

FIRMS US/Canada – An Extension of NASA Near Real-Time FIRMS for the Forest Service and Inter-agency Wildfire Management Community

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Background

Since the 1970s, the USFS Forest Service (USFS) has utilized NOAA satellites and satellite platforms, sensors and related systems and its limited capabilities to monitor, monitor and manage natural resources on **National Forest System (NFS)** lands, as well as lands managed by other federal agencies, and state/private lands.

USFS Active Fire Mapping Program Objectives

- Facilitate situational awareness for national and regional managers at the **USFS**, **USFS**, **USFS**, and **USFS**.
- Enable rapid response to active fires, including **USFS**, **USFS**, and **USFS**.
- Provide consistent, reliable and easy to access fire mapping products and information to inform the general public about current national fire activity.

USFS Active Fire Mapping Program Enabled by NASA Near Real-Time Capabilities

As a result of the **USFS** and **USFS** Forest Service's (USFS) Active Fire Mapping (AFM) Program in 2008, AFM ingested data provided by the **USFS** Land Remote Sensing System to generate active fire detection and imagery data products. Current active fire processing and mapping capabilities and systems processing algorithms provided by the **USFS** Forest Service's (USFS) Active Fire Mapping (AFM) Program.

FIRMS - Global

NASA's Fire Information for Resource Management System (FIRMS) was originally developed by the University of Maryland using data from NASA's Earth Observing System and the United States Forest and Agriculture Organization (USFS) and the United States Forest Service (USFS) and the United States Forest Service (USFS).

FIRMS US/Canada

To comply with agency-level department information technology (IT) requirements, the Forest Service recently upgraded its systems, satellite data processing and fire mapping data processing and production applications to a computing platform on **USFS** Cloud-based System (USFS). As a result of this upgrade, the Forest Service is also processing with **USFS** Active Fire Mapping (AFM) and **USFS** Active Fire Mapping (AFM) and **USFS** Active Fire Mapping (AFM).

ABSTRACT CONTACT AUTHOR PRINT GET POSTER

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PRESENTED AT:

AGU FALL MEETING
Online Everywhere | 1-17 December 2020

BACKGROUND

Since the 1970s, the USDA Forest Service (USFS) has utilized NASA airborne and satellite platforms, sensors and related science and technical capabilities to assess, monitor and inventory natural resources on National Forest System (NFS) lands (<https://www.fs.fed.us/ivm/>), as well as lands managed by other federal agencies, and state/private forestry lands throughout the United States. This long-term coordination between the two agencies includes numerous collaborations in support of support Forest Service research and operational efforts in the United States and with international partners.

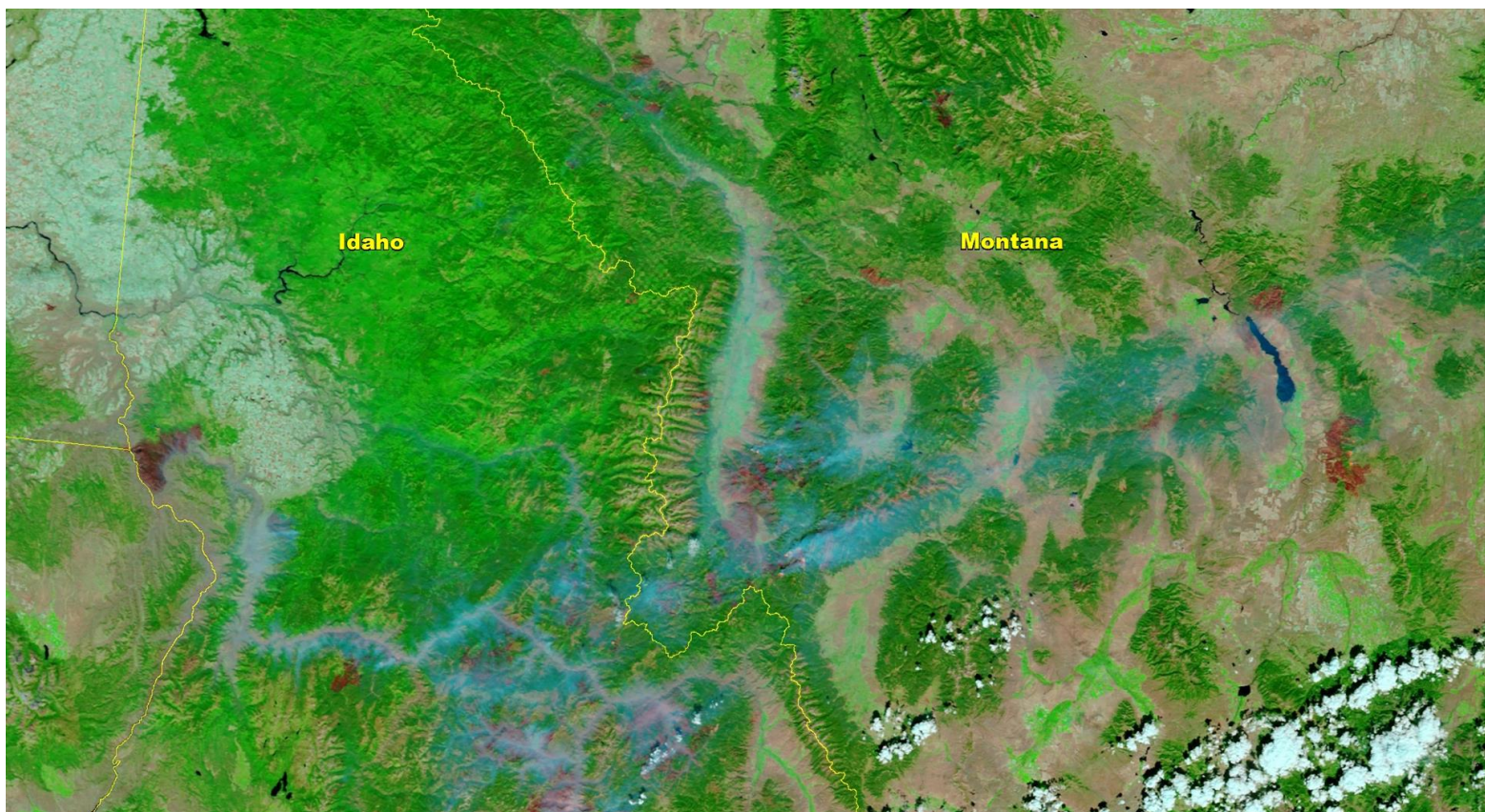


A wildfire on the Boise National Forest in southwest Idaho. Image captured on 8/27/2016. Credit: USDA Forest Service/Flickr

