


## Activity #1 – Why are there no active fire detections for areas where fire activity is likely or anticipated?

Background: The ability to detect fire activity via satellite is affected by several technical and environmental factors. See the FIRMS FAQ [“Why was a particular fire not detected?”](#) for details.

- Use FIRMS US/Canada (with ADVANCED MODE / Custom selected in the FIRMS map legend on the right) to view VIIRS 375m NOAA-20 and Suomi NPP wildland fire activity displayed on VIIRS S-NPP Corrected Reflectance imagery for May 27, 2023. Using the Location Tool, type the following lat/long (59.4239, -120.0284) into the Find Location
  - What is the name of this location?
- Zoom out until Northwest Alberta, Northeast British Columbia and the Southern Northwest Territories are displayed. Click [here](#) for a shared FIRMS map.
  - In the FIRMS map legend on the right, display only the fire activity detected by VIIRS NOAA-20 during the daytime overpasses for May 27, 2023. Do this by unchecking all the Fires/Hotspots layers (Landsat, VIIRS / Suomi NPP, MODIS / Aqua and MODIS / Terra) excepts VIRRS / NOAA-20, then selecting the “+” button next to VIIRS / NOAA-20, and turning off the detections acquired on the nighttime observations by clicking the “Night” button.
  - Note the large number of fire detections observed by NOAA-20 VIIRS for the three (not including the Rainbow Lake fire) large fires in the center of the map view (Lat: 59.4239, Lon: -120.0284). *User Tip: Close the Location Tool, and then use the cursor and click on individual fire detections to view their attributes.*
    - Select the  button next to the VIIRS / NOAA-20 to pop-up a description of this layer and a description of each of the attributes.
      - What does FRP mean and what is the unit of measurement?
      - What does the BRIGHT\_T14 attribute mean and what is the unit of measurement?
  - Also note the large size of these fires. They range from 100,000 to 200,000 hectares in size (*User Tip: Use the Measure tool (located at the bottom of the map interface in the center) to estimate the Area of the large to wildfires in the map extent*).
- Use the Timeline (*located at the bottom of the map interface*) to advance the date to May 28 (the imagery and fire detection data will automatically update for the selected date).
  - Note the detected fire activity for all four fires on May 28th compared to May 27<sup>th</sup>. Use the timeline to alternate back and forth between the two dates compare.
- Use the Timeline on the FIRMS map interface to advance the date to May 29<sup>th</sup>.
  - Note the detected fire activity for all three fires on May 29<sup>th</sup> compared to the May 27<sup>th</sup> and May 28<sup>th</sup> (*User Tip: Use the timeline to click and alternate back and forth between the three dates to compare*).


- Use the timeline on the FIRMS map interface to advance the date to May 30<sup>th</sup>.
  - Note the detected fire activity for all three fires on May 30<sup>th</sup> compared to the May 27<sup>th</sup>, May 28<sup>th</sup> and May 29<sup>th</sup>.
  - Why do you think the detected fire activity over these multiple days vary?

What data layers can you turn on to help inform your answer (*User Tip: investigate the Dynamic Imagery drop down for May 29 2023*)?


- List three reasons what else could affect the ability of satellites to detect fire activity? (*User Tip: Refer to the referenced FIRMS FAQ above for help*).

## Activity #2 – Understanding Band Combinations and Spatial Resolution of Different Sources of Imagery in FIRMS


Background: In addition to viewing fire activity, smoke, etc., multispectral satellite imagery (such as those from MODIS and VIIRS) can be manipulated to enhance and display particular features.

- In FIRMS US/Canada, use the Location Tool and Find Location tab to zoom into the area of Michigan Bluff, California. This area experienced a 31,500 hectare wildfire, called the Mosquito Fire, in late summer 2022. Set the date to Sep 25, 2022 (*User Tip: use either the Timeline (located at the bottom of the map interface) or the calendar feature in the main menu*). Identifying burned area can be helpful for understanding the impacts of fire, potential for soil erosion, monitoring trends in burn severity, calculating emissions estimates, etc.
- The map is centered on the burned area. Turn on the VIIRS NOAA-20 Corrected Reflectance (true color) composite imagery acquired on September 25, 2022. A “true color composite” means the visible light bands of the VIIRS imagery (red, green and blue) are presented in the corresponding red, green and blue color channels of the display. This results in a natural color image that represents the Earth’s surface as it would appear to the human eye.
- The visible light bands of VIIRS are acquired at a spatial resolution of 750 meters or 375 meters, which is relatively coarse. At this spatial resolution, it makes it difficult to distinguish details of the landscape. Also, due to the combustion of vegetation, residual ash, exposed soil, etc., burned areas will appear dark gray/tan in the visible part of the spectrum. Consequently, in a true color composite image, burned areas can be difficult to distinguish from the surrounding healthy, dense vegetation cover (forests, etc.) that appear dark green. However, other bands of VIIRS can be useful for distinguishing burned area.
- Select the  on the MAIN MAP MENU to access the drop down menu and select the BURNED AREA MODE. The map should still be located over Michigan Bluff
- Now let’s view the burned area as a false color composite image to enhance its visibility. In the FIRMS map legend on the right, toggle on the VIIRS NOAA-20 Corrected Reflectance 721 image at the bottom of the “Dynamic Imagery” dropdown.

