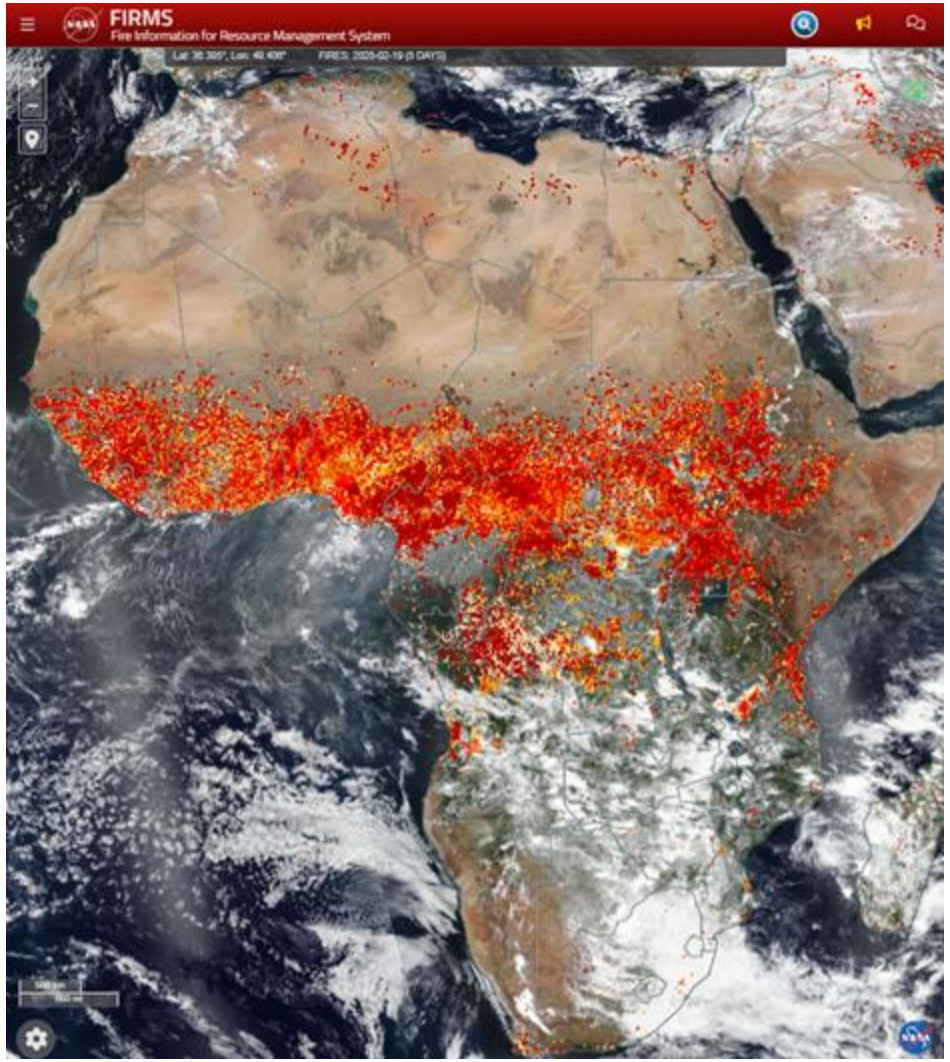
Fire Information for Resource Management System (FIRMS)

Fire Information for Resource Management System (FIRMS)

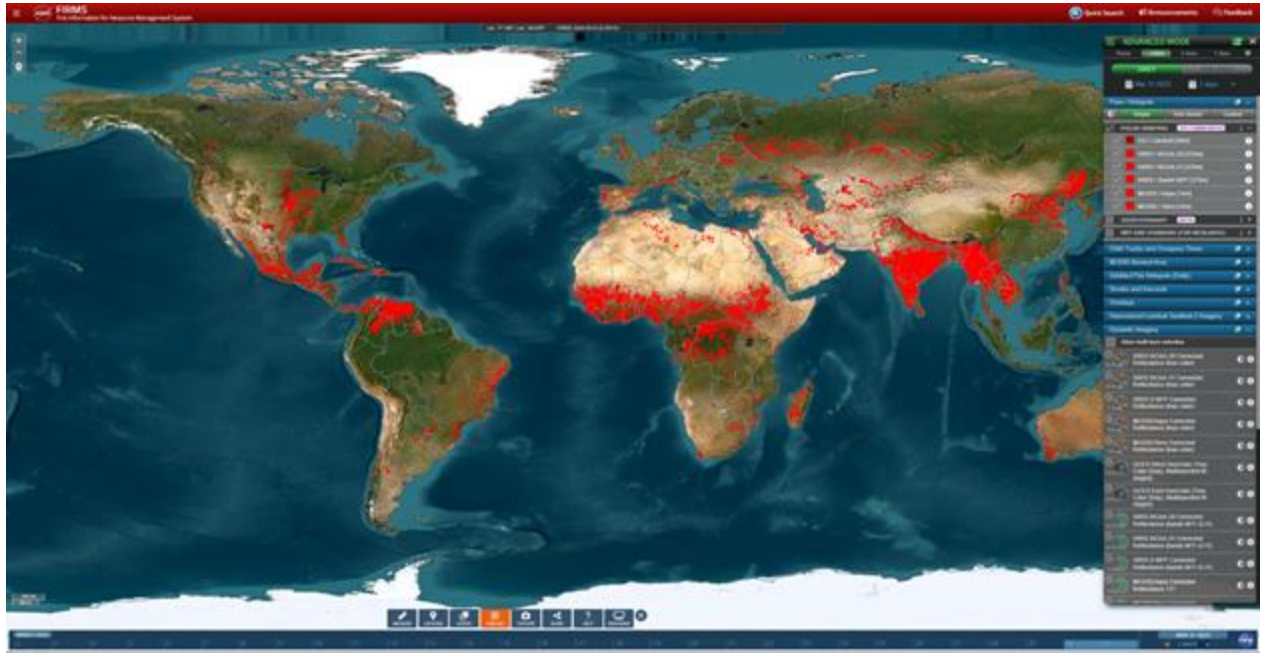
- FIRMS Website

- Provides multiple sources of time sensitive derived active fire detection data products and satellite imagery.
- Objectives:
  - Provide global, low-latency satellite imagery and active fire products from multiple missions.
  - Monitor fire location, extent, intensity, environmental effects, and support emergency response.
  - Support science-based decisions through standardized interfaces for operational users and researchers.



