Part 1 Questions & Answers Session A

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Brad Quayle (brad.quayle@usda.gov), Jenny Hewson (jennifer.h.hewson@nasa.gov), or Diane Davies (diane.k.davies@nasa.gov).

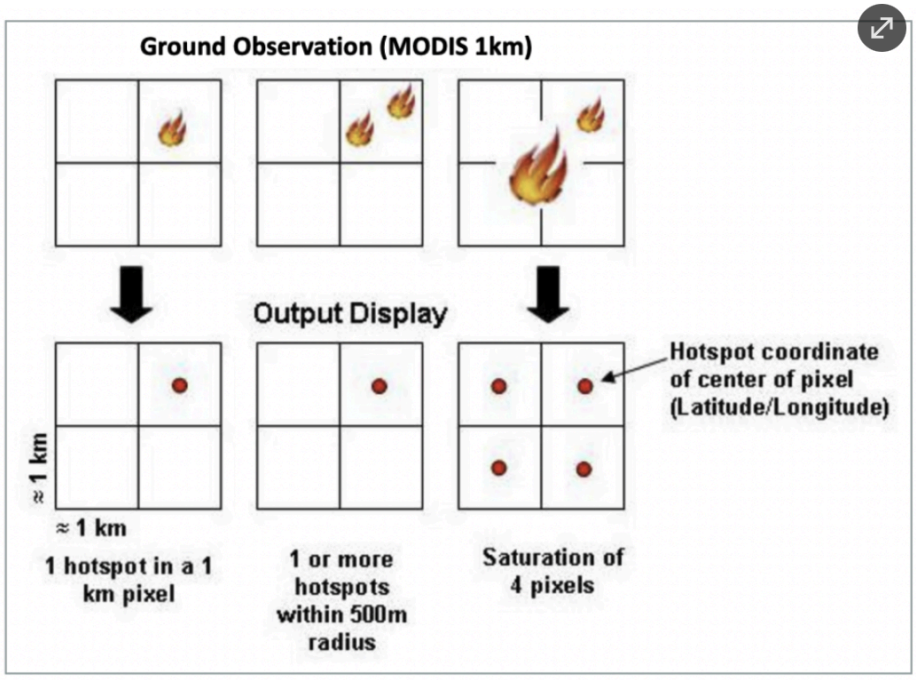
Question 1: Do the points reported by FIRMS represent the spatial centroid of an area with anomalous reflectance detected by the sensor, or do they correspond to the center of the sensor pixel that recorded the thermal anomaly? How is the location reported by FIRMS interpreted exactly, and what is the underlying physical principle behind the sensor's detection of these anomalies?
Answer 1: The points correspond to the center of the sensor pixel that recorded the thermal anomaly. In the FIRMS FAQ What does a fire detection mean on the ground? Satellites take a 'snapshot' of events as they pass over Earth. Each hotspot/active fire detection represents the center of a pixel flagged as containing one or more fires or other thermal anomalies (such as volcanoes). For MODIS, the pixel is approximately 1 km, and for VIIRS, the pixel is approximately 375 m. The "location" is the center point of the pixel (not necessarily the coordinates of the actual fire). The actual pixel size varies with the scan and track. The figure below often helps visualize this.

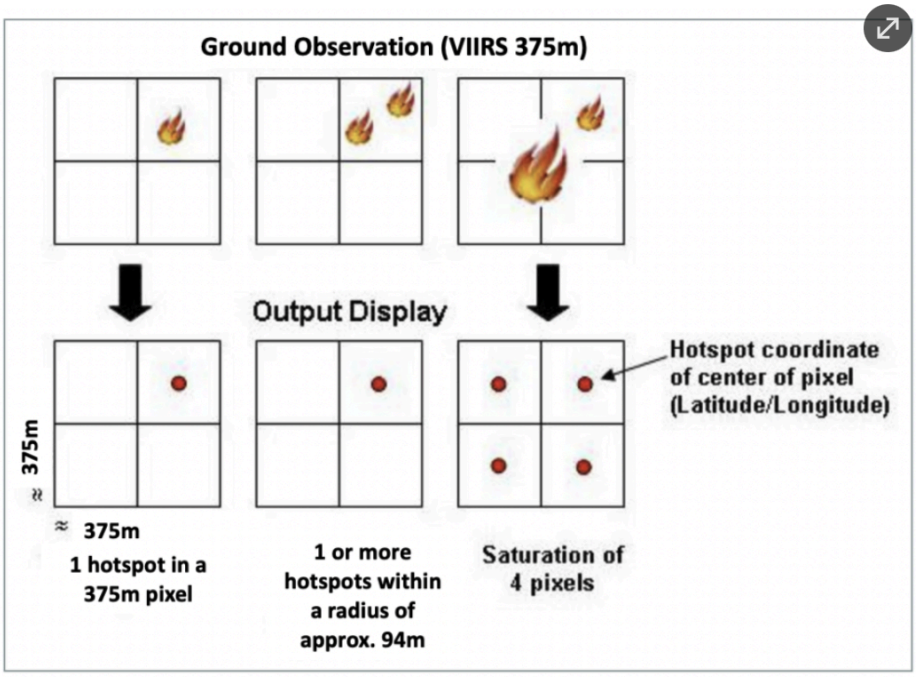
You also ask about the underlying physical principle behind the sensor's detection of these anomalies?