Wildland fires are a significant agent of disturbance in the United States and Canada, burning approximately 5.5 million hectares annually (National Incident Coordination Center, 2020 (<https://www.nifc.gov/nicc/sitreprt.pdf>) and Canadian Wildfire Information System, 2020 (<https://cwfis.cfs.nrcan.gc.ca/report>)). The Forest Service plays an essential role in coordinating national remote sensing programs for wildfire management activities. A key element of NASA/Forest Service collaboration is the use of NASA Earth observation assets to detect, monitor and characterize of wildland fire activity to support wildland fire management. The timeliness of geospatial data and information products derived from satellite observations, including availability in ready to use formats and integration into mapping and visualization applications, increases their value for wildfire management.

In 2001, mission science team members at NASA Goddard Space Flight Center (GSFC) and the University of Maryland (UMd) developed the MODIS Land Rapid Response System (https://eosps.gsfc.nasa.gov/sites/default/files/eo_pdfs/Sept_Oct01.pdf#page=8). This system processed raw data from the

operational MODIS data stream to generate higher level, science grade products on a timely basis, including satellite imagery and active fire detection data. A catalyst for the Rapid Response effort was coordination by NASA GSFC and UMD with the USDA Forest Service to deliver handcrafted imagery and active fire geospatial products during the 2000 western United States fire season, the most severe fire season on record at the time. The MODIS Land Rapid Response System soon increased its scope to support environmental monitoring, hazard assessment and decision making on a global scale.

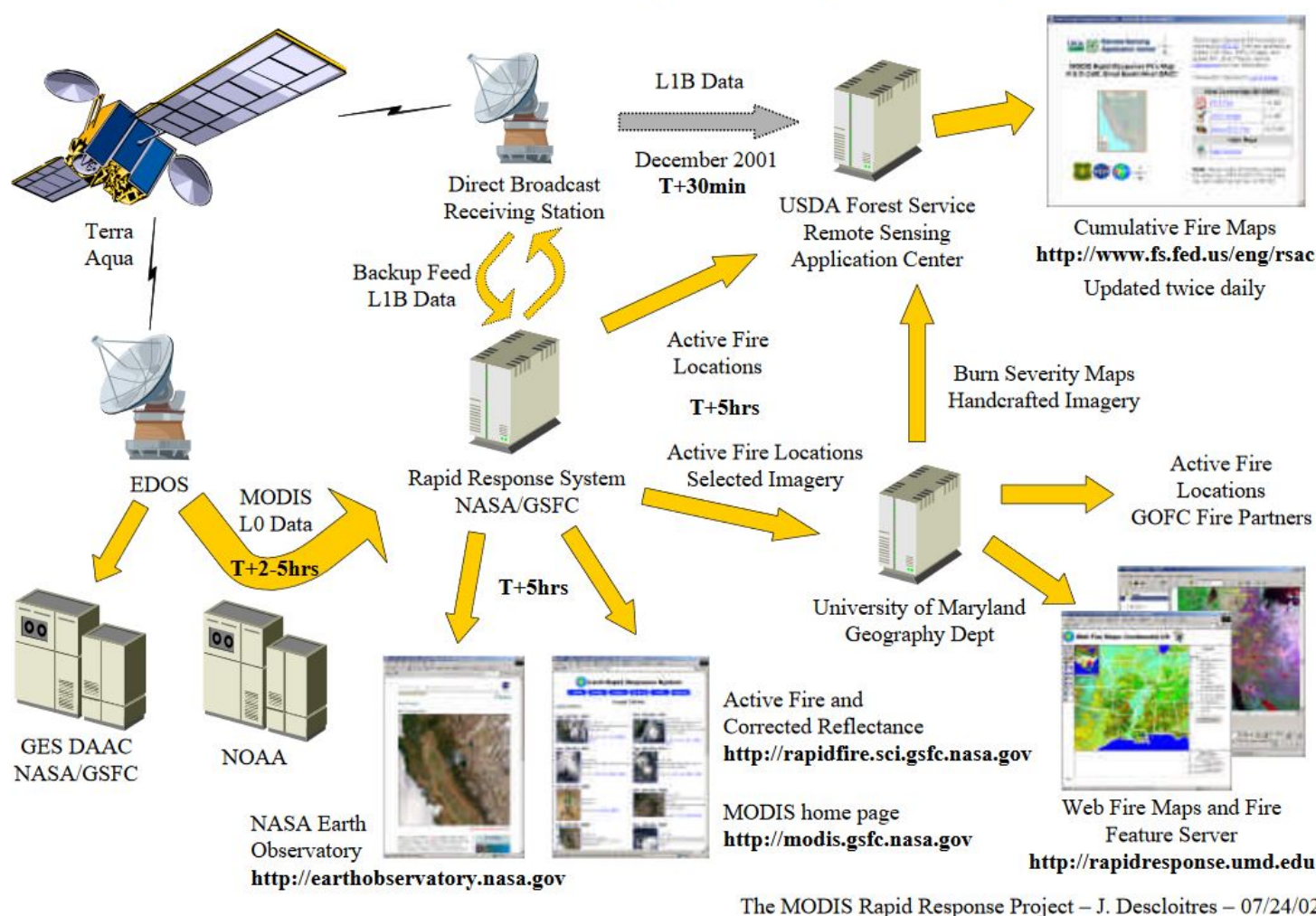


Terra MODIS false color composite image acquired on Aug 23, 2000 of wildfire activity in western Montana and Central Idaho.

