Fire and Smoke Initiative Brief

Bill Sjoberg/Andy Edman

Representing the Fire and Smoke Initiative Team

19 July 2017

Outline

- JPSS PGRR Background including Fire and Smoke Initiative
- Key Organizations in Fire Weather Support
- Fire Event Questions
- How Satellites Help
- What is Happening Now?
- What is Going on in the Future?
- Model Validation
- Discussion

JPSS PGRR Background Definitions

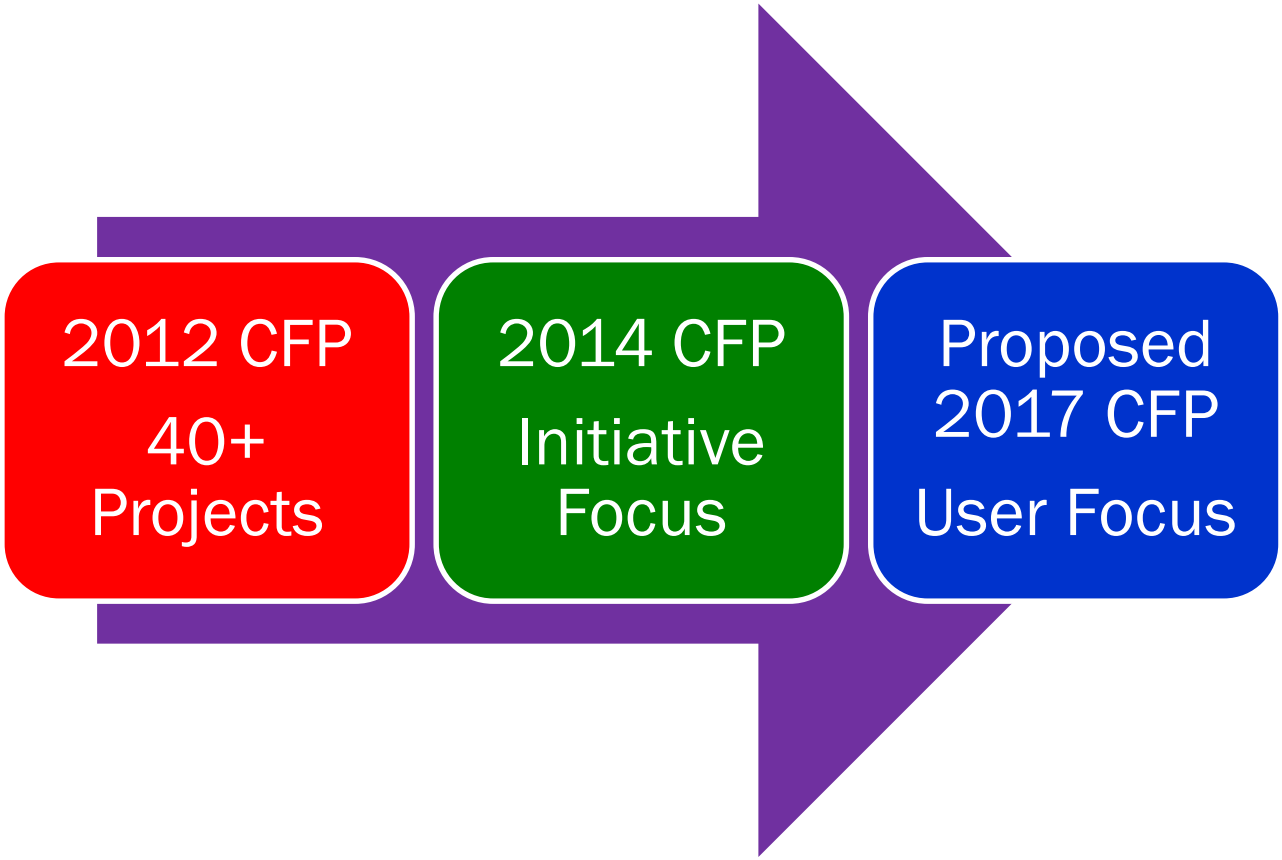
- **Proving Ground**
  - Demonstration and utilization of data products by the end-user operational unit, such as a NWS Weather Forecast Office or Modeling Center.
  - Promote outreach and coordination of new products with the end users, incorporating their feedback for product improvements

- **Risk Reduction**
  - Development of new research and applications to maximize the benefits of JPSS satellite data
    - Example - use of Day Night Band for improved fog and low visibility products at night, benefiting transportation industry.
  - **Encourages fusion of data/information from multiple satellite, models and in-situ data**
  - **Encourages use of satellite data to improve model forecast**

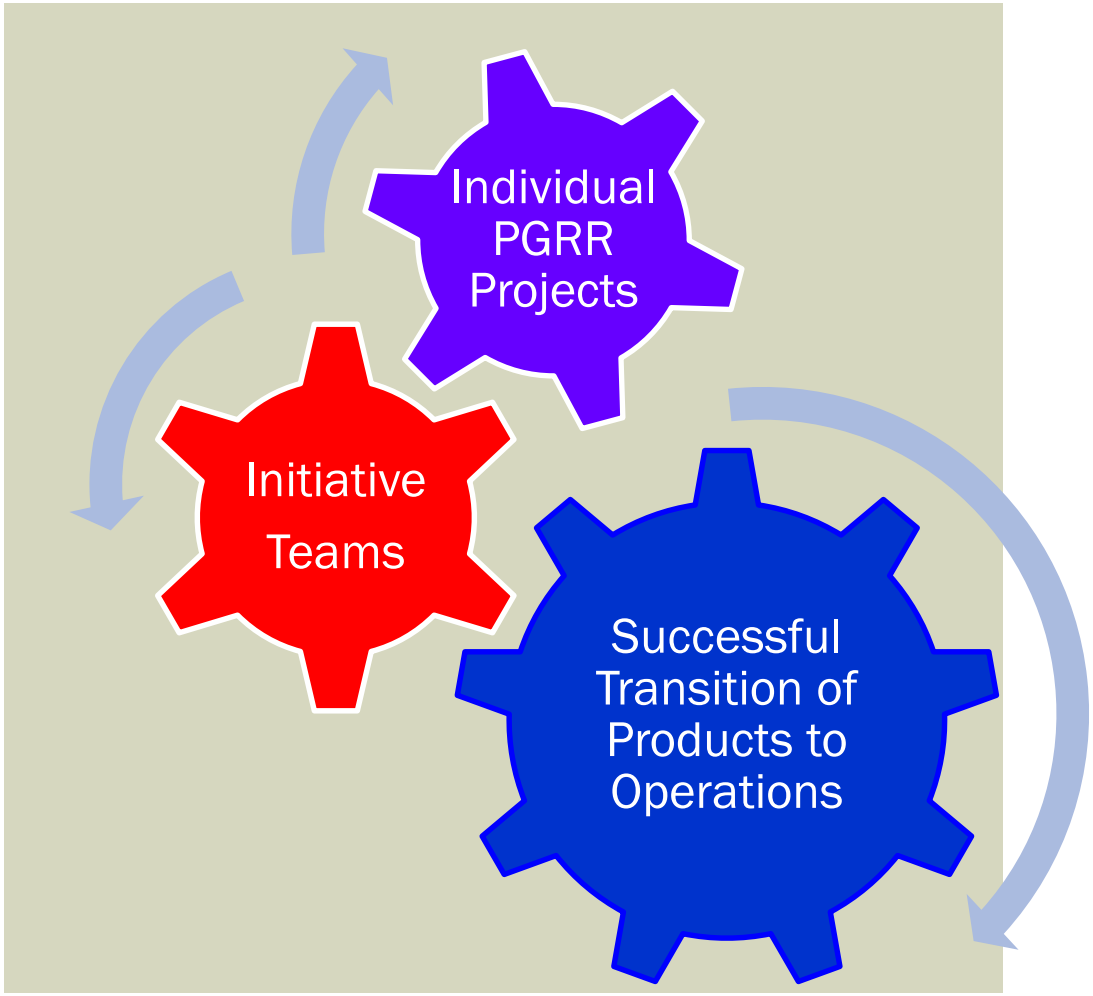
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JPSS PGRR Background
RFP Timelines



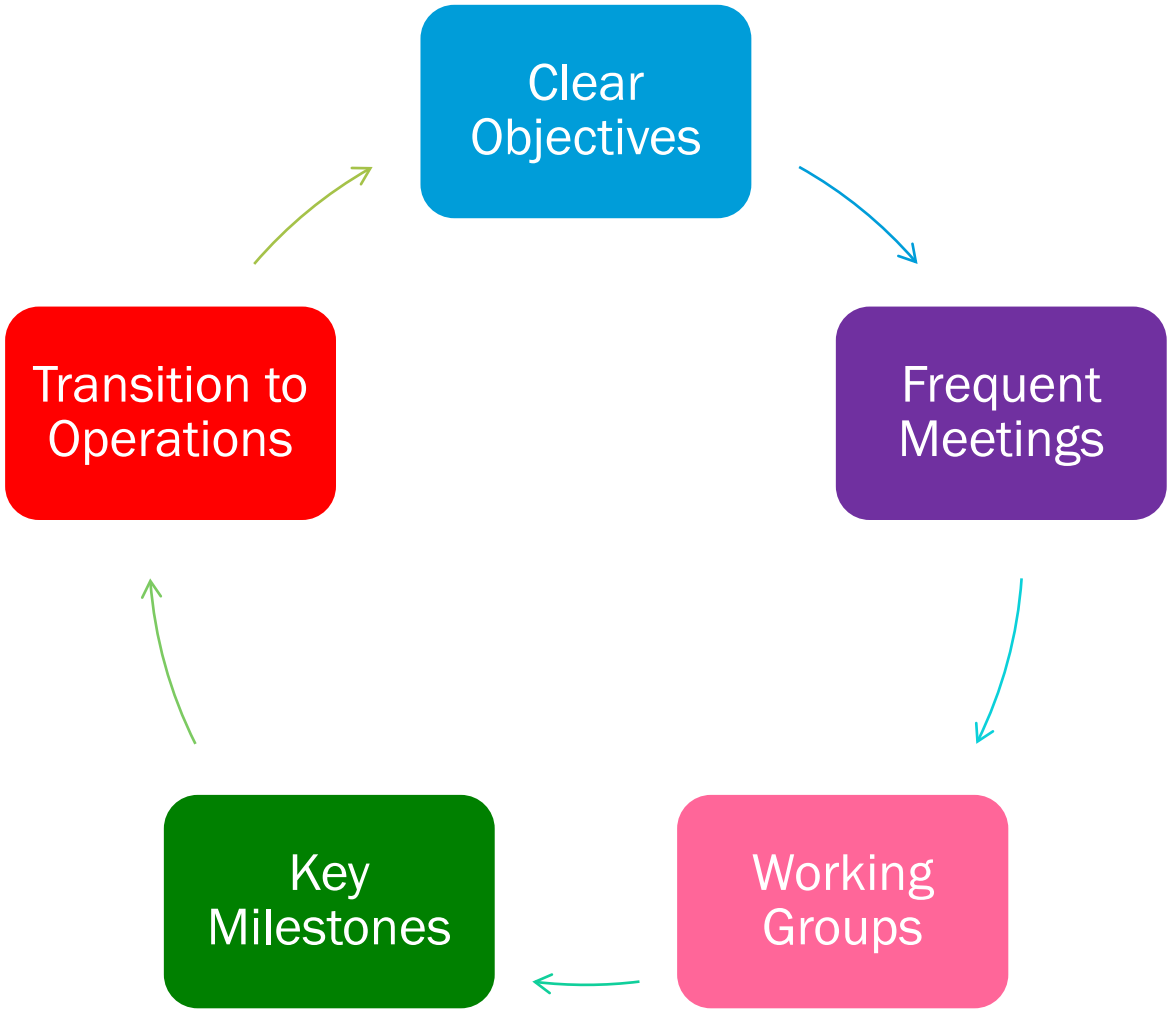
JPSS PGRR Background
Success of PGRR Initiatives



JPSS PGRR Background
PGRR Initiatives List



JPSS PGRR Background Best Practices



JPSS PGRR Background
F&S Initiative Initial Objectives

- Organize a forum to allow stakeholders supporting Fire and Smoke products development to interact with key users of the capabilities.
- 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 Fire and Smoke 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 that can be maintained over the long term.
- As the Initiative Team met over the months and years, actions were taken to implement these objectives, and new objectives were identified and worked.