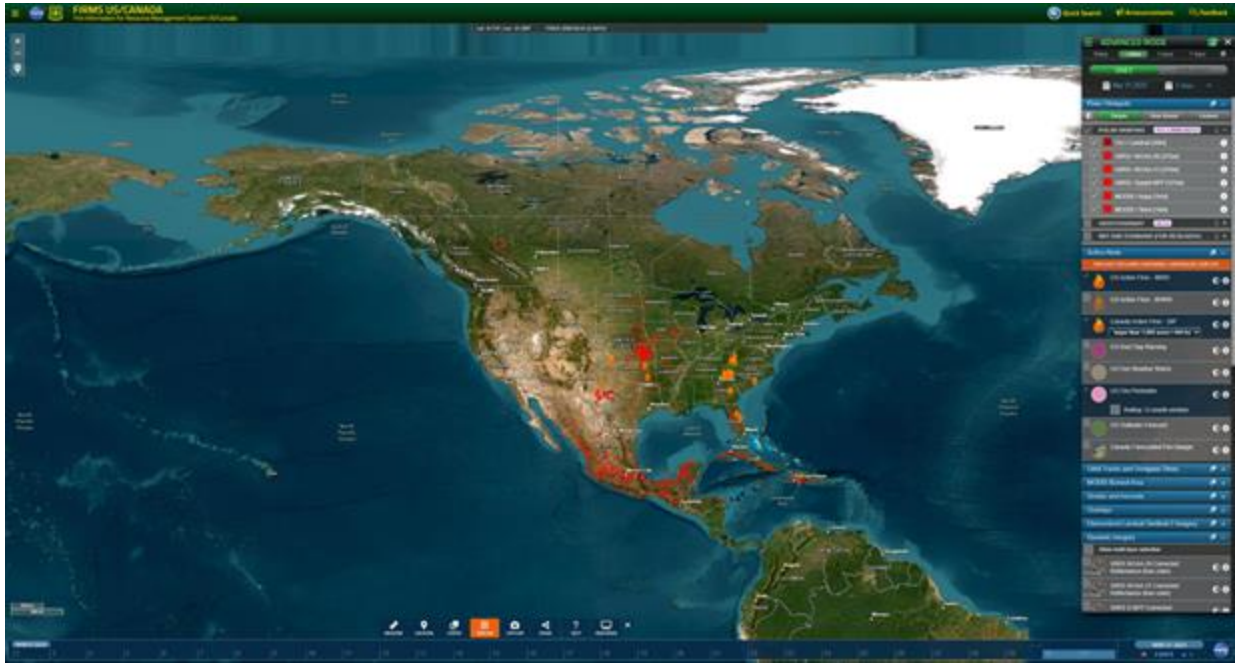
FIRMS – Global

- FIRMS Global
- Low-latency imagery and active fire detection products for the world
- Developed by University of Maryland in early 2000s and used data from MODIS
- Transitioned to NASA's Land, Atmosphere Near real-time Capability for Earth observation (LANCE) in 2012



FIRMS – US/Canada

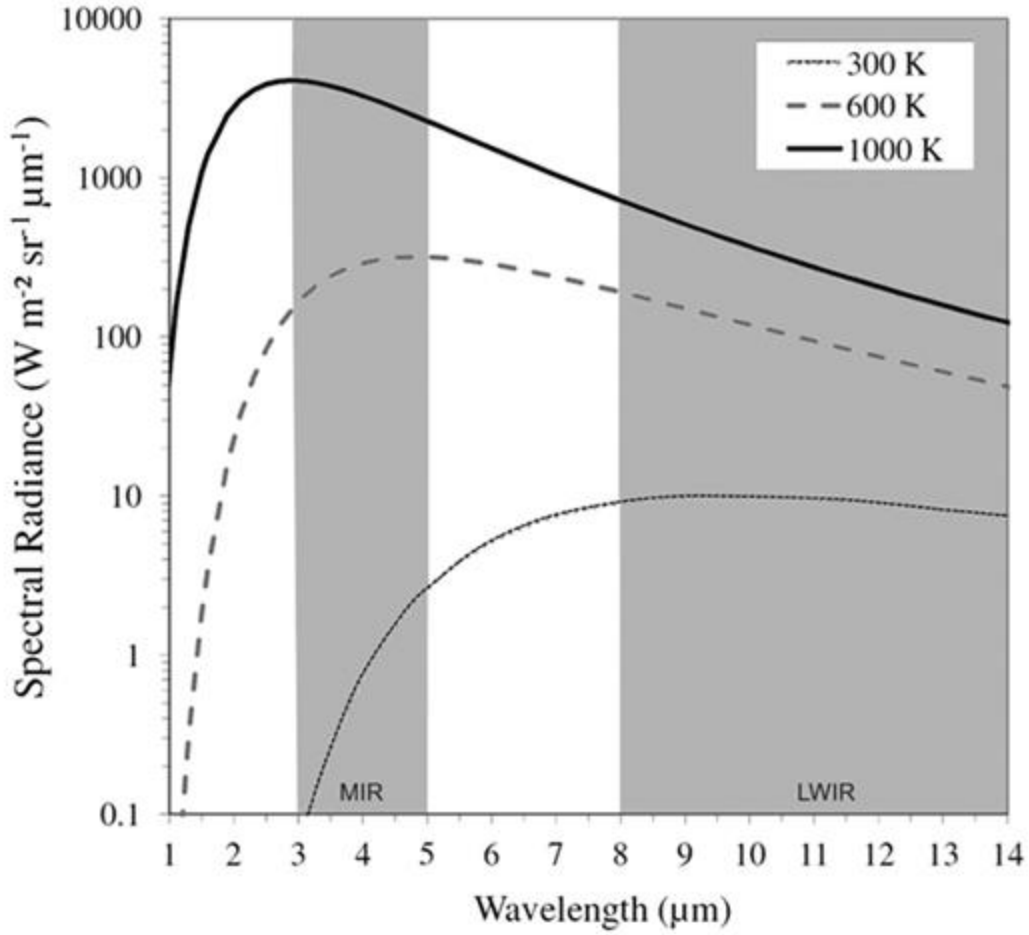
- FIRMS US/Canada
- Low-latency imagery and active fire detection products for the US & Canada
- Developed in partnership with USDA Forest Service
- Extension of the Forest Service's Active Fire Mapping Program developed in 2001 that used data from MODIS and direct broadcast/direct readout
- Integrated with FIRMS Global within NASA LANCE in 2021



