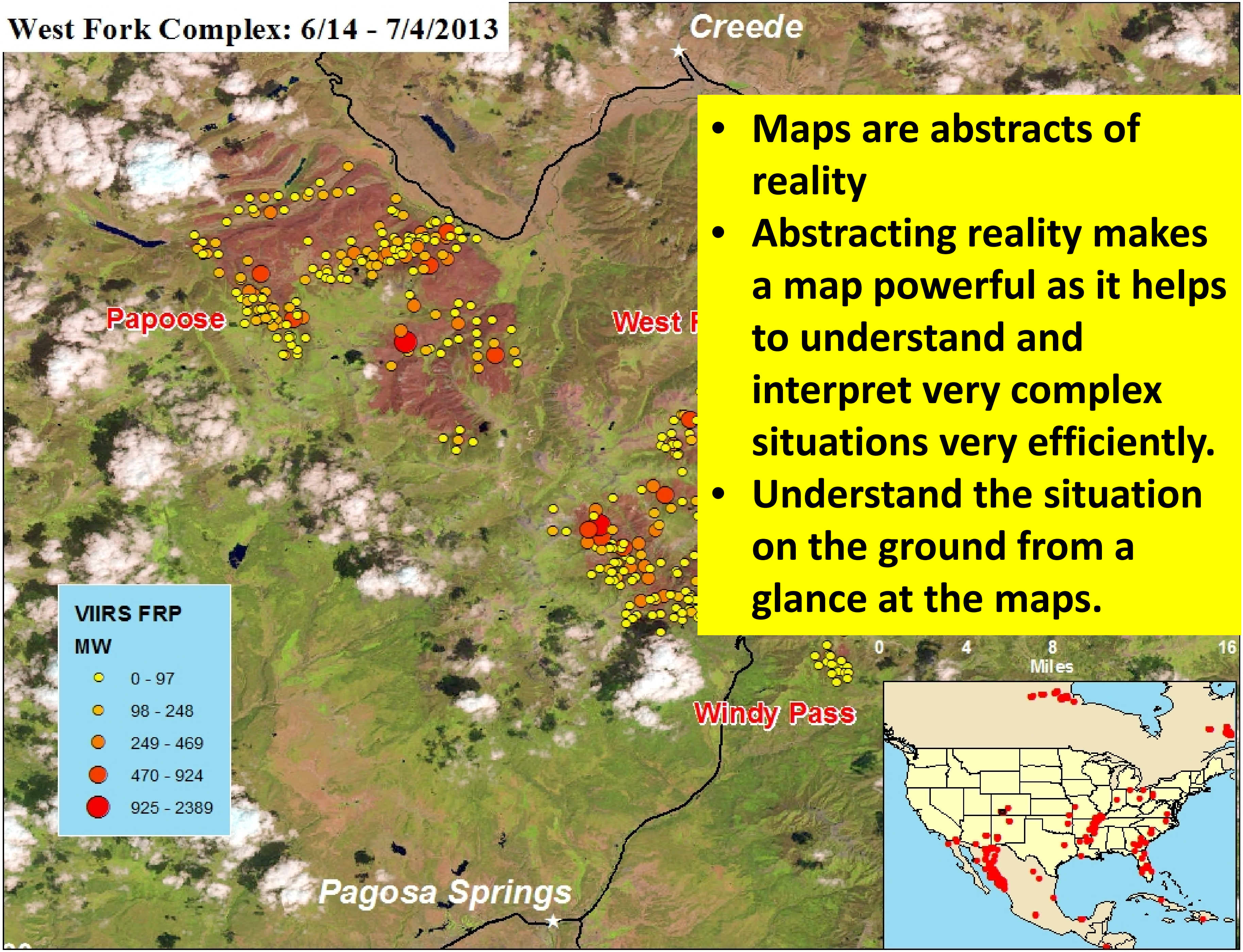
West Fork Complex

Eric Morgan and Chris Johnson (FBANs)

Mark Loeffelbein and Kelly Hooper (IMETs)

Nick Giannettino (Planning Section Chief)

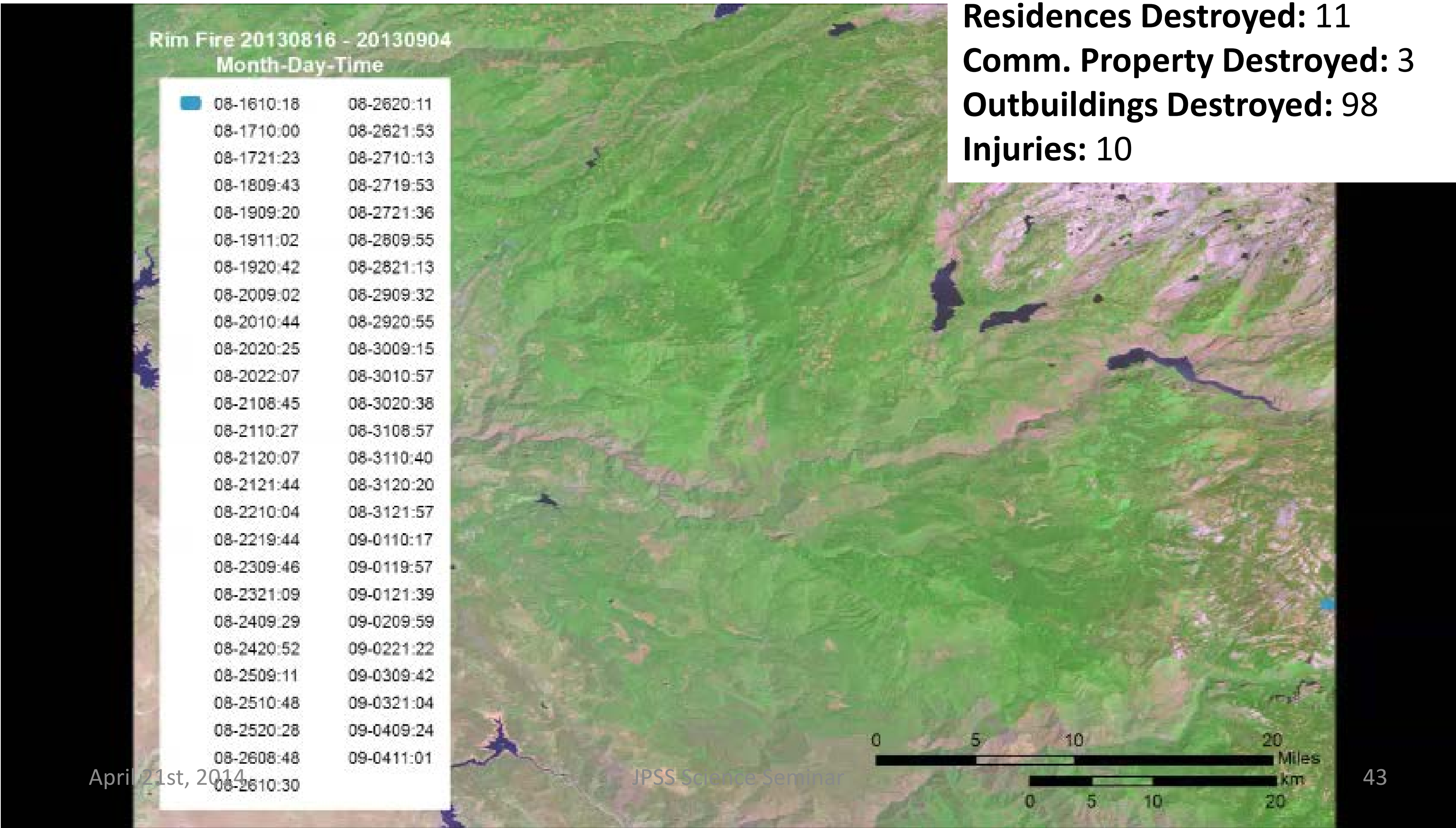
West Fork Complex: 6/14 - 7/4/2013



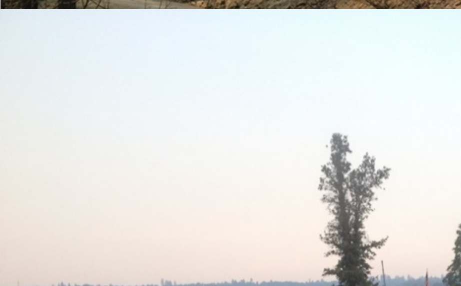
- Maps are abstracts of reality
- Abstracting reality makes a map powerful as it helps to understand and interpret very complex situations very efficiently.
- Understand the situation on the ground from a glance at the maps.

Rim fire

Acres Burned: 257,135 acres
Fire Start Date: August 17 2013
Fire Cause: *Under Investigation*
Cost to date: $127.2 million
Containment: 95%
Structures Threatened: 0
Residences Destroyed: 11
Comm. Property Destroyed: 3
Outbuildings Destroyed: 98
Injuries: 10