JPSS PGRR Background Telecon Participants

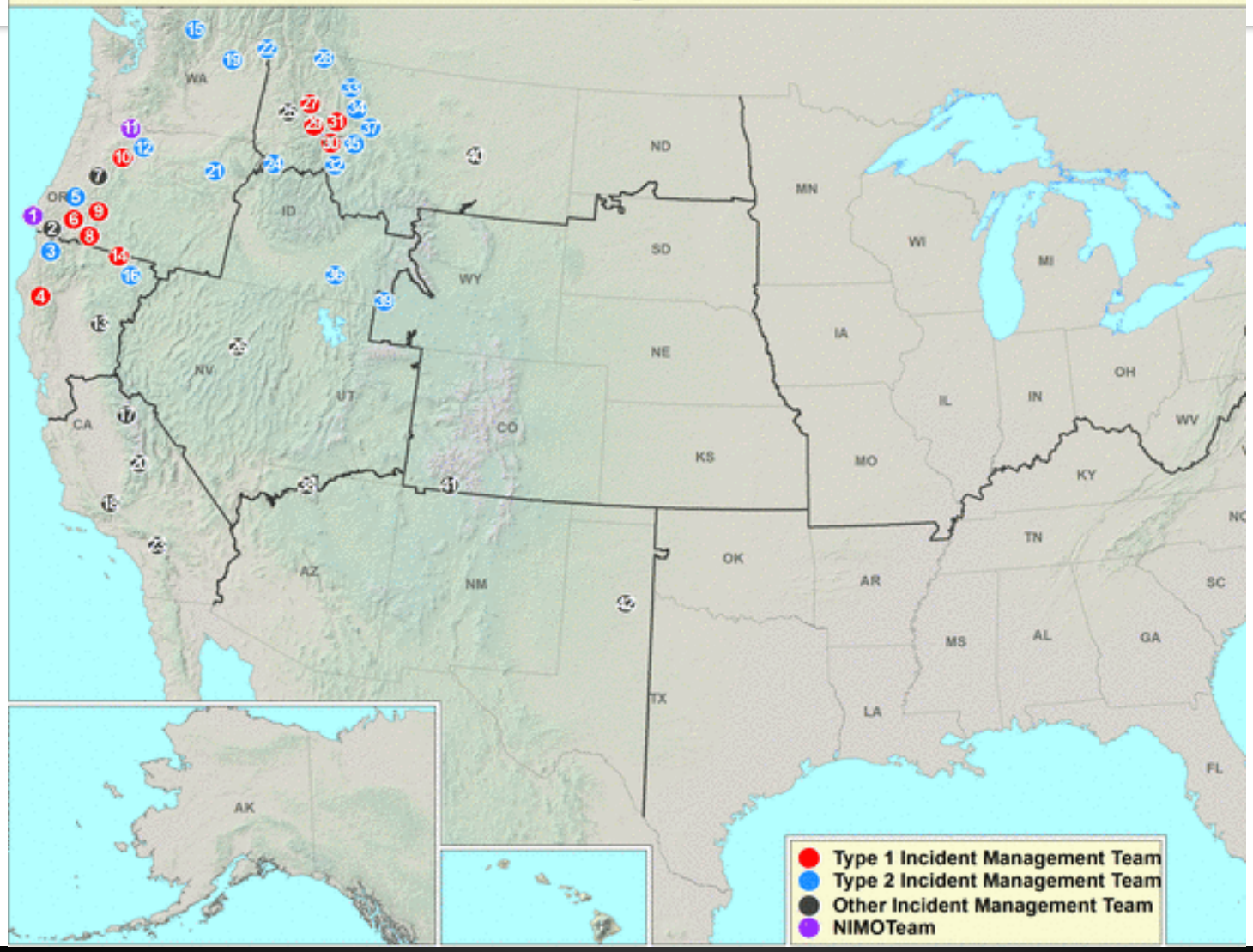
Name	Organization	Name	Organization
Tim Barker	NWS	Valerie Mikles	STAR
Nazmi Chowdhury	JPSS	Tony Mostek	NWS
Ivan Csiszar	STAR	Brian Motta	NWS
Andy Edman	NWS	Susan O'Neill	USDA Forest Service
Evan Ellicott	U of MD	Brad Pierce	STAR
Mitch Goldberg	JPSS	Julie Price	JPSS
Robyn Heffernan	NWS	Katherine Rowden	WFO Spokane Hydrologist
Amy Huff	Penn State	Bill Sjoberg	JPSS
Eric James	ESRL/GSD	Eric Stevens	GINA
Shobha Kondragunta	STAR	William Straka	CIMSS
Scott Lindstrom	CIMSS	Jorel Torres	JPSS Training Liaison
Mark Loeffelbein	NWS	Christine Waigl	UAF
Jeff McQueen	STAR		

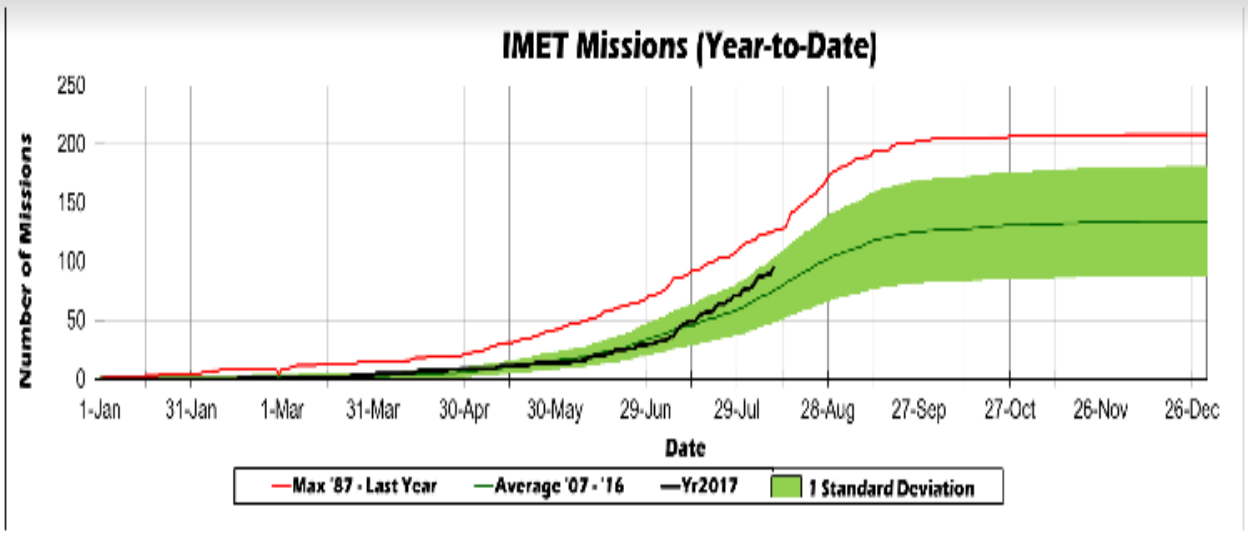
Key Organizations in Fire Weather Support

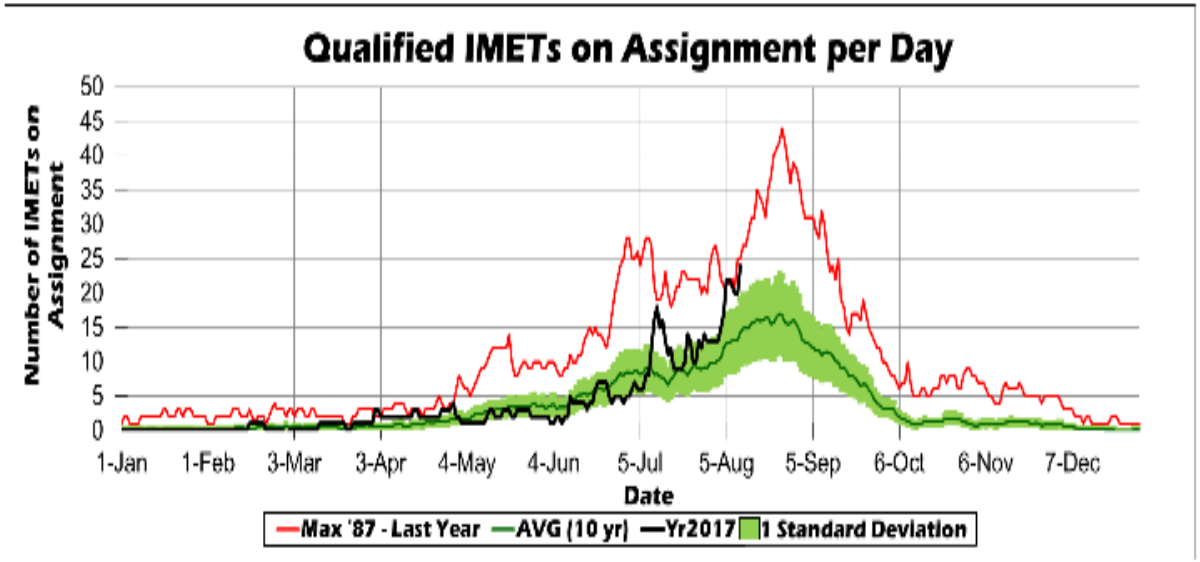
- National Weather Service (WFOs, IMETs
- National Interagency Fire Center
- National Interagency Coordination Center
- Bureau of Land Management
- US Forest Service
- US Fish and Wildlife Service
- National Park Service
- The National Wildfire Coordinating Group
- Regional Geographic Area Coordination Centers
- Air Quality Organizations