Satellite-Based Detection of Fires

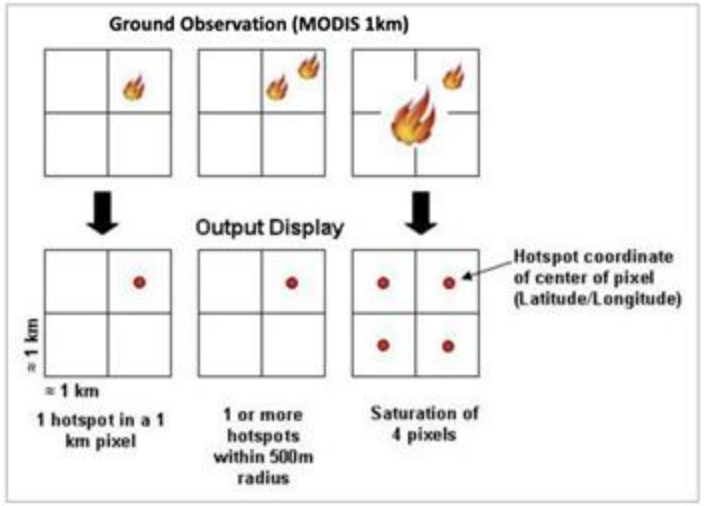
How is a fire detected by satellite?

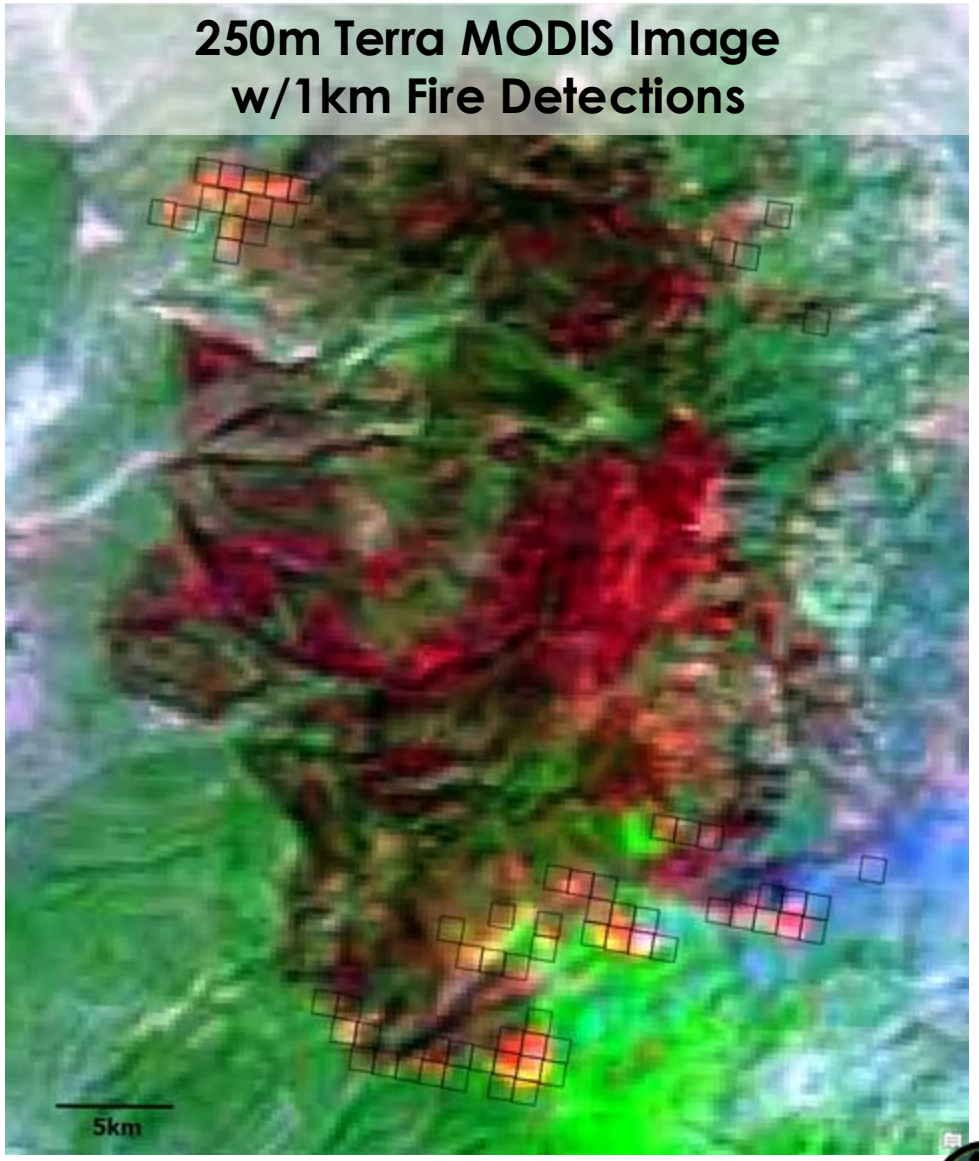
- Satellites detect fires at the time of observation or overpass.
- Specific reflective and emissive bands located on the satellite sensor are used to detect fires.
  - Leverage response from fires in Mid-Wave InfraRed (MWIR) and Long-Wave (LWIR) bands
  - Other bands used for masking, rejection of false positives, etc.
- Typical Temperatures:
  - Earth's Surface: ~300K
  - Smoldering Fires: 600K to 800K
  - Flaming Fires: ~1000K and Higher



What does a detection mean on the ground?

