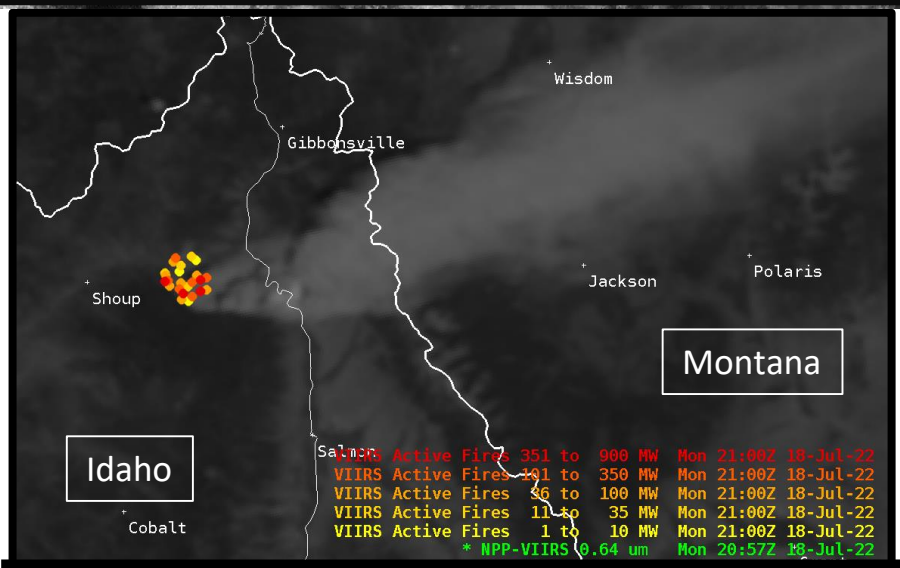
VIIRS Active Fire

Quick Guide

Why is the VIIRS Active Fire (VIIRS–AF) important?

The VIIRS-AF product provides information on fires and thermal anomalies for each location across the globe at least twice a day. VIIRS-AF includes data on fire location, fire intensity, and fire confidence intervals. Incident METeorologists (IMETs) can utilize the data to support agencies in operational fire response decisions. The product information is used in monitoring the distribution of fires (e.g., active fires, the identification of new fires) and their intensities (i.e., Fire Radiative Power, FRP).



VIIRS-AF overlaid onto VIIRS 0.64 µm visible imagery, observing the Moose Fire in Idaho. The colors represent fire intensities: yellow (less intense fire pixels) < orange < red < dark red (most intense fire pixels).

VIIRS-AF algorithm and specifications

Algorithm	Wavelengths and Resolutions	Latency
The hybrid threshold and contextual algorithm builds on the Moderate Resolution Imaging Spectroradiometer (MODIS) fire and thermal anomalies product. There are three main display aspects: fire pixel location, fire confidence, and FRP values. An internal cloud mask is used to identify areas where fire detection was not attempted. A water classification scheme is also applied.	**Wavelengths:** 3.74 µm (i4), 11.5 µm (i5), 0.64 µm (i1), 0.86 µm (i2), 1.61 µm (i3), and 4.05 µm (m13). *Note, i4 and i5 wavelengths are used for fire detection.* **Spatial:** 375 m **Temporal:** At least 2 overpasses per day, per satellite over CONUS. More frequent coverage north of 50 degrees latitude. *In AWIPS, the fire points are viewed at hourly timestamps.*	**Regional LDM:** 1- 1.5 hours **Direct Broadcast (DB) sources:** ~ 30-minutes

Impact on Operations

Primary Application

24/7 Fire Monitoring: Identify and locate fires during the day or night; along with point sources for smoke.

Fire Radiative Power: Higher FRP values equate with higher fire intensity and/or larger fires. Smoldering fires are generally 175-575°C whereas intense fires reach 525-925°C. Burning characteristics also depend on fuel type, moisture, temperature and wind.

Small-scale fires and features: At ~375-m, VIIRS-AF detects smaller and less intense fires than GOES. VIIRS-AF also include persistent anomaly flags (e.g., gas flares).

Smoke Model Forecasting: data are employed in smoke and air quality products (e.g., the High-Resolution Rapid Refresh (HRRR) Smoke).

Limitations

Obscuration: Terrain, thin clouds and thick smoke may obscure or lower fire intensity values. Areas with thick or cold clouds are masked by the internal cloud mask.

False Alarms: During the daytime, potential false alarms include reflected solar radiation from solar panels, hot and bright surfaces, sun glint from small lakes or ponds, as well as reflection from clouds. Nighttime false alarms include hot smoke plumes and reflected solar energy from cloud tops near the terminator.