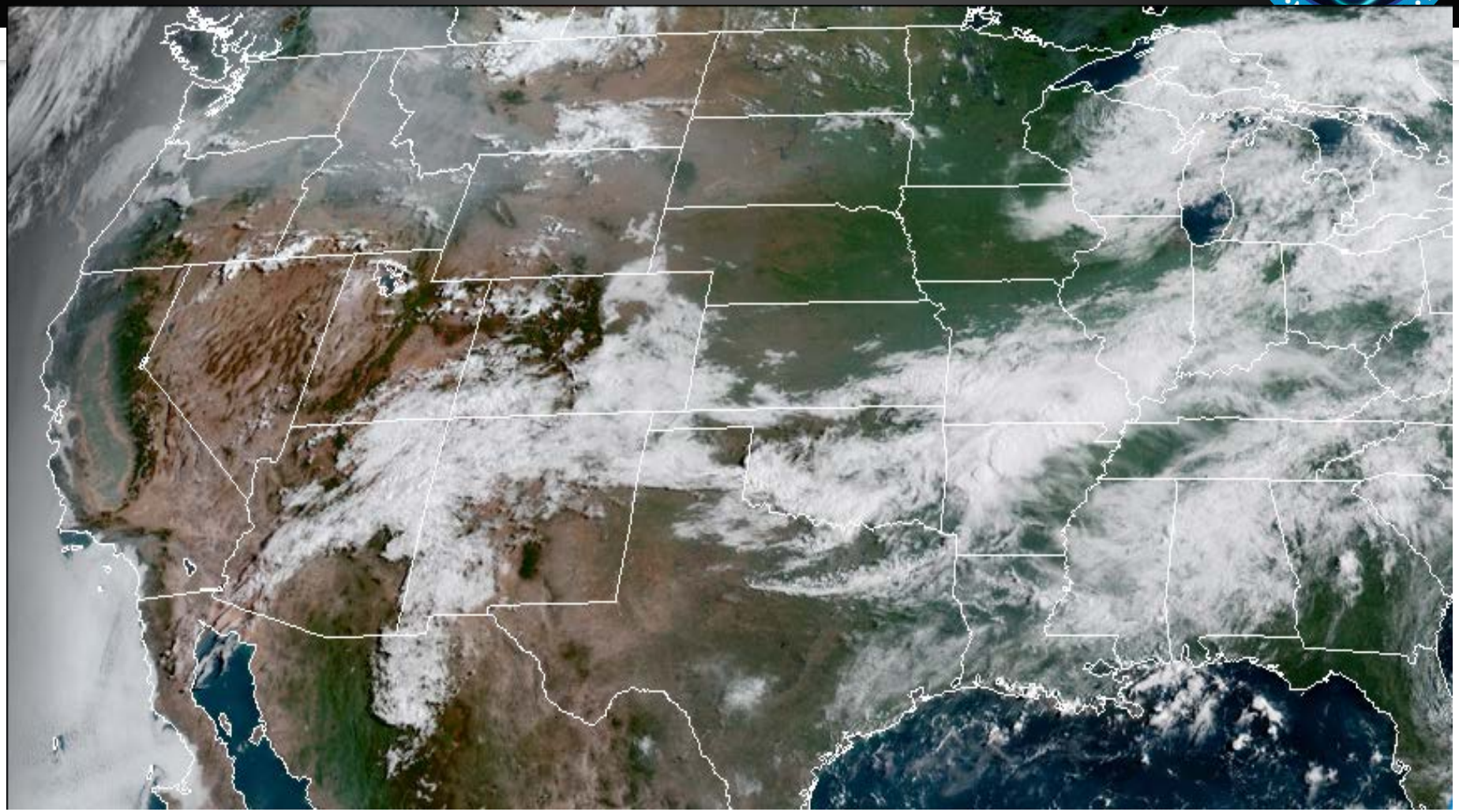
Current Large Incidents

August 12, 2017



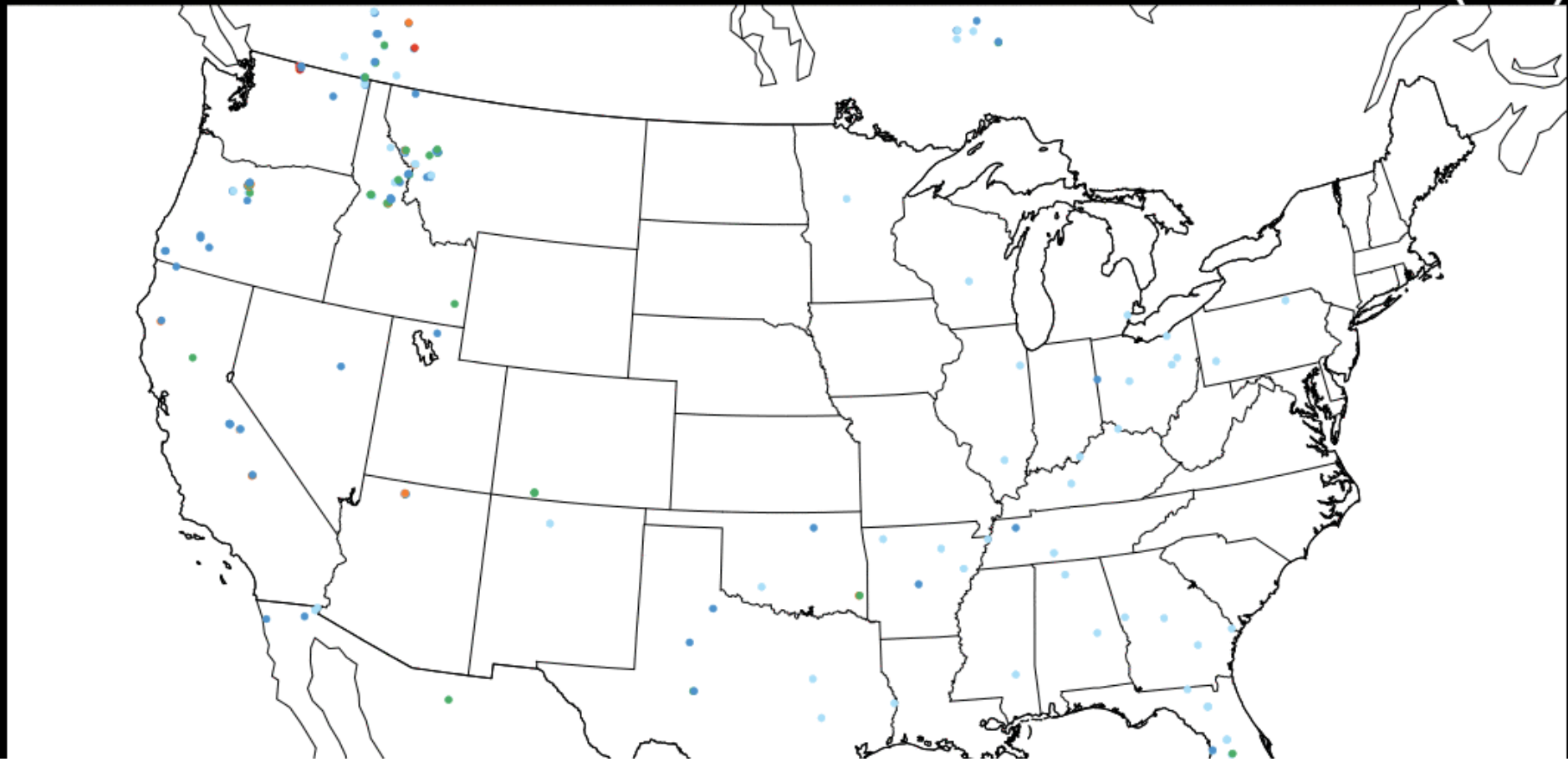

IMET Missions (Year-to-Date)
Number of Missions
250
200
150
100
50
0
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Max '87 - Last Year
Average '07 - '16
Yr2017
1 Standard Deviation

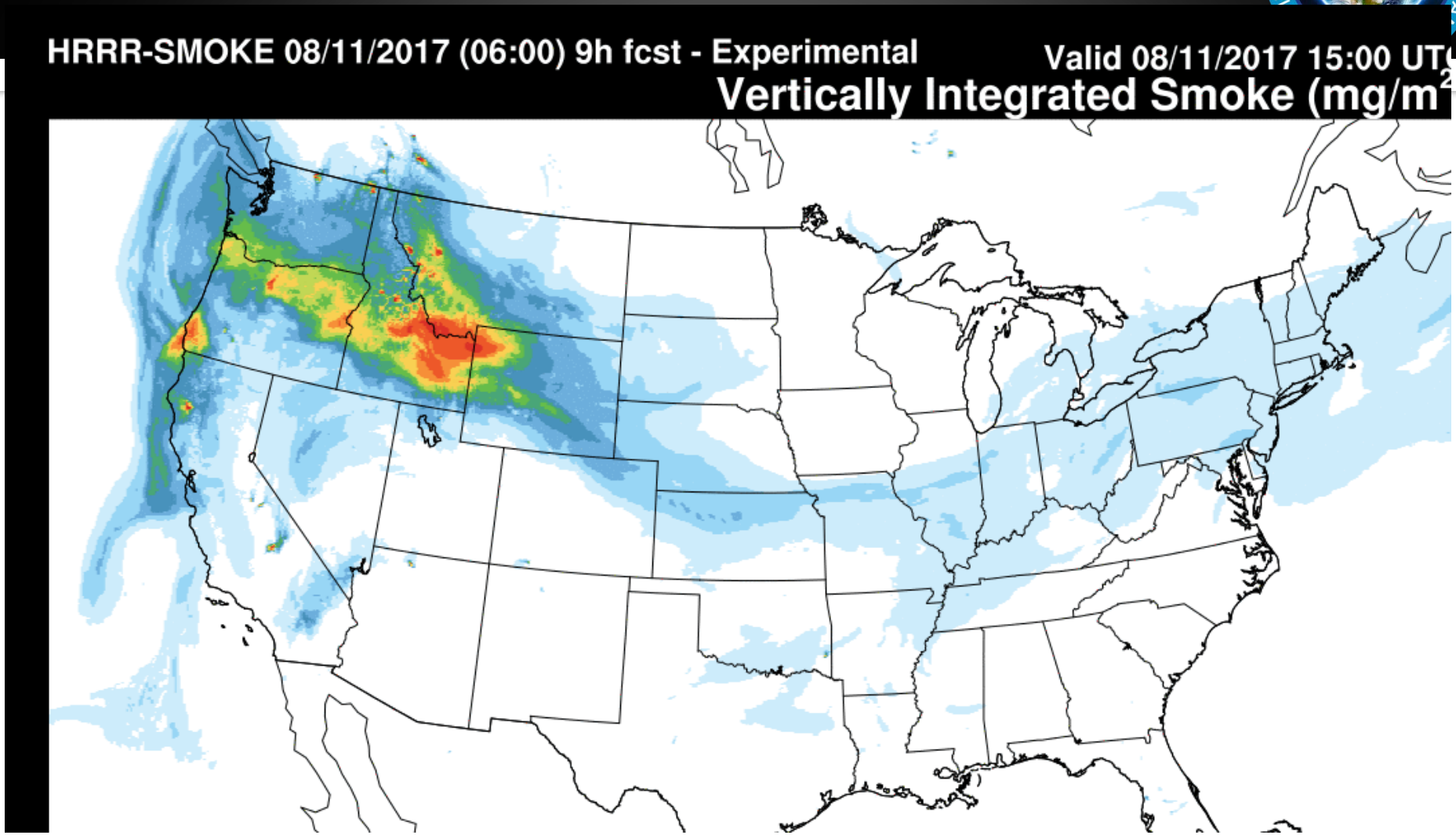

Qualified IMETs on Assignment per Day
Number of IMETs on Assignment
50
45
40
35
30
25
20
15
10
5
0
1-Jan
1-Feb
3-Mar
3-Apr
4-May
4-Jun
5-Jul
5-Aug
5-Sep
6-Oct
6-Nov
7-Dec
Date
Max '87 - Last Year
AVG (10 yr)
Yr2017
1 Standard Deviation

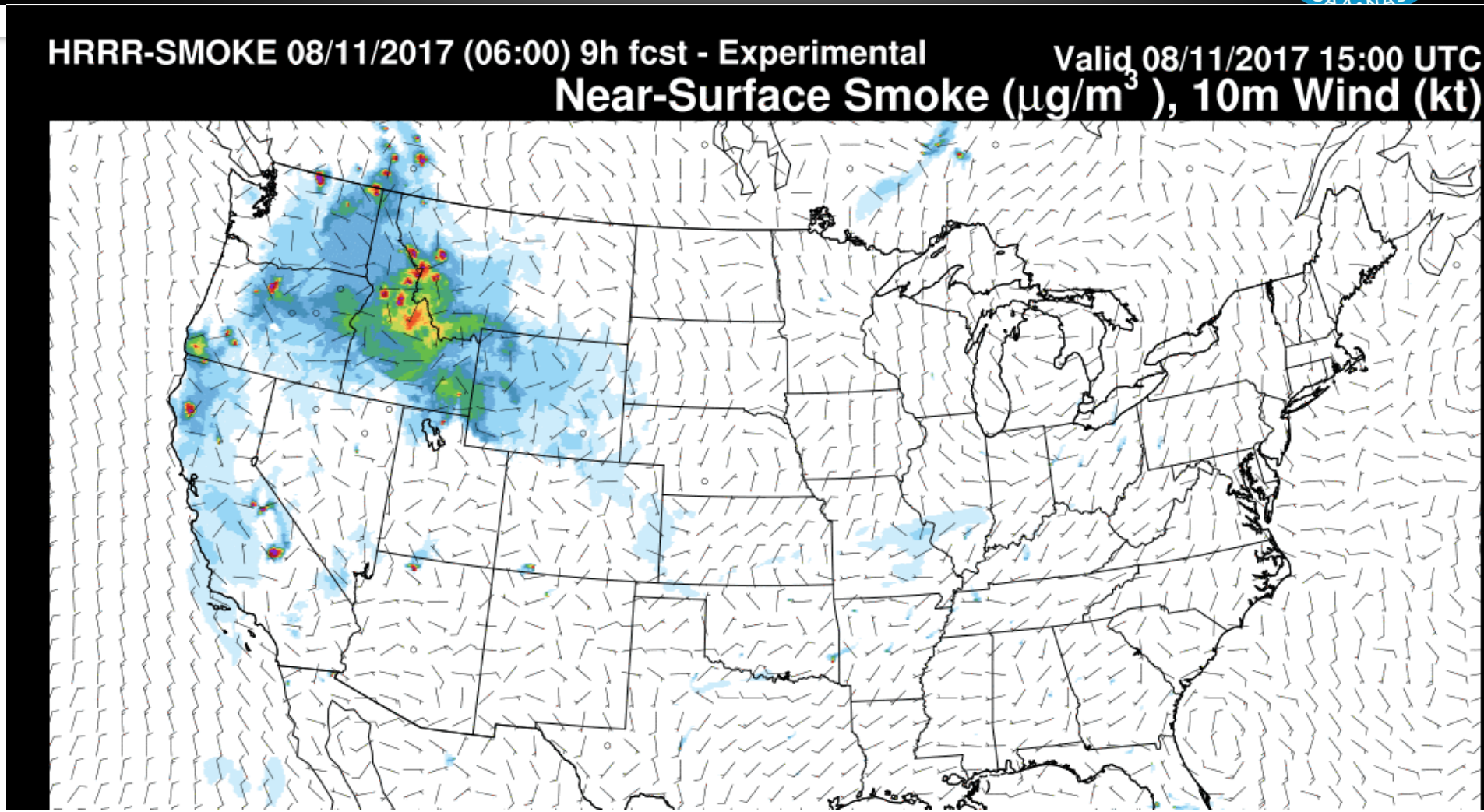


HRRR-SMOKE 08/11/2017 (06:00) - Experimental

VIIRS Fire Radiative Power (MW)



