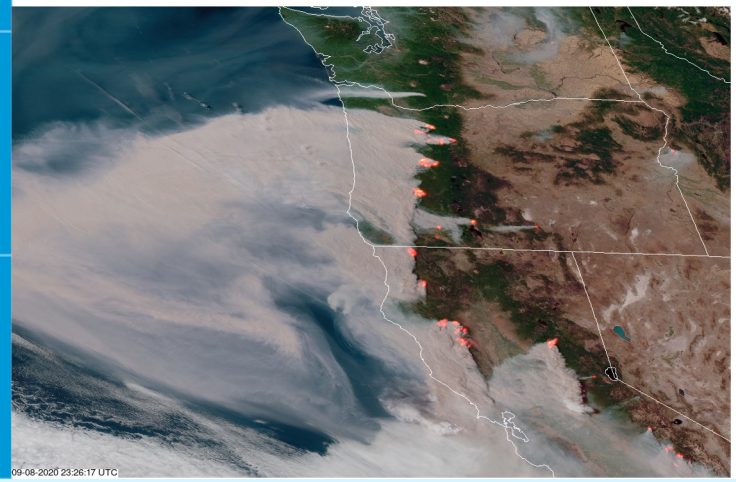
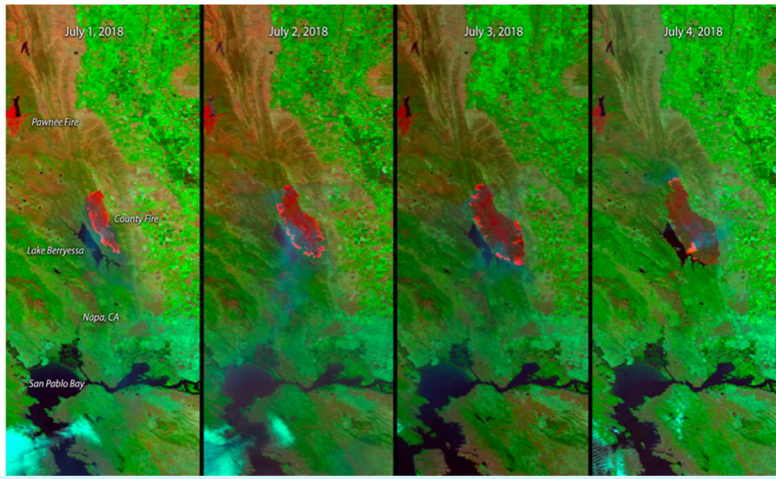
Rethinking How Satellite Data Are Transformed Into Actionable Insights for Fire Applications

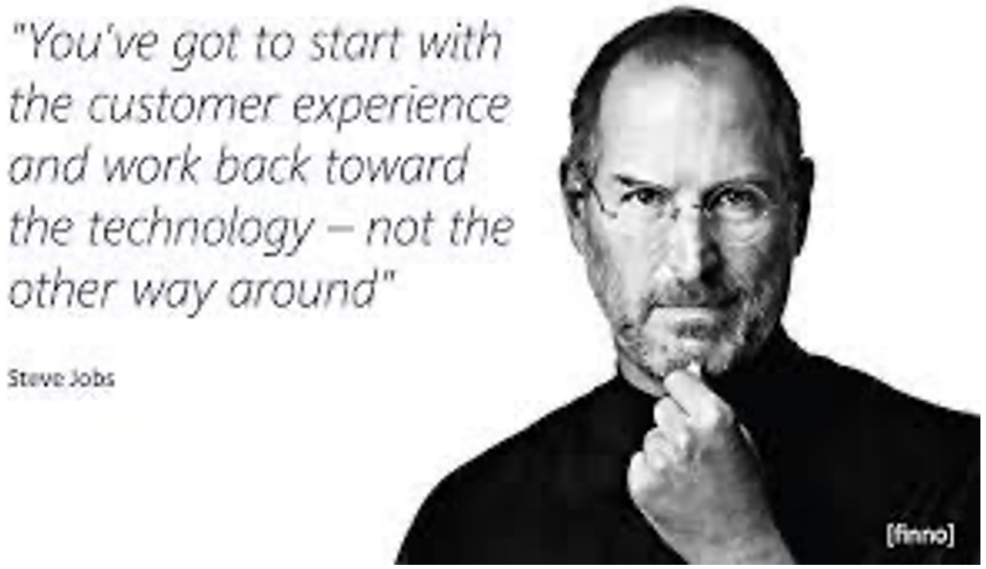


Mike Pavolonis

NOAA/NESDIS Fire Lead



Impact Centric Framework



Less: “Here is a product I developed. How can it help you?”

More: Start with a focus on tasks users are trying to accomplish

Product vs Impact Mindset

Algorithm/Product Centric Focus

- Develop a new or improved algorithm/product
- Example goal: develop an algorithm for satellite-based fire detection

Impact Centric Focus

- Develop and deliver timely, accurate, and actionable information
- Example goal: improve the timeliness of the response to a new fire ignition

NOAA Service Delivery Framework

Actionable information and analysis ready data

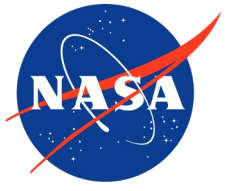
Build: NOAA Fire Weather Customers / Partners

Local

Regional

Geographic Area Coordination Centers

National



FEMA

NGOs Academia Media Research Consortias

Gather: Identifying Critical Gaps

Wildland Urban Interface Fire Operational Requirements and Capability Analysis

Report of Findings

May 31, 2019

Homeland Security Science and Technology

U.S. Fire Administration

FEMA

Link

NWCG Satellite Data Task Team

NATIONAL WILDFIRE COORDINATING GROUP ™

Report on Satellite Technology Requirements for Wildland Fire Services in the CONUS

August 19, 2020

Lindley, T. T., C. M. Gravelle, S. M. O'Neill, D. C. Daily, W. Schroeder, S. Triplett, C. Belognie, B. Gardunio, and C. Thompson, 2020: Report on satellite technology requirements for wildland fire services in the CONUS. Satellite Data Task Team, Fire Environment Committee, National Wildfire Coordinating Group.

NWCG Satellite Data Task Team

Report on Satellite Technology Requirements for Wildland Fire Services in the CONUS