- Driven by the characteristics of the fire.
- Detected fire activity is often less than the pixel size.
  - Small or large, intense fire(s)
  - Less intense fire burning over a broader area
- Pixel size for fire detection data is determined by sensor spatial resolution.
- Detection coordinates are the center of a pixel containing fire activity.





What sizes/types of fires can be detected by satellite?

- Sensor Spatial Resolution
- Fire Size/Intensity
  - MODIS (1000m)
    - ~1,000m^2 smoldering to flaming fires in good conditions (day)
    - ~100m^2 flaming fire in good conditions (day)
  - VIIRS I-Band (375m)
    - ~100m^2 smoldering to flaming fires in good conditions (day)
    - ~20m^2 flaming fire in good conditions (day)
    - ~2m^2 flaming fire in good conditions (night)
  - Landsat OLI (30m)
    - ~10-20m^2 smoldering to flaming fires in good conditions (day)
    - ~4m^2 flaming fire in good conditions (day)
    - ~1m^2 flaming fire in good conditions (night)
- Algorithms and products are not perfect!

Schroeder et al., 2016

Schroeder et al., 2014

Schroeder & Giglio, 2017

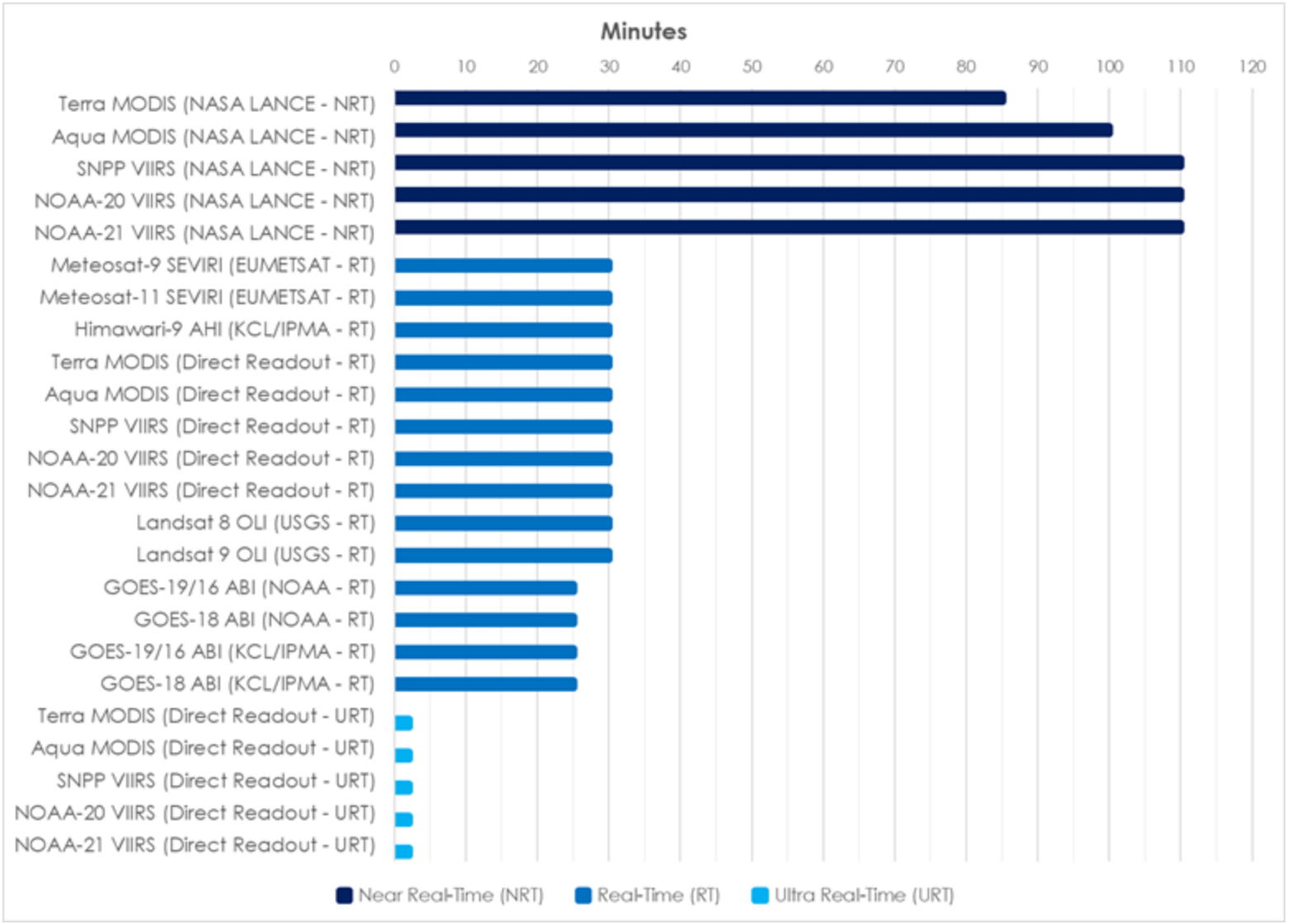
Summary of Satellite Data Product Availability in FIRMS