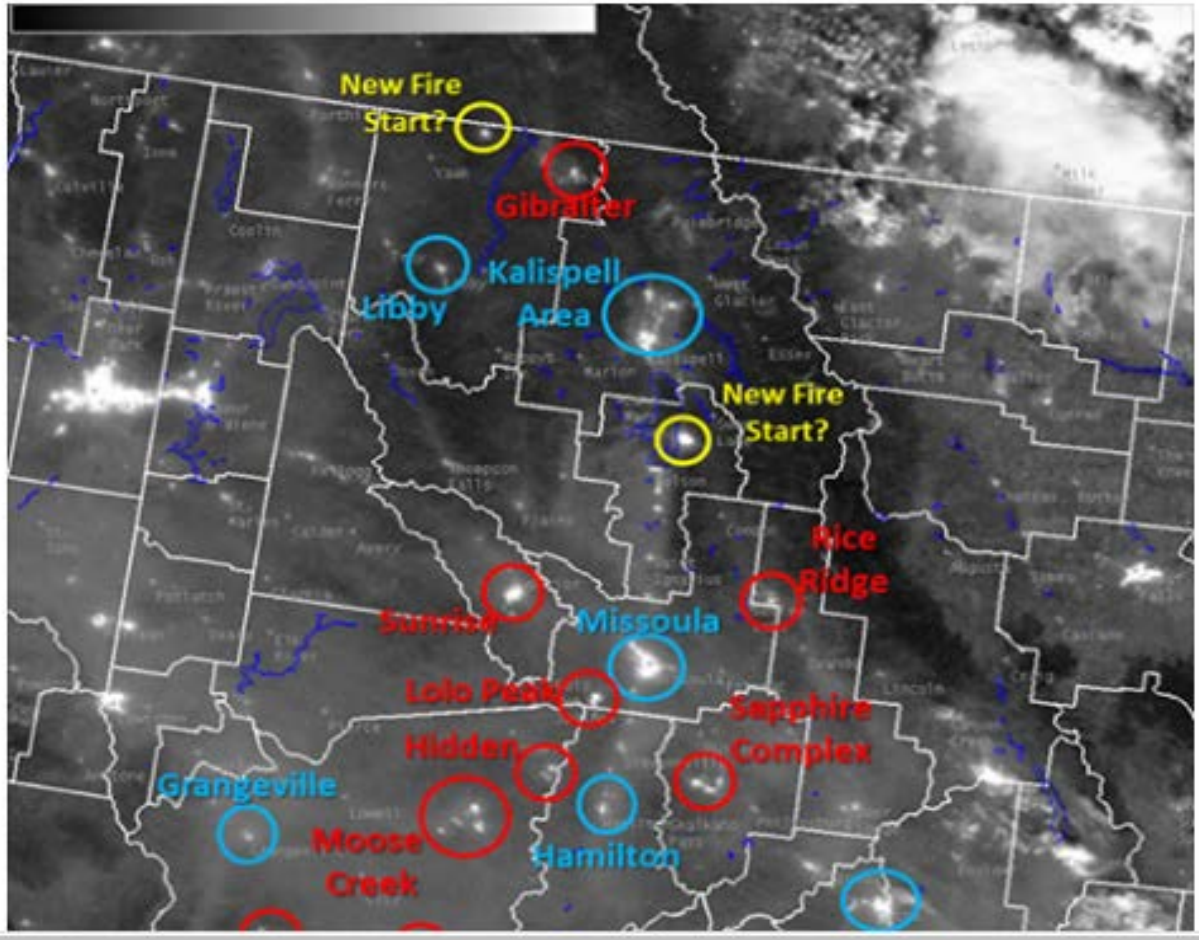

HRRR-SMOKE 08/11/2017 (06:00) 9h fcst - Experimental
Valid 08/11/2017 15:00 UT
Vertically Integrated Smoke (mg/m


HRRR-SMOKE 08/11/2017 (06:00) 9h fcst - Experimental
Valid 08/11/2017 15:00 UTC
Near-Surface Smoke (μg/m3), 10m Wind (kt)

US National Weather Service Missoula Montana

Yesterday at 5:59am

Both the city lights (blue circles) and visible light energy from active wildfires (red circles) were visible early this morning on the #VIIRS day/night band. Even think it shows a few possible new fire starts too (yellow circles).



FIRESCIENCE.GOV

Research Supporting Sound Decisions

Facebook Twitter Website LinkedIn Email

Wildland fire smoke health effects on wildland firefighters and the public



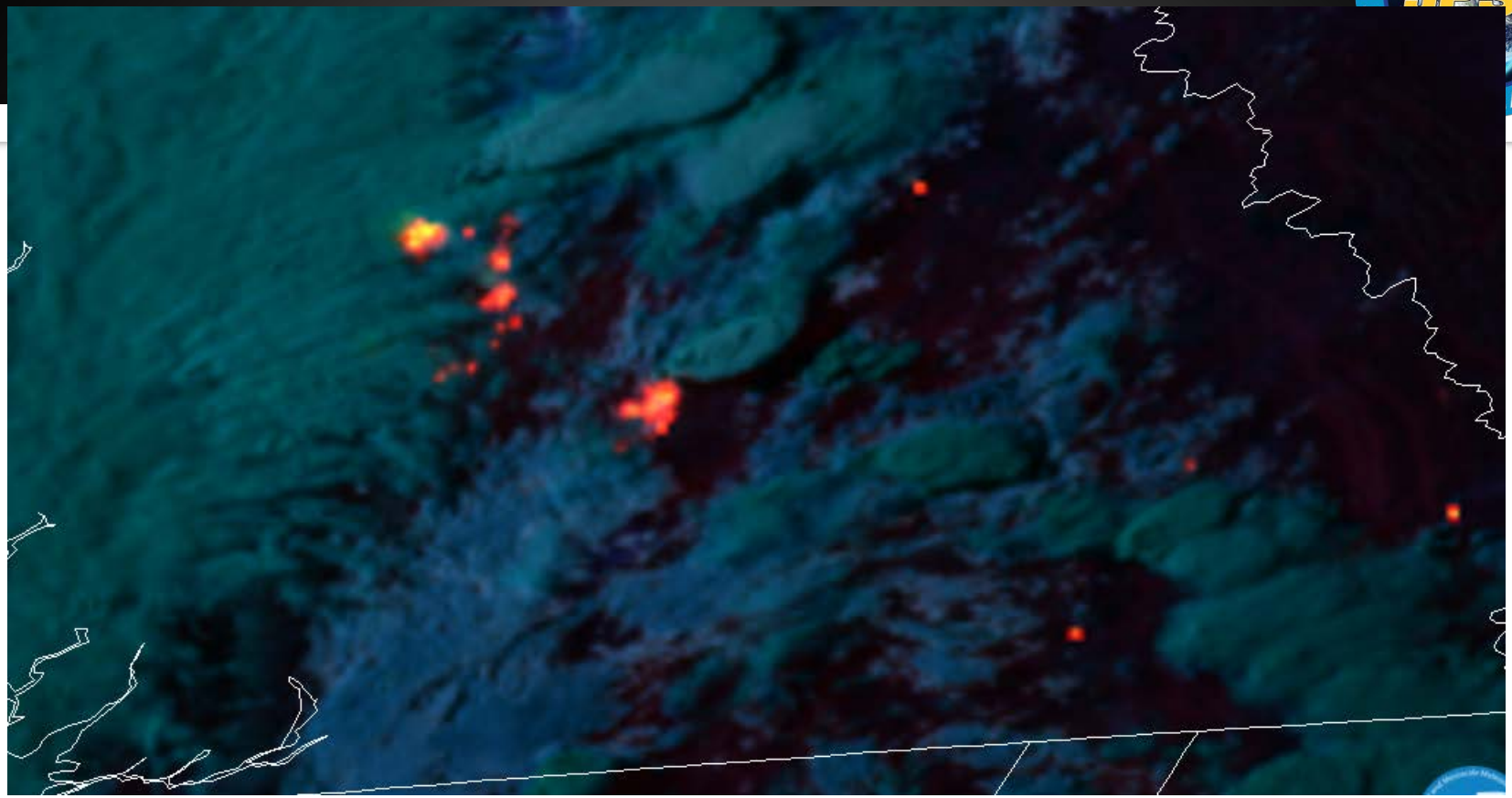
Issues

FRP is not always provide consistent behavior

Fire pulse and evolve – but there are detection issues with FRP that need further work

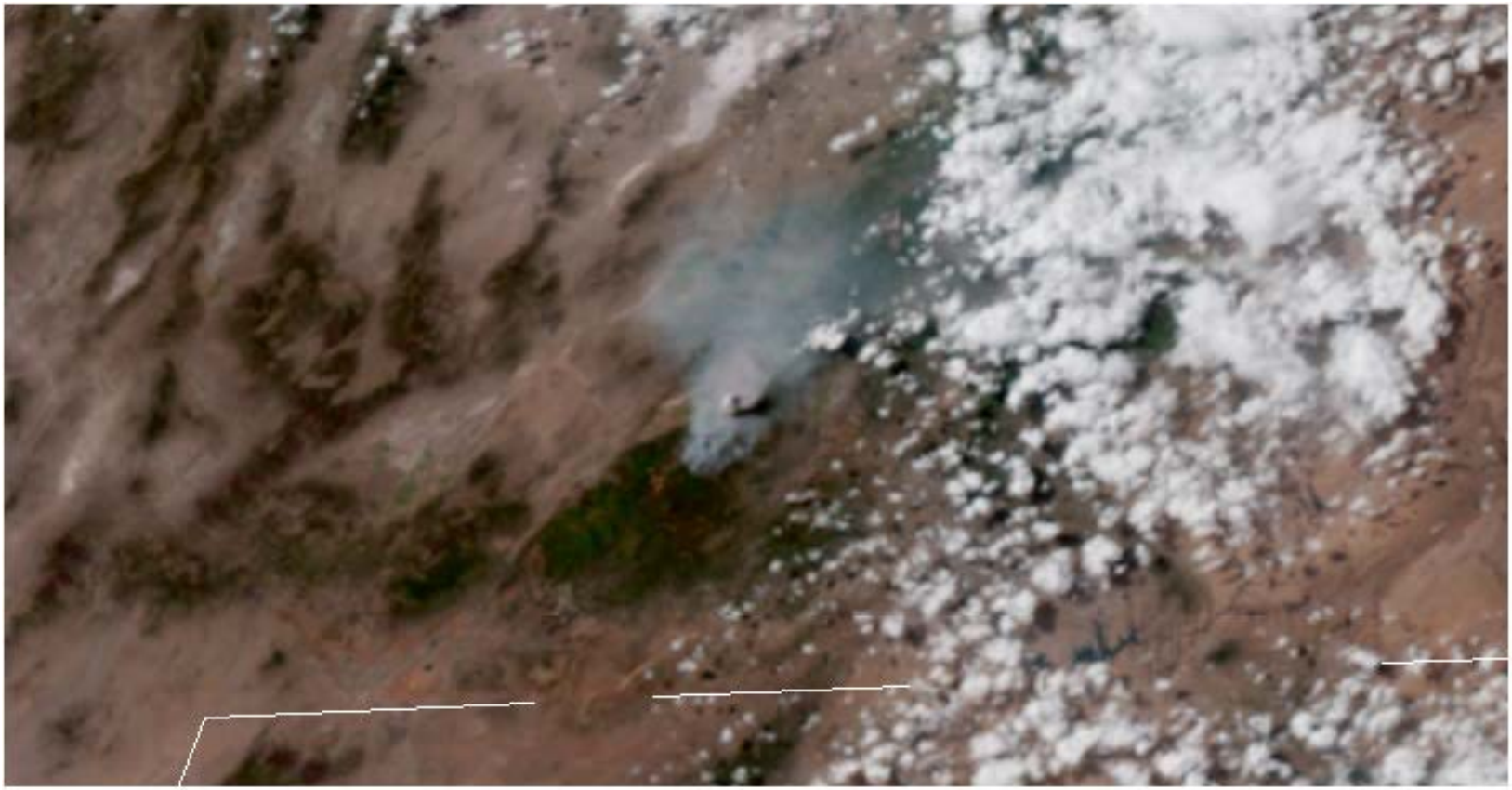
Similar comments from WFOs

BC Fires Aug 12



http://rammb-slider.cira.colostate.edu/?sat=goes-16&sec=mesoscale_02&x=901&y=460&z=2&im=60&ts=2&st=0&et=0&speed=130&motion=loop&map=1&lat=0&p%5B0%5D=20&opacity%5B0%5D=1&hidden%5B0%5D=0&pause=0&slider=-1&hide_controls=0&mouse_draw=0&s=rammb-slider