Link

Link

Translate/Assess: High Priority NESDIS Activities

Pre-ignition

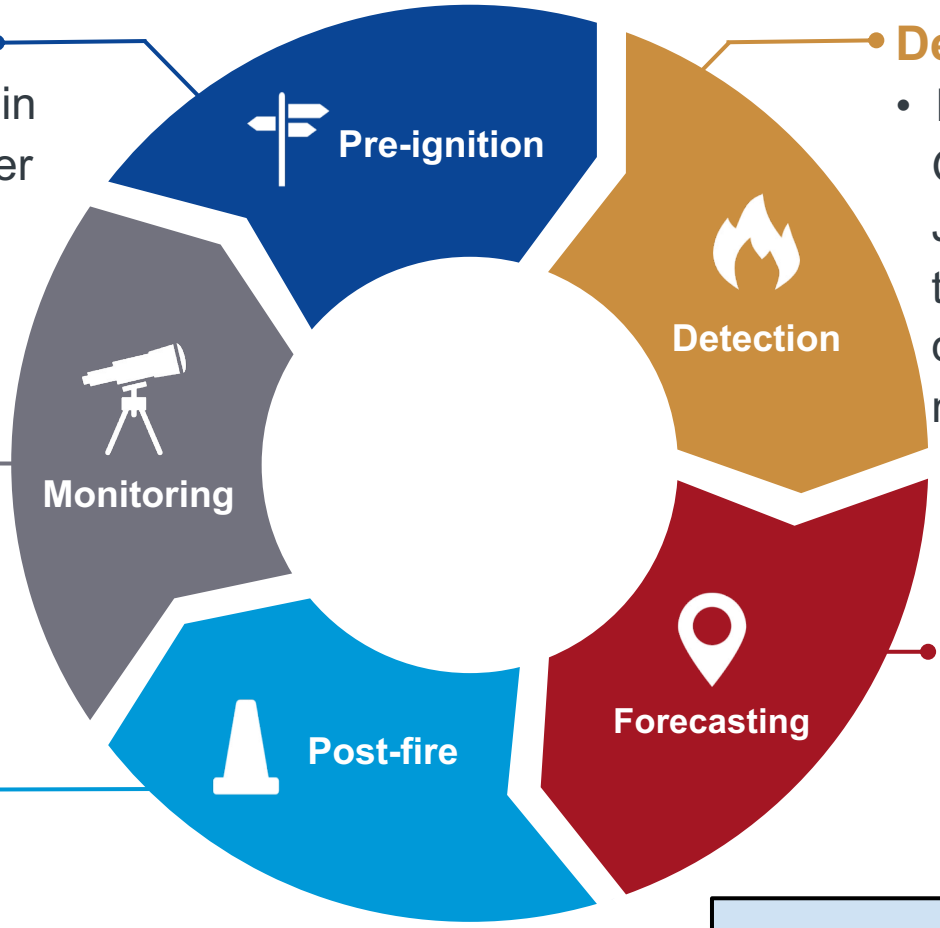
- Datasets required to train and calibrate fire weather prediction models and assess threat potential

Monitoring

- Information rich database to support long-term monitoring of trends and patterns

Post-fire

- Multi-satellite burn scar database



Detection

- Fully utilize GOES and JPSS for timely fire detection and notifications

Forecasting

- Optimize satellite derived information for fire behavior and smoke forecasting (advanced fire characterization)

Overarching: effective dissemination and interoperability, with robust user interfaces

Assess: Current NESDIS Fire Product & Services

GOES-R Ground Segment	GOES-R ABI Products
NDE and **CSPP**	JPSS EDRs
Enterprise Algorithms	Non-NOAA Satellite Products
OSPO/SAB	Hazard Mapping System
NCEI	Fire data and information

Assembly required!

Address: Dedicated Fire Information System

Single or multi-source GEO or LEO satellite data + supplemental data

NESDIS Fire Information System

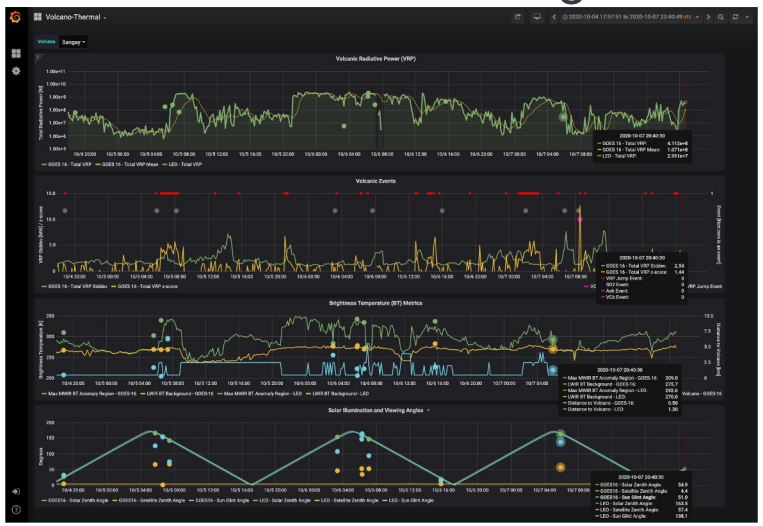
NESDIS Fire Storefront

Fire Software Repository

Progress on Address/Deliver/Evaluate: The NESDIS Fire Pilot Project

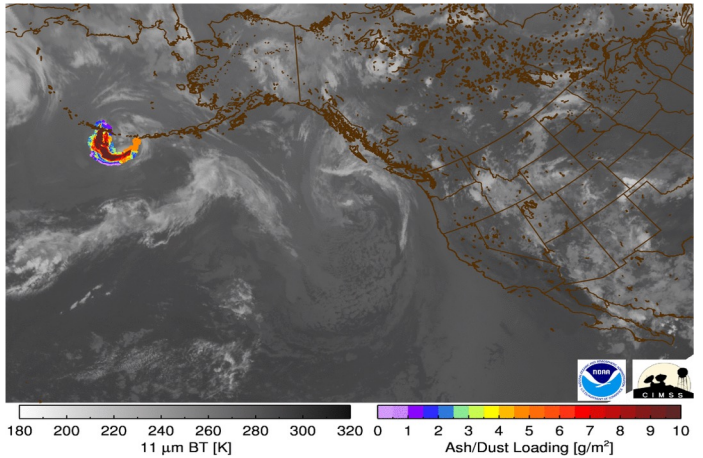
The VOLcanic Cloud Analysis Toolkit (VOLCAT)