Rim fire

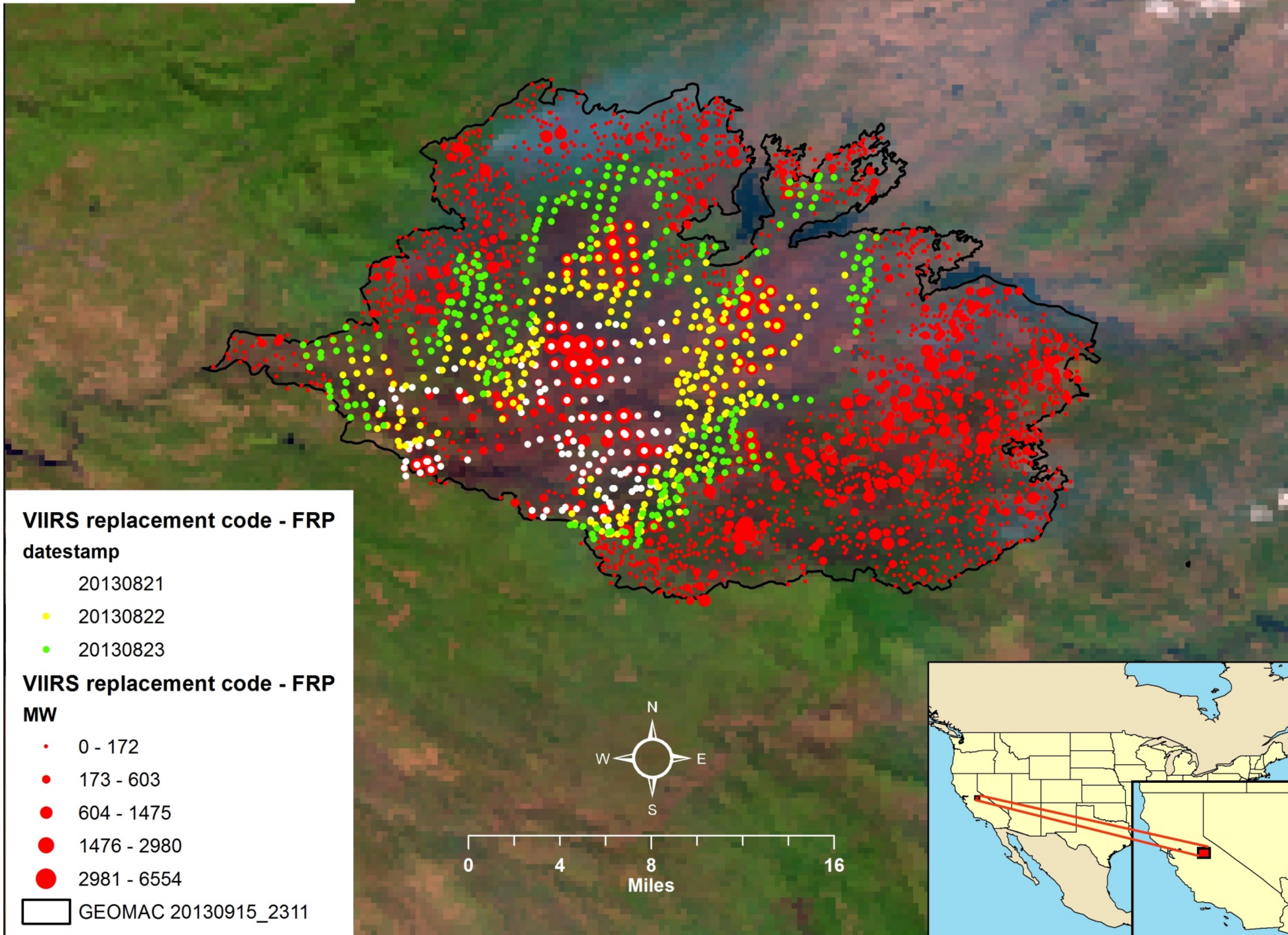


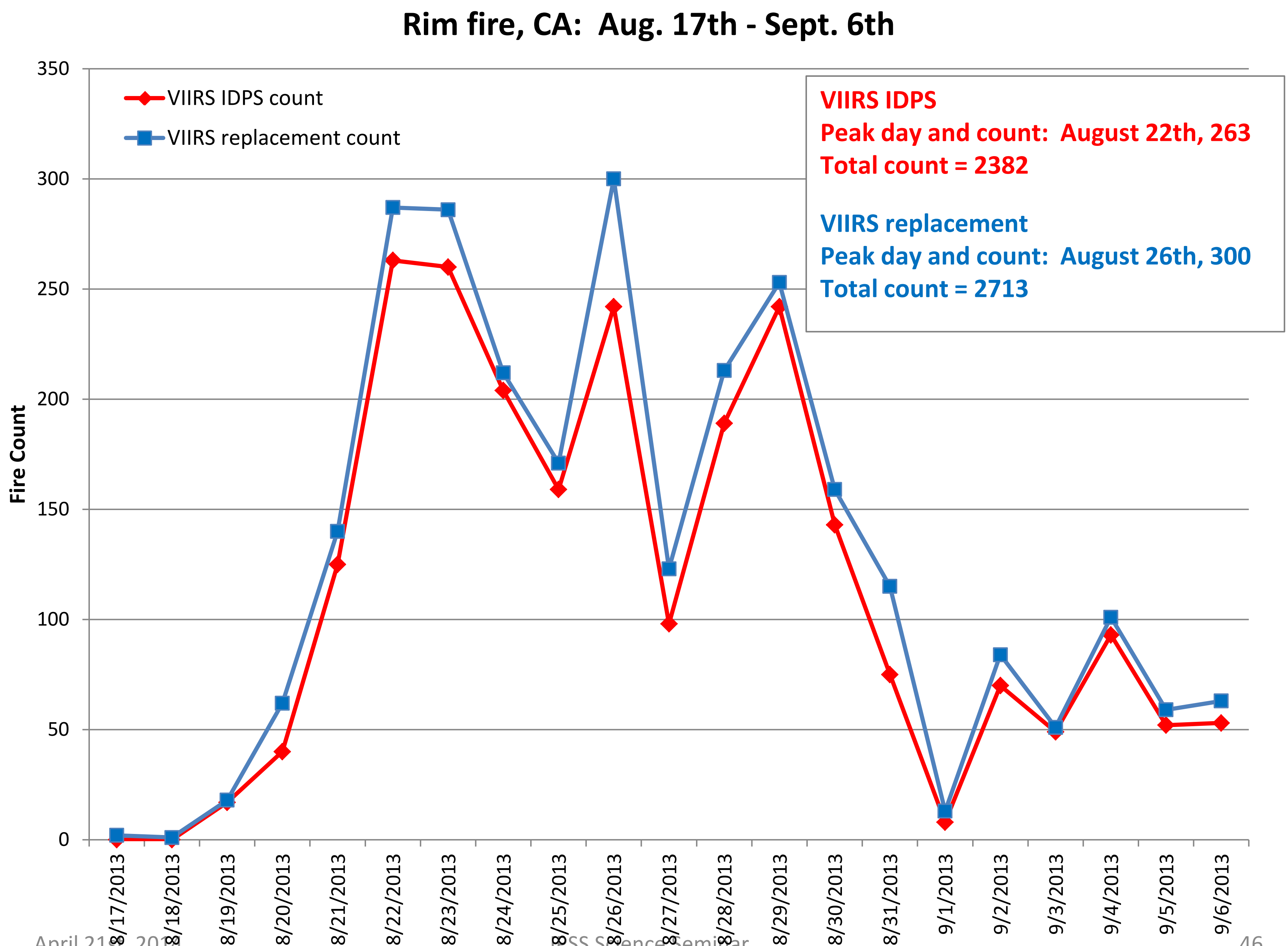

Mark Hale - FBAN


Ben Newburn - FBAN


Mark Pellerito and Joel Curtis- IMETs

Rim fire, CA: 8/17 - 9/8





Rim fire, CA: Aug. 17th - Sept. 6th
VIIRS IDPS count
VIIRS replacement count
VIIRS IDPS
Peak day and count: August 22th, 263
Total count = 2382
VIIRS replacement
Peak day and count: August 26th, 300
Total count = 2713
Fire Count
0
50
100
150
200
250
300
350
8/17/2013
8/18/2013
8/19/2013
8/20/2013
8/21/2013
8/22/2013
8/23/2013
8/24/2013
8/25/2013
8/26/2013
8/27/2013
8/28/2013
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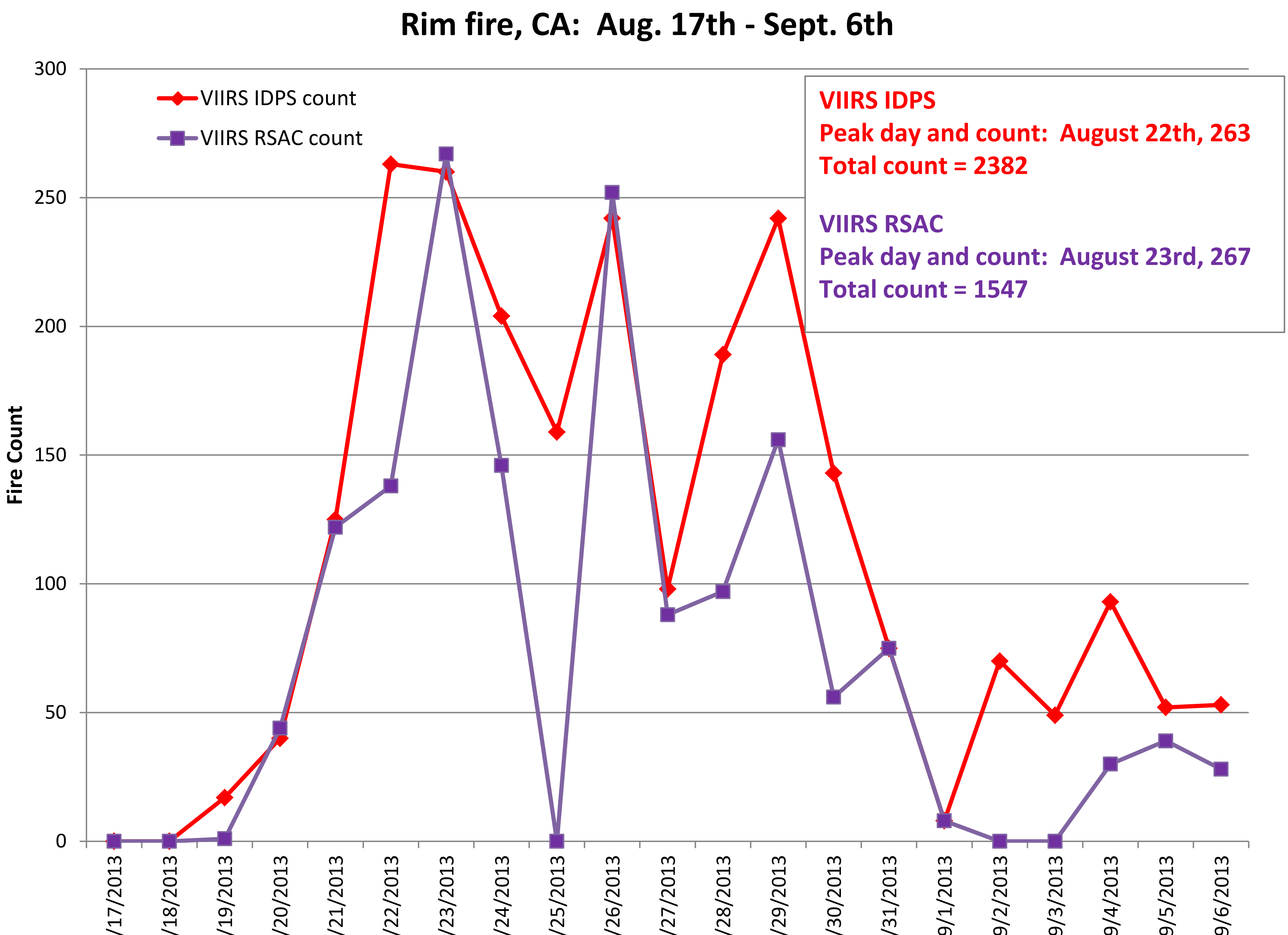
9/4/2013
9/5/2013
9/6/2013


Rim fire, CA: Aug. 17th - Sept. 6th
VIIRS IDPS count
VIIRS RSAC count
VIIRS IDPS
Peak day and count: August 22th, 263
Total count = 2382
VIIRS RSAC
Peak day and count: August 23rd, 267
Total count = 1547
Fire Count
300
250
200
150
100
50
0
8/17/2013
8/18/2013
8/19/2013
8/20/2013
8/21/2013
8/22/2013
8/23/2013
8/24/2013
8/25/2013
8/26/2013
8/27/2013
8/28/2013
8/29/2013
8/30/2013
8/31/2013
9/1/2013
9/2/2013
9/3/2013
9/4/2013
9/5/2013
9/6/2013

Rim fire "Debrief"
Evan Ellicott

__Background:__ The objective of the JPSS VIIRS Active Fire (AF) Proving Ground and F
(PGRR) project is to maximize the benefits and performance of SNPP data, algorithms, and
downstream operational and research users. The VIIRS Active Fire product is critical for d
resource management and expected to be used by real-time resource and disaster manag
quality monitoring; ecosystem monitoring; climate studies, etc. With this in mind our goa
project are product evaluation and improvement and the development of a near-real-tim
product delivery system to support fire management and NOAA operations.

My visit to the West Fork Complex near Pagosa Springs, Colorado, in June 2013 of
hand insight to the operational structure, work and information flow, as well as an opport
demonstrate th

- **Latency** – this is critical component to operational management of an incident. Getting RS data to the Situation Unit Leaders and others in the Planning Section, as well as Command Cadre, as quickly as possible. That said, the current RS data they use – primarily NIROPS, is only once a day and at night. I explained how VIIRS (and MODIS) p around the same time NIROPS flights are imaging the f additional sampling points to confirm heat sources an difference between NIROPS, VIIRS, and MODIS could c using MODIS-Terra (~10am/pm) along with afternoon information, would offer a sense of the fire's diurnal a
- **User-friendly format** – this has been a consistent the the format be easily ingested into a GIS or Google Eart straightforward, both in terms of where to go to get it metadata file with clear, concise descriptions should b
- **Product availability user knowledge** – there is a spec of data is available, the most appropriate application, accuracy with and between datasets. This may be the

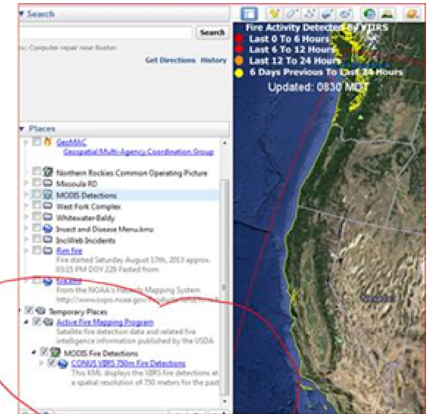
Based on feedback from members of the recommendations to Brad Quayle at the many in the wildland firefighting community RS data and the portals providing it are something of a blackbox.

The following is insight and comments gathered from specific user-groups:

- **IMETs:** My discussions with the IMETs (Mark Pellerito and Joel Curtis) offered simila what I had heard at the West Fork Complex, mainly that they were not really up to sp VIIRS sensor's characteristics and capabilities, particularly fire detection (and hopefu fire characterization).
  - What they want in any data source is timeliness and user-friendly format. For on Wednesday and Thursday (9/11-12) a cold front moved in to the East of the producing convective cells and lightning activity. There was concern about out stirring up the fire as well as lightning activity generating new fires. The IMETs checking their models and GOES regularly (meaning constantly) during these e

1. *The KML feeds on the "Fire Data in Google Earth" for VIIRS, AVHRR, and GOES are often confused with the maps above them. In other words, I spoke with several individuals who state that they thought the VIIRS data was only for Alaska. Although a little bit of clicking quickly resolves this confusion, I can also see how someone might initially come to this conclusion:*

2. *When you click on the VIIRS detection (current) link and it opens in Google Earth the content tree shows:*
   i. *Active Fire Mapping Program > MODIS Fire Detections > __And then you have to open this layer to see that it is actually VIIRS__*

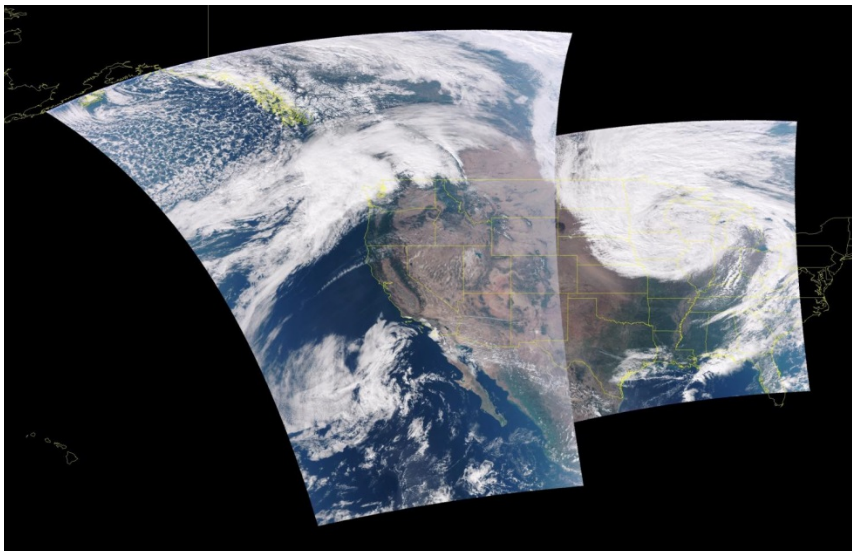


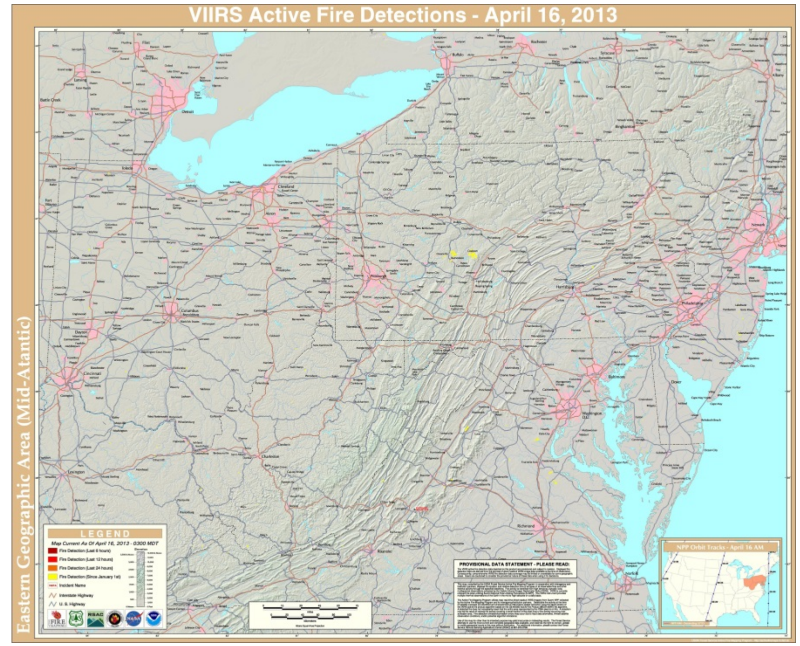
3. *And then reading about the VIIRS footprint is a little confusing for some folks:*
   a. *"This KML displays the VIIRS fire detections at a spatial resolution of 750 meters for the past 6 hours, 6-12 hours, 12-24 hours and the previous 6 day period. __Each 750 meter VIIRS fire detection__ is depicted as a point representing the* ***centroid of the 1km pixel*** *where the fire is detected. The 750 meter footprint of the VIIRS pixel __for each detection__ is*

Take Home Messages

- **Latency is critical.**
- **Data format.**
  - User friendly (e.g. KML/KMZ).
  - Time is limited and they need “simple-stupid” products/data that can be opened and viewed quickly (i.e. Google Earth).
- **Users need one-stop shopping** (e.g. COP)
  - Need to obtain and use polar orbiting and geostationary data effectively.
  - Example – using the sequence of Aqua/VIIRS (0100), Terra (1000), Aqua/VIIRS (1300), Terra (2200) to build a picture of fire progression and location.
- For many, fire intensity (FRP) was not even a metric they were aware of.
- The thermal channels (e.g. MODIS channel 31/32) often used at night to see cloud/smoke location to estimate when and where it will impact fire behavior, inversions, and track movement.
  - We could be promoting other VIIRS products (cloud micro physics, AOD) along with the AVAFO. This would also assist the Smoke/Air Quality Analyst on the fire, who was also unaware of these types of products and their potential use (he was from the US Fish & Wildlife).
- **Fire Behavior Analysts (FBANs) and Long Term Analysts (LTANs)** – we are missing an audience here who was keenly interested in fire location, intensity, and vegetation products (e.g. EVI, NDVI, dNBR, etc.)

Partnership with the Direct Broadcast community





Processing codes are now available in the Community Satellite Processing Package (CSPP; University of Wisconsin; http://cimss.ssec.wisc.edu/cspp/) and International Polar Orbiter Processing Package (IPOPP; NASA Direct Broadcast Laboratory; http://directreadout.sci.gsfc.nasa.gov/). The Active Fires product team works with the providers of CSPP and IPOPP to ensure that the latest algorithms are included.