Satellite - Sensor	Active Fire	True Color Composite Imagery	False Color Composite Imagery	DNB Imagery	DNB/IR Composite Imagery	Burned Area	Vegetation Indices	Aerosol Indices	Snow Cover
GOES-16 ABI									
GOES-18 ABI									
Meteosat-9 SEVIRI									
Meteosat-11 SEVIRI									
Himawari-9 AHI									
Terra MODIS									
Aqua MODIS									
S-NPP VIIRS									
NOAA-20 VIIRS									
NOAA-21 VIIRS									
Sentinel-3A SLSTR									
Sentinel-3B SLSTR									
Landsat 8 OLI									
Landsat 9 OLI									
Sentinel 2A MSI									
Sentinel 2B MSI									

Available – Provided in FIRMS	Available – Planned to Include in FIRMS	Available – Not Planned to Include in FIRMS	Available – Not Provided in FIRMS	Not Available

Active Fire Detection Data Latency in FIRMS

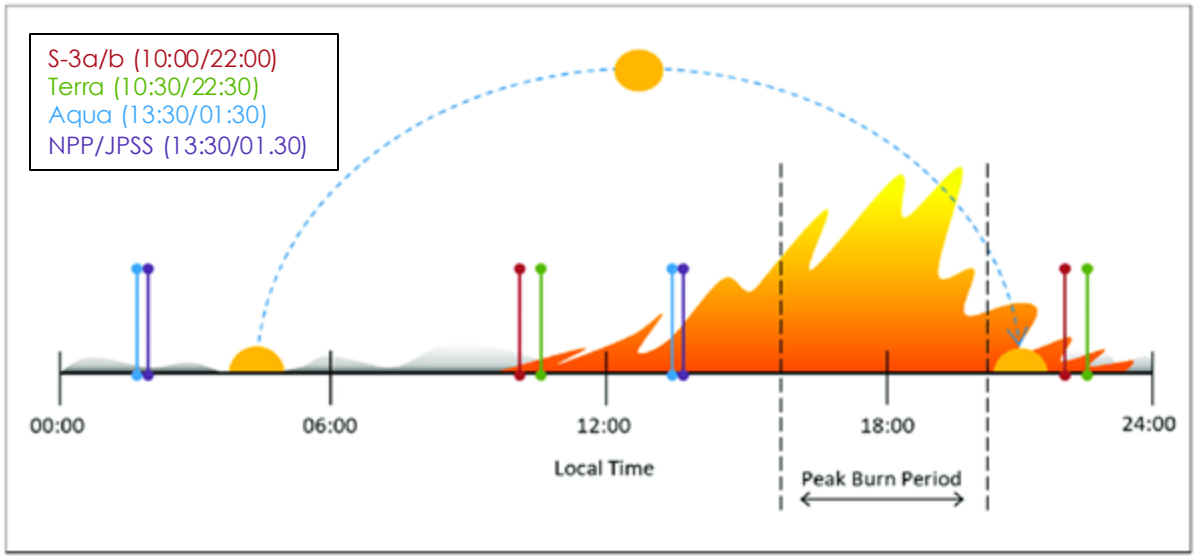
From satellite acquisition to FIRMS…



Factors Affecting Satellite Ability to Detect/Monitor Fire Activity

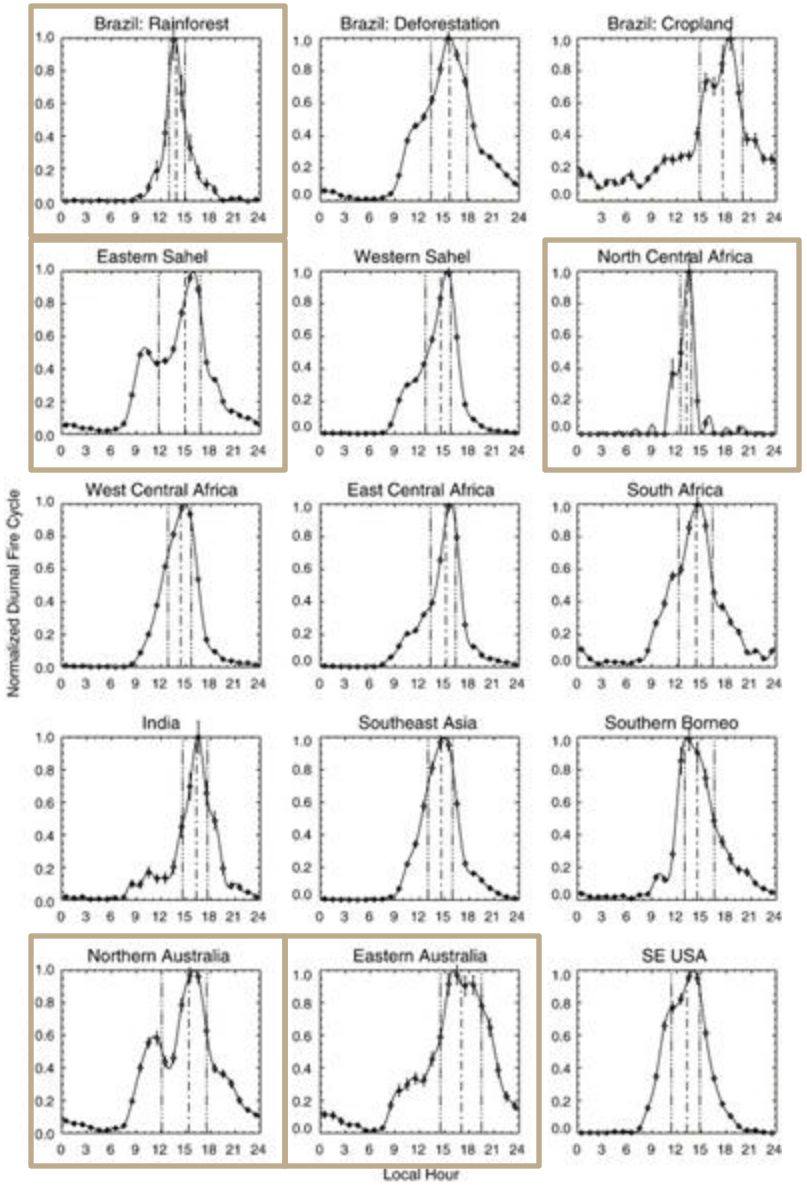
- Sensor Temporal Resolution
- Sensor Overpass Time