Thermal Monitoring

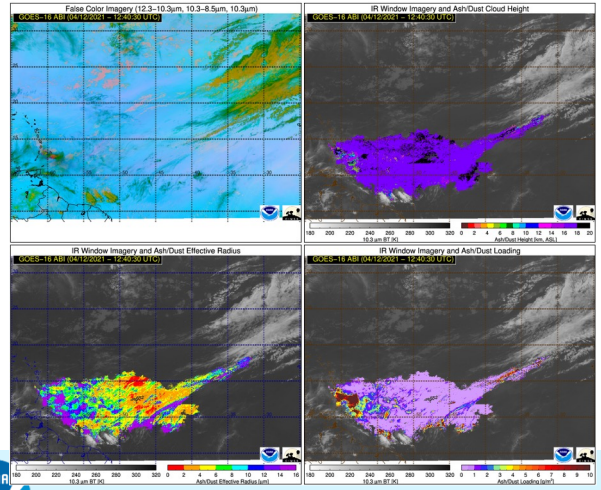


Eruption Alerts

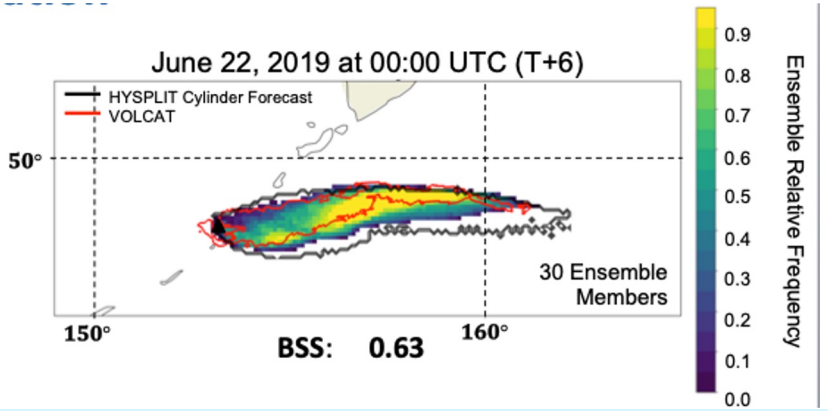
Volcanic Cloud Tracking



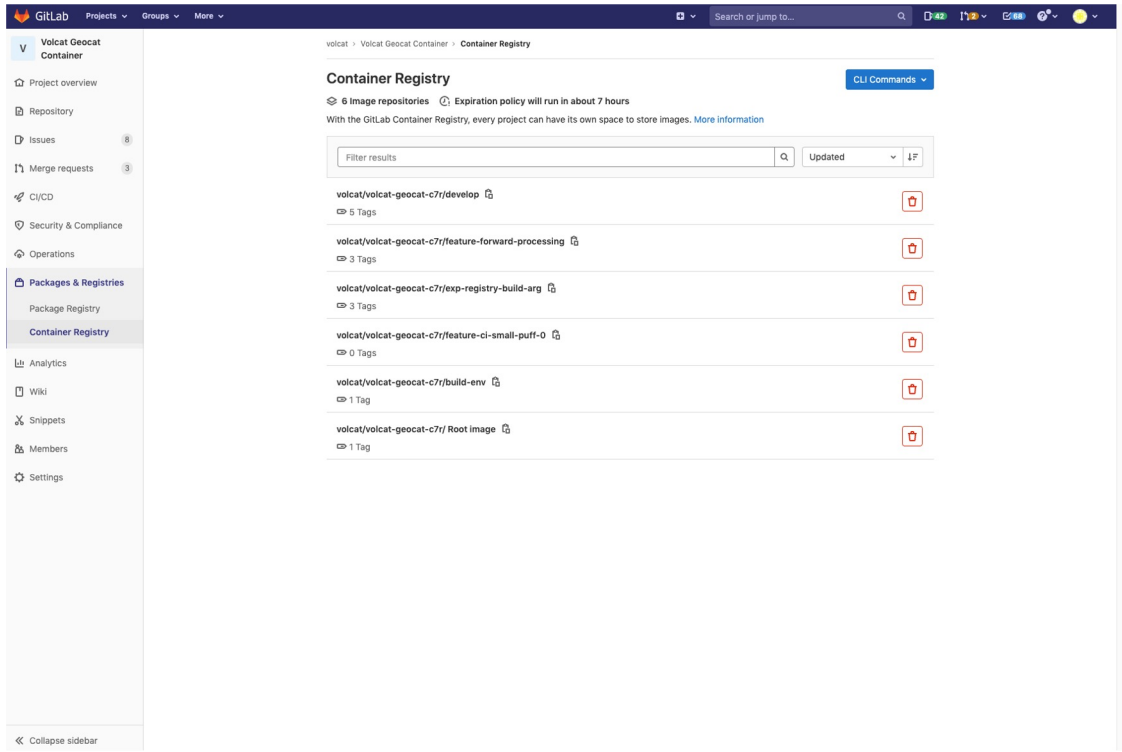
Volcanic Cloud Characterization



Dispersion & Transport Forecasting

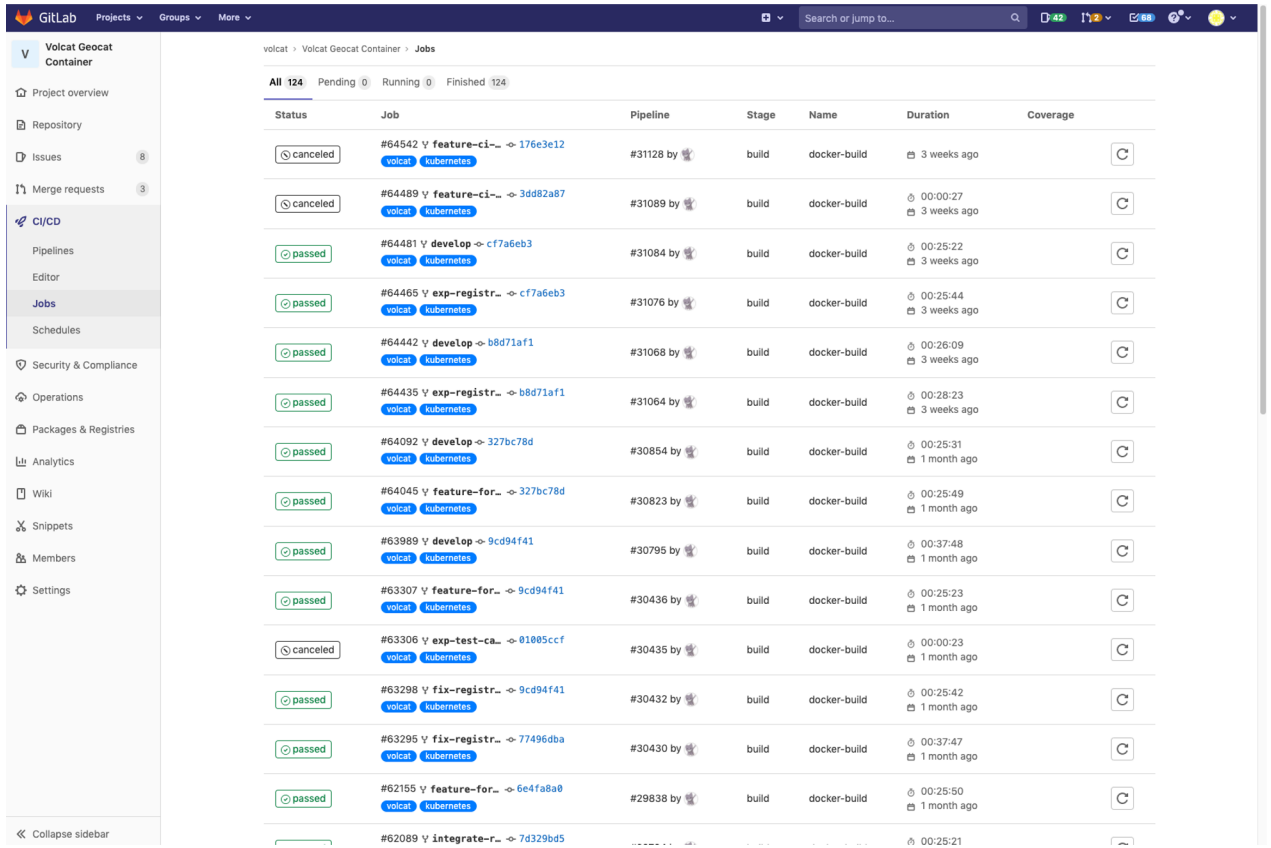


VOLCAT Software Practices



Containerization

Automation

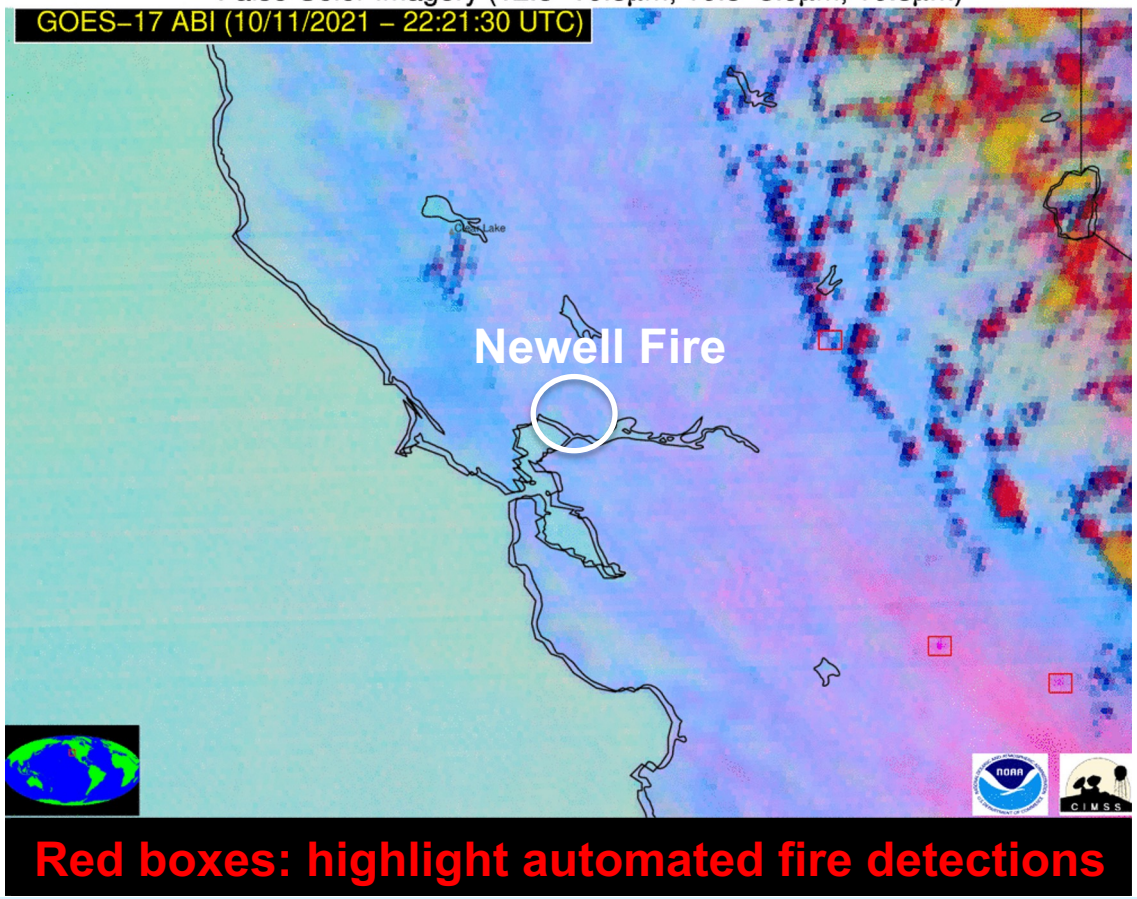


New experimental automated fire alerting system

- User configurable web dashboard displays newly detected fire events as a function of NWS fire weather products (e.g. red flag warnings, SPC outlook, etc.)
- Powered by an improved satellite fire detection algorithm

The Newell Fire in Napa, County, CA was detected by the improved NESDIS detection algorithm at 6:12pm PDT on 11 Oct 2021 (fire was first reported at 6:30pm PDT)

False Color Imagery (12.3–10.3µm, 10.3–3.9µm, 10.3µm)



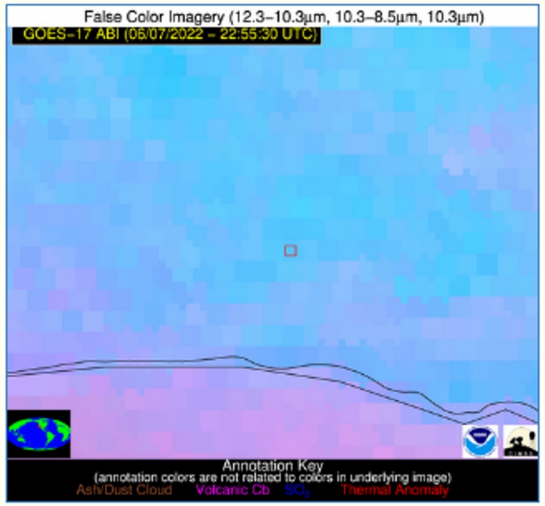
Value of Low Latency Satellite Data

Wildfire Alert Report

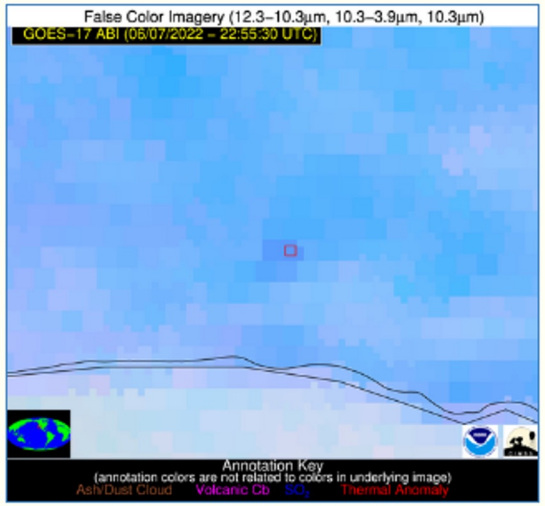