Active Fire Mapping (AFM) Program

(http://activefiremaps.fs.fed.us)

- Satellite detection and monitoring of wildfire activity in CONUS, Alaska, Hawaii & Canada

  Leverages NASA and NOAA assets

  MODIS GOES
  AVHRR VIIRS

- Facilitates decision support for strategic planning & response for U.S. and Canadian fire agencies
  - Prioritize allocation of fire suppression assets
  - Integrated into fire-related applications and decision support systems

- Developing new capabilities
  - Early detection
  - Spatially refined data

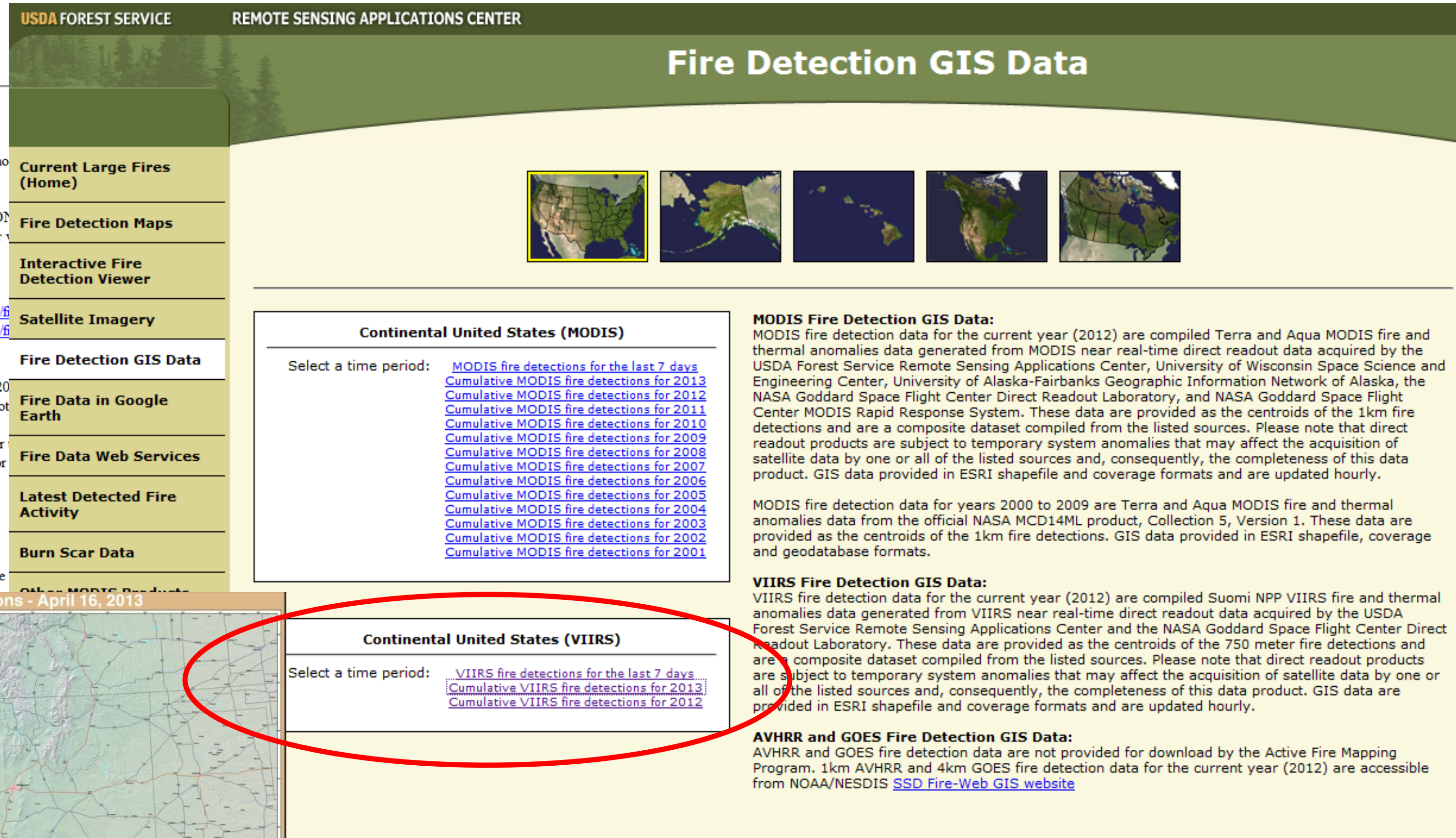
VIIRS Active Fire Detections for CONUS (2013) – 1/1/2013 through 04/16/2013 0100 MDT (Provisional)

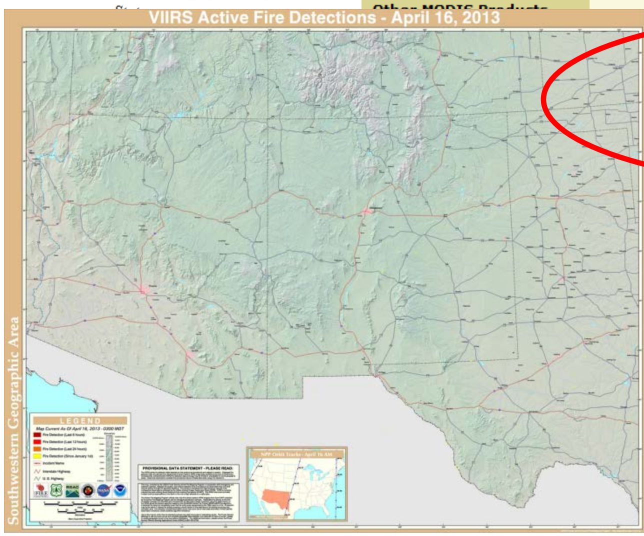
Metadata also available as

Metadata:

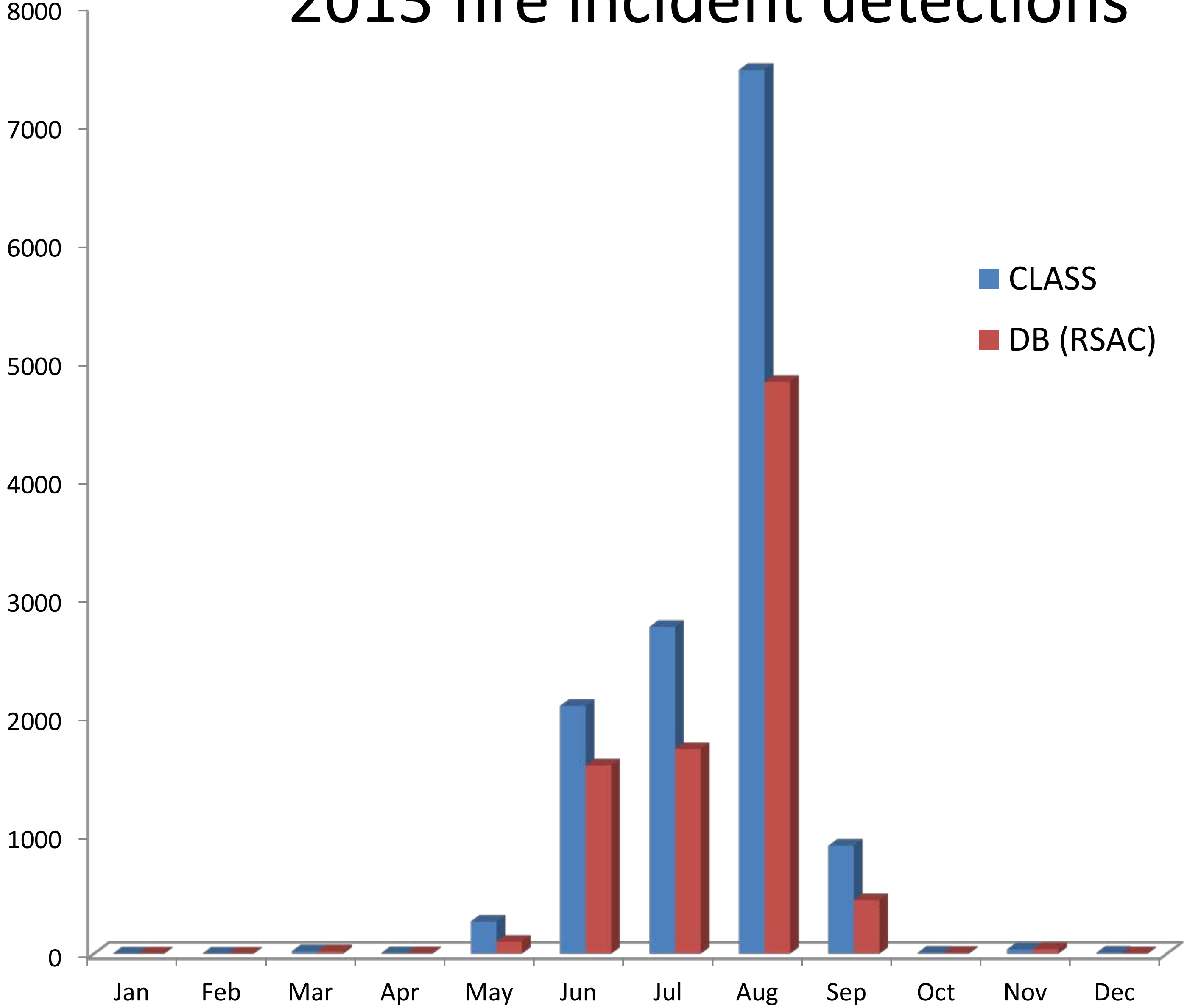
- Identification_Information
- Data_Quality_Information
- Spatial_Data_Organization_Information
- Spatial_Reference_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:
Citation:
Citation_Information:
Originator: USDA Forest Service, Remo
Publication_Date: 20130416
Title:
VIIRS Active Fire Detections for the CON
Geospatial_Data_Presentation_Form:
Publication_Information:
Publication_Place: Salt Lake City
Online_Linkage:
<http://activefiremaps.fs.fed.us/data_viirs/fi
<http://activefiremaps.fs.fed.us/data_viirs/fi
Description:
Abstract:
This coverage represents available year 20
between the USDA Forest Service Remot
Purpose:
These fire detection data are collected for
meters and therefore are only intended for
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20130505
Ending_Date: 20130416
Currentness_Reference: publication date





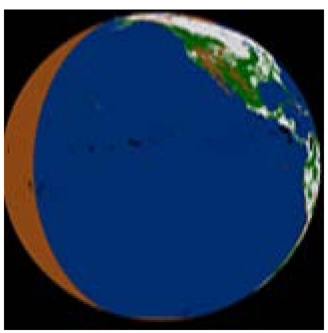
2013 fire incident detections



GOES AND GOES-R STATUS AND ACTIVITIES

GOES Fire Product Overview

- Contextual Fire Detection and Characterization Algorithm, a baseline product for GOES-R Advance Baseline Imager (ABI)
- FDCA is the ABI implementation of the Wildfire Automated Biomass Burning Algorithm (WFABBA)
- WFABBA has been operational at NESDIS since 2002, development began in 1995
- WFABBA has been implemented on a global geostationary constellation consisting of GOES, MSG, MTSAT, and COMS



GOES-West

GOES-East

METEOSAT

COMS

MTSAT

(http://wfabba.ssec.wisc.edu/wfabba.html)

Geostationary fire detection and characterization

- GOES Spatial resolution is 4 km at satellite sub-point and temporal resolution varies with location from 15 minutes (even more frequently in Rapid Scan mode) to 3 hours
- GOES-R Spatial resolution will be 2 km and temporal resolution will be 5 minutes for CONUS and 15 minutes for the full disk
- Both versions provide fire locations, detection categories, instantaneous fire size, temperature, and fire radiative power and pixel masks that define, for each non-fire pixel, why it was not classified as a fire (unusable surface type, such as water or desert, cloudy fields of view, block-out zones, etc)
- 24/7 monitoring of a hemisphere allows for tracking trends and early detection
- The fire's radiative power (FRP), size, and temperature can be used to estimate emissions and intensity

    FRP is related to the mass consumed

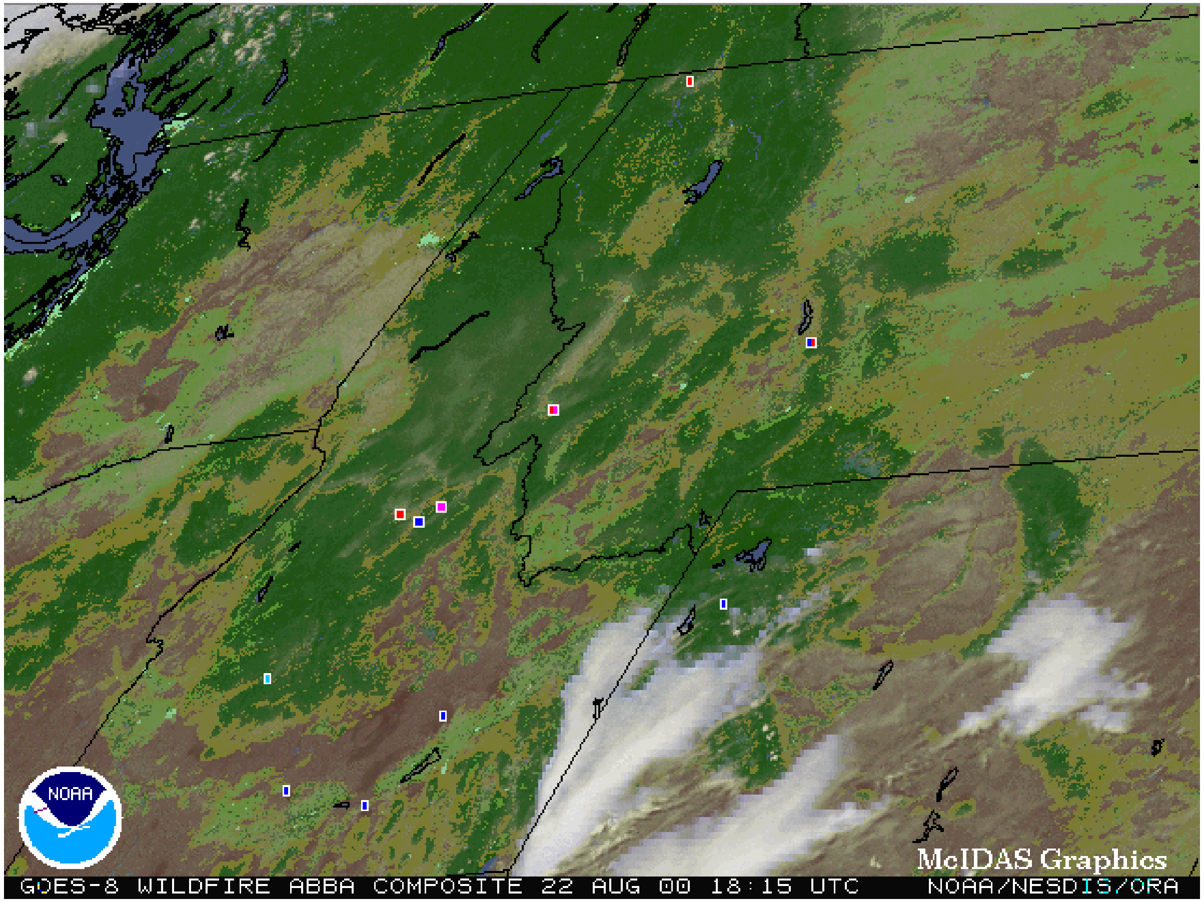
    FRP is proportional to temperature to the fourth power times size
- Works best with at least 2 IR bands: ~4 µm and ~11 µm. If available, a visible band and a ~12 µm band allow for better cloud screening
- Requires some ancillary data (total precipitable water, surface emissivity, surface type)
- Current hardware can process a full disk image in 5-10 minutes. Best hardware <5 minutes