Cedar City Fire Jun 26 2016



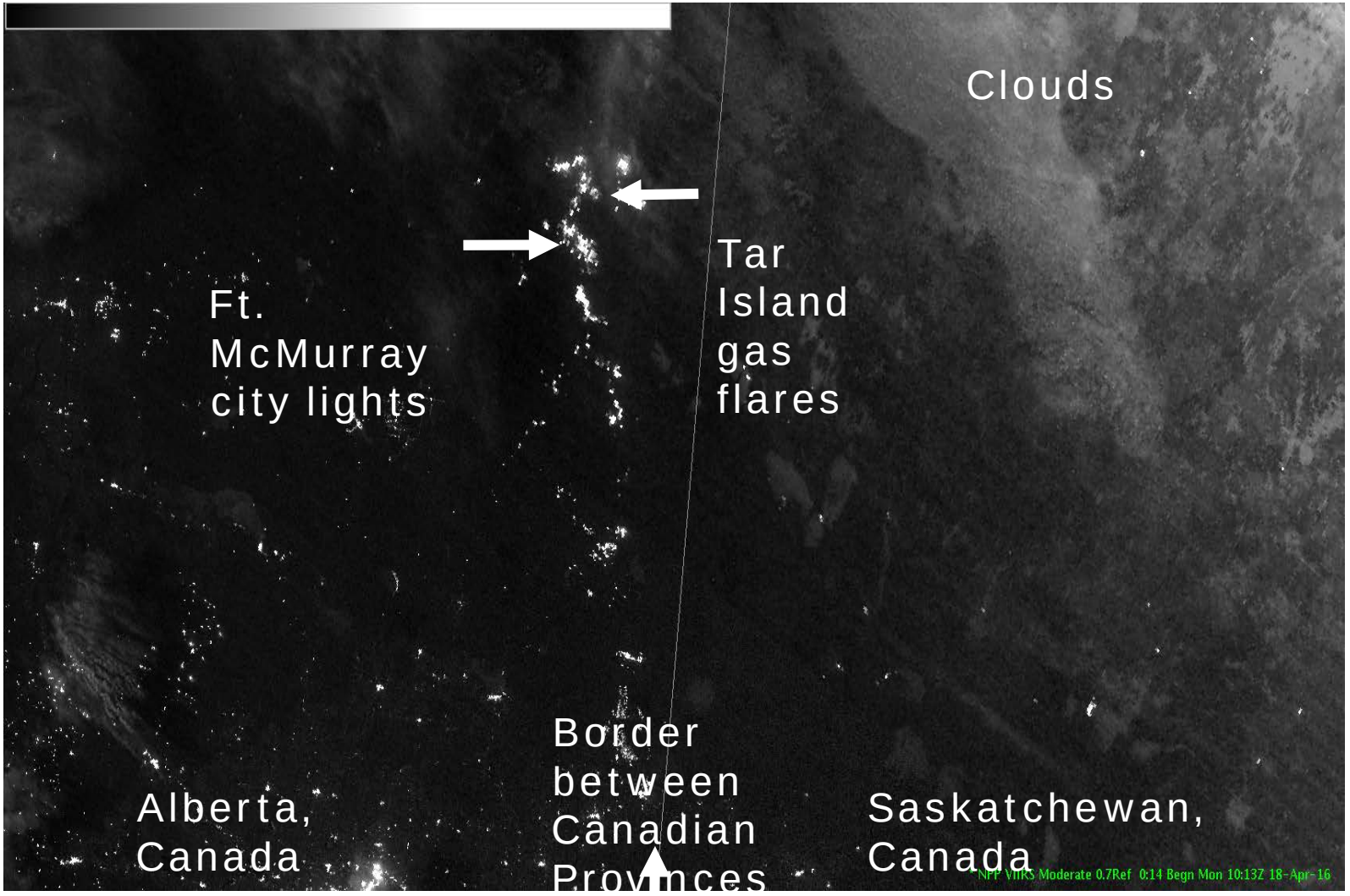
Fort McMurray Fire



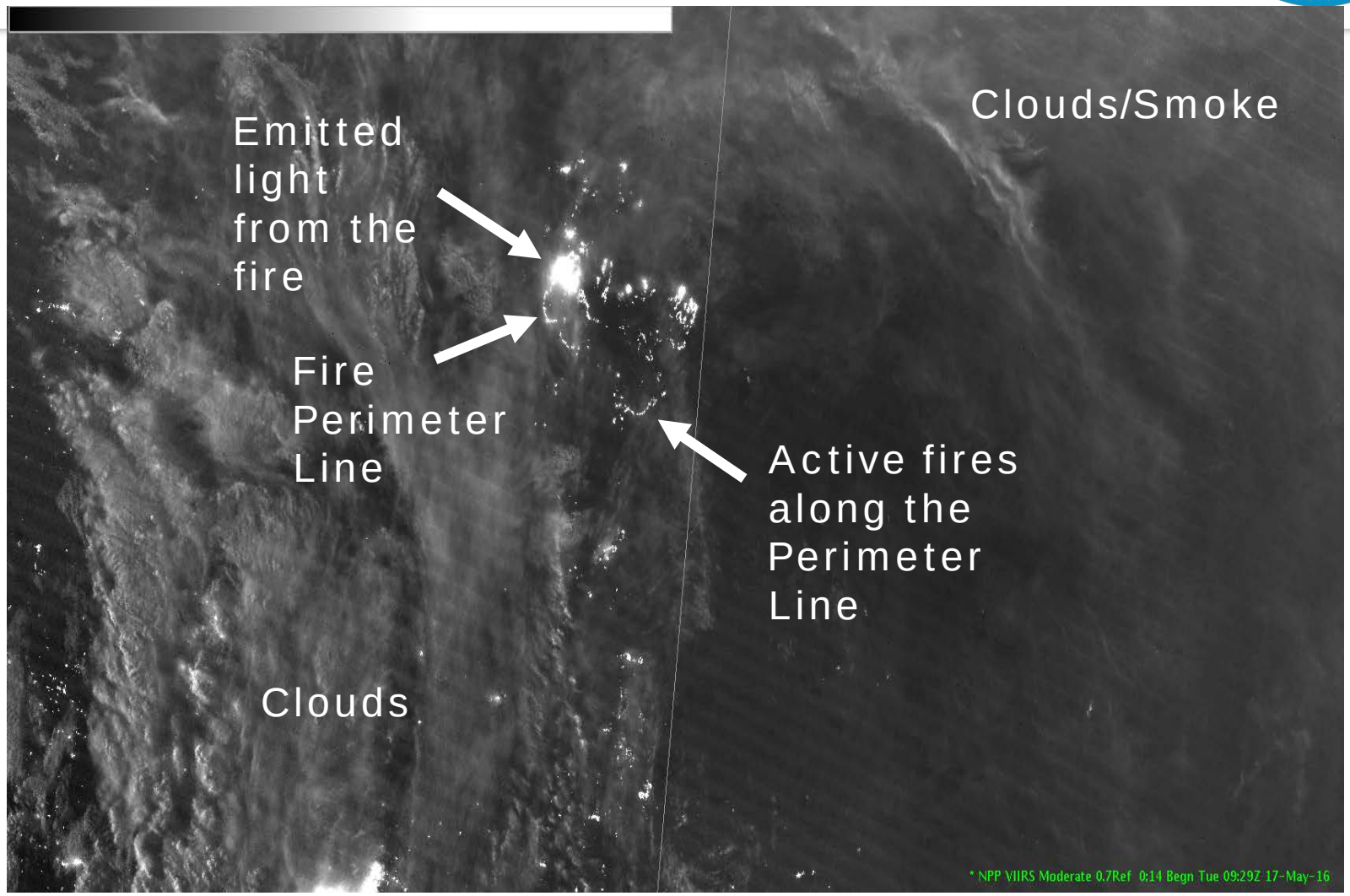




Suomi NPP IMAGERY - Before the fire

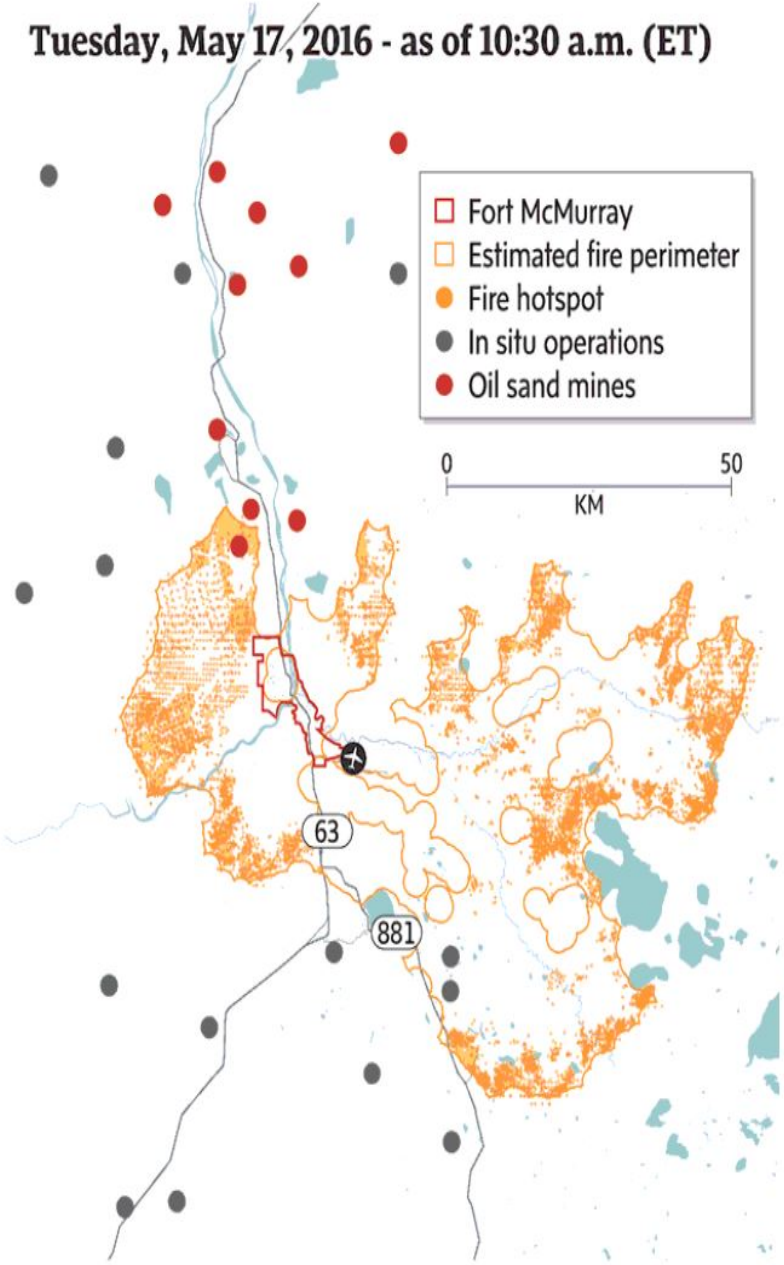


Suomi NPP Imagery of Ft McMurray Wildfire
7 May at 0930 UTC

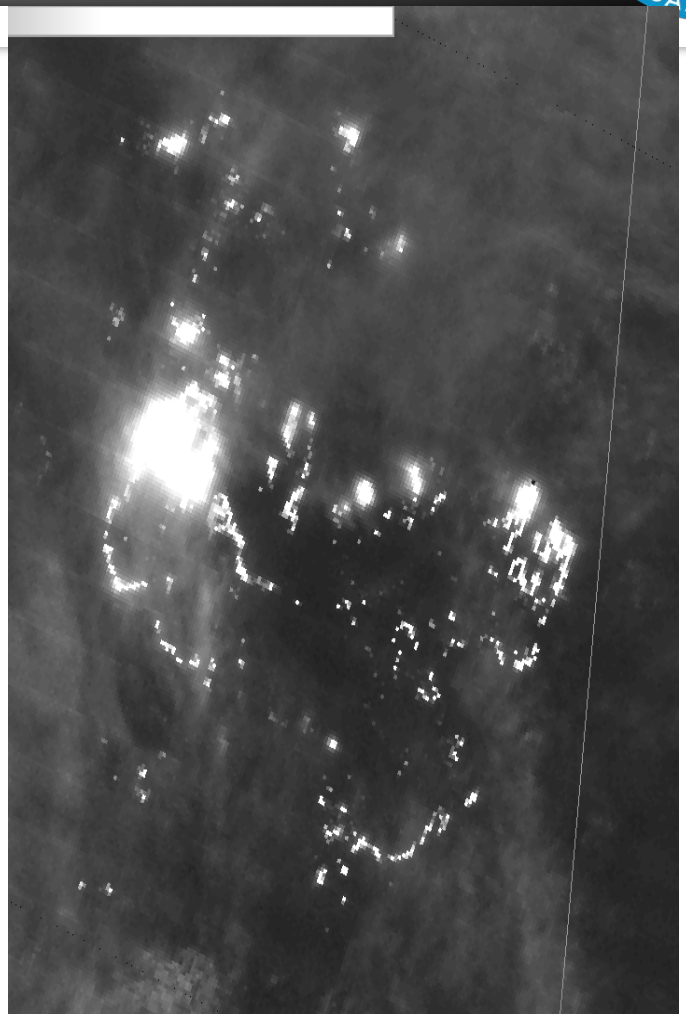


Suomi NPP Imagery of Ft McMurray Wildfire
18 May at 0915 UTC



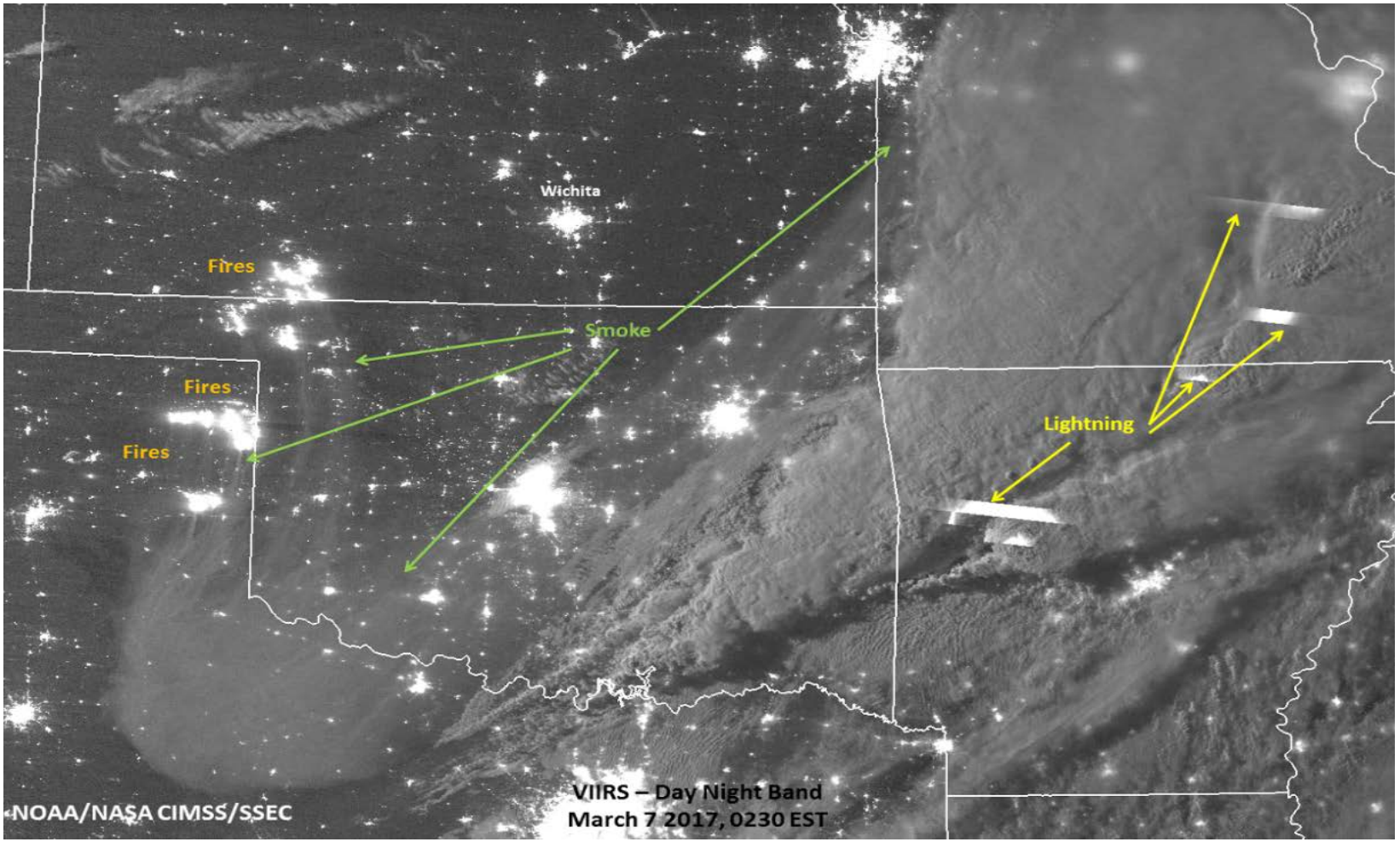


NCC Imagery 17 May 2016