Date:	2022-06-07
Time:	22:55:30
Production Date and Time:	2022-06-07 22:56:45 UTC
Primary Instrument:	GOES-17 ABI
Wmo Spacecraft Id:	664
Location/orbit:	GEO
L1 File:	OR_ABI-L1b-RadM1-M6C14_G17_s20221582255256_e20221582255313_c20221582255364.nc
L1 File(s) - Temporal	OR_ABI-L1b-RadM1-M6C14_G17_s20221582254256_e20221582254313_c20221582254366.nc
Number Of Thermal Anomaly Alerts:	1

Hide details ▲

Possible Wildfire



False Color Image (12-11, 11-8.5, 11) [zoomed-in]



False Color Image (12-11, 11-3.9, 11) [zoomed-in]

Basic Information

State/Province(s)	California
Country/Countries	USA
County/Locality(s)	Santa Barbara County, California
NWS WFO	Los Angeles/Oxnard CA
Identification Method	Enhanced Contextual (Clear)
Mean Object Date/Time	2022-06-07 22:55:30UTC
Radiative Center (Lat, Lon):	34.600°, -120.060°
Nearby Counties (meeting alert criteria):	Santa Barbara County (0.00 km)
Total Radiative Power Anomaly	n/a
Total Radiative Power	30.30 MW

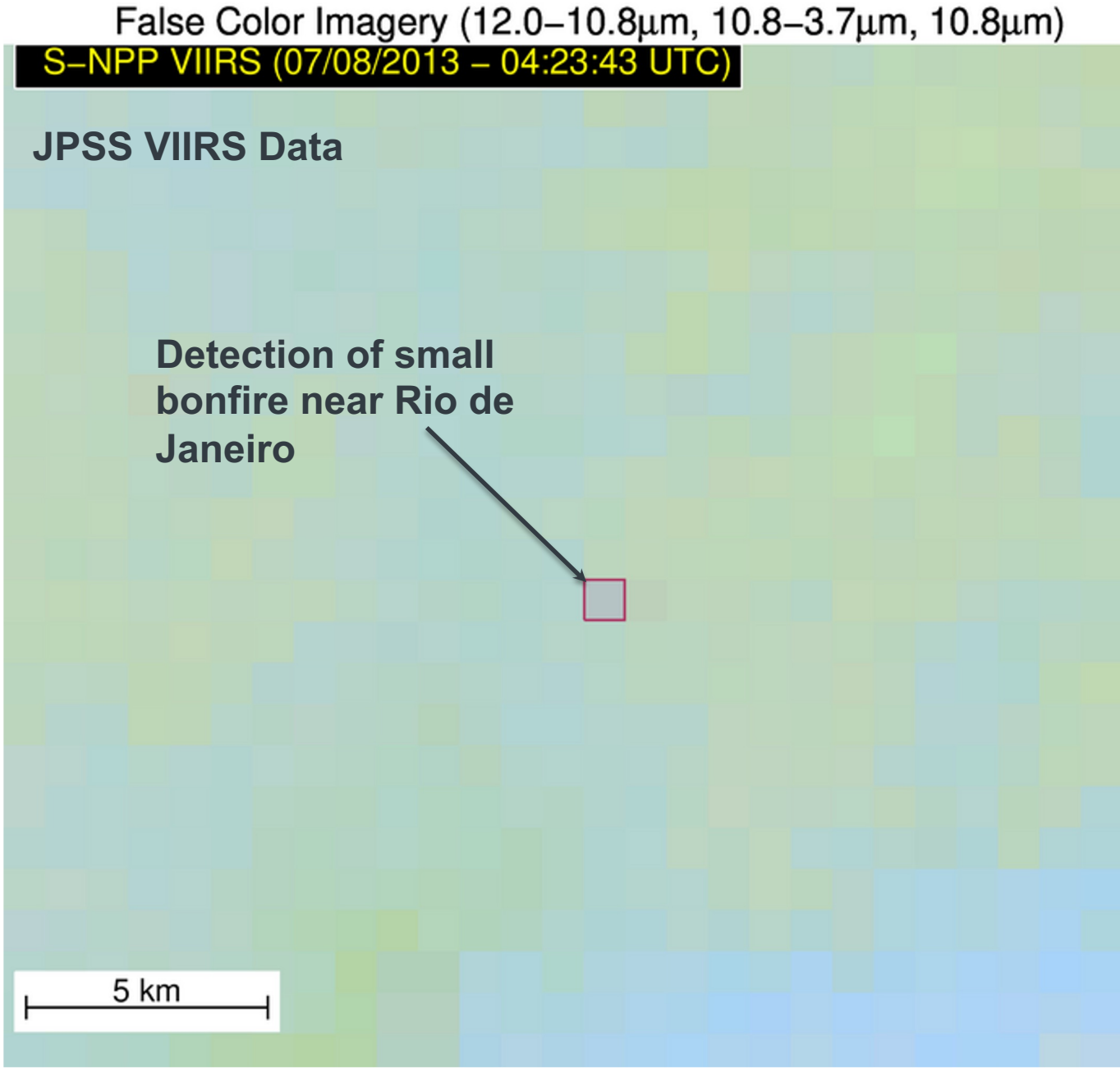
Show More ▲ View all event imagery »