- In this composite, the VIIRS shortwave infrared band (band M11), near infrared band (band I1) and red band (band 1) correspond to the red, green and blue display channels. Shortwave infrared radiation is strongly absorbed by open water and moisture in vegetation and is strongly reflected in exposed, rocky and dry soils. Inversely, near infrared energy is reflected strongly by healthy vegetation and is mainly absorbed by the bare ground. Burned areas appear dark brown or reddish-brown and healthy vegetated areas appear bright green in this particular composite. Although the burned area is now more apparent, the spatial resolution of these bands is still relatively coarse and does not present a refined image.
  - What is the spatial resolution of this VIIRS NOAA-20 Corrected Reflectance 721 721 imagery?

*(User Tip: select the  next to the layer to access information about the layer including, for example, Temporal Coverage, relevant References, etc.)*

- Next, we'll view the burned area using higher spatial resolution imagery. In the FIRMS map legend on the right, locate the "Harmonized Landsat / Sentinel-2 Imagery" group, select the "+" to open the group, and toggle on the Landsat 8/9 Adjusted Reflectance HLS S30 Nadir BRDF (false color – vegetation) *(User Tip: Imagery in the "Harmonized Landsat / Sentinel-2 Imagery" group, are dynamically generated and can take time to load)*
- Landsat and Sentinel-2 imagery are the highest spatial resolution imagery available in FIRMS and made available through the Harmonized Landsat Sentinel-2 (HLS) project. The imagery is available as true and false color composites, similar to the MODIS and VIIRS imagery. Although collected at much higher spatial resolution, this imagery is acquired less frequently (every 8 days for Landsat and every 4-5 days for Sentinel-2). The Landsat composite image renders the burned area at much higher spatial resolution and with more detail than the much coarser MODIS or VIIRS imagery.
  - What is the spatial resolution of the Landsat composite image?

*(User Tip: select the  next to the layer to access information about the layer including, for example, Temporal Coverage, relevant References, etc.)*

- Using the Location Tool, type the following lat/long (38.6853, -120.3196) into the Find Location tab to recenter the display, or click with the cursor and pan approximately 50KM southeast of the Mosquito Fire. The east-west trending burned area you now see is the 90,000 hectare Caldor Fire which occurred in 2021.
  - Can you see evidence of other recent and older occurrences of disturbance in the areas around the Mosquito and Caldor fires in the Landsat false color composite? Particularly in the area between the two burned areas and to the east of the Mosquito Fire area? Use this lat/long (38.8734, 120.5296) and this [Wikipedia entry](#) for details. What was the name of this fire, and when did it occur?

### Activity #3 – Analyzing the associated impacts of wildfires.

Background: In addition to the immediate impacts of wildfire, there are many associated impacts including on air quality. Smoke from wildfires, for example, can cause air pollution and impact public health. Multispectral imagery and derived products can be used to inform these impacts.

- In FIRMS US/Canada, access the ADVANCED MODE and set the date to Jun 03, 2023. Zoom out to the extent of the US and Canada and toggle on the VIIRS NOAA-20 Corrected Reflectance (true color) image in the “Dynamic Imagery” dropdown and the VIIRS 375m/ NOAA-20 fire detections in the Fires / Hotspots dropdown.
  - In addition to the cloud that is present in much of the image, what do you think is the tan colored substance in the Great Slave Lake region of the Northwest Territories (*User Tip: this lat/long (62.8297, -114.6455) will help pinpoint the area*)
  
- FIRMS includes several layers that help inform air pollution resulting from wildfire smoke. Canada experienced many wildfires in 2023 and associated wildfire smoke. Zoom out to the extent of the US and Canada again and toggle on the OMPS Aerosol Index layer in the “Smoke and Aerosols” dropdown.
  - What is OMPS short for?
  
  - What do higher values of the OMPS Aerosol Index (AI) indicate?
  
  - In addition to smoke from wildfires, list one other type of event that result in aerosols in the atmosphere that can be identified and tracked by the AI layer?
  
- Use the Timeline to advance the date to Jun 04, Jun 05, and Jun 06. The AI layer tracks the transport of smoke from the wildfires in western Canada over Canada and into the NE US.
  - Which state in the NE experienced an AI value of 4.500 and greater? (*User Tip: select the button in the OMPS Aerosol Index layer and increase the threshold to 4.5*)