USFS ACTIVE FIRE MAPPING PROGRAM ENABLED BY NASA NEAR REAL-TIME CAPABILITIES

An outcome of the MODIS Land Rapid Response System was the initiation of the Forest Service Active Fire Mapping (AFM) (<https://fsapps.nwcg.gov/afm/>) Program in 2001. AFM ingested data provided by the MODIS Land Rapid Response System to generate active fire detection and imagery data products. Direct readout data processing technologies and science processing algorithms provided by the NASA Direct Readout Laboratory, NASA mission science teams and the MODIS Land Rapid Response System have also been essential to AFM. In 2002, the Forest Service began to integrate regional Terra and Aqua MODIS direct readout data from multiple ground station partners in North America in addition to global MODIS Land Rapid Response data. This integrated data stream provided the near real-time, comprehensive satellite imagery and active fire detection data to facilitate operational AFM fire geospatial products for nearly all the US and Canada.

MODIS Rapid Response Project: Design



Conceptual design diagram of the MODIS Land Rapid Response System (Descloitres et al., 2002)

(https://www.researchgate.net/publication/224723850_The_MODIS_rapid_response_project)

Over the subsequent years, AFM has continued to leverage NASA near real-time data processing and delivery capabilities. In 2011, the NASA Land, Atmosphere, Near Real-Time Capabilities for EOS (LANCE) (<https://earthdata.nasa.gov/earth-observation-data/near-real-time>) assimilated the MODIS Rapid Response System into its system operations. LANCE delivers a suite of low latency land and atmosphere science products (3 hours or less after observation) derived from global observations provided by 10 NASA EOS satellite platforms, including Terra and Aqua MODIS and S-NPP and NOAA-20 VIIRS. To enhance

the ability of global users to access and visualize near real-time MODIS and VIIRS active fire detection data, in 2012 LANCE assimilated the NASA Fire Information for Resource Management System (FIRMS) (<https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms>). Since the inception of FIRMS, the Forest Service AFM Program has continued to leverage both FIRMS and direct readout sources of imagery and active fire data from MODIS and VIIRS to meet operational requirements.

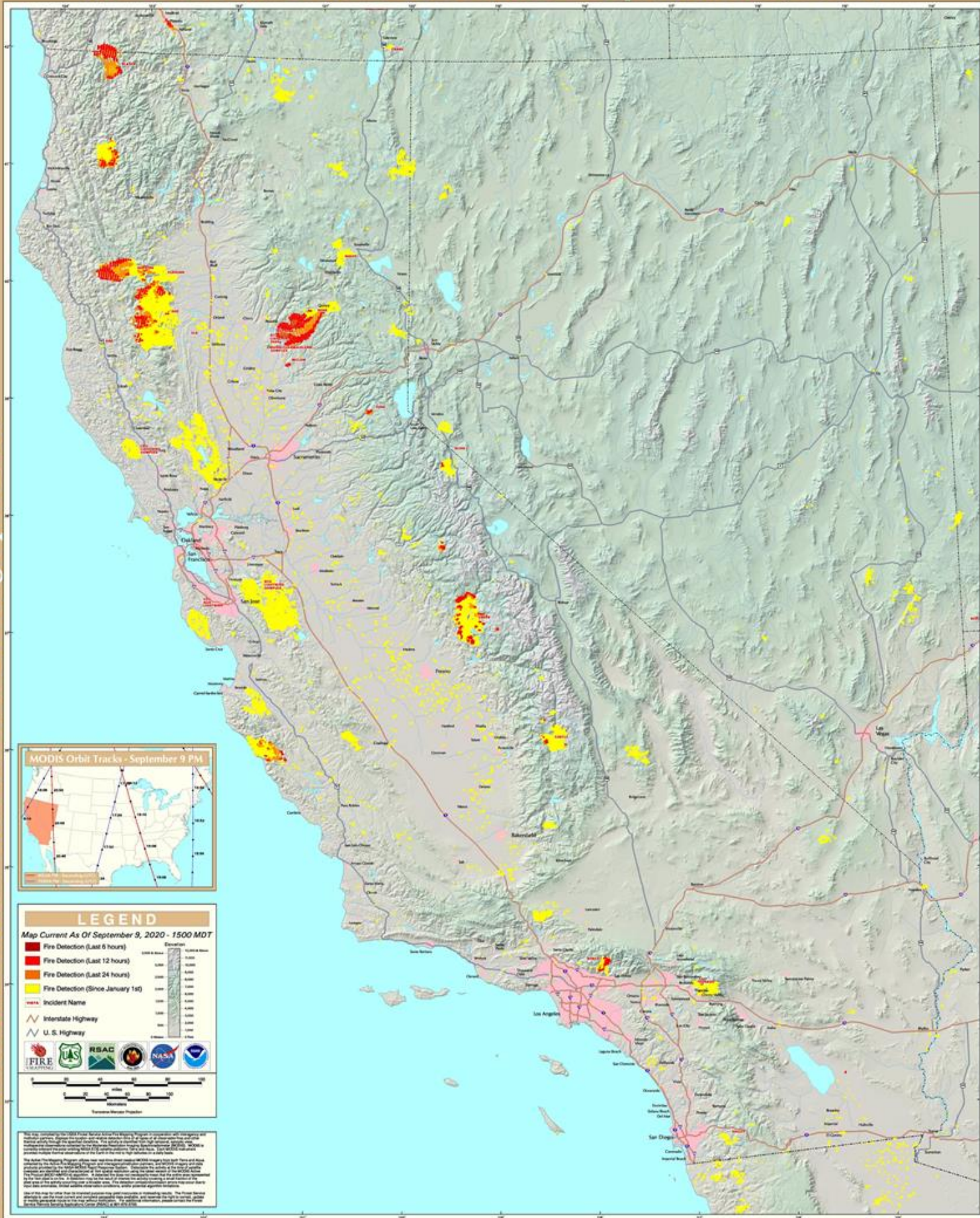
USFS ACTIVE FIRE MAPPING PROGRAM OBJECTIVES

AFM provides value-added geospatial fire products depicting the location, extent, intensity and impacts of wildfire activity at a regional/national scales. Primary objectives of the AFM Program data and products include:

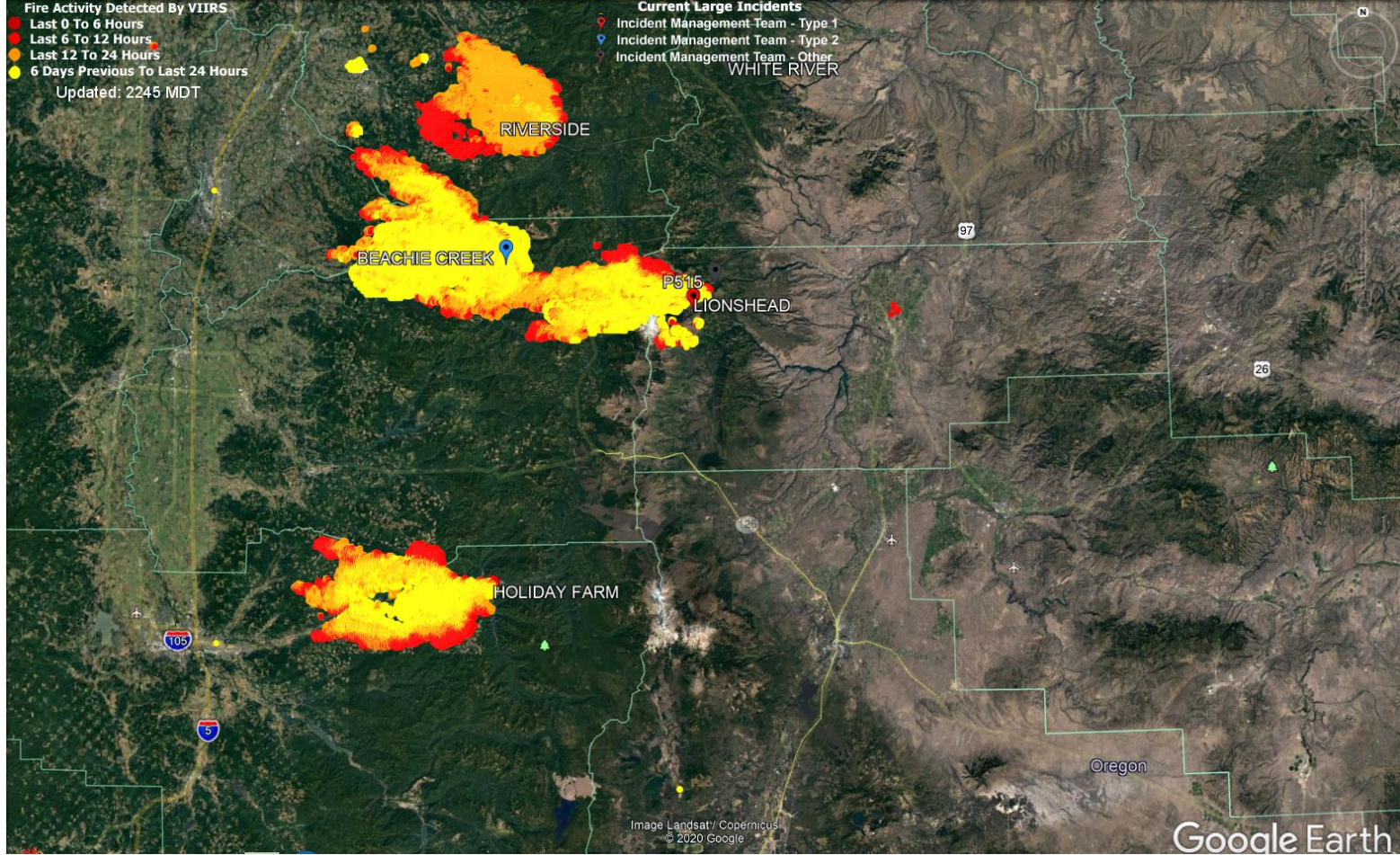
- Facilitate situational awareness for national and regional managers at the National Incident Coordination Center (NICC) (<https://www.nifc.gov/nicc>) and Geographic Area Coordination Centers (GACCs) (<https://gacc.nifc.gov/>) and inform strategic planning and response decisions.
- Focus and plan daily airborne infrared imaging flights conducted by the National Infrared Operations (NIROPS) (<https://fsapps.nwcg.gov/nirops>) unit to support tactical scale fire mapping of incidents.
- Deliver essential data for spatial modeling and data analytics within operational fire management applications, such as Wildland Fire Decision Support System (WFDSS) (https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml).
- Provide consistent, reliable and easy to consume fire mapping products and information to inform the general public about current wildland fire activity.

MODIS Active Fire Detections - September 9, 2020

California North/South & Great Basin West Geographic Area



California/Nevada MODIS active fire detection map. Sept 9, 2020



VIIRS active fire detection data for western Oregon on Sept 9, 2020 presented KML format.





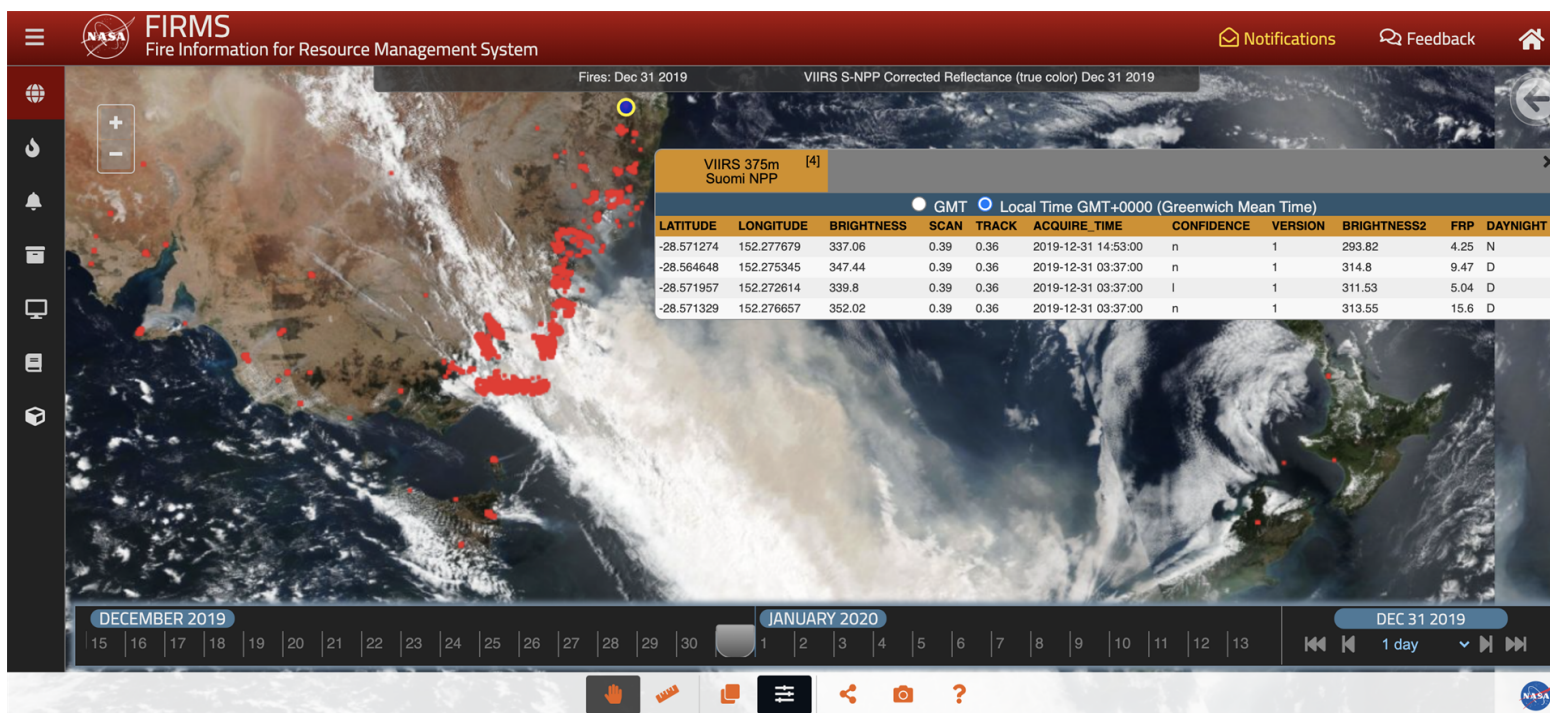
Aqua MODIS True Color Composite for Sept 9, 2020