Fire alerts from 1-minute GOES-R GRB data are generated within 90 seconds of acquisition

Satellite Sensor Agnostic Detection Solution

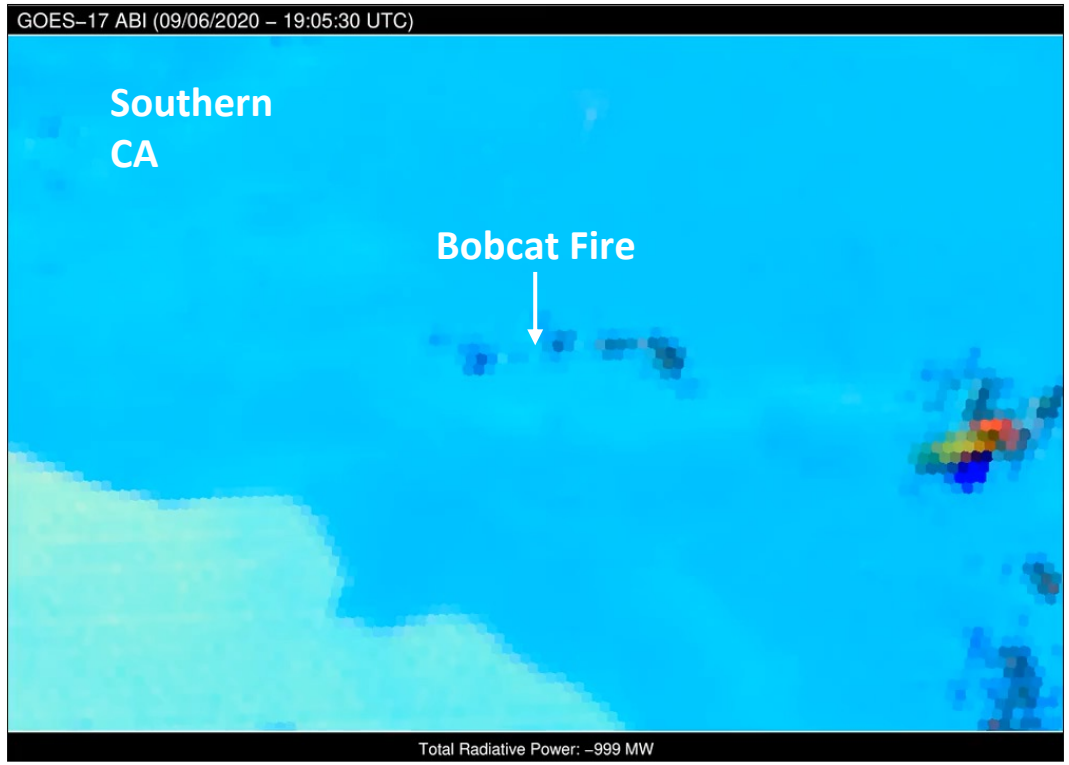
Higher spatial resolution =
Detection of smaller fires