Diurnal Wildfire Activity Cycle



Credit: Johnson et al., 2020
https://doi.org/10.3390/s20185081

Diurnal Fire Cycle: Tropics & Sub-Tropics



Credit: Giglio, 2007:
https://doi.org/10.1016/j.rse.2006.11.018

Factors Affecting Satellite Ability to Detect/Monitor Fire Activity

- Atmospheric Obscurations
  - Cloud Cover
  - Dense Smoke
  - Fog

- Biophysical Setting
  - Forest Canopy
  - Less Forested Areas
  - Terrain

Demo – FIRMS

NASA Worldview

NASA Worldview

- Website
- Access Earth satellite remote sensing data easily
  - 1000+ global, full-resolution satellite imagery layers
  - Some imagery available in near real time (NRT)
  - Choose date or date range
  - Browse, search, save, share & download imagery layers
  - Worldview is built by the NASA/GSFC Earth Science Data and Information System (ESDIS) Project

Worldview Controls

Mobile Browser

- Search by location
- Share image
- Change projection
- Help/info

- View layers, events
- Add image layers
- Download data

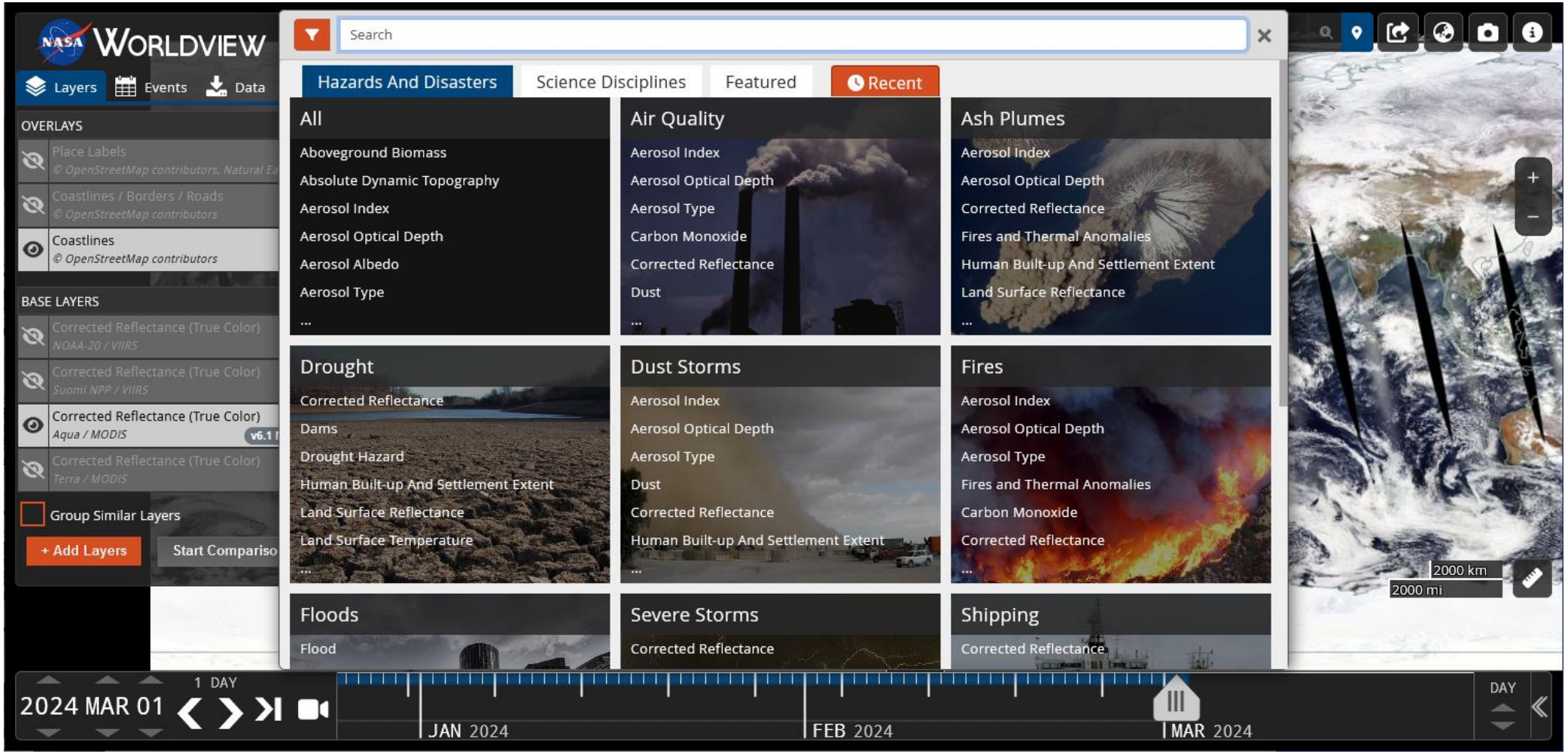
- Zoom via buttons or mobile device pinch