FIRMS - GLOBAL

NASA's Fire Information for Resource Management System (FIRMS (<https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms>)) was originally developed by the University of Maryland using funds from NASA's Applied Sciences program and the United Nations Food and Agriculture Organization. FIRMS is now part of LANCE (<https://earthdata.nasa.gov/earth-observation-data/near-real-time>) and distributes Near Real-Time (NRT) active fire data within 3 hours of satellite observation from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Terra and Aqua satellites and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the joint NASA/NOAA Suomi National Polar orbiting Partnership (Suomi NPP) and NOAA-20 satellites.



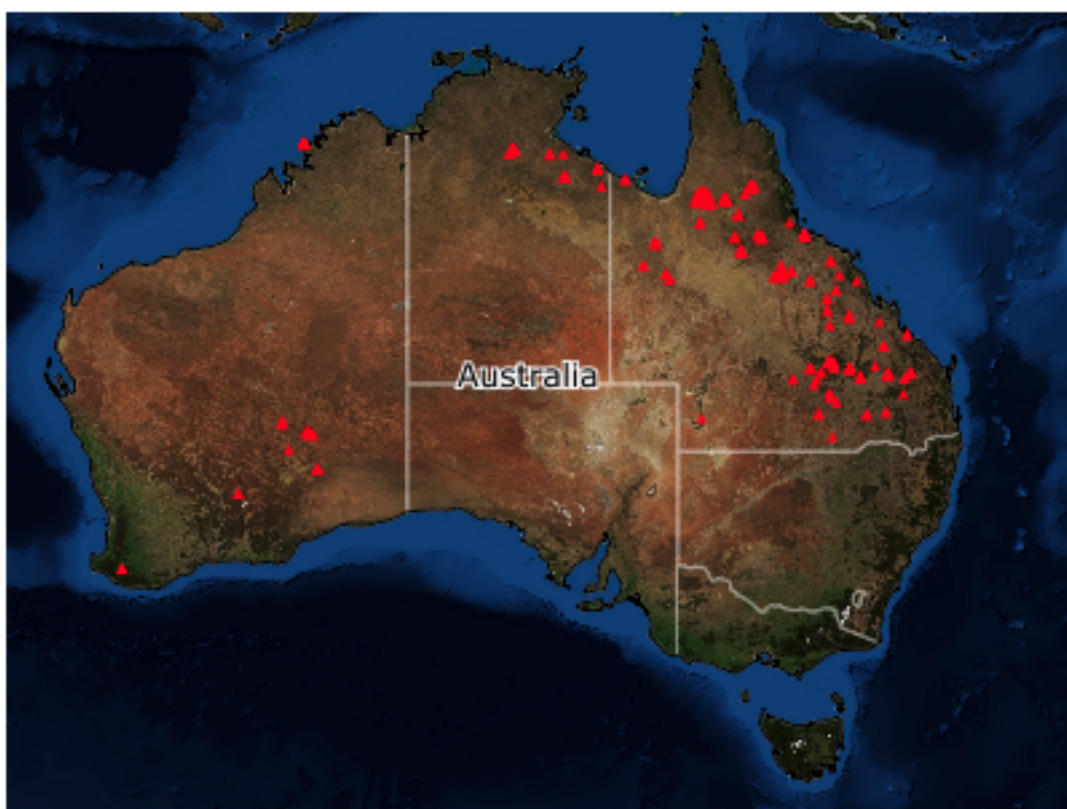
Global active fire/hotspot data are made available through a Fire Map interface (above) as well as in email alerts, webservice and SHP, KML and TXT files.