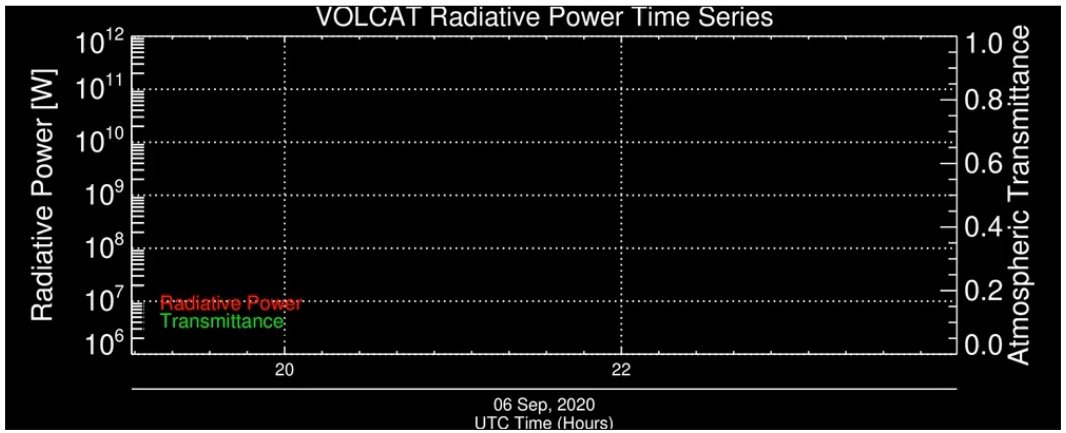
Stock photo

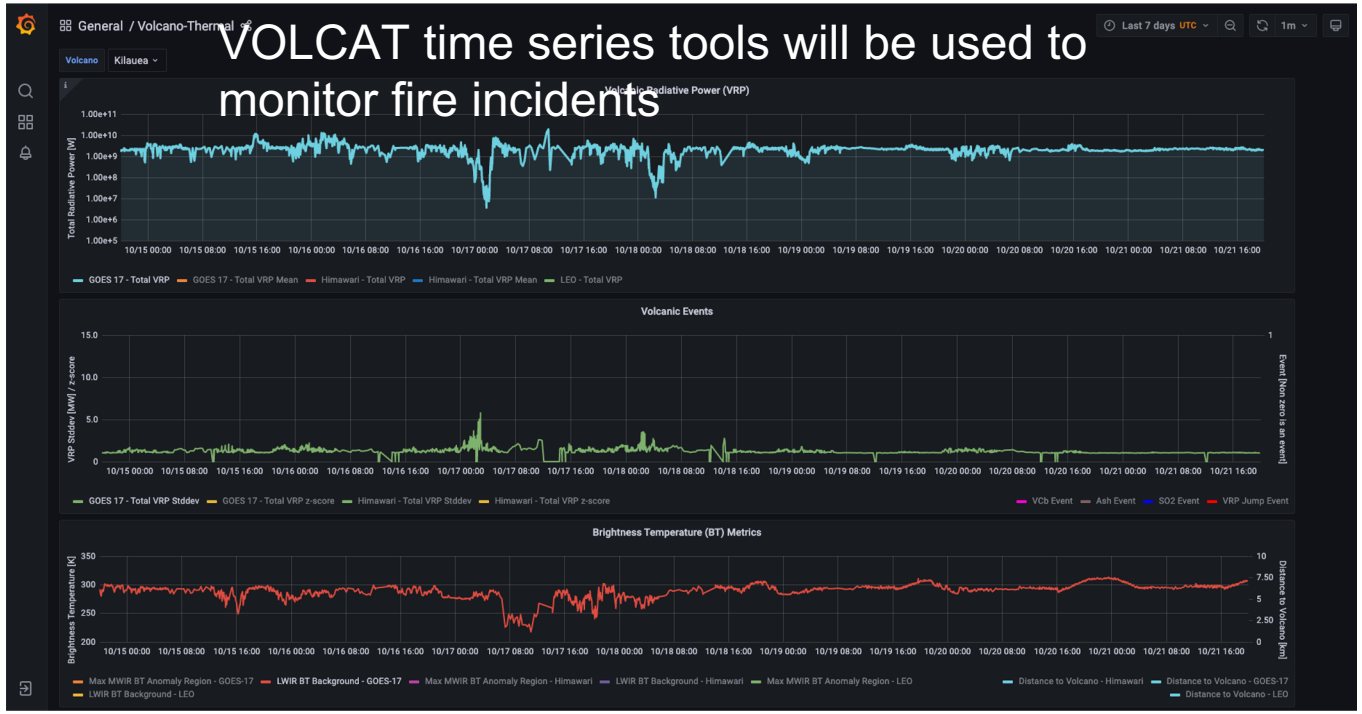


Near continuous fire intensity monitoring

By tracking fire detections over time and correcting for atmospheric attenuation (including clouds), fire radiative power (FRP) can be monitored in a near continuous manner from GEO satellites







Satellite Data Sources

Current GEO:

GOES-16 ABI

GOES-17 ABI

GOES-18 ABI

Meteosat-11 SEVIRI

Meteosat-8/9/10 SEVIRI

Himawari-8/9 AHI

GEO-KOMPSAT-2A AMI

Current LEO:

SNPP VIIRS

NOAA-20 VIIRS

Terra-MODIS

Aqua-MODIS

Metop-B AVHRR

Metop-C AVHRR

Sentinel-3a SLSTR

Sentinel-3b SLSTR

Upcoming:

GOES-U ABI

MTG-I1 FCI

JPSS-2 VIIRS

Metop-SG A1 - Metimage

WildfireSat

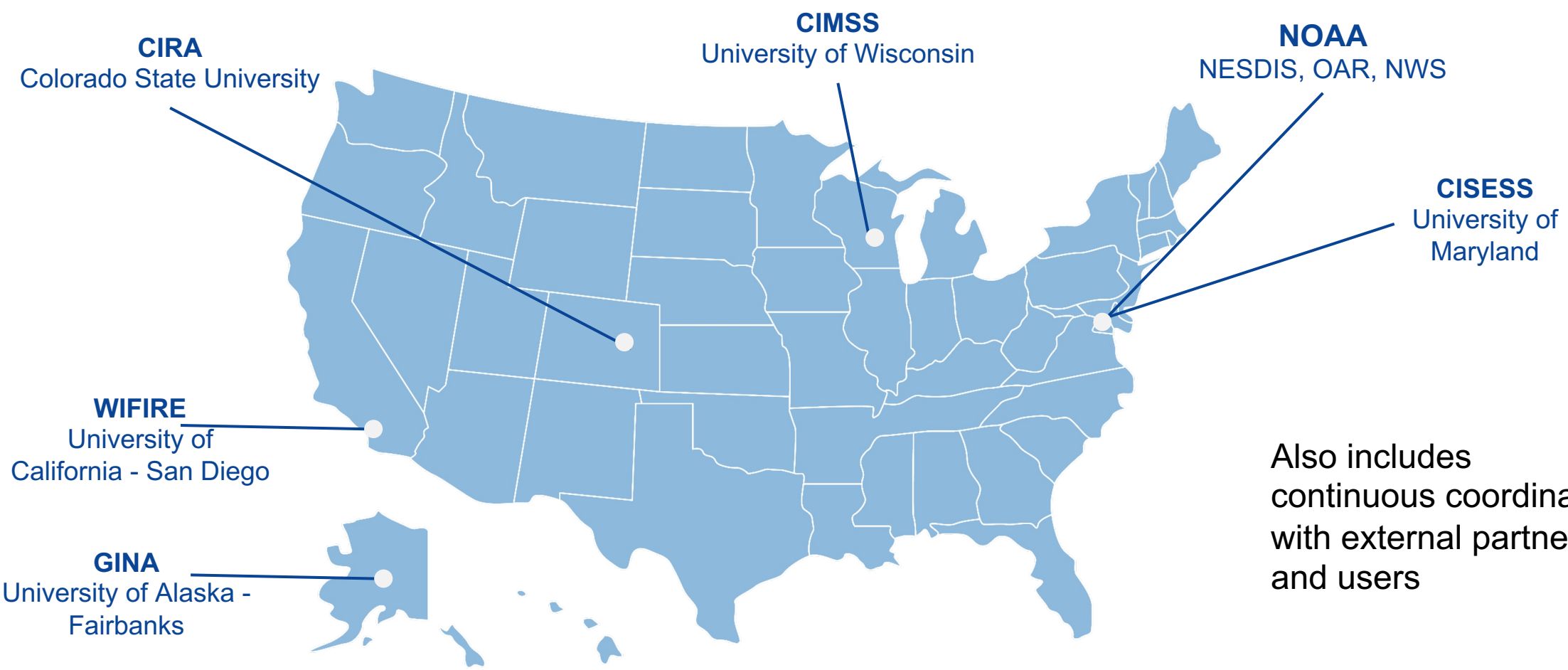
Currently supported

Will be supported in the future

Next Step: Kickoff transformation projects

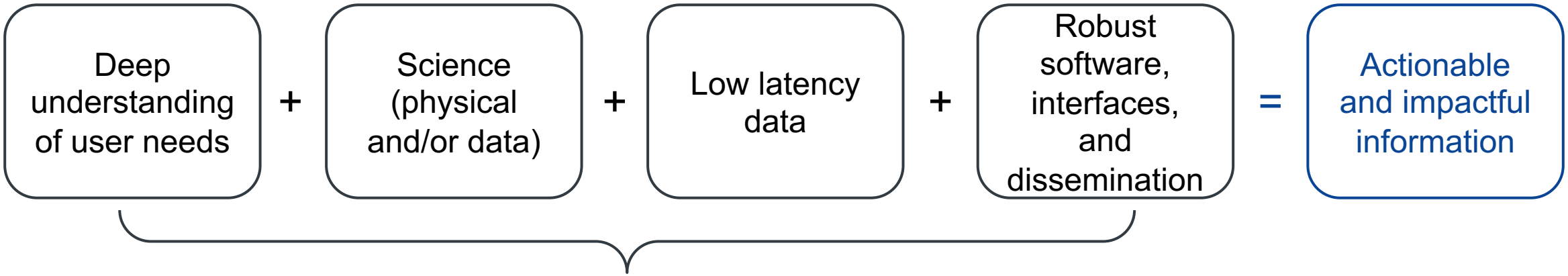
Disaster Relief Supplemental Act (2022-2024)
Infrastructure Investment & Jobs Act (2022-2025)

Fire Product & Services Transformation Team



Also includes continuous coordinate with external partners and users

Impactful Service Delivery for Time Sensitive Applications:



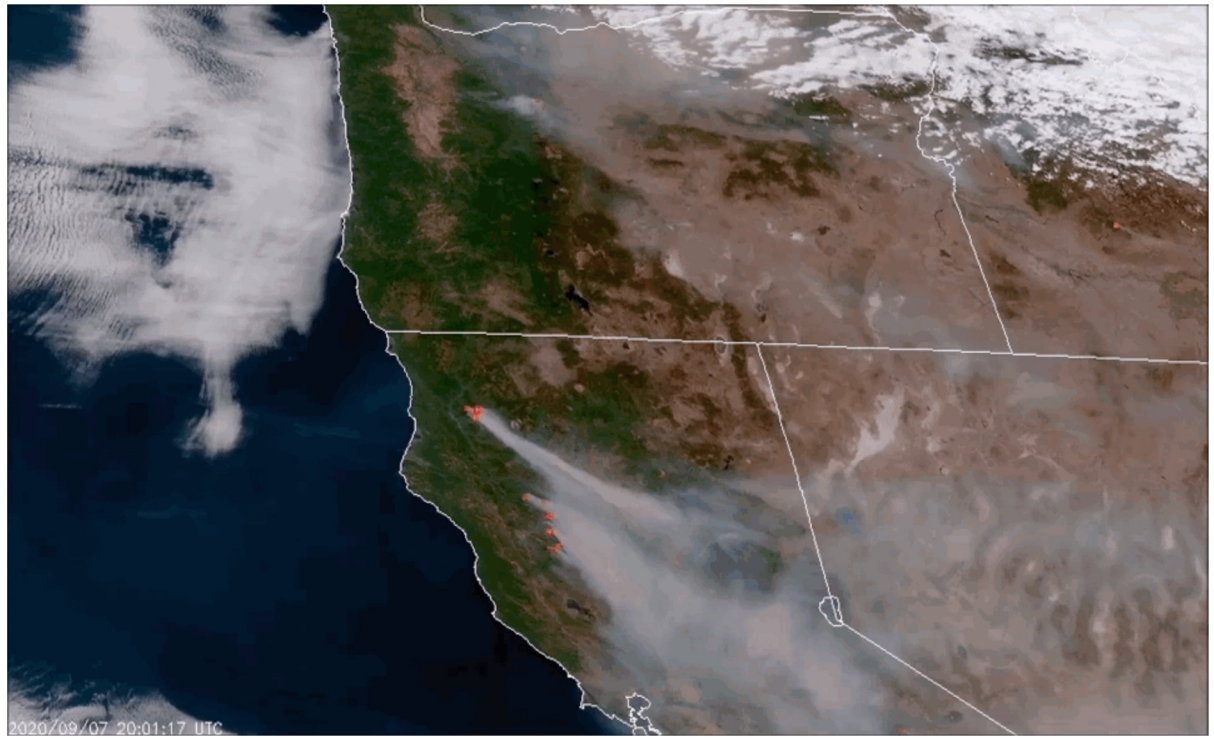
For wildfire and many other applications, each of these must be in place to achieve impact goals

Processing at direct readout sites should be part of the equation in order to realize the full potential of satellite assets

Extra Slides

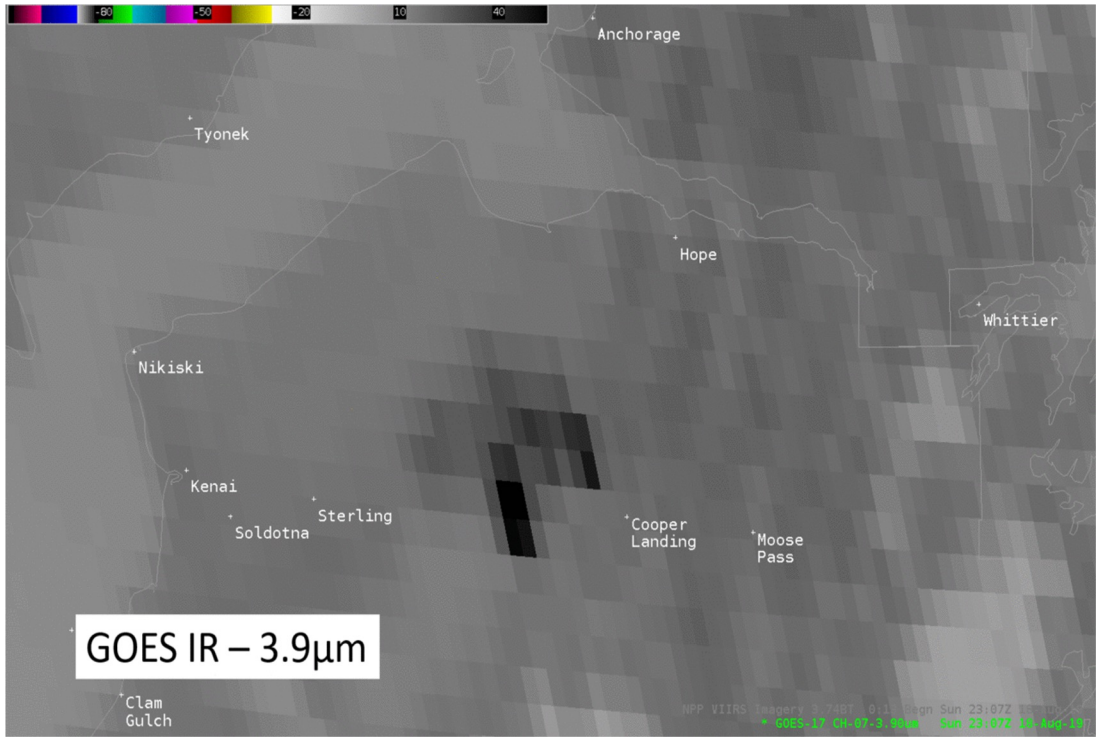
Translate: NOAA Satellite Capabilities

GOES-R Series - Geostationary



Oregon and California Fires, September 7 – 9, 2020
GOES-East and West provides nearly continuous observations of fires at a 2-3 km resolution (function of latitude ~6 km in central Alaska)

JPSS Series - Polar orbiting



Spatial resolution is important - JPSS polar orbiting satellites are particularly critical for higher latitudes - Next generation GEO-XO will improve GOES-R spatial resolution by 4X

Value of Low Latency Satellite Data

FireGuard Detection - California /Santa Barbara County
1 message

donotreply@eros.nwcg.gov <donotreply@eros.nwcg.gov>
To: Mike.Pavolonis@noaa.gov

Tue, Jun 7, 2022 at 6:05 PM

The GOES-R based fire ignition alerts often precede independent alerts from the DoD-based FireGuard system by 5-15 minutes

Hello, this email is to inform you that FireGuard has detected heat in an area where you expressed i
****PLEASE DO NOT RESPOND TO THIS EMAIL!!!!**

GACC	OSCC
Dispatch	Santa Barbara Dispatch Center
County	Santa Barbara
State	California
Coordinates	Lon: -120.0743, Lat: 34.5934
DPA/Jurisdiction	STATE
Heat Detection Acres	2.72
Temperature	77
Relative Humidity	41
Wind Speed	4.63
Wind Direction	W

Wildfire Alert Report

Date:	2022-06-07
Time:	22:55:30
Production Date and Time:	2022-06-07 22:56:45 UTC 5:57 PM
Primary Instrument:	GOES-17 ABI
Wmo Spacecraft Id:	664
Location/orbit:	GEO
L1 File:	OR_ABI-L1b-RadM1-M6C14_G17_s20221582255256_e20221582255313_c20221582255364.nc
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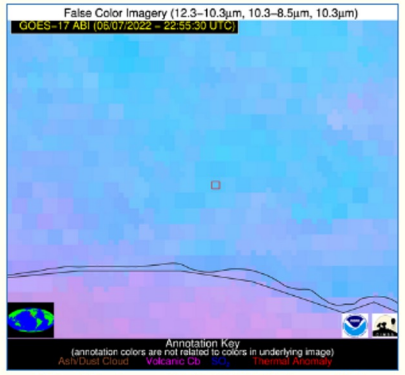