Geostationary fire detection and characterization

- Spatial resolution is more coarse than for polar orbiting satellites
- The fire's radiative power (FRP), size, and temperature can be used to estimate emissions and intensity
    - FRP is related to the mass consumed
    - FRP is proportional to temperature to the fourth power times size
- The large footprint makes early detection of wildfires difficult, but is still useful where human observers are few and far between
- Works best with at least 2 IR bands: ~4 µm and ~11 µm
- If available, a visible band and a ~12 µm band allow better cloud screening
- Requires some ancillary data (total precipitable water, surface emissivity, surface type)
- Algorithm is contextual to best handle estimating background surface radiance
- Current hardware can process a full disk image in 5-10 minutes. Best hardware <5 minutes
- Location given is the center of the pixel and subject to navigation error of satellite

Temporal resolution, WFABBA Example

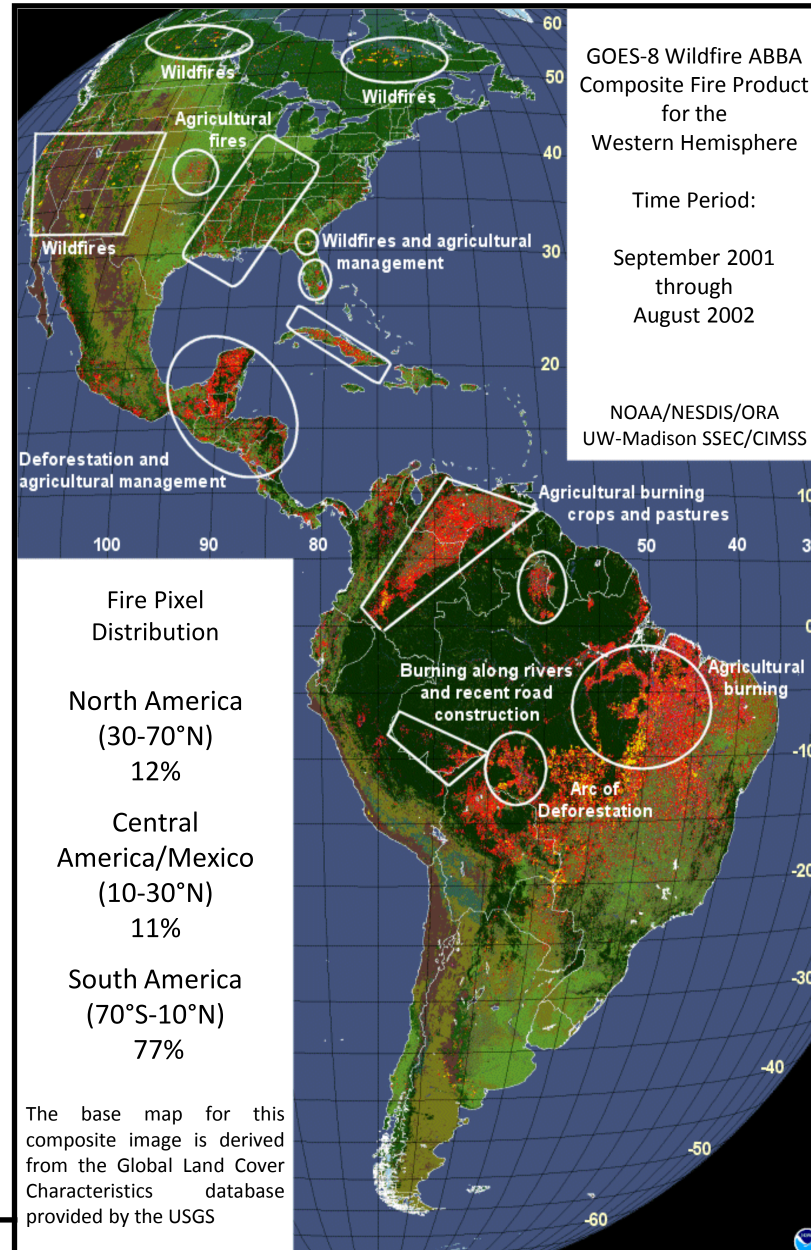
- 22 August 2000, 18:15 to 23:45 UTC
- Fire complex had started on 14 August
- Loop shows intensification in the afternoon as the winds pick up
- Valley smoke can be seen, as well as a fire induced cloud with a glaciated top



Annual Distribution of Fires in the Western Hemisphere

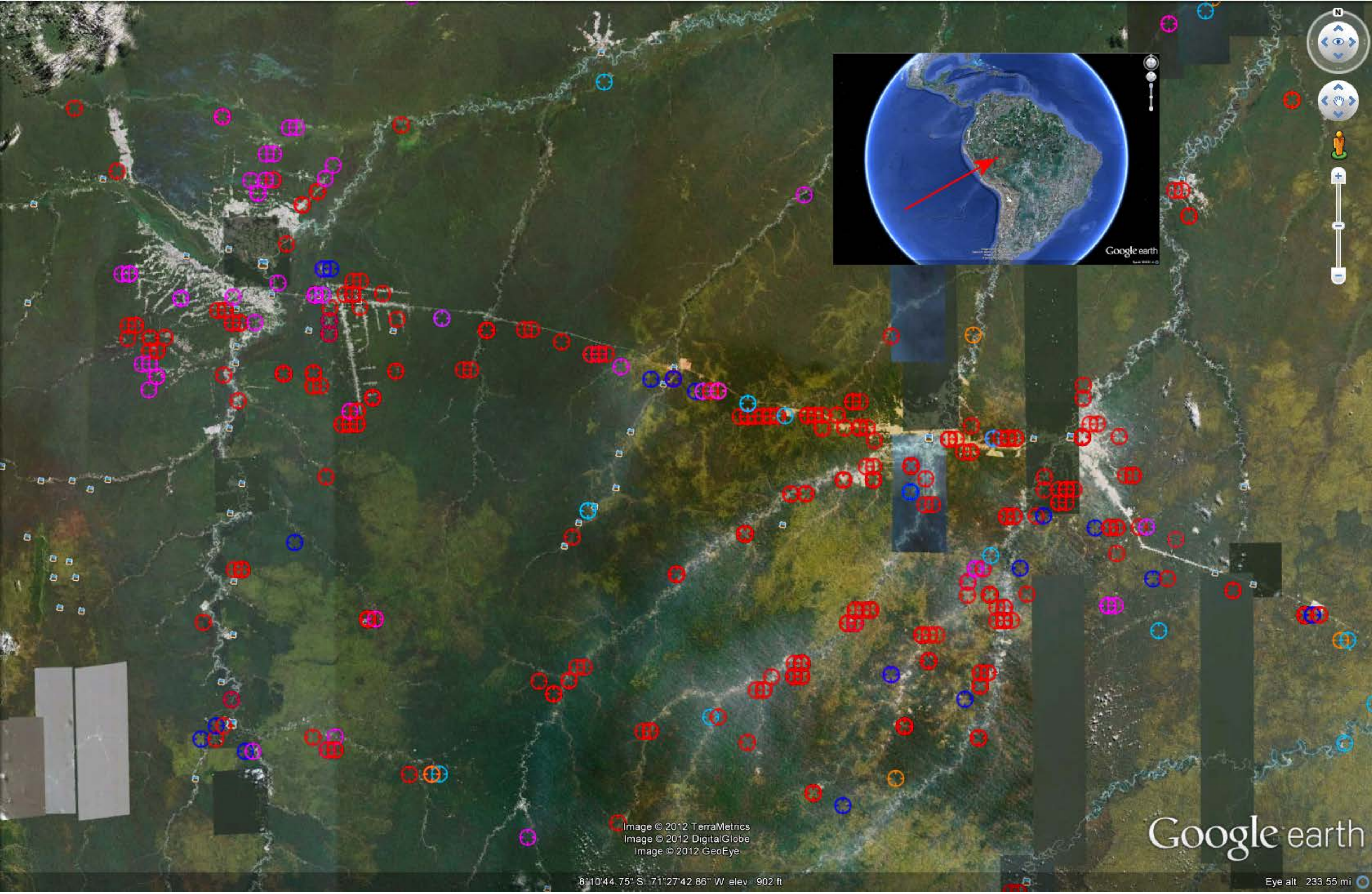
SEPTEMBER 2001 – AUGUST 2002

This WF_ABBA fire product composite was generated from over 15,000 half-hourly GOES-8 images. The composite shows a much higher incidence of burning in Central and South America, primarily associated with deforestation and agricultural management. Approximately 1.67 million fire pixels were identified from September 2001 through August 2002. A 10% increase was observed over the previous year.



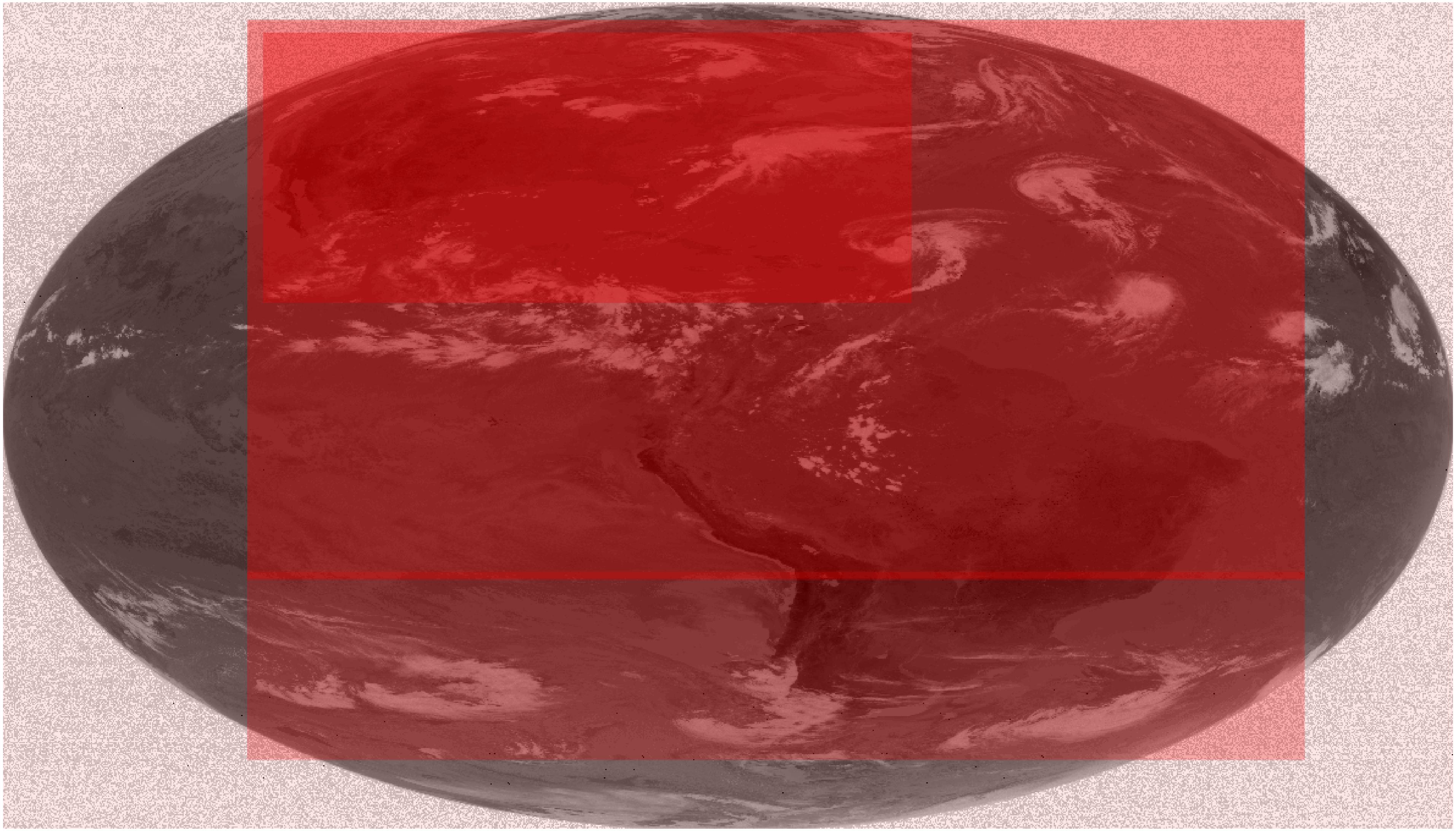
WF_ABBA Fire Pixel Category

Processed | Saturated | Cloudy | High Possibility | Medium Possibility



GOES-12 composite for 8 September 2010 showing burning in western Brazil. The icons roughly approximate the satellite footprint and not the size of the fire. Red indicates high confidence fires with associated size, temperature, and power. Other colors represent cloud covered fires (purple), saturate pixels (yellow), and other confidence levels. The fires line up along previous clearings and roads, a common pattern for fires in the South American forest.

Spatial Frequency



Typical current GOES-East spatial frequency. GOES-8 28 August 1995 17:45 UTC image shaded by relative frequency of coverage.

GOES-R Advanced Baseline Imager (ABI)

Table 1. Summary of the wavelengths, resolution, and sample use and heritage instrument(s) of the ABI bands. The minimum and maximum wavelength range represent the full width at half maximum (FWHM or 50%) points. [The Instantaneous Geometric Field Of View (IGFOV).]