NASA FIRMS: Fire Email Alert

786 fires/hotspots detected during the most recently processed satellite overpass

(lat:-41.60, lon:111.20, lat:-12.90, lon:158.60)



[View map image on NASA FIRMS server](#)

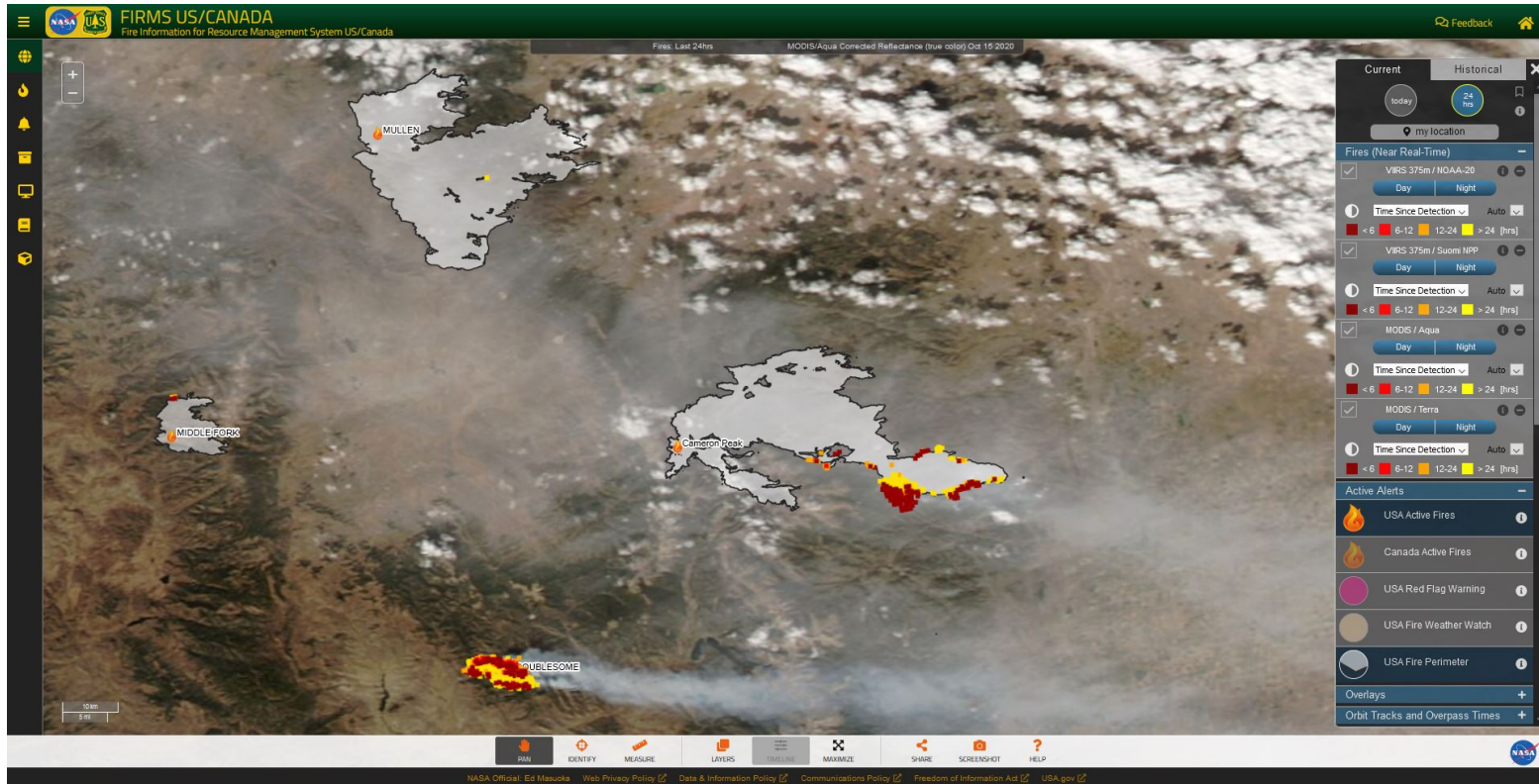
NOTE: Cloud cover might obscure active fire detections.

This email was generated on 2020-11-22 18:24:03 UTC

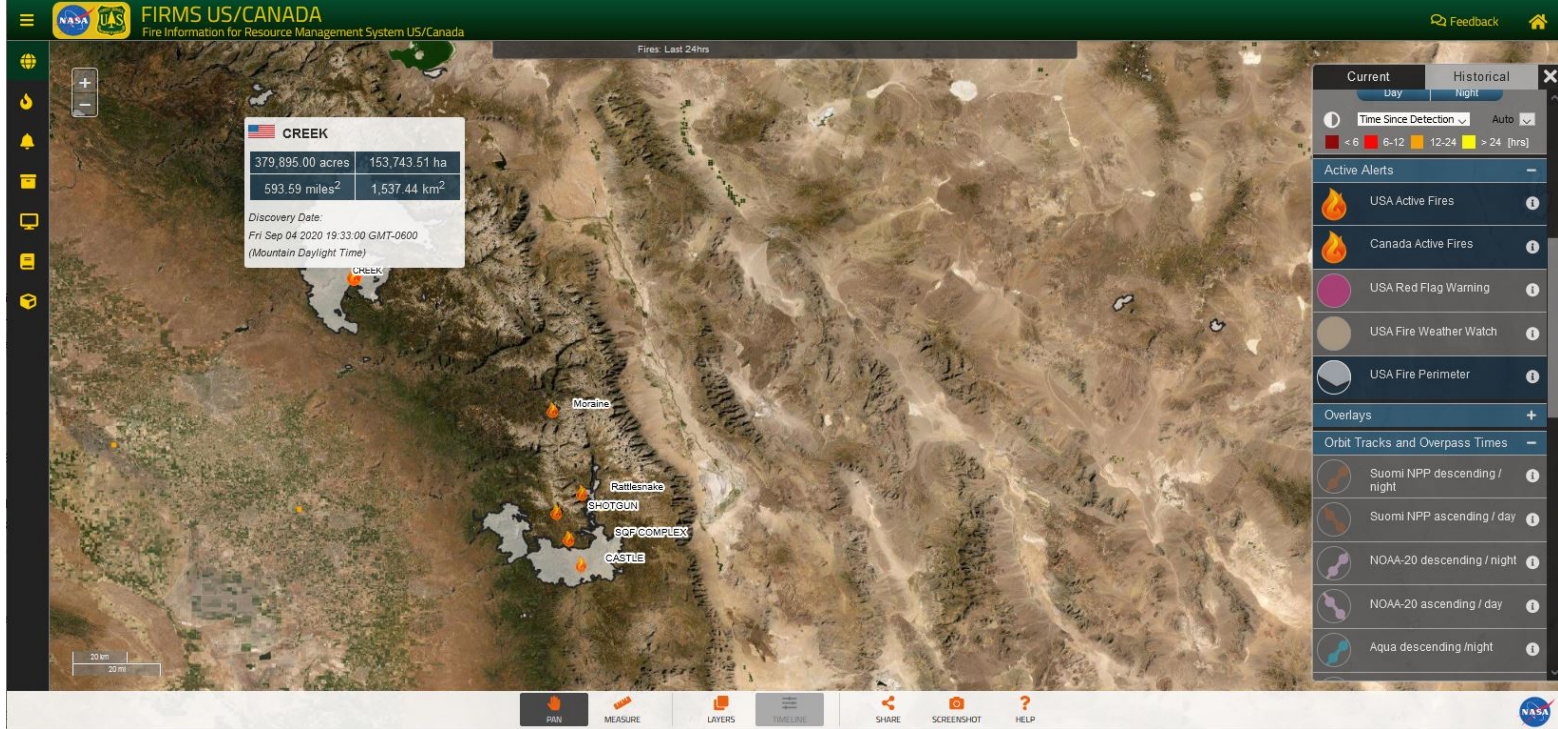
NASA FIRMS Data Source: VIIRS 375m S-NPP