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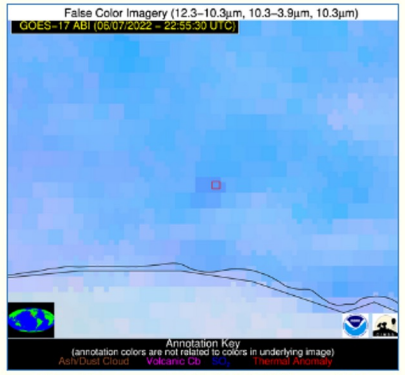

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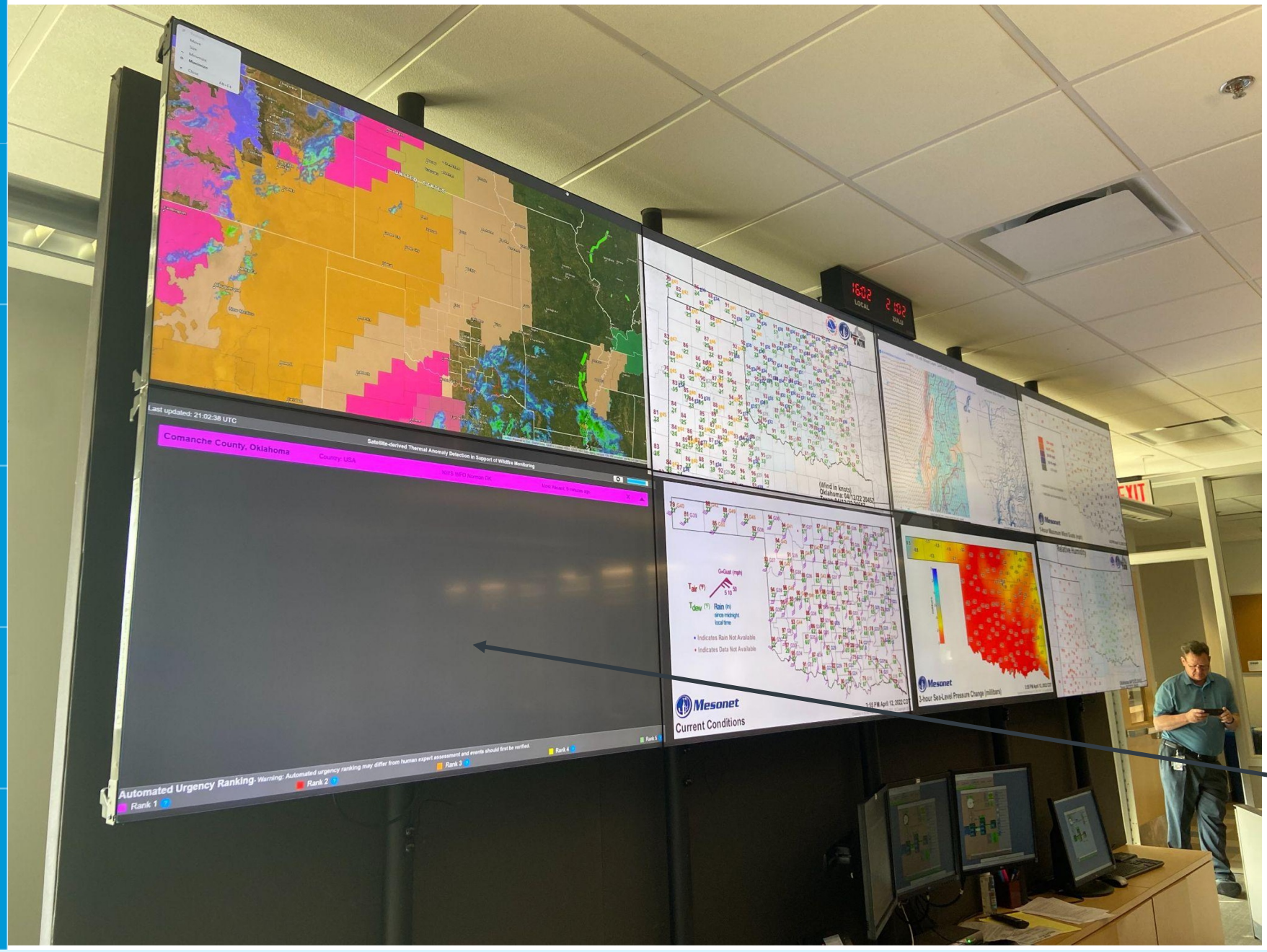
Total Radiative Power Anomaly	n/a
Total Radiative Power	30.30 MW

Show More ▲ View all event imagery »

NESDIS Value Proposition

- Deep knowledge of satellite data and a long history of fire product development
- Operational mission
- Trusted source of environmental intelligence (including transparency)
- Ability to scale capabilities
- Strong partnerships and user engagement
- Critical piece of the coordinated NOAA contribution



Committed to co-development with user community

NRT demonstrations enable effective co-development

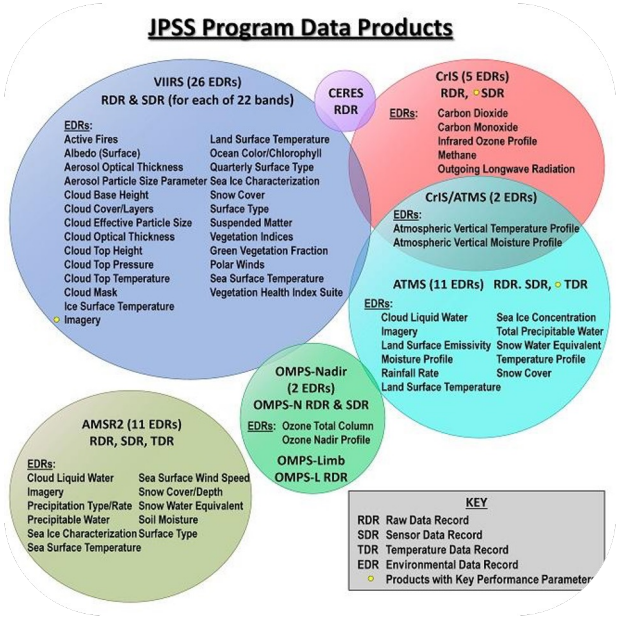
Prototype NESDIS fire ignition dashboard on the situational awareness wall at the NWS Norman, OK WFO during a wildfire outbreak day in April 2022

Product Centric Framework

Satellite Sensor and Ancillary Data

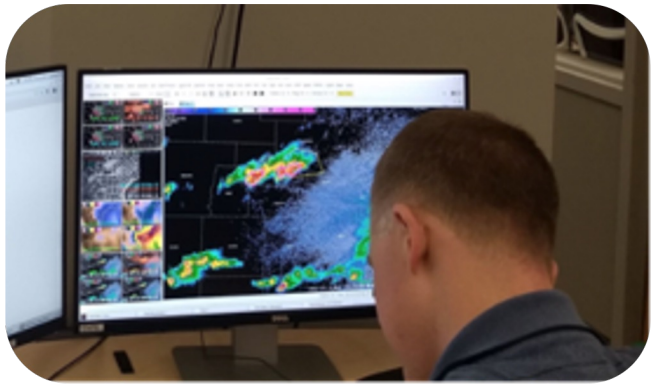
Satellite and sensor requirements are based on stakeholder needs and support a large range of applications

Data Products



Science algorithm development is primarily focused on geophysical data products with generic requirements

Product-side User Engagement



Integration of geophysical data products into user applications mainly occurs after algorithm development

Cross-cutting Impact Goals

- Provide satellite-derived information that helps improve the timeliness of the response to a new fire incident
- Enhance fire monitoring and forecasting in support of incident management
- Enable the development of improved fire emission databases and smoke forecasting models
- Streamline fire product and information access
- Better understanding of long-term fire trends and patterns
- More responsive to evolving user needs