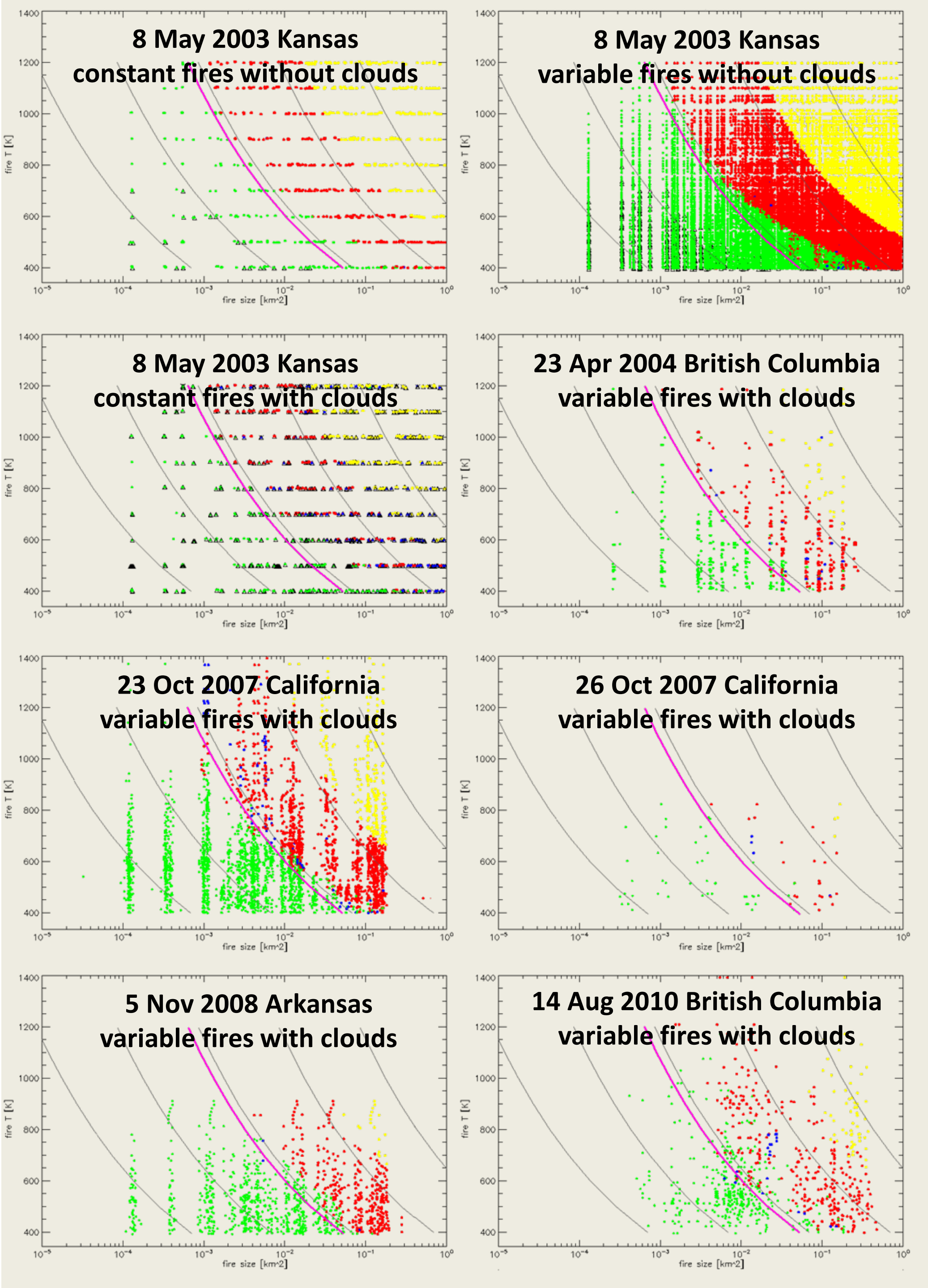
Future GOES imager (ABI) band	Wavelength range (µm)	Central wavelength (µm)	Nominal subsatellite IGFOV (km)	Sample use	Heritage instrument(s)
1	0.45–0.49	0.47	1	Daytime aerosol over land, coastal water mapping	MODIS
2	0.59–0.69	0.64	0.5	Daytime clouds fog, insolation, winds	Current GOES imager/ sounder
3	0.846–0.885	0.865	1	Daytime vegetation/burn scar and aerosol over water, winds	VIIRS, spectrally modified AVHRR
4	1.371–1.386	1.378	2	Daytime cirrus cloud	VIIRS, MODIS
5	1.58–1.64	1.61	1	Daytime cloud-top phase and particle size, snow	VIIRS, spectrally modified AVHRR
6	2.225–2.275	2.25	2	Daytime land/cloud properties, particle size, vegetation, snow	VIIRS, similar to MODIS
7	3.80–4.00	3.90	2	Surface and cloud, fog at night, fire, winds	Current GOES imager
8	5.77–6.6	6.19	2	High-level atmospheric water vapor, winds, rainfall	Current GOES imager
9	6.75–7.15	6.95	2	Midlevel atmospheric water vapor, winds, rainfall	Current GOES sounder
10	7.24–7.44	7.34	2	Lower-level water vapor, winds, and SO_2	Spectrally modified current GOES sounder
11	8.3–8.7	8.5	2	Total water for stability, cloud phase, dust, SO_2 rainfall	MAS
12	9.42–9.8	9.61	2	Total ozone, turbulence, and winds	Spectrally modified current sounder
13	10.1–10.6	10.35	2	Surface and cloud	MAS
14	10.8–11.6	11.2	2	Imagery, SST, clouds, rainfall	Current GOES sounder
15	11.8–12.8	12.3	2	Total water, ash, and SST	Current GOES sounder
16	13.0–13.6	13.3	2	Air temperature, cloud heights and amounts	Current GOES sounder/ *GOES-12+* imager

http://www.goes-r.gov/spacesegment/ABI-tech-summary.html

The detection threshold in ABI simulated data

The charts depict the GOES-R FDCA fire detection and classification as a function of the model simulated ABI fire size and fire temperature. Fire detection case studies of simulated ABI data (developed at CIRA). The FDCA is quite successful detecting fires with FRP > 75 MW (purple curved line, gray curved lines are on a log scale of MW).

Fire cluster detection rates >95%. For individual pixels the detection rates are >80%.



Not Detected

Processed Fire Pixel

Cloudy Fire Pixel

Medium Probability Fire Pixel

Not Detected, Block-out zone

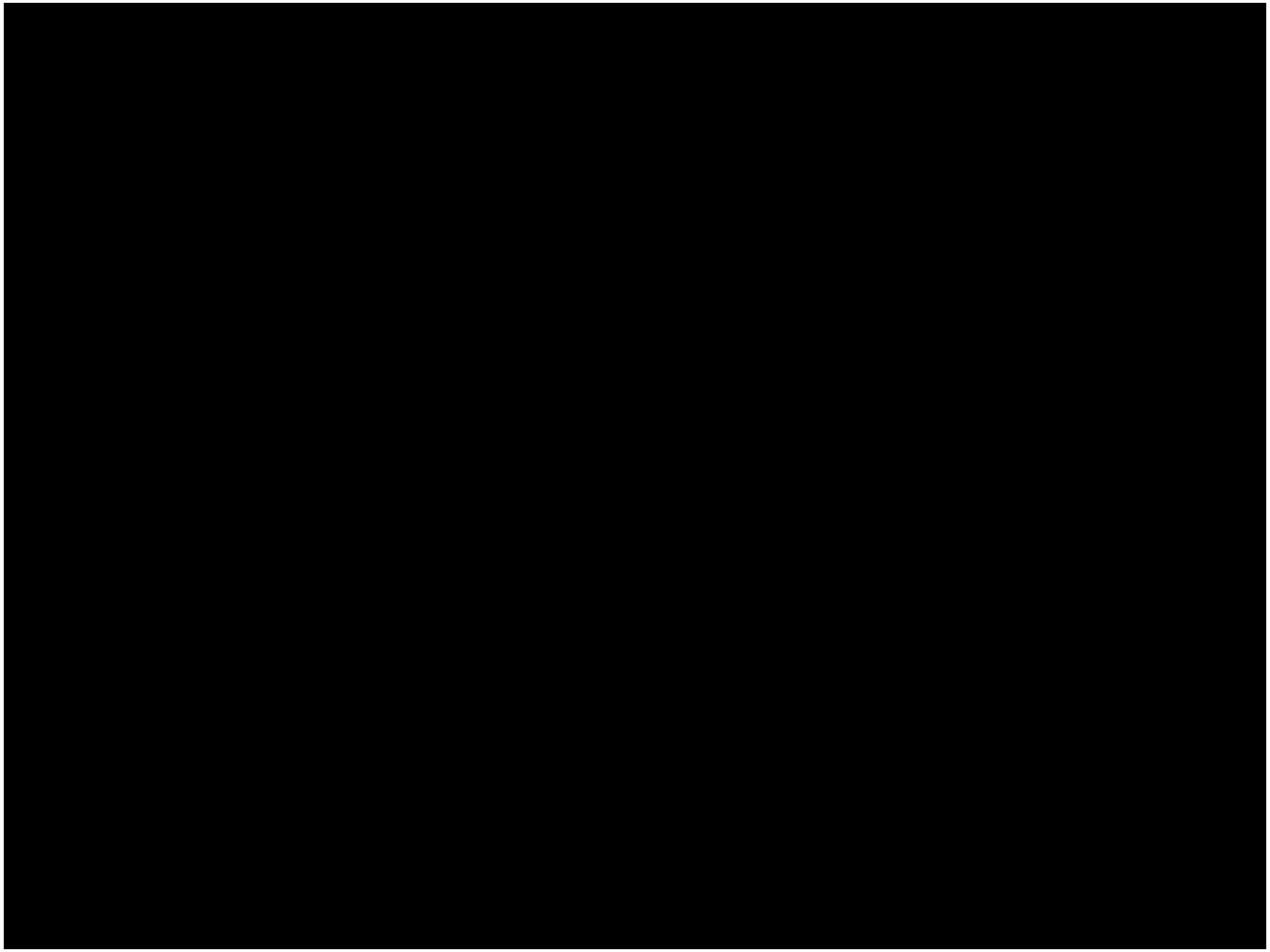
Saturated Fire Pixel

High Probability Fire Pixel

Rimfire: August 22 and 25, 2013

- Loop of GOES-14 visible SRSOR data

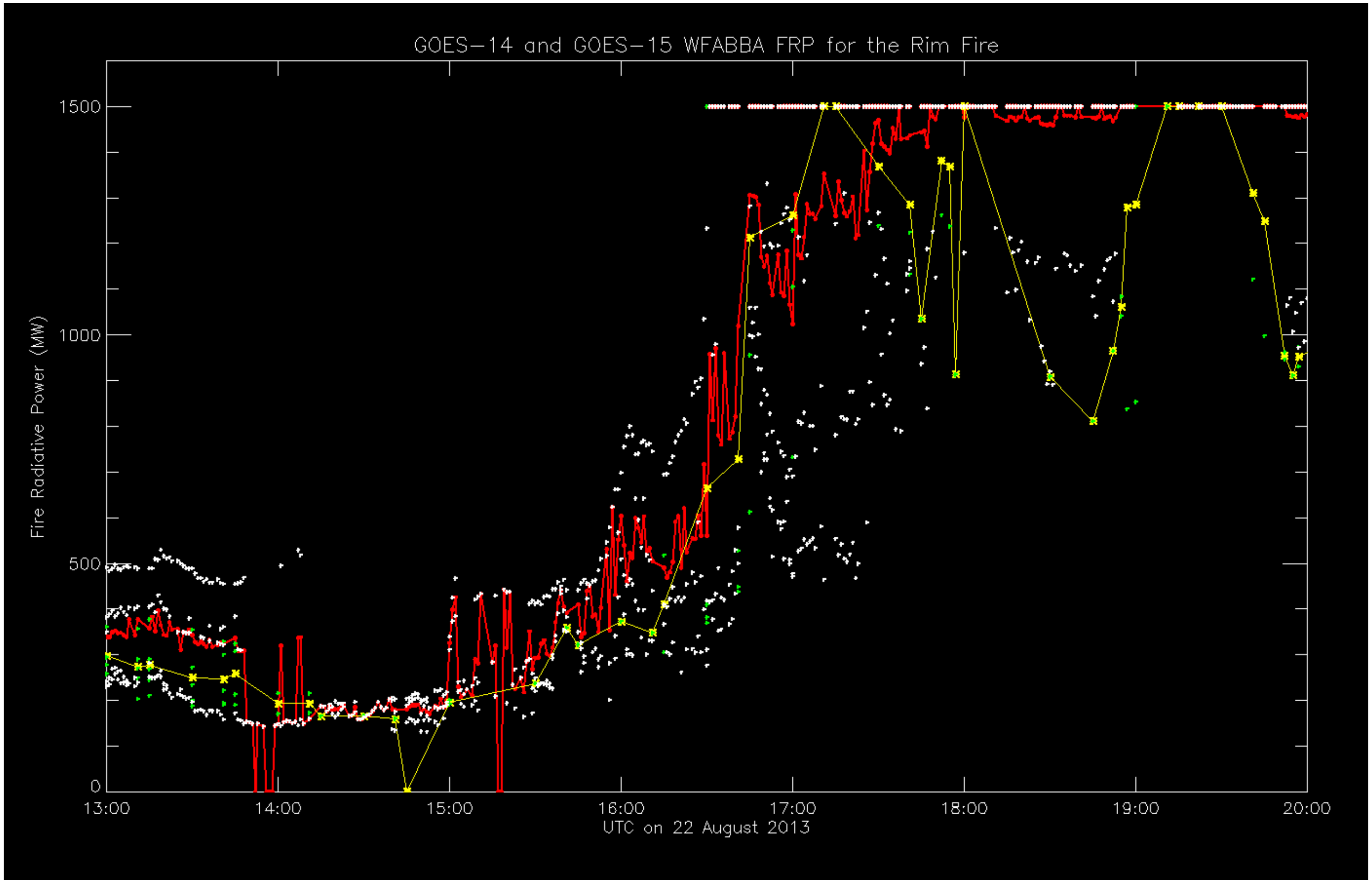
http://cimss.ssec.wisc.edu/goes/srsor2013/800x1000_GOES_B1_RIM_FIRE_animated_2013234_150000_182_2013234_200000_182_X.mp4



Rimfire: GOES-14/-15 WFABBA FRP

22 August 2013

GOES-14 SRSOR allowed it to capture intensification of the fire before it was clear from the GOES-15 data (which was on the normal operational schedule). Agreement between the two is good despite different viewing angles and instrument differences

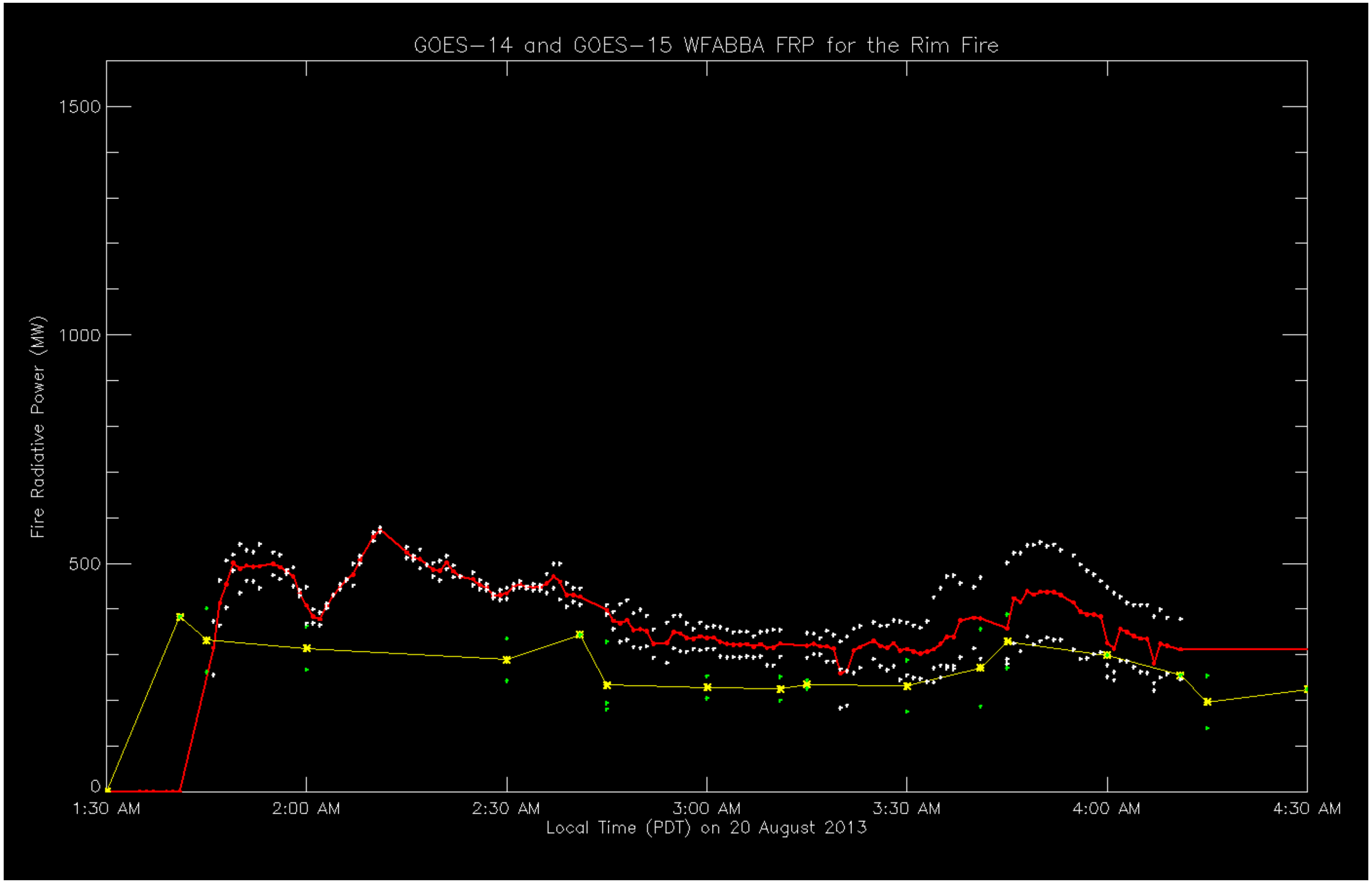


White dots: GOES-14 per-pixel FRP; Red dots and trendline: GOES-14 FRP averaged over fire pixels, saturated pixels assigned 1500 MW
Green dots: GOES-15 per-pixel FRP; Yellow dots and trendline: GOES-15 FRP averaged over fire pixels, saturated pixels assigned 1500 MW