FIRMS US/CANADA

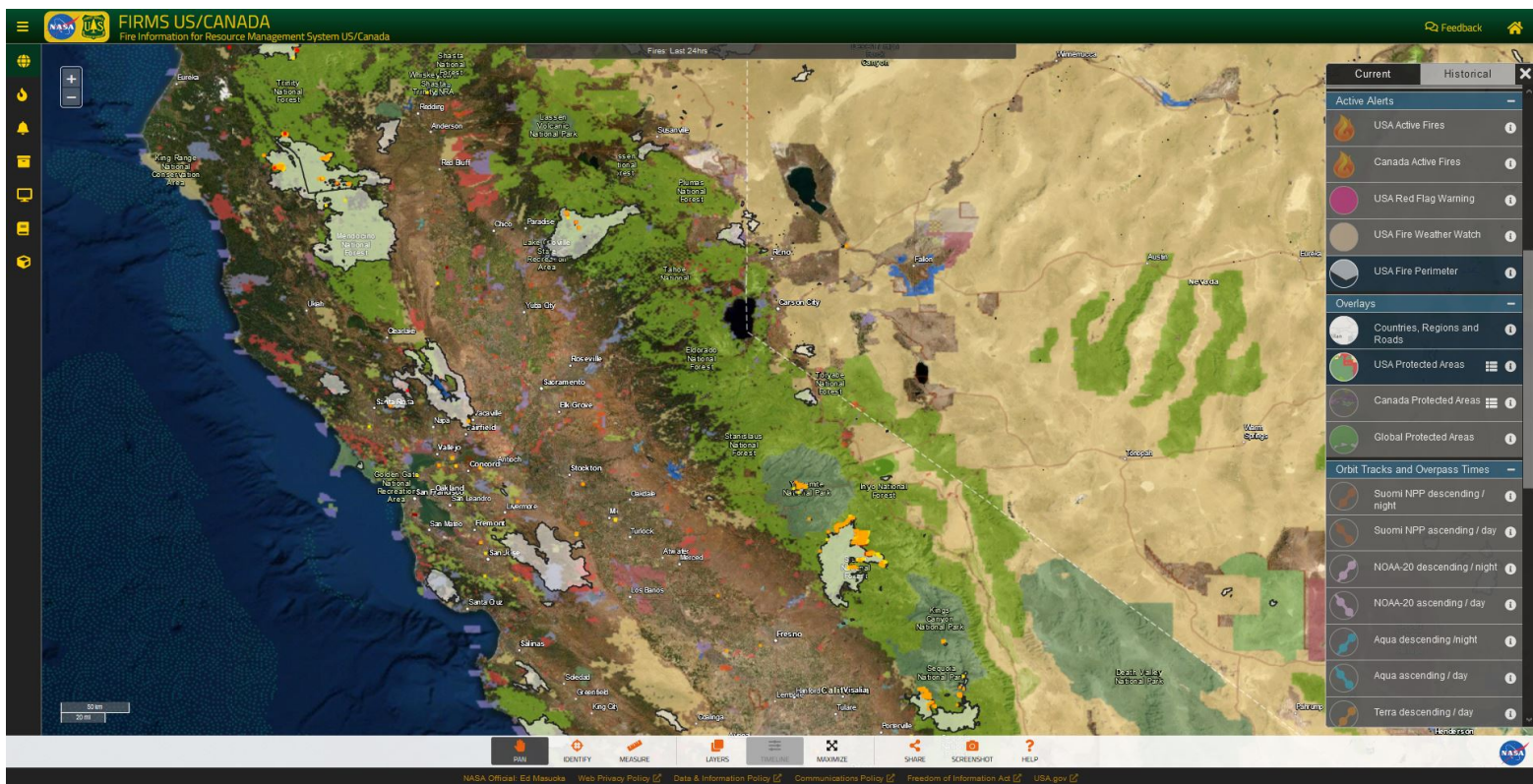
To comply with agency and department information technology policy requirements, the Forest Service recently migrated its upstream satellite data processing and fire mapping data processing and production applications to a computing platform at NASA Goddard Space Flight Center. As a subsequent step to the platform migration, the Forest Service is also partnering with NASA to optimize and modernize its ability to disseminate near real-time active fire detection data products, imagery and related science data products. This effort involves the migration of the current AFM website capabilities for fire data/product and imagery dissemination and mapping/visualization into an enhanced FIRMS-like framework known as FIRMS US/Canada. The initial release of FIRMS US/Canada is planned for early CY2021 and, in addition to current FIRMS capabilities, it will include the following additional fire map viewer contextual layers and enhancements:



- Additional capability to render active fire data such as time since detection to depict active fire fronts, etc.