Temporal Frequency: Over CONUS, polar-orbiting data is available at least 2 times per day, per satellite, unlike GOES data that exhibit a higher temporal resolution.

Contributors: CIRA, GINA, and NOAA/NESDIS [2022 Update]

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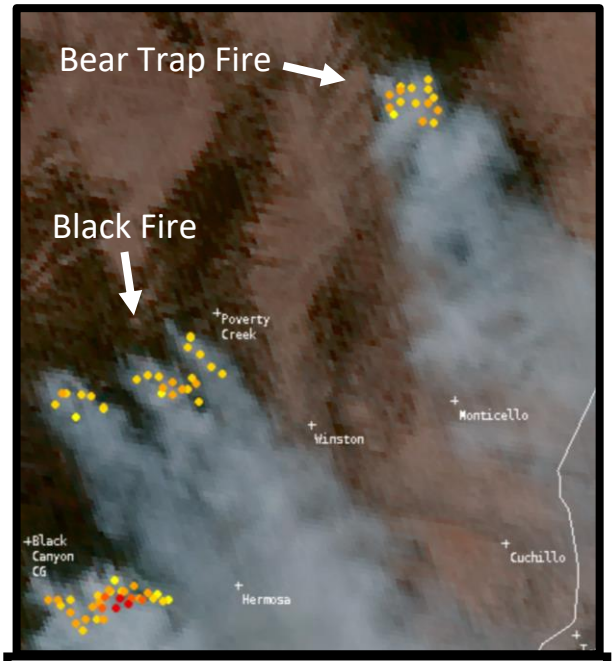
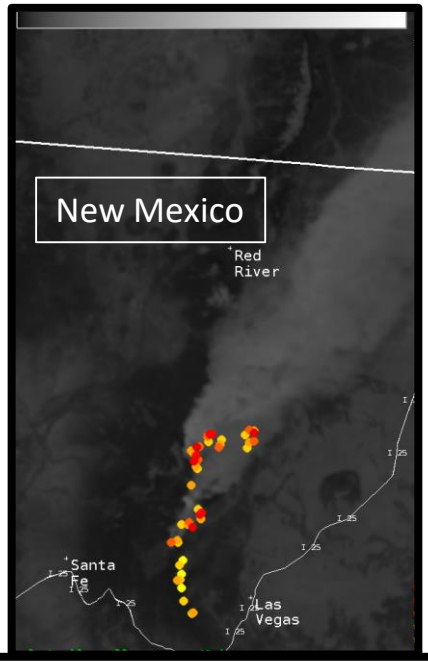
Imagery Interpretation

- 1 to 10 MW
- 11 to 35 MW
- 36 to 100 MW
- 101 to 350 MW
- 351 to 900 MW
- 901 to 2500 MW
- >= 2500 MW

**MW = MegaWatts, a proxy for fire intensity.*



VIIRS-AF observations of the Bear Trap Fire and the Black Fire in New Mexico on 25 May 2022.



VIIRS-AF observations of the Calf Canyon – Hermits Peak Fire on 11 May 2022.

Tips for Assessing VIIRS Active Fire Detections

Find the fire pixel location in the VIIRS i4 (3.74 µm) imagery:

- ❑ Check how it compares with its surroundings. Are there other fires in the area?
- ❑ Are there nearby clouds, terrain, or shadows that could be impacting the detection?
- ❑ Are there adjacent anomalously cold pixels suggesting fold-over from saturation?
- ❑ Are there persistent anomalies such as volcanoes, industrial sites, solar farms, etc.?

Examine the VIIRS i5 (11.5 µm) at the location of the fire pixel:

- ❑ See if it's also warm or if there are corresponding cold pixels from cloud tops.
- ❑ Are there clouds around the hot pixel especially in areas designated as "night"?
- ❑ Comparisons with i4 are especially important when reflectance bands are not available.

Examine the VIIRS i1 (0.64 µm) and Day Land Cloud Fire RGB (day) or Day/Night Band (DNB):

- ❑ Check for clouds in the proximity of the hot pixels.
- ❑ Look for high reflectances, such as cloud tops, sun glint, solar farms, etc.
- ❑ Check the DNB for light from large burning fires at night.

Resources

Satellite Book Club (SBC) Seminar
The VIIRS Active Fire Product

Geographic Information Network of Alaska (GINA)
VIIRS-AF: Algorithm Basics and Anomalous Detections

VIIRS-AF Algorithm: Quick Guide for non-AWIPS Users

RealEarth
DB Near-Real Time Data: VIIRS I-Band Fire Points

Center for Satellite Applications and Research (STAR) JPSS Website
VIIRS-AF Algorithm Theoretical Basis Document (ATBD)

Hyperlinks not available when viewing material in AIR Tool