Rimfire: GOES-14/-15 WFABBA FRP

20 August 2013

Due to 30 minute gap in coverage between 2-2:30 AM PDT, GOES-15 missed an intensification event. The difference in magnitudes could be due to the position of the fire (one satellite might have a better view due to terrain), cloud/smoke position, or some other factor.



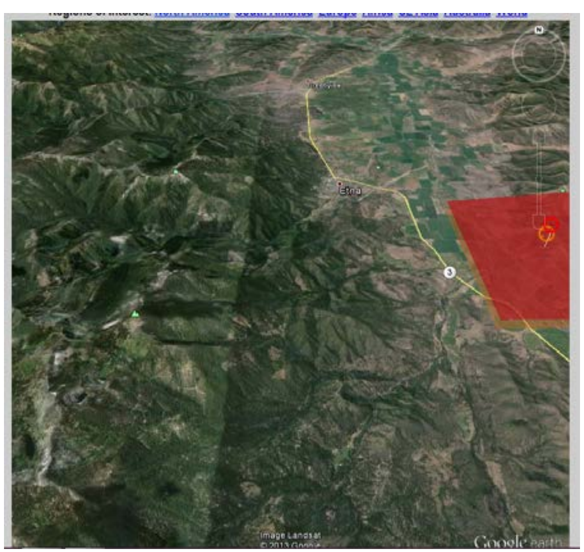
White dots: GOES-14 per-pixel FRP; Red dots and trendline: GOES-14 FRP averaged over fire pixels, saturated pixels assigned 1500 MW
Green dots: GOES-15 per-pixel FRP; Yellow dots and trendline: GOES-15 FRP averaged over fire pixels, saturated pixels assigned 1500 MW

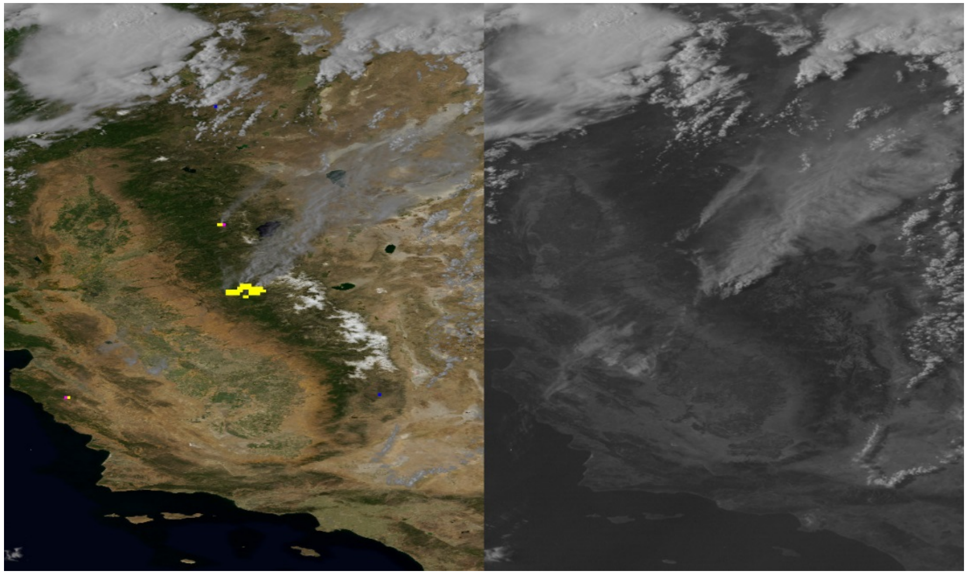
Geostationary fire data: Users and distribution

- Primary users of WFABBA data have been aerosol modelers who use the characteristics and the masks
- NWS makes little or no use of the data – this is a problem; the data is not available in AWIPS, only in ASCII, McIDAS AREA, and NetCDF
- There have been discussions with NWS Incident Meteorologists (IMETs) from the NWS offices in Boulder and Monterey regarding how the algorithm output can best be tailored to fit their needs. IMETs provide weather monitoring and forecast support during major wildfires
- Users need the fire data quickly and in easy to understand formats
- Current and future systems can provide minimal latency
- Presentation is the primary problem: How can the data be presented in its most useful form? Should it be presented alongside meteorological information? Should data from various platforms be fused? What should imagery look like? Should fire data be examined on a fire pixel or fire cluster level?

Geostationary fire data: Users and distribution

Left: An example of the resolution an IMET would find useful for WFABBA/FDCA imagery. The fire pixel is red.
Right: FDCA fire data (yellow) merged with Blue Marble Second Generation and concurrent visible imagery. “Pretty pictures” such as this (and animations of them) are useful to a wide variety of users and are popular with the general public.



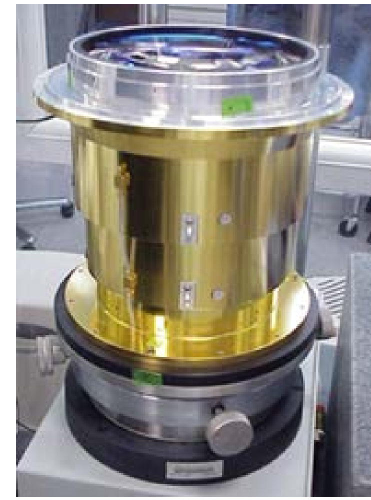


Geostationary fire data: Public benefits

How does geostationary fire data address applicable identified NWS information gaps (as recorded at the 13 March 2014 WORKING GROUP FOR WILDLAND FIRE WEATHER (WG/WFW) meeting):

- Limited observations and measurements near fires
  - Fire property observations available as frequently per minute if SRSO operations are requested (in GOES-R era that could be 30s if the FDCA is allowed to run on “MESO” data)
- Real-time detection of fires
  - The fundamental function of the WFABBA and FDCA is low-latency, real-time detection of fires
- Improved high-res model forecast guidance
  - Does not directly apply, however displays of past fire behavior such as FRP could be coupled with meteorological observations and predictions to give users a quick idea of what could happen at a given fire event by visually correlating detected fire behavior to meteorological variables
- IMET capability improvements (training, customer interface)
  - A high frequency source of fire data would be available to IMETs

Geostationary Lightning Mapper



GLM is a baseline instrument on GOES-R

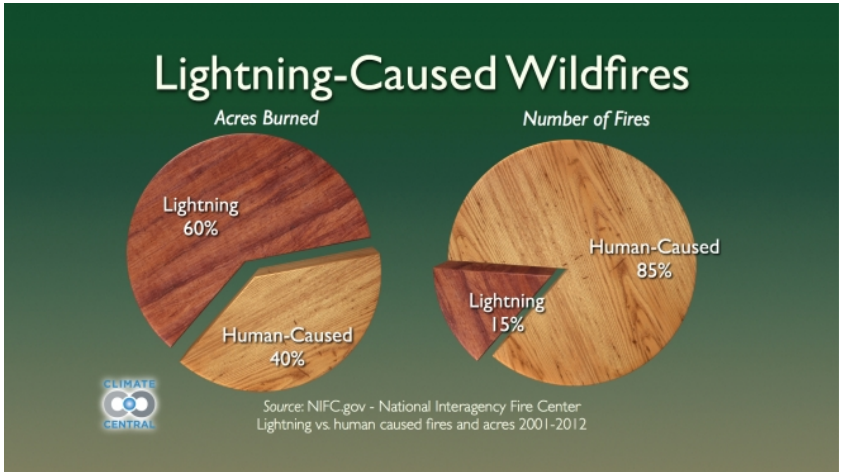
- Staring CCD imager (1372x1300 pixels)
- Near uniform spatial resolution (8 km nadir, 14 km edge)
- Coverage up to 52 deg N lat
- 70-90% flash detection day and night
- Single band 777.4 nm
- 2 ms frame rate, < 20 sec product latency
- 7.7 Mbps downlink data rate (for comparison- TRMM LIS is 8 kbps)

Additional Details

- GLM will observe intra-cloud (IC) and cloud-to-ground (CG) lightning
- The first flash in a storm is almost always IC (and most flashes are IC)
- Will provide spatial and temporal resolutions that are currently unavailable
- Must use existing networks to simulate future capabilities

with input from Scott Rudlosky (STAR)

Geostationary Lightning Mapper



Fire Applications

- Lightning is responsible for 15% of wild fires but 60% of the acres burned
- Lightning flash characteristics are indicative of their fire ignition potential
- This can be combined with information on fuel conditions, fuel moisture, and rainfall to diagnose the fire threat

Study of the WFABBA database

- A study of fire detections correlated with NLDN lightning data showed a slight increase in fire incidence near lightning in the Western US, and a decrease in fires near lightning in the Eastern US
- This results appears to reflect the amount of rainfall associated with the lightning-producing storms, and suggests that combining GLM data with other information could yield a useful index indicating the likelihood of fires

with input from Scott Rudlosky (STAR)

Geostationary Lightning Mapper

Future Lightning/Fire Products

- The SPC forecasts the dry thunderstorm threat, and their predictions will benefit from the assimilation of JPSS, ABI, and GLM observations
- GLM observations will be combined with information from existing ground-based lightning detection networks to provide the best possible estimate of the strength, polarity, and duration of lightning flashes
- This lightning information can then be combined with data from other satellite or ground-based sensors (e.g., rainfall, soil moisture) to diagnose the threat of lightning ignited wildfire
- **The ultimate application will provide targeted monitoring for the earliest hot spots associated with lightning ignited fires**

with input from Scott Rudlosky (STAR)

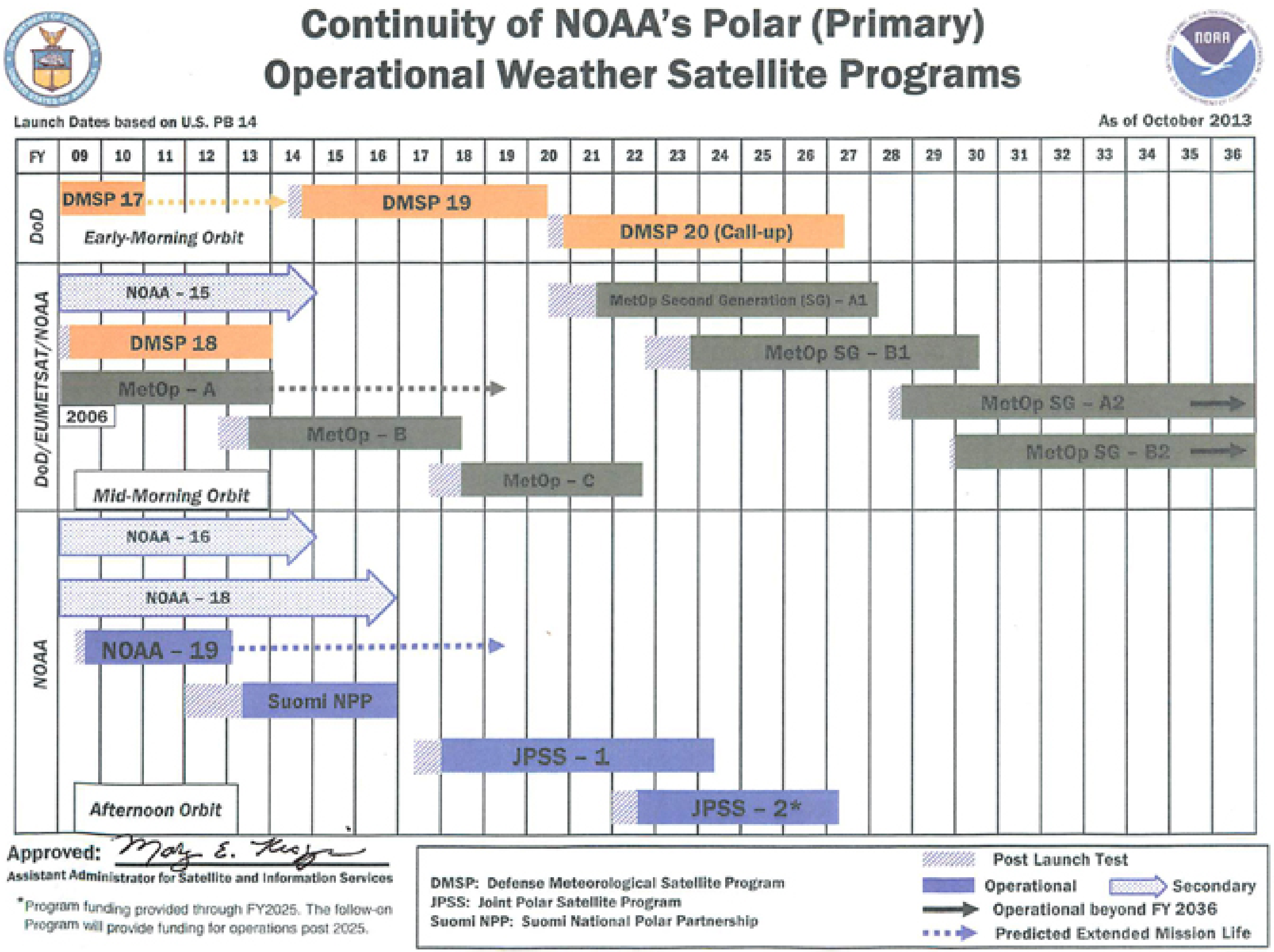
Summary and Conclusions

- Increasing use of satellite-based fire information within NOAA as well as other Federal Agencies
- New capabilities from polar and geostationary platforms represent continuity and incremental improvement
  - AVHRR – MODIS – VIIRS
    - VIIRS detections/FRP available, no burned area product (yet)
  - GOES Imagery – GOES-R ABI
    - Improved quality detections
  - Need for better synergy of products, including other data sources (e.g. GLM etc.)
- Diverse end user needs and applications
  - Direct use of fire information (location, characteristics)
  - Fire information as model input
    - Emission source information for air quality / transport modeling
    - Fire location / intensity information for fire spread modeling
- Multi-agency coordination is necessary, including the leveraging of funding resources
  - Product development: NOAA, NASA, USGS
  - Applications: NOAA, NASA, USFS, USDA, EPA, etc.