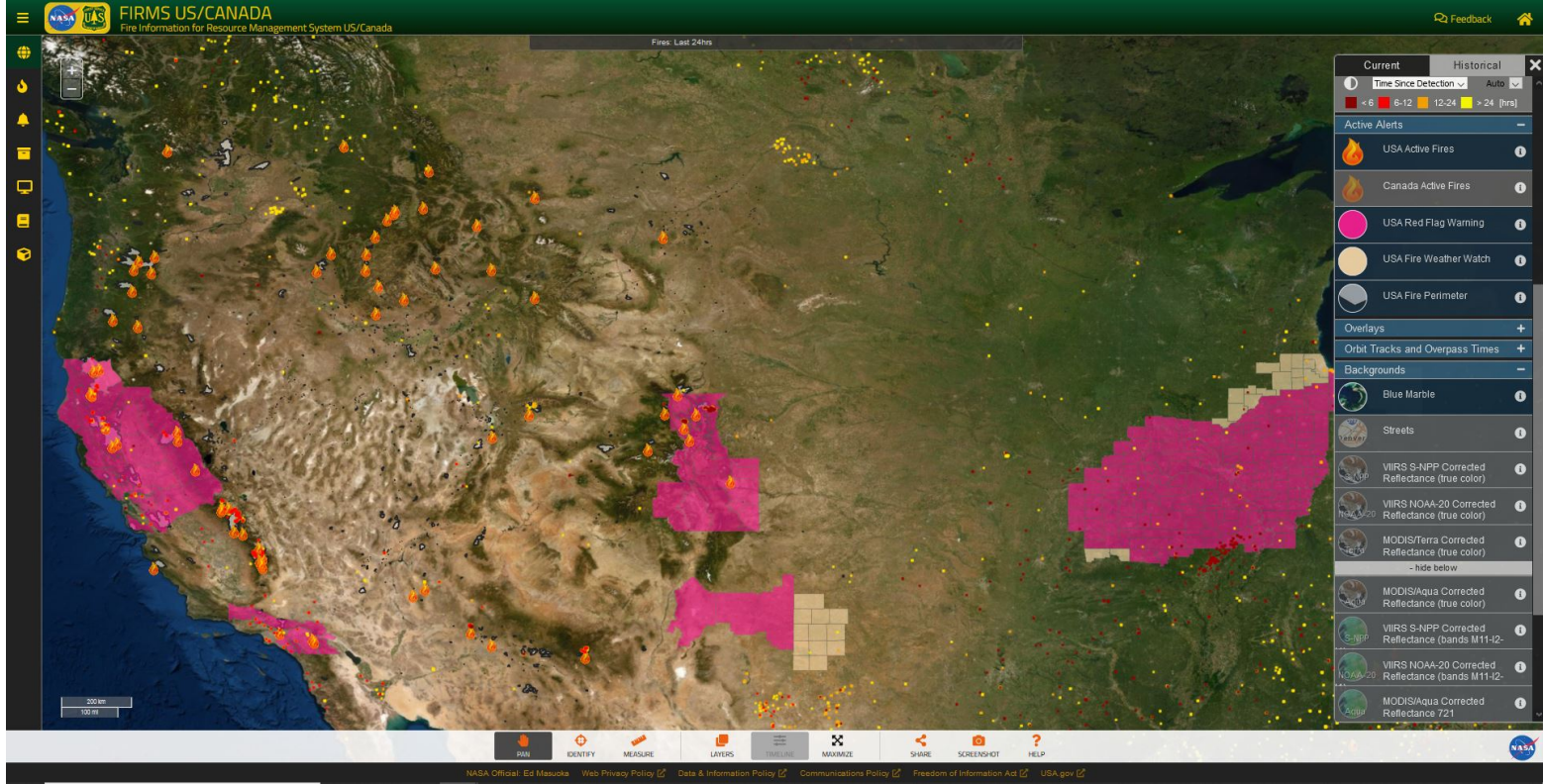


- Current US and Canada large incident locations and information



- US and Canada administrative ownership boundaries

- Daily fire danger forecasts



- Current NWS fire weather watch/red flag warning areas

Additional enhancements for this Phase 1 release are also being integrated to web mapping services and time enabled web mapping services, and downloadable active fire data sets and virtual globe products, for MODIS and VIIRS active fire detection data. Linkages to existing NASA tools for generating imagery subset products (WorldView Snapshots (<https://wvs.earthdata.nasa.gov/>)) and Global Imagery Browse Services (GIBS) (<https://earthdata.nasa.gov/eosdis/science-system-description/eosdis-components/gibs>) imagery web services will also be integrated.

Future Plans

The Forest Service and NASA are planning Phase 2 enhancements to be implemented in the FIRMS US/Canada fire mapping framework after its initial release in early CY2021. The team is also coordinating with NASA LANCE to investigate new enhancements that will benefit both FIRMS and LANCE users in general. These enhancements include integrating MODIS and VIIRS land and atmosphere direct readout data products to increase the timeliness of these data for low latency users. Additionally, in an effort to enable additional daily fire detection coverage and extend the continuity of current detection capabilities, the team is also actively investigating the integration of additional near real-time active fire detection data products from other satellite assets. These and other planned enhances would be introduced into both the global and US/Canada versions of FIRMS.

ABSTRACT

As a part of broader, long time collaboration efforts between the two agencies, the USDA Forest Service has partnered with NASA for nearly 20 years to leverage near real-time MODIS and VIIRS fire products to support wildfire management. The timely availability of these data to the Forest Service and interagency partners indicate the location, extent, intensity and impacts of wildfire activity at a regional/national scale as well as informs decisions by fire managers regarding strategic planning and response to wildfire incidents.

Historically, Forest Service use of MODIS and VIIRS fire data products has included coordinating with multiple ground station partners in North America to collect direct broadcast data and use data processing technologies and science processing algorithms provided by the NASA Direct Readout Laboratory to produce near real-time data for those regional areas. The derived data were integrated at the Forest Service to produce and disseminate operational value-added fire geospatial products to the user community. In this automated workflow, direct readout data were also complemented with low latency active fire detection data available from the NASA Fire Information for Resource Management System (FIRMS) to overcome direct readout coverage limitations and routine anomalies associated with satellite direct broadcast data.

The Forest Service has recently migrated its operational fire mapping framework for the U.S. and Canada, the Active Fire Mapping Program, to NASA Goddard Space Flight Center. As part of this effort, the Forest Service is partnering with NASA to integrate and leverage FIRMS tools and capabilities. FIRMS US/Canada is a customized version of FIRMS to disseminate operational fire data, mapping and visualization products for the US and Canada in near real-time. The web-based application integrates additional near real-time science data products provided by NASA Land, Atmosphere for Near Real-Time capabilities for EOS (LANCE) and other cooperators, includes additional geospatial data layers for context and interpretation, as well as additional functionality and tools. This presentation is an overview of the FIRMS US/Canada effort planned for formal release in 2021.