at 0929Z (i.e., 05:29 a.m. ET)

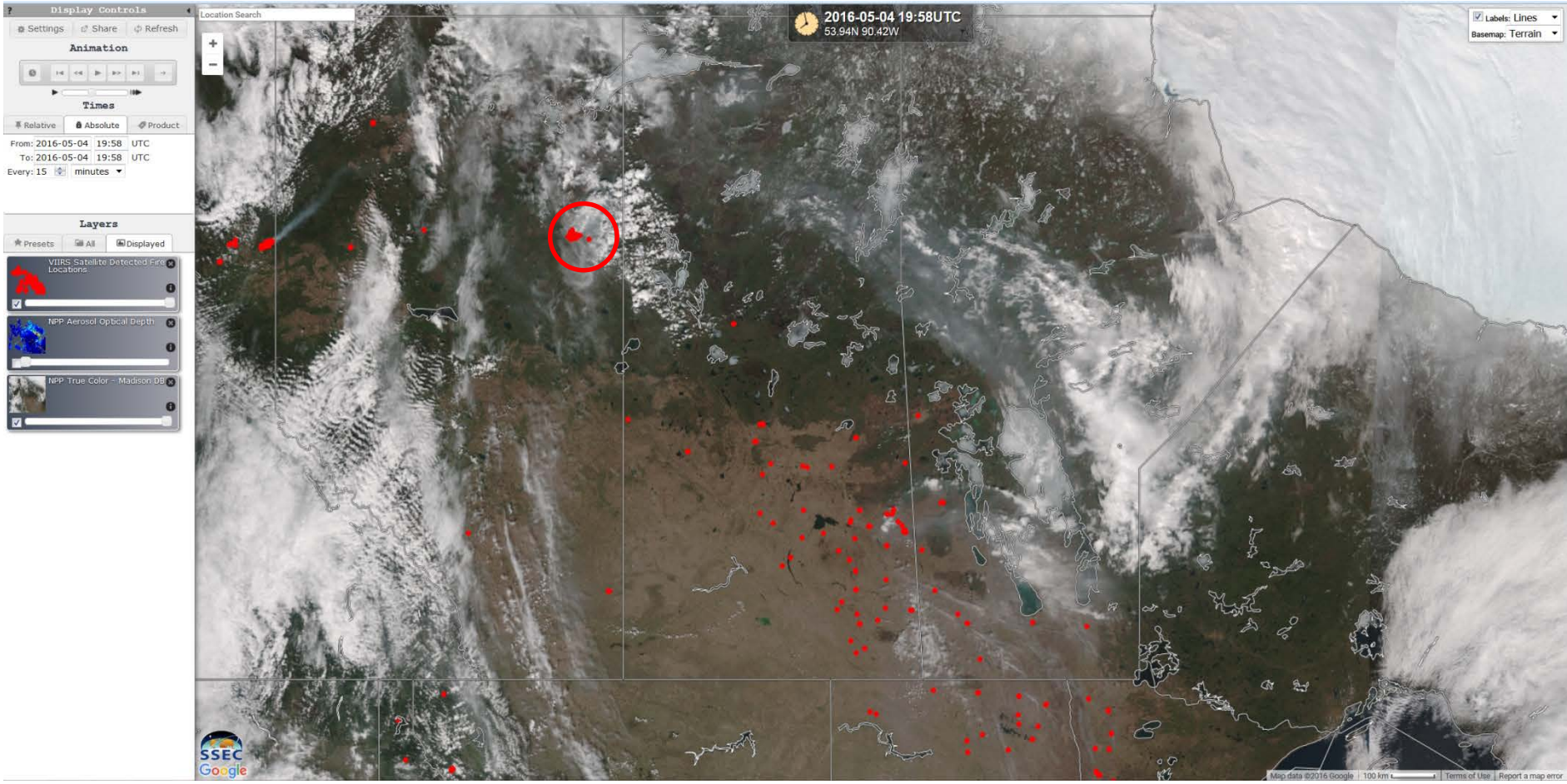


COMPARISON BETWEEN ESTIMATED FIRE PERIMETER AND NCC IMAGERY

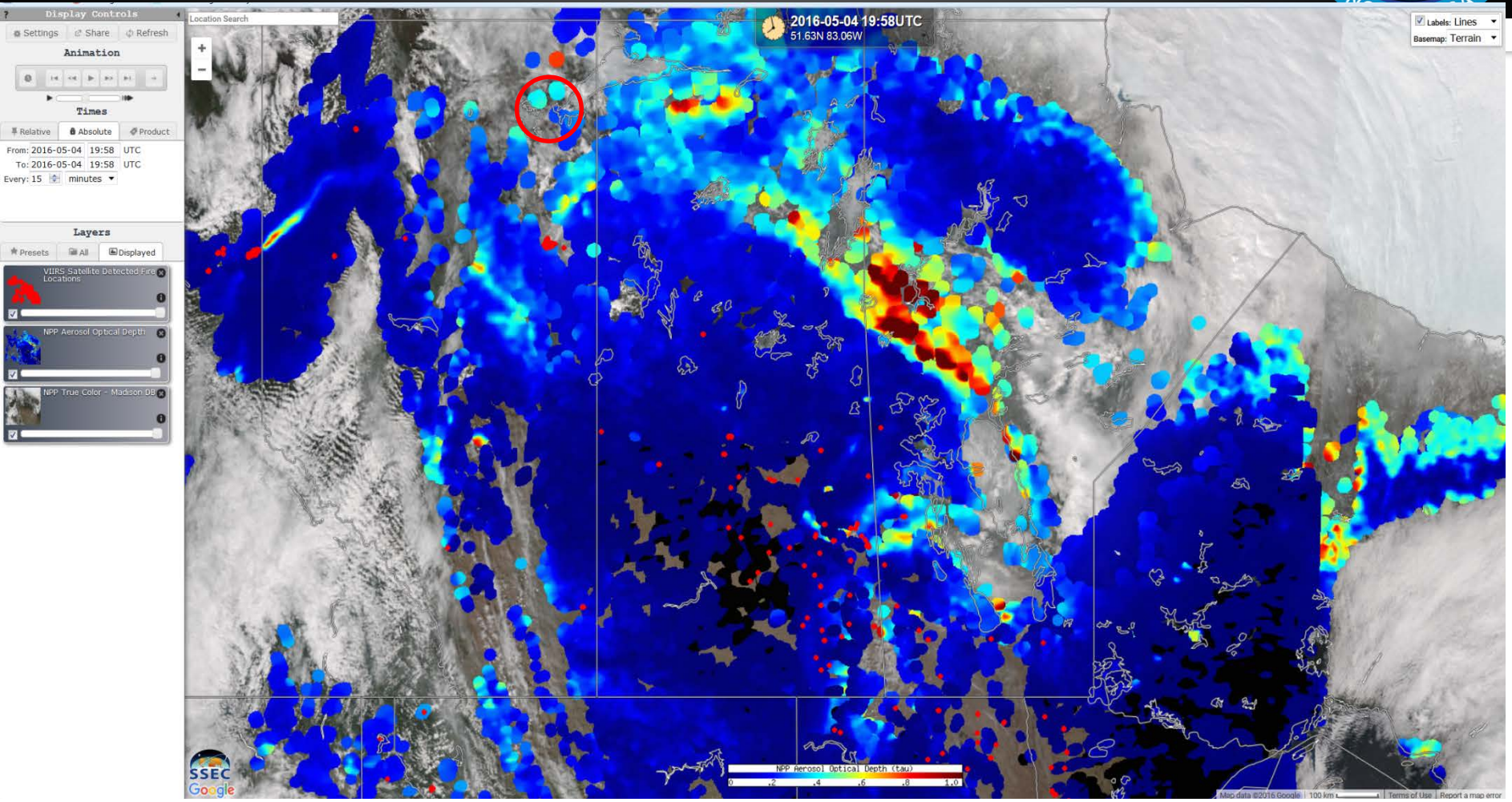
OK Fires – 7 Mar 2017



RealEarth Image May 04, 2016
VIIRS Fire Detection and True Color Composite
Fort McMurray Wildfire Smoke Plume

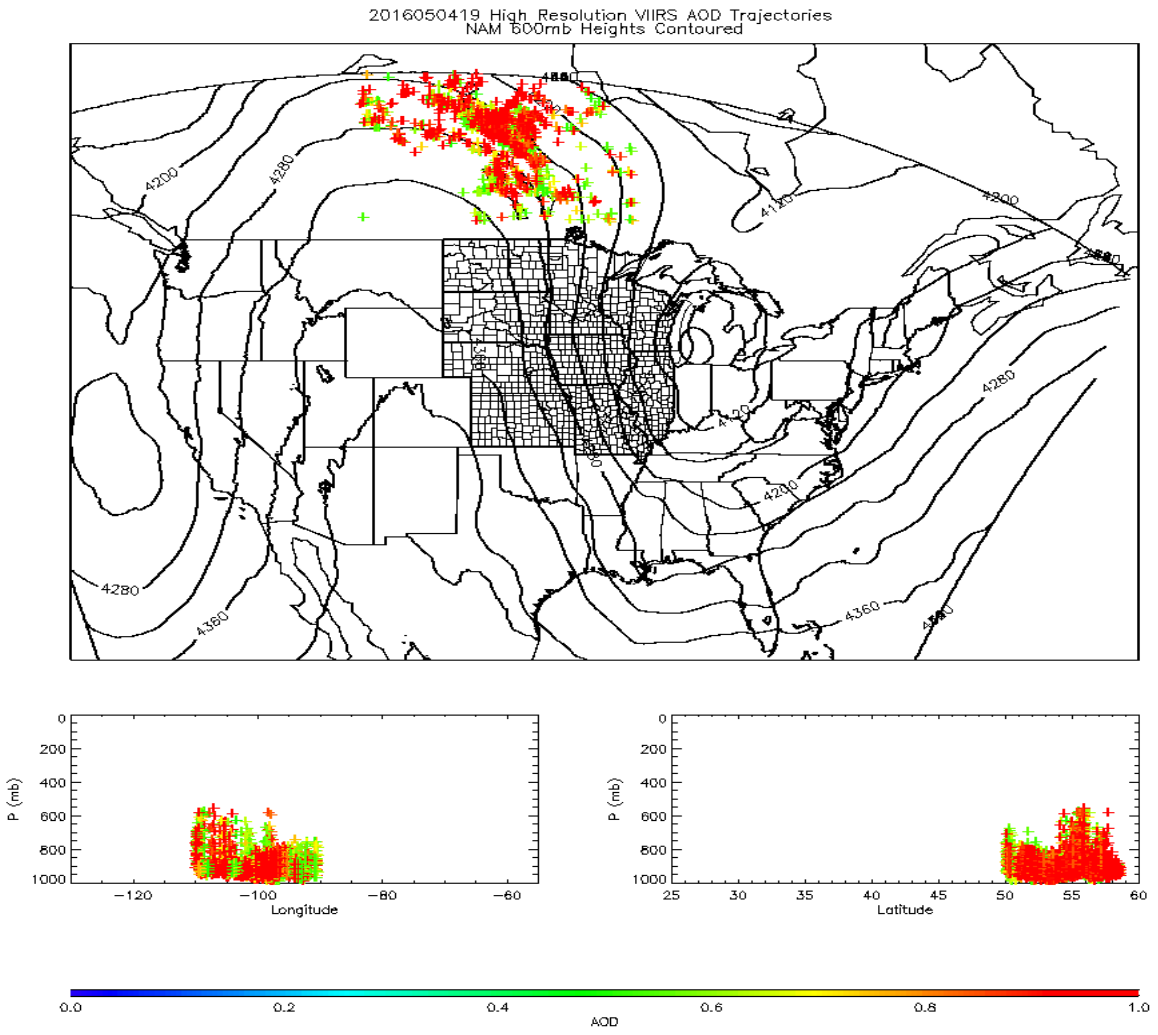


RealEarth Image May 04, 2016
VIIRS Fire Detection, True Color composite and AOD
Fort McMurray Wildfire smoke plume