Thank You

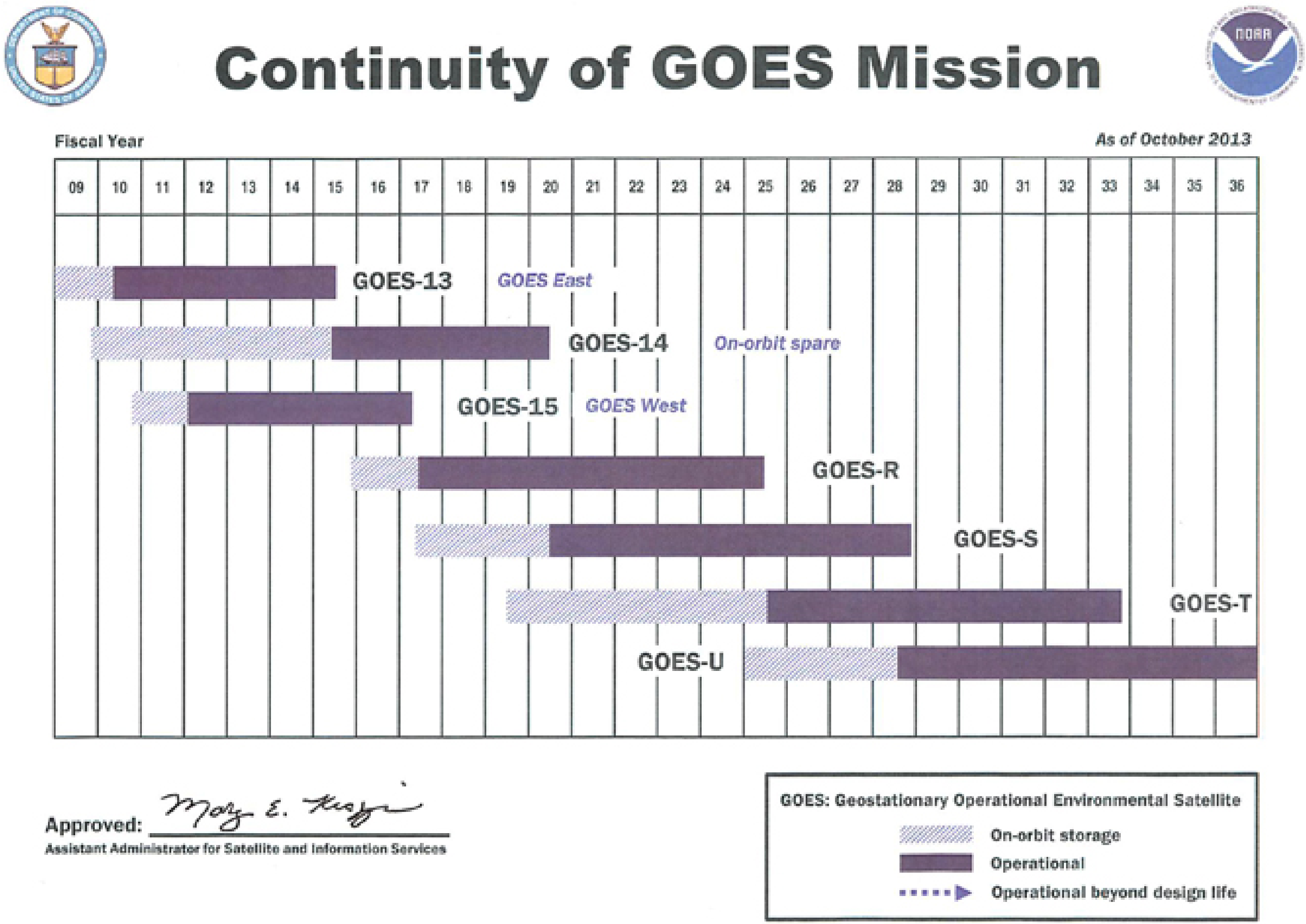
Backup slides

Polar satellite flyout schedule



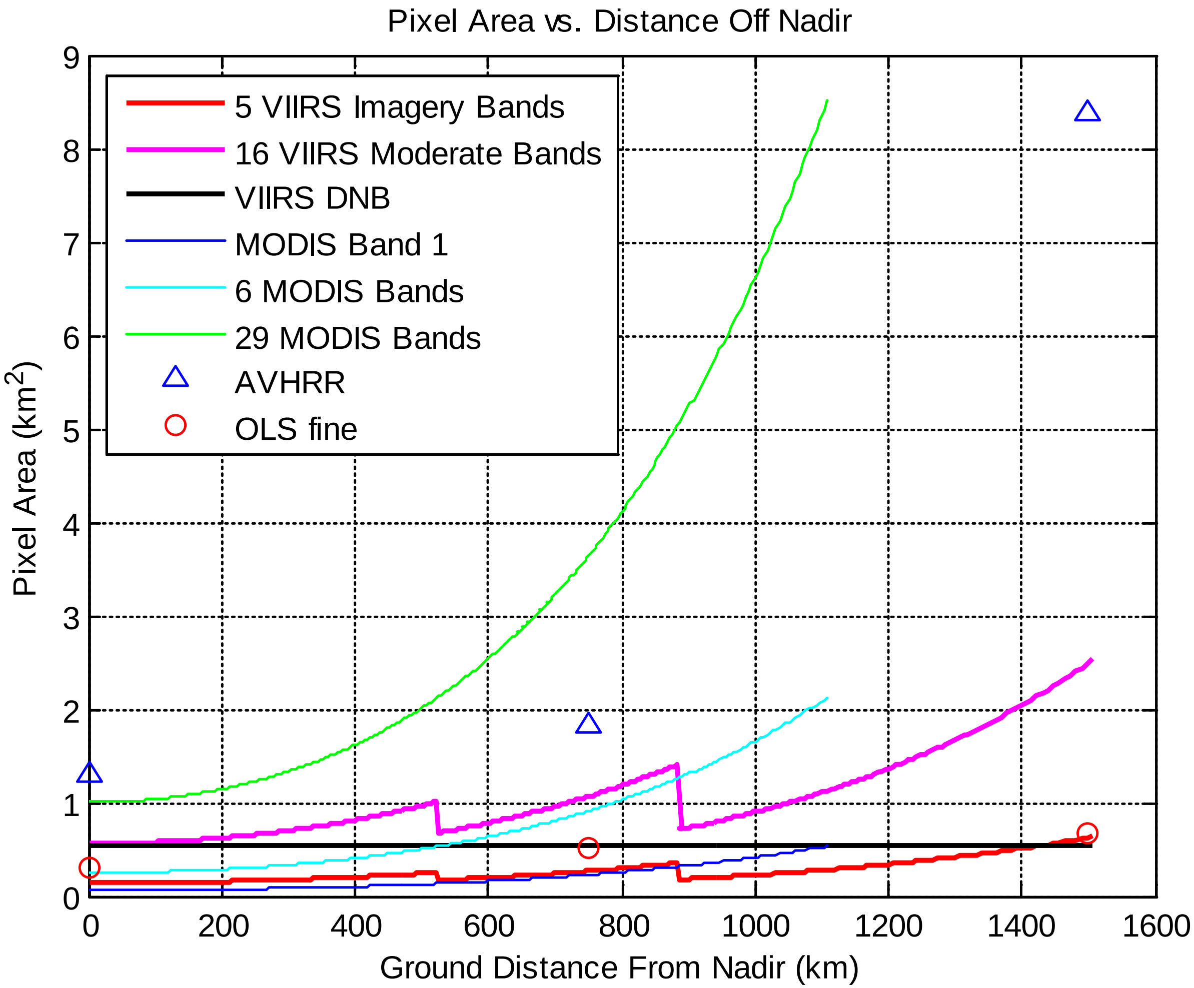
http://www.nesdis.noaa.gov/flyout_schedules.html

Geostationary satellite flyout schedule



http://www.nesdis.noaa.gov/flyout_schedules.html

Near-constant pixel size



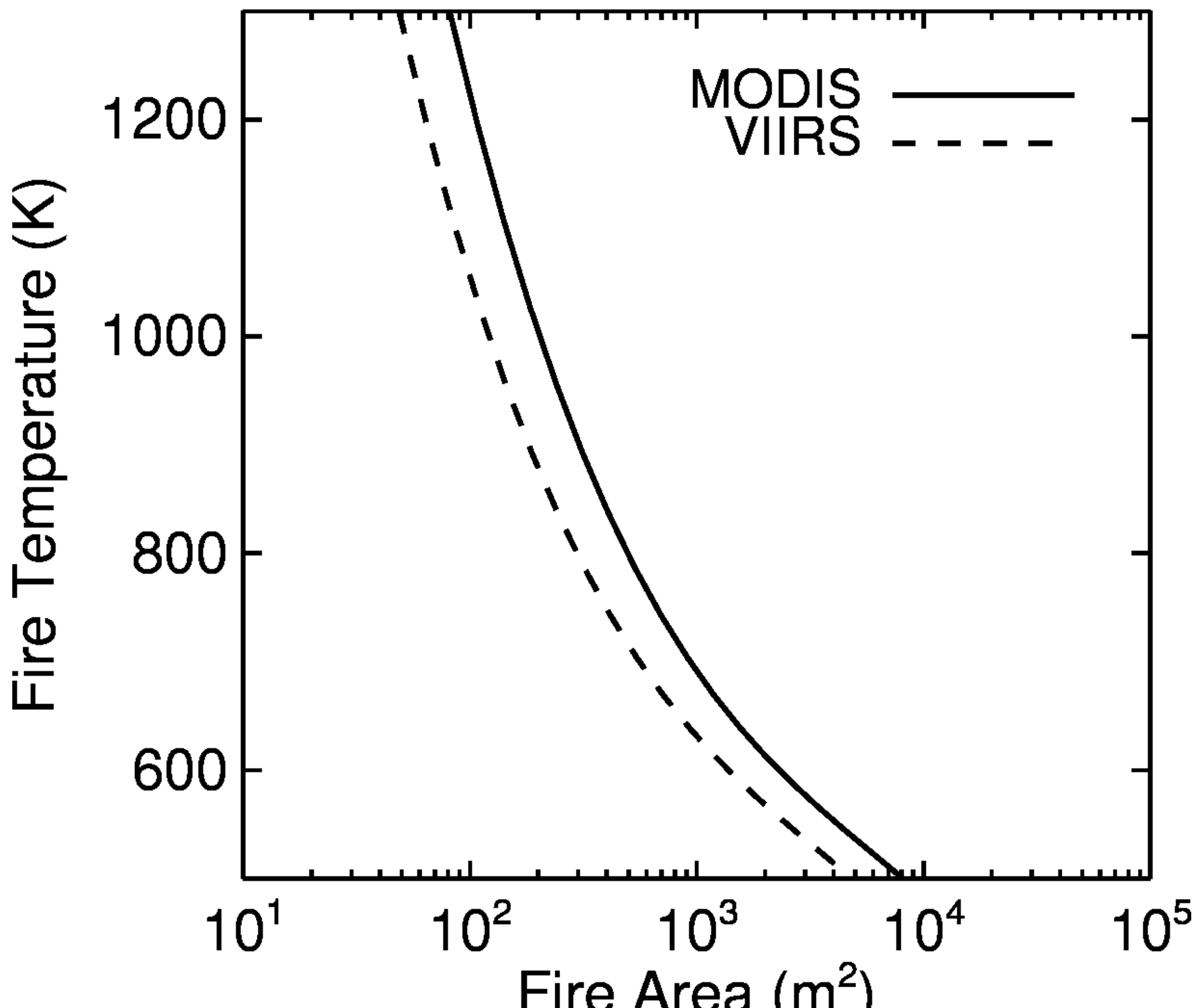
Spatial Resolution Comparisons for VIIRS, AVHRR, MODIS and OLS at Nadir and Across Swath

Because of aggregation VIIRS has much better resolution away from nadir, pixel area 8 times smaller than AVHRR or MODIS

Northrup Grumman & Raytheon

MODIS and VIIRS fire detections at nadir: modeling

VIIRS spatial resolution is higher that of MODIS; in general, ***VIIRS is expected to detect smaller fires at nadir***



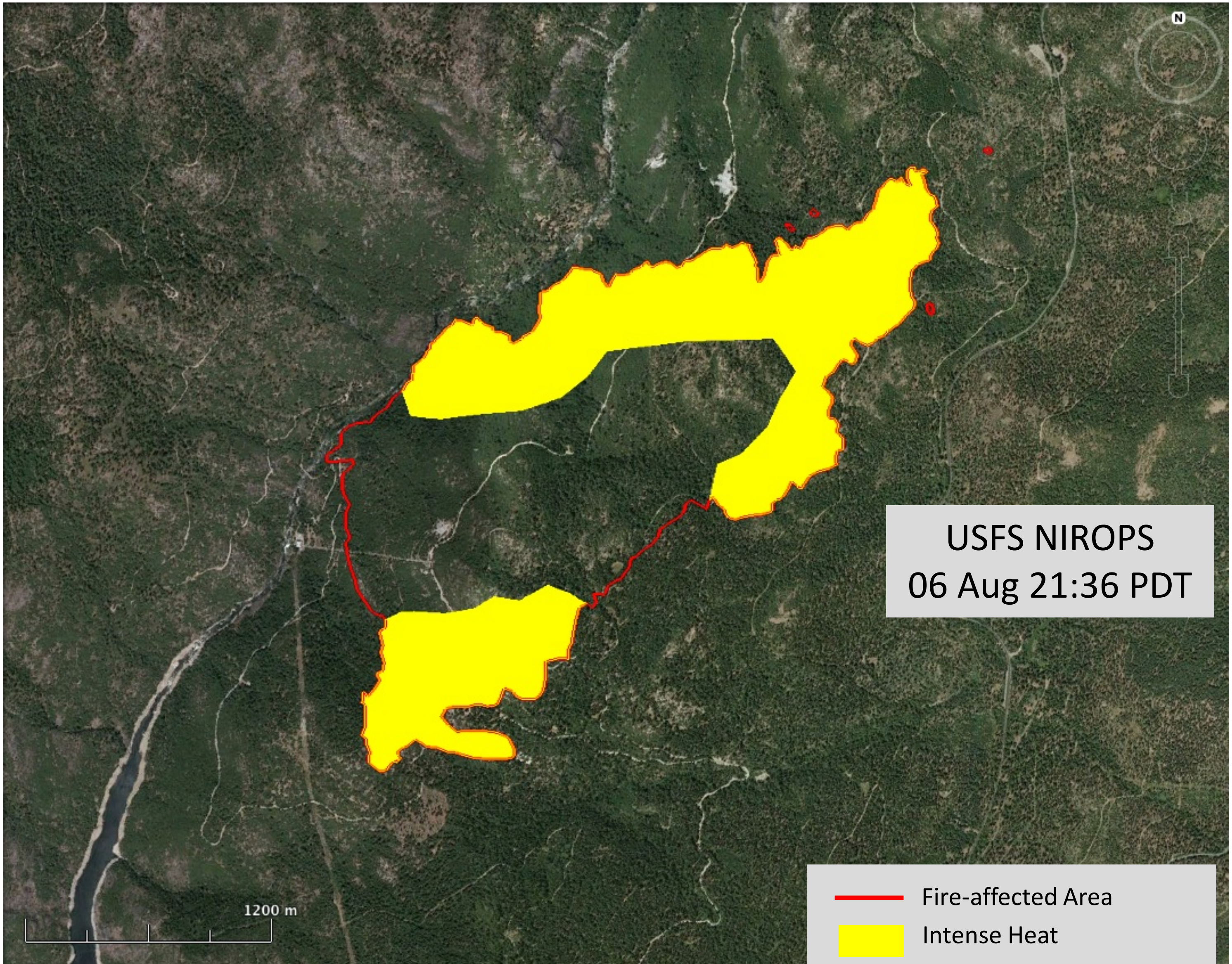
90% probability of detection;
boreal forest;
nadir view

Csiszar, I., W. Schroeder, L. Giglio, E. Ellicott, K. P. Vadrevu, C. O. Justice, and 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.