- Choose date & time
- Create an animation

Desktop Browser

Explore Imagery Layers

Organized by application area and science discipline

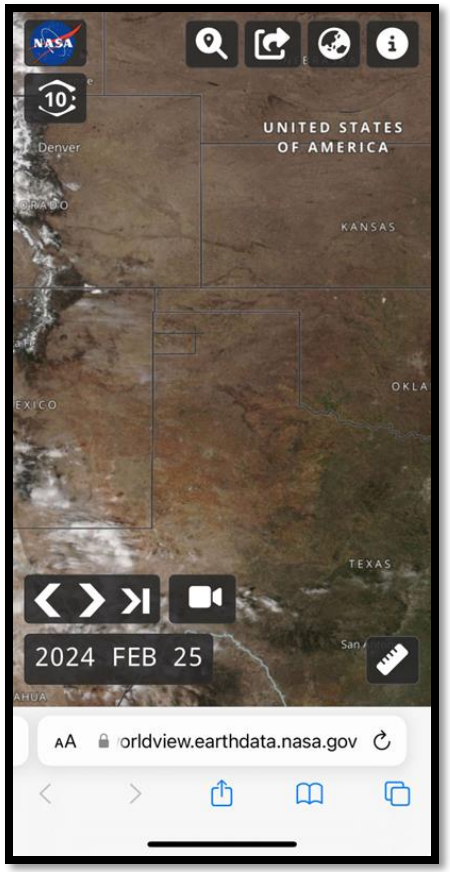


Worldview Exercise – Part 1

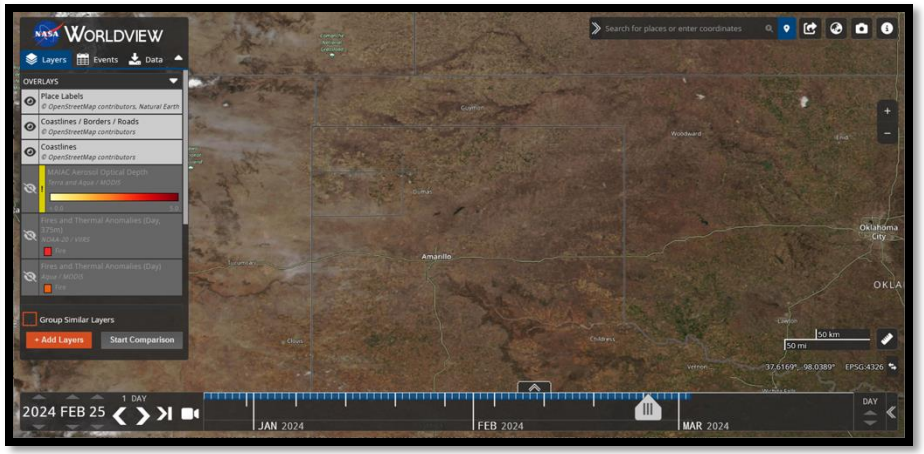
Explore Worldview navigation

1. Zoom in and out
2. Change the date and see the event evolve
3. Examine satellite basemap layers
4. Explore available layers
   - Fire detections from MODIS
   - Fire detections from VIIRS
   - Aerosols from MODIS
5. Make an animation