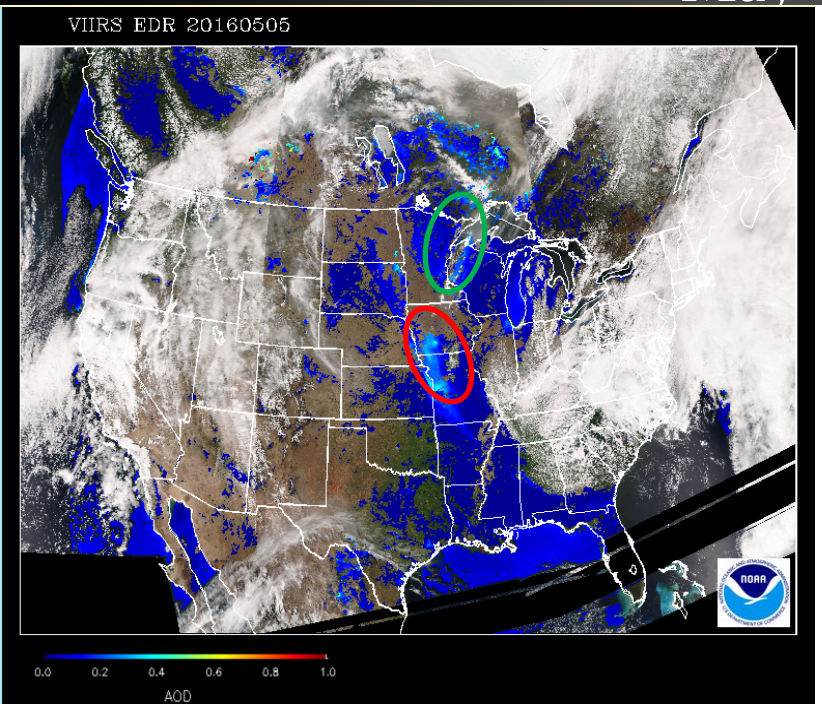


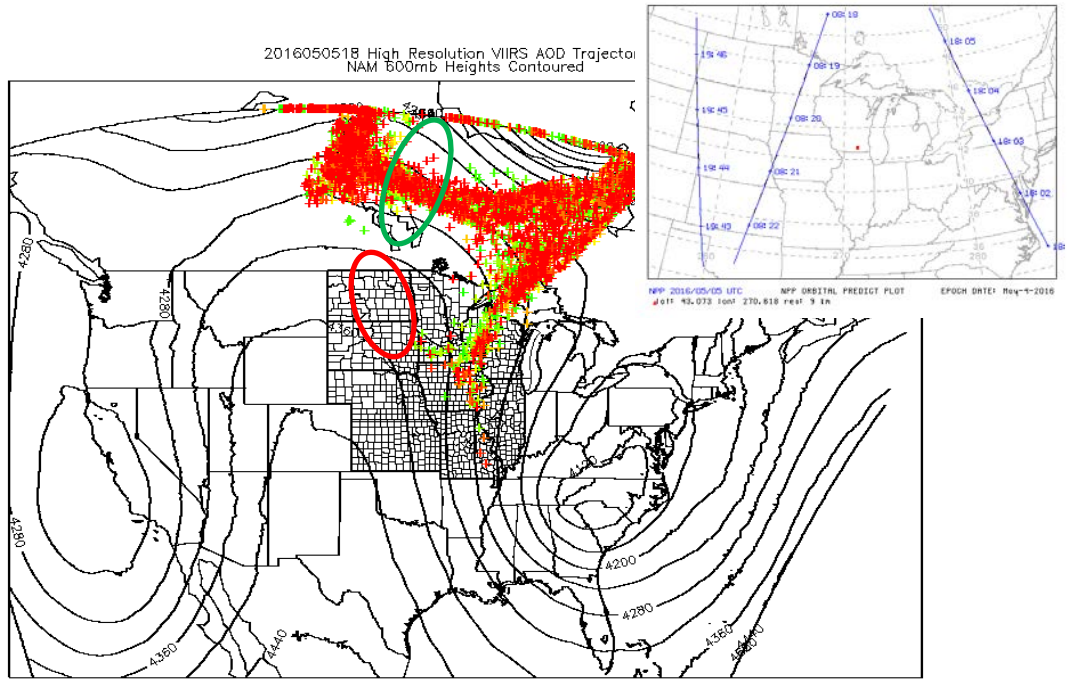
IDEA-I High resolution (NAM 3km) Trajectory Forecast
Fort McMurray Wildfire
May 04, 2016

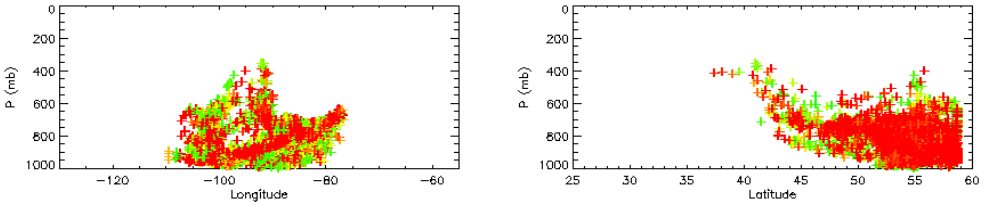
- IDEA-I high resolution trajectory forecast colored by initial AOD
- Upper panel shows NAM 600mb heights and precipitation (purple)
- Lower panels show longitude and latitude cross sections
- Only AOD>0.5 initialized



IDEA-I High resolution (NAM 3km) Trajectory Forecast
Fort McMurray Wildfire
May 05, 2016









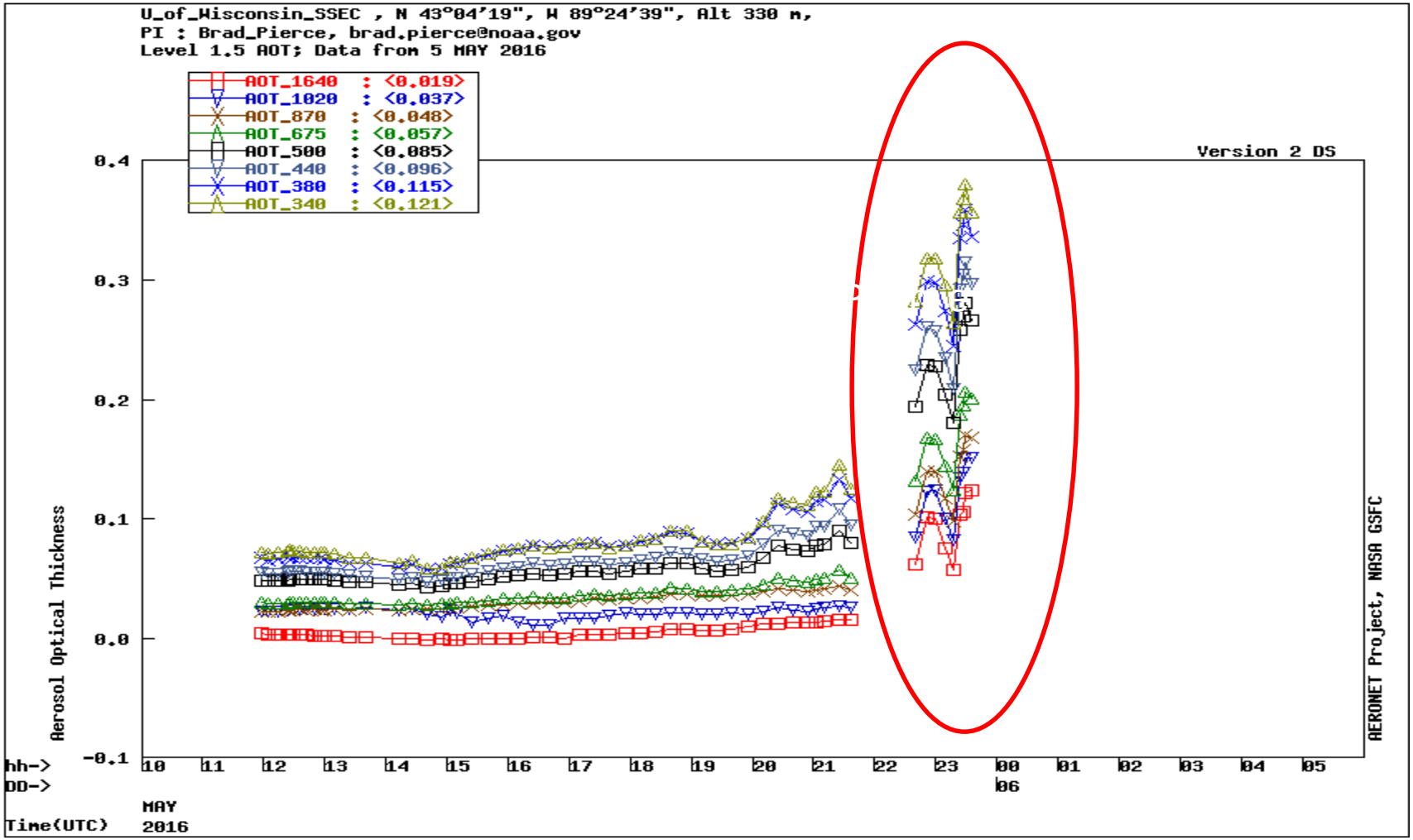
- May 05, 2016 VIIRS AOD shows plume along MN/WI and IA/MO boarders
- IDEA-I high resolution trajectory forecast predicts southern extent too far east

Smoke from Fort McMurray Wildfire
Mount Horeb, WI (South Central WI)
7:30pm Central May 05, 2016



questions

UW-Madison SSEC Aeronet AOD
May 5, 2016



Fire Event Questions

- **Weather (General Conditions)**
  - What are the high/low temperature ranges across the fire area for today?
  - How low will the humidity be today and will it change over the wester part of the AOR?
  - What are the wind direction, speed and gusts over the northern ridge?
  - When will the thunderstorms breakout this afternoon and will they be severe?
  - How strong will the cold front be as it moves through tomorrow? When will it exit the area?
  - When will this high temperatures and low humidity pattern break?
  - Will the valley drainage winds be as strong tomorrow morning as they were today?

- **Operational (Weather Impact on Specific Decisions)**
  - With the forecast wind change, the fire may threaten Forward Camp Bravo. How confident are you in the timing?
  - The aircraft with the fire retardant just had a weather cancel due to high winds. How soon will the winds die down?
  - Will we be able to get the smoke jumpers in the air this afternoon and what are the conditions in the landing zone?
  - Will we have to close the interstate due to low smoke visibility? How close will the fire be to the interstate?
  - Will the smoke be elevated or near the ground tomorrow in Bozeman MT?
  - How soon will we have to declare a health alert due to smoke?