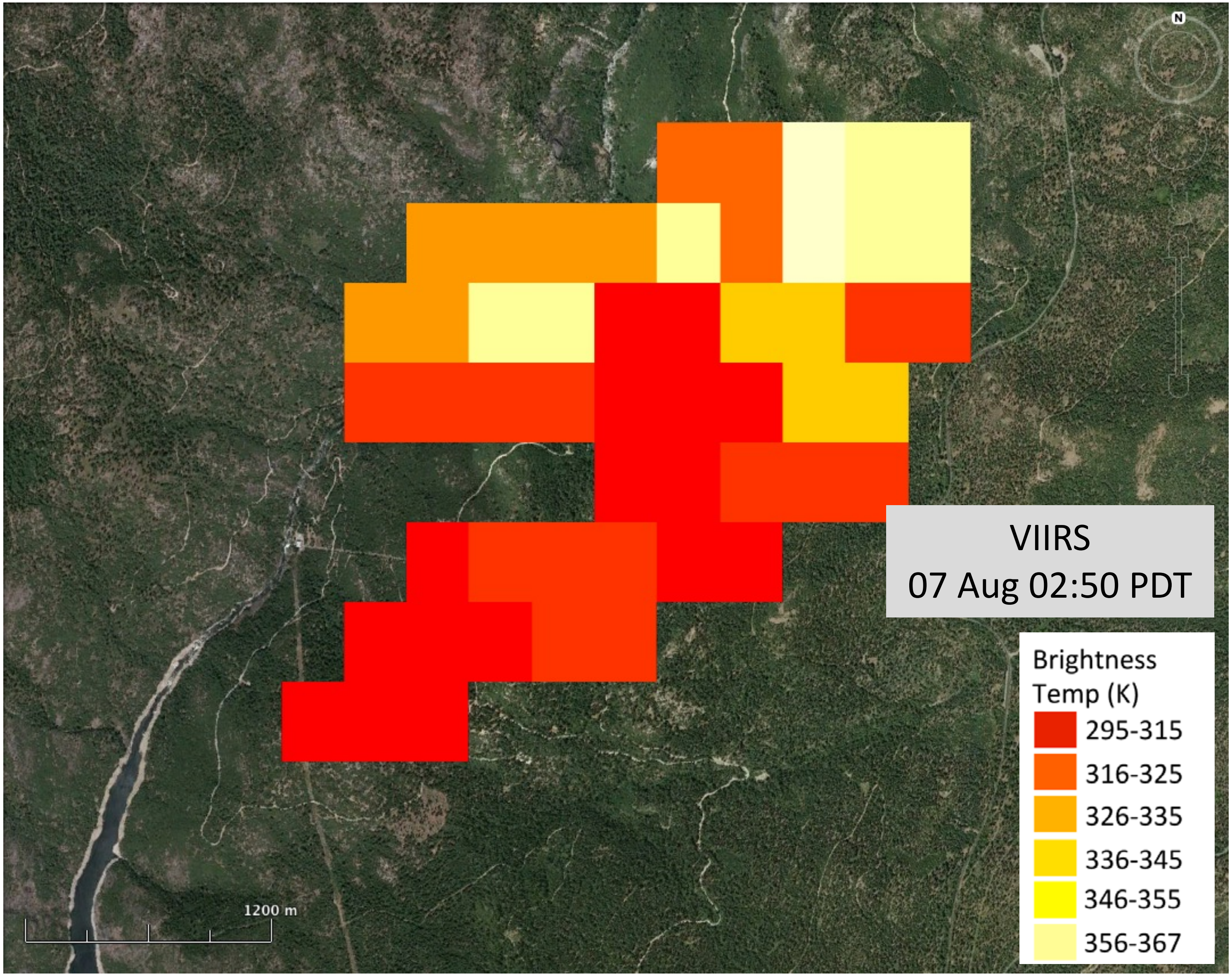
AF product is Provisional

- August 22nd, 2013 the VIIRS AF team provides a presentation to propose the product is ready for provisional status.
- October 23rd, 2013 it is deemed provisional as **October 16th, 2012** by the AERB and ready for operational evaluation
- **The main point for provisional is user readiness for operational evaluation**
- <u>Provisional definition</u>
  - Product quality may not be optimal
  - Incremental product improvements are still occurring as calibration parameters are adjusted with sensor on-orbit characterization (versions will be tracked)
  - General research community is encouraged to participate in the QA and validation of the product, but need to be aware that the product validation and QA are ongoing
  - Users are urged to consult the SDR product status document prior to use of the data in publications
  - **Ready for operational evaluation**

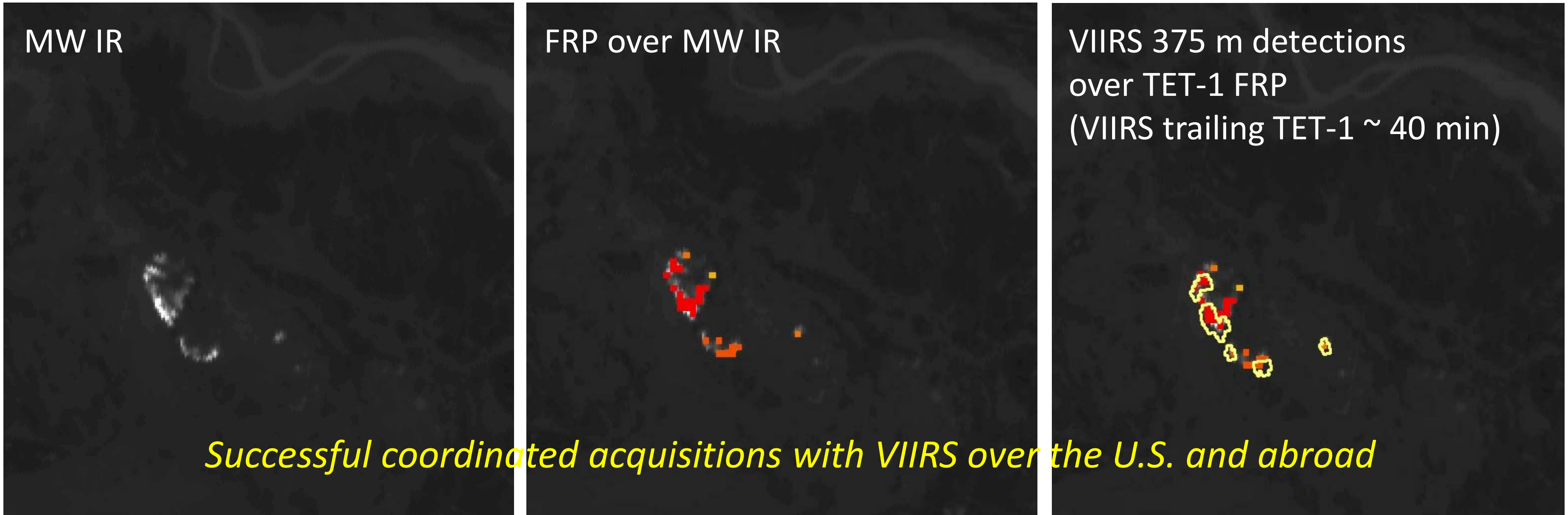
Validation Using Near-Coincident Airborne Reference Data



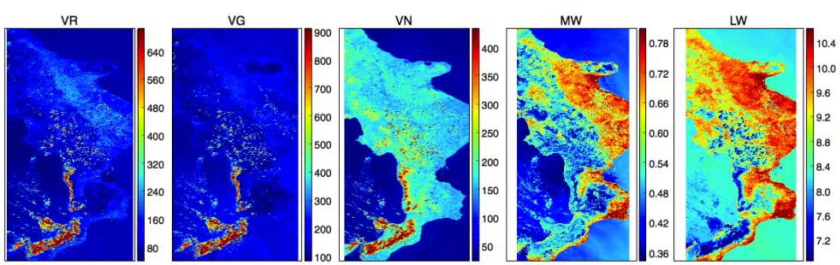
Validation Using Near-Coincident Airborne Reference Data



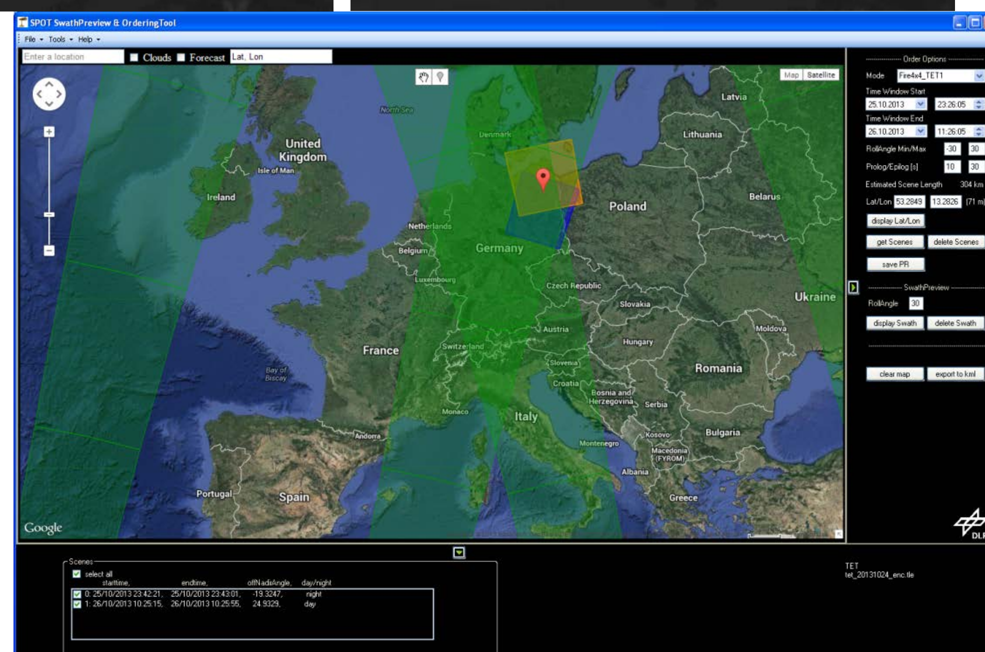
Progress with DLR/TET-1 Data



Five channels (40-370 m resolution)



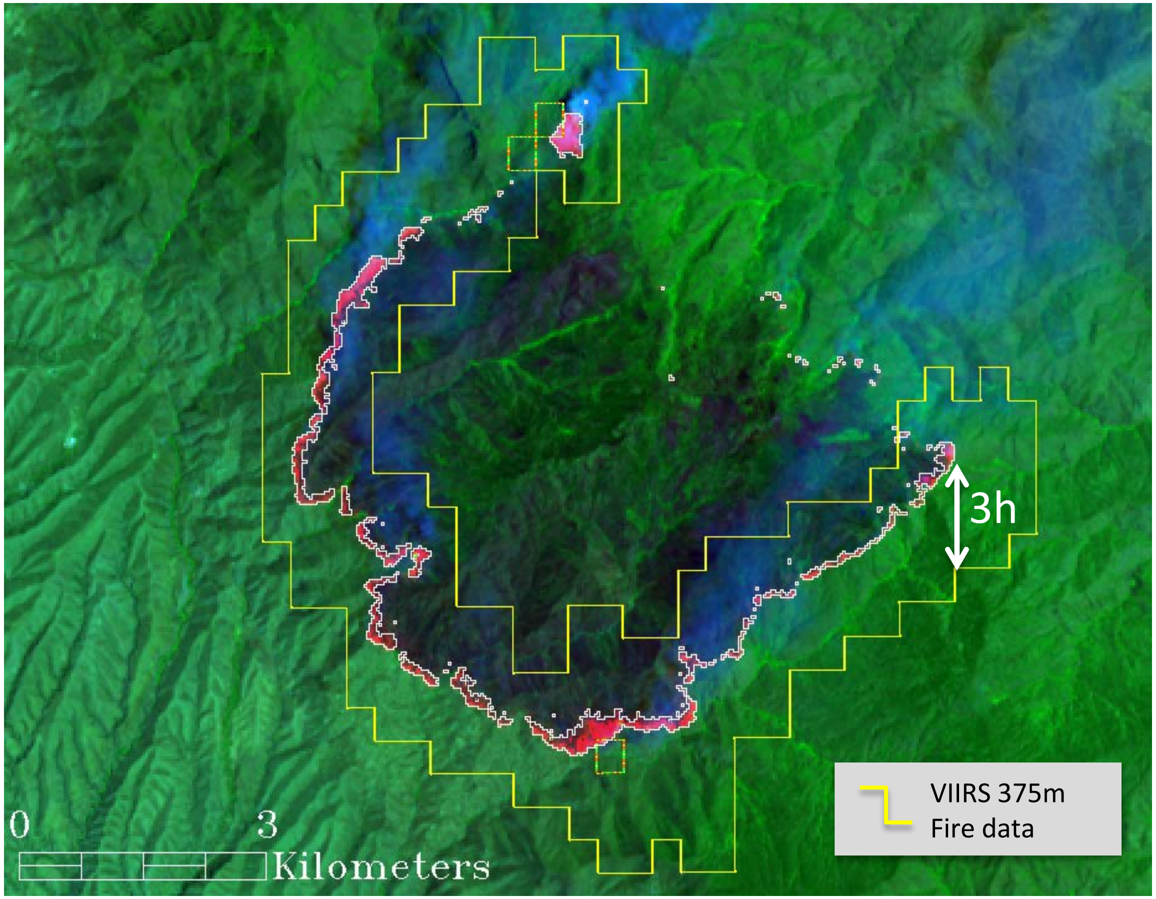
Spectral radiance (W/m²sr)



TET-1 Swath Preview
and Ordering Tool
Developed

New 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)



Slide courtesy of Dr Wilfrid Schroeder