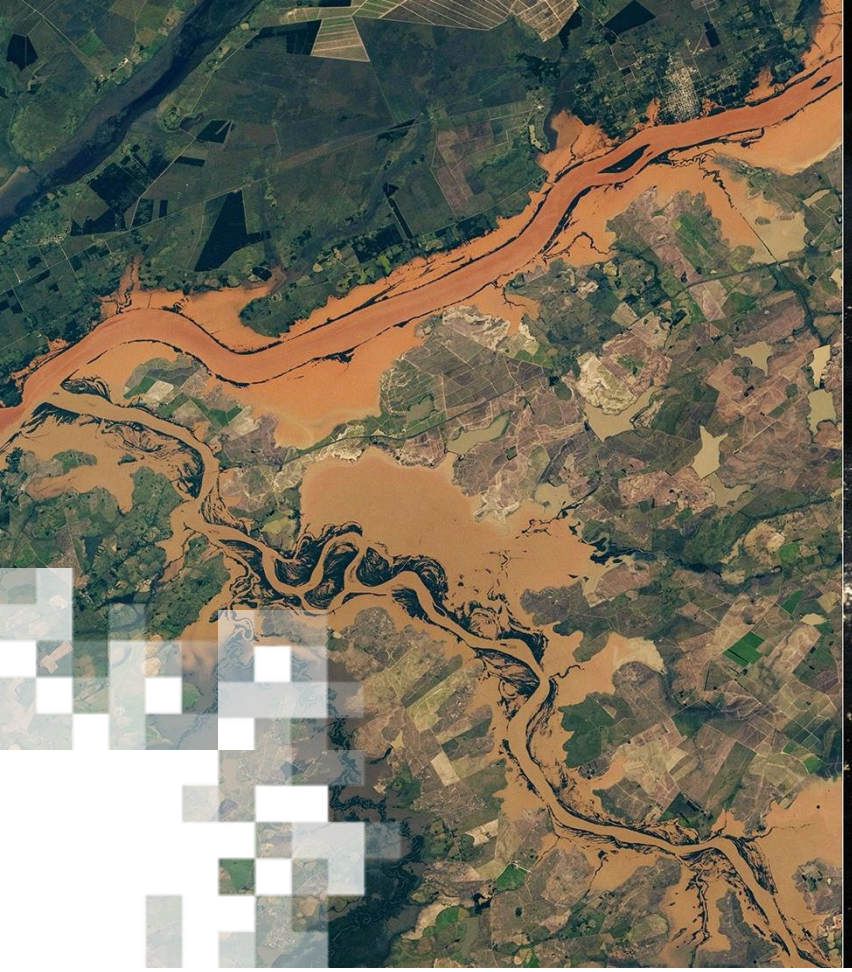
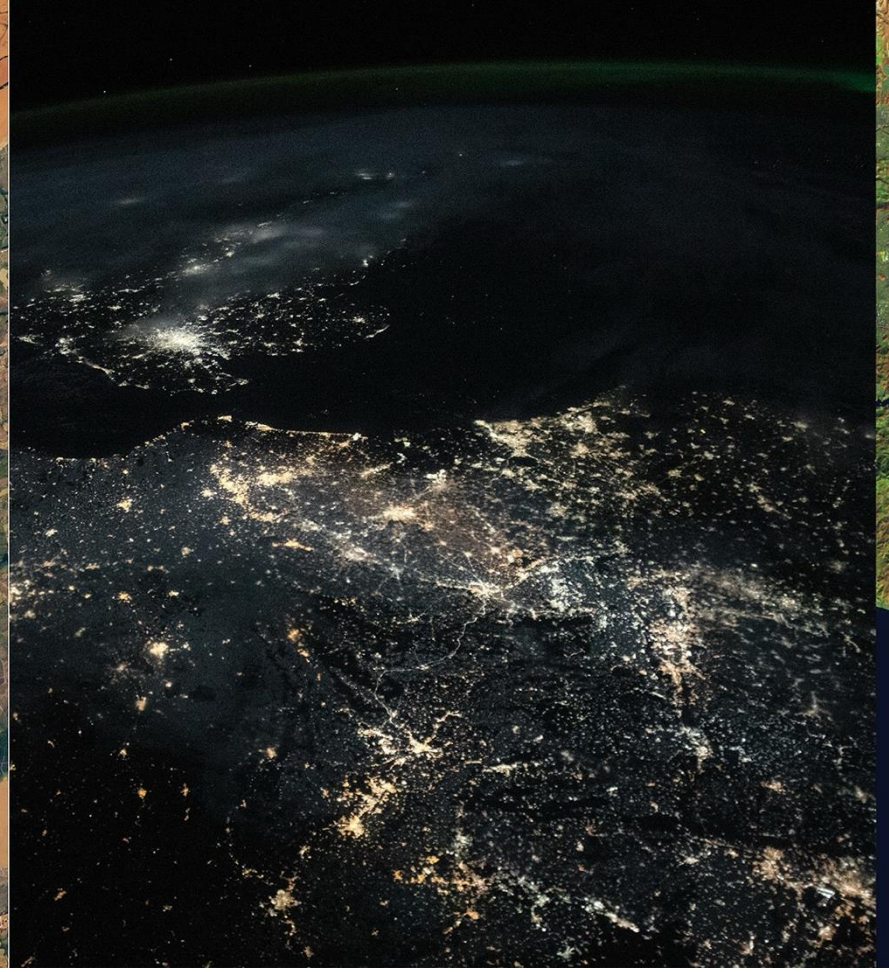
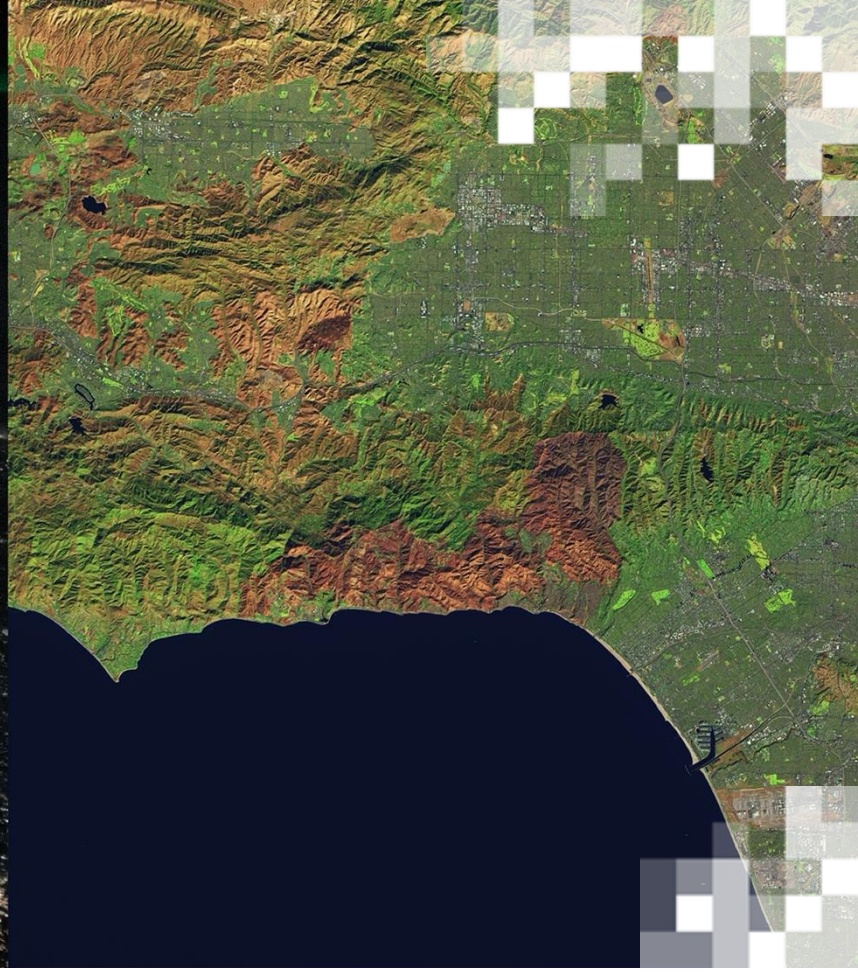
Smokehouse Creek Fire, TX
Feb 26, 2024



go.nasa.gov/3wON6he



Demo – Worldview

Exercise

Cameron Peak fire

- Wildfire that started near Chambers Lake, Colorado on August 13, 2020
- Fire burned 208,663 acres (326 sq mi.) through the Arapaho and Roosevelt National Forests
- Largest wildfire in Colorado history
- Forced the evacuation of over 6,000 residents
- Exercise:
  - Explore FIRMS & Worldview
  - Adapt GEE code from Eaton Fire (LA) case study
  - Develop your own case study in a domain that aligns with your work experience or personal interests.

Image credit: U.S. Forest Service

Contact Information

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ARSET Website

ARSET YouTube


APPLIED REMOTE SENSING TRAINING PROGRAM
TRAIN - EMPOWER - ADVANCE

Thank You!