Discussion

- How do we make weather organizations aware of the Satellite data and products available to them?
- How do we ensure these capabilities are consistently available when needed?
- We need to work with current and future users to maximize benefit of these products.
- We need to have training available in ways that the user can fit it into their busy schedule.
- We need to maintain a process to capture user feedback and adjust products to better serve them

How Satellites Help

- Satellites are part of an integrated observation system for decisionmakers supporting remotely through WFOs, NWS regions, and NCEP Centers.
  - WFO ASOS surface observations and upper air soundings
  - Ground based lightning systems
  - Radar
  - Remote Automated Weather Stations (RAWS)
  - Weather information from deployed fire personnel (ground and aviation)
  - Forecast, fire weather and other specialized models
- Satellite data and products are available to deployed IMETS
  - Use the AWIPS Thin Client to get access to observations, models, and satellite products
  - Can access websites for supplemental information (HRRR)
  - Reach back to supporting WFOs for assistance and more detailed analysis
- Satellite Capabilities Impact
  - What is happening now? Geostationary and Polar-Orbiting imagery for weather, fire, and smoke, Day-Night-Band, and VIIRS NUCAPS Soundings in convective environment
  - What is going to happen in the future? VIIRS Fire Radiative Power as input to smoke models
  - Are the models handling things well? JPSS validate model forecasts to give confidence in future model output

The Real-Time HRRR-Smoke Web-Site (rapidrefresh.noaa.gov/HRRRsmoke)

HRRR Model Fields - Experimental

Model: HRRR-smoke (Experimental) Area: NW Date: 14 Sep 2016 - 06Z

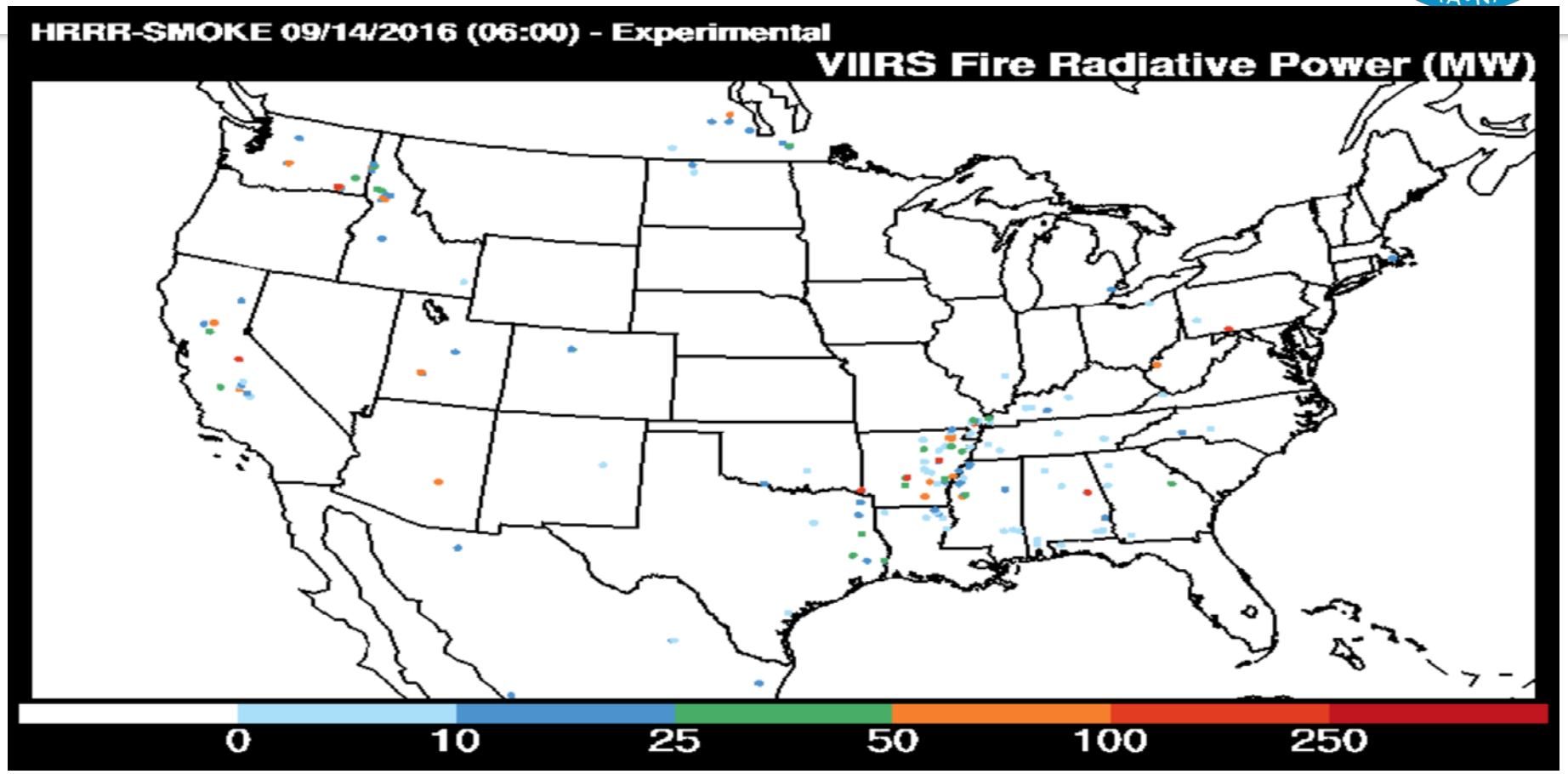
*** Experimental, Not for Official Guidance *** - see description. Alaska Version

Model: HRRR-smoke (Experimental) **Domain:** NW **Date:** 14 Sep 2016 - 06Z

CONUS
NW
NC
NE
SW
SC
SE
Great Lakes
NE CO
SEA
SFO
MKX
OKX
IAD
MIA
ATL

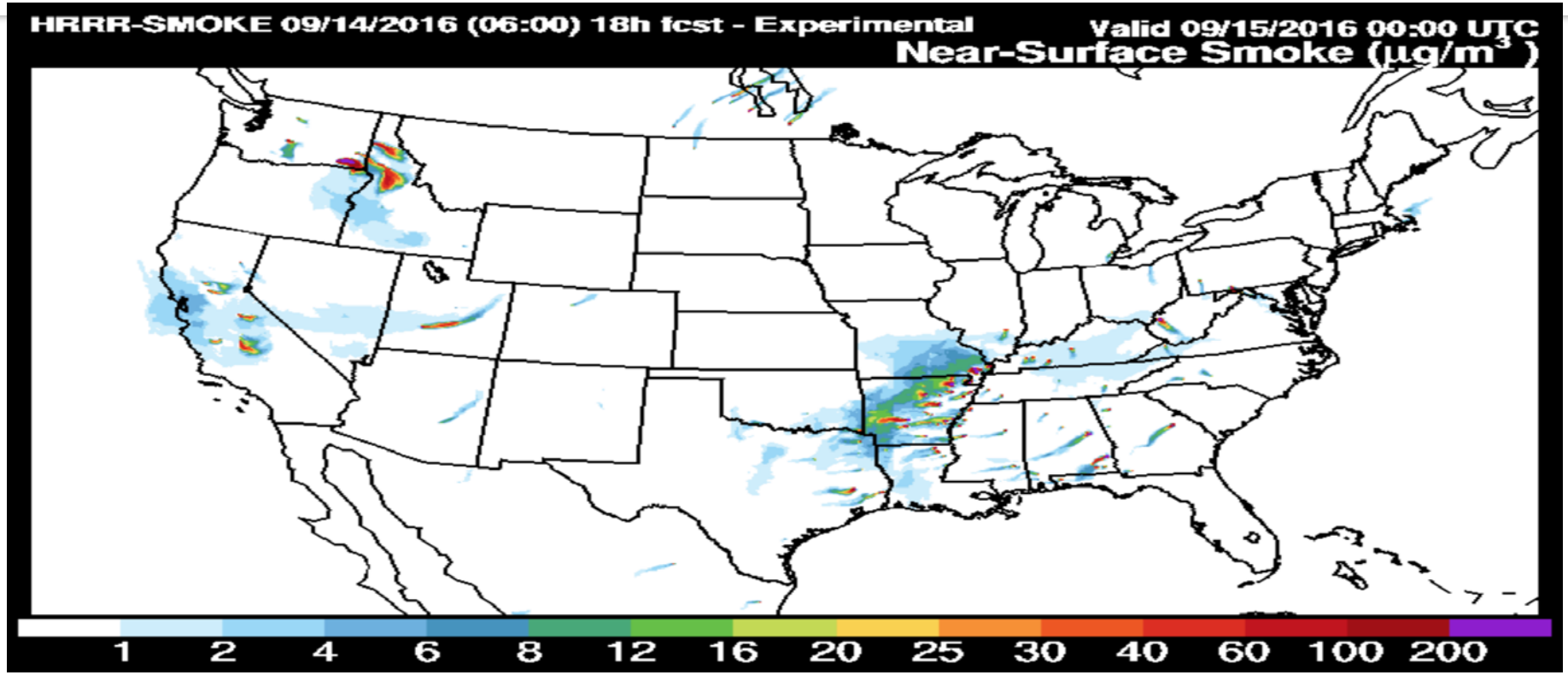
	All times	Loop	Wed 06	Wed 07	We 08	ed 11	Wed 12	Wed 13	Wed 14	Wed 15	Wed 16	Wed 17	Wed 18
			00	01	02	05	06	07	08	09	10	11	12
all fields			00	01	02	05	06	07	08	09	10	11	12
fire radiative power	✔	✔	00	01	02	05	06	07	08	09	10	11	12
near-surface smoke	✔	✔	00	01	02	05	06	07	08	09	10	11	12
vertically integrated smoke	✔	✔	00	01	02	05	06	07	08	09	10	11	12

The Real-Time HRRR-Smoke Web-Site (rapidrefresh.noaa.gov/HRRRsmoke)



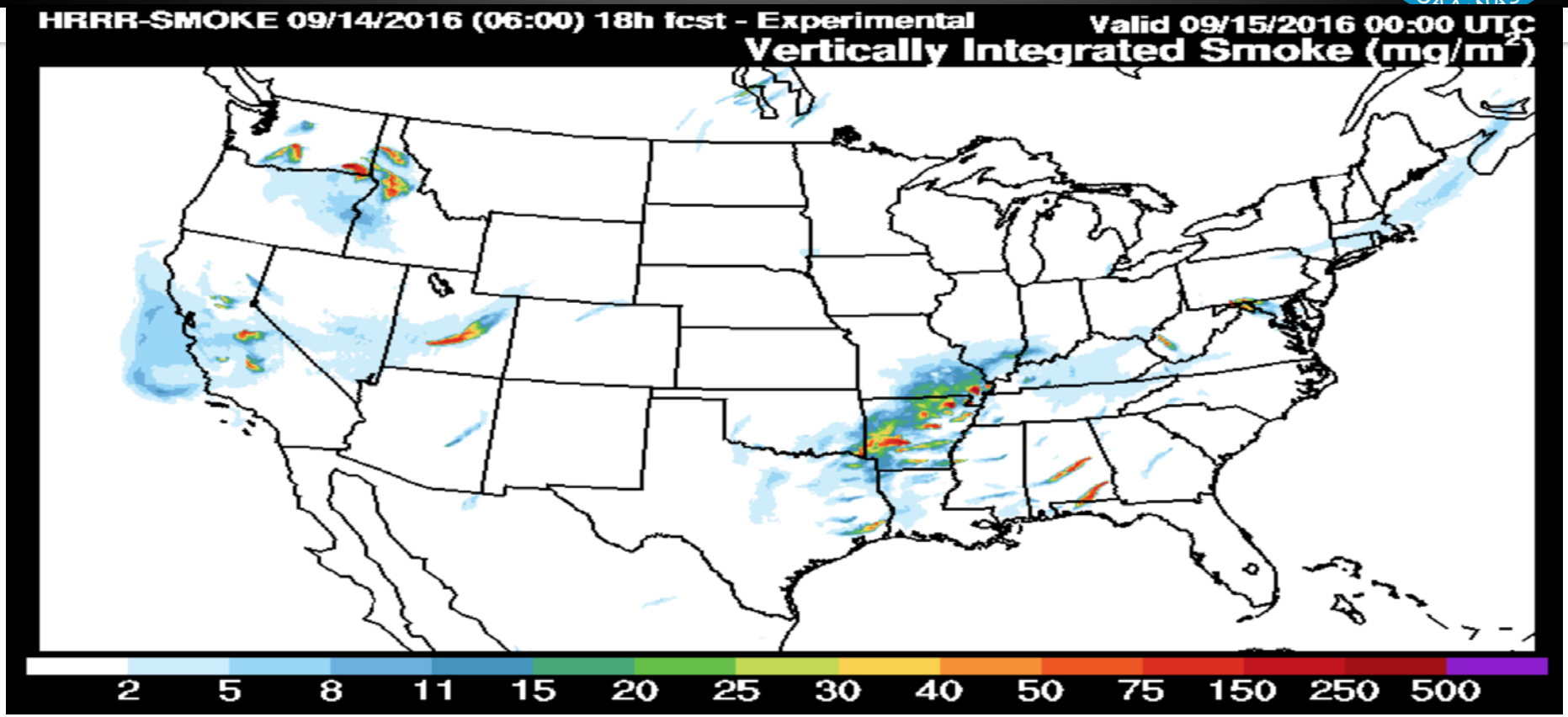
The Fire Radiative Power (FRP) data are processed during HRRR-Smoke initialization by processing FRP for the model domain detected during previous 24 hours by VIIRS. Then the model simulates fire emissions and plume rise using the static FRP fields for 36 hours of smoke forecast. The following plot shows processed FRP values from VIIRS for the model grid cells (each size of 3x3 km) containing fires for 6Z September 14th, 2016 experimental smoke forecast.

The Real-Time HRRR-Smoke Web-Site (rapidrefresh.noaa.gov/HRRRsmoke)



This plot shows simulated fire emitted fine particulate matter (PM2.5 or fire smoke) concentrations at the first model level (~8m above ground). The following plot shows forecast of near-surface fire smoke for Sep 14th, 8pm EDT over the CONUS domain. This forecast is based on the model simulation of 18 hours from the model initialization time, which is 2am EDT, Sep. 14th.

The Real-Time HRRR-Smoke Web-Site (rapidrefresh.noaa.gov/HRRRsmoke)



This plot shows simulated total PM2.5 mass within vertical columns over each model grid cell (or fire smoke). These columns reach as high as ~25 km above ground. The purpose of showing such plots is to display the effect of fire smoke load which includes smoke in boundary layer as well as aloft, illustrating the integral effect of fire smoke throughout the atmosphere. The following plot shows a forecast of vertically integrated fire smoke for Sep 14th 8pm EDT.

Validation of Models