Fire detection is performed using a contextual algorithm that exploits the strong emission of mid-infrared radiation from fires. The NASA MODIS algorithm examines each pixel of the MODIS swath, and ultimately assigns to each pixel one of the following classes: missing data, cloud, water, non-fire, fire, or unknown. More information can be found in: Giglio, L., Descloitres, J., Justice, C. O., & Kaufman, Y. (2003). An enhanced contextual fire detection algorithm for MODIS. *Remote Sensing of Environment,* 87: 273-282. doi:10.1016/S0034-4257(03)00184-6

In keeping with MODIS, the VIIRS algorithm is a hybrid thresholding and contextual algorithm using radiometric signals from 4 micron and 11 micron bands (M13 and M15, respectively) and additional bands and a suite of tests for internal cloud mask and rejection of false alarms. The product primarily contains latitude and longitude data for

those pixels classified as thermal anomalies. More information can be found in: Schroeder, W., Oliva, P., Giglio, L., & Csiszar, I. A. (2014). The New VIIRS 375m active fire detection data product: algorithm description and initial assessment. *Remote Sensing of Environment*, 143: 85-96. doi:10.1016/j.rse.2013.12.008





Question 2: I am from Nepal and have been using FIRMS data since 2013. Last year we suppressed one fire in Kathmandu which took us around 12 hours. I understand that in Nepal, Aqua and Terra run around 10:30 am and 2:45 pm. The fire we suppressed was big and took around 6am to 6pm. I checked the active fire record of FIRMS that day and the next day, but it never showed the fire data on the record. What could be the reason?
Answer 2: There are several reasons why MODIS or VIIRS may not have detected a fire: The fire may have started and ended between satellite observations; cloud cover, heavy smoke, or tree canopy may completely obscure a fire; occasionally the instruments are inoperable and can observe nothing during these times (see data outages and known issues for MODIS and VIIRS); the fire may have been too small or too cool to be detected. The VIIRS 375 m active fire product provides a greater response over fires of relatively small areas due to its higher spatial resolution and it has improved nighttime performance. For more information on the minimum size of fire that can be detected using MODIS data see "What size fires can be detected?" and "How do I know if a fire detection was missed due to cloud or missing data?"

If you would like us to look into this more we would need to know exact dates and locations but hopefully after the next training you will be able to do this yourself 🙂

Question 3: Doesn't Landsat 8/9 Thermal Infrared Sensor (TIRS) use thermal bands in the range 10-12 µm, which essentially belongs to the 8-14 µm region? We've been taught in one of our courses that this band is ideal for measuring radiant temperatures of objects that occur naturally on the Earth's surface. For very hot objects such as wildfires and volcanoes, we use thermal bands sensitive to the 3-5 µm region. How reliable is Landsat data for wildfire detection, because wildfires usually burn at 800+ degrees celsius?
Answer 3: Landsat provides better active fire detection performance compared to coarser spatial resolution sensors, such as MODIS and VIIRS. TIRS is not used. The Landsat Fire and Thermal Anomalies (LFTA) product is predicated on previous NASA-sponsored research to develop an active fire detection algorithm for the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) aboard Terra. The product is based on multispectral imagery acquired by the Operational Land Imager (OLI) sensor aboard the Landsat 8 and Landsat 9 satellites. The 30 m active fire detection data has 1,000 times and 160 times finer spatial resolution than the 1 km MODIS and 375 m VIIRS active fire detections, respectively. However, unlike MODIS and VIIRS, Landsat does not provide comprehensive global coverage on a daily basis.

Each Landsat satellite typically images the same location on Earth every 16 days, but provides spatially explicit data and detail of observable fire activity at the time of the satellite overpass. These data augment fire management capabilities when available and can potentially enable applications at tactical scales.
Flaming fires as small as approximately 4 m^2 have a better than 50% chance of detection during the daytime observations. Nighttime detection of similar fire activity improves to an area as small as 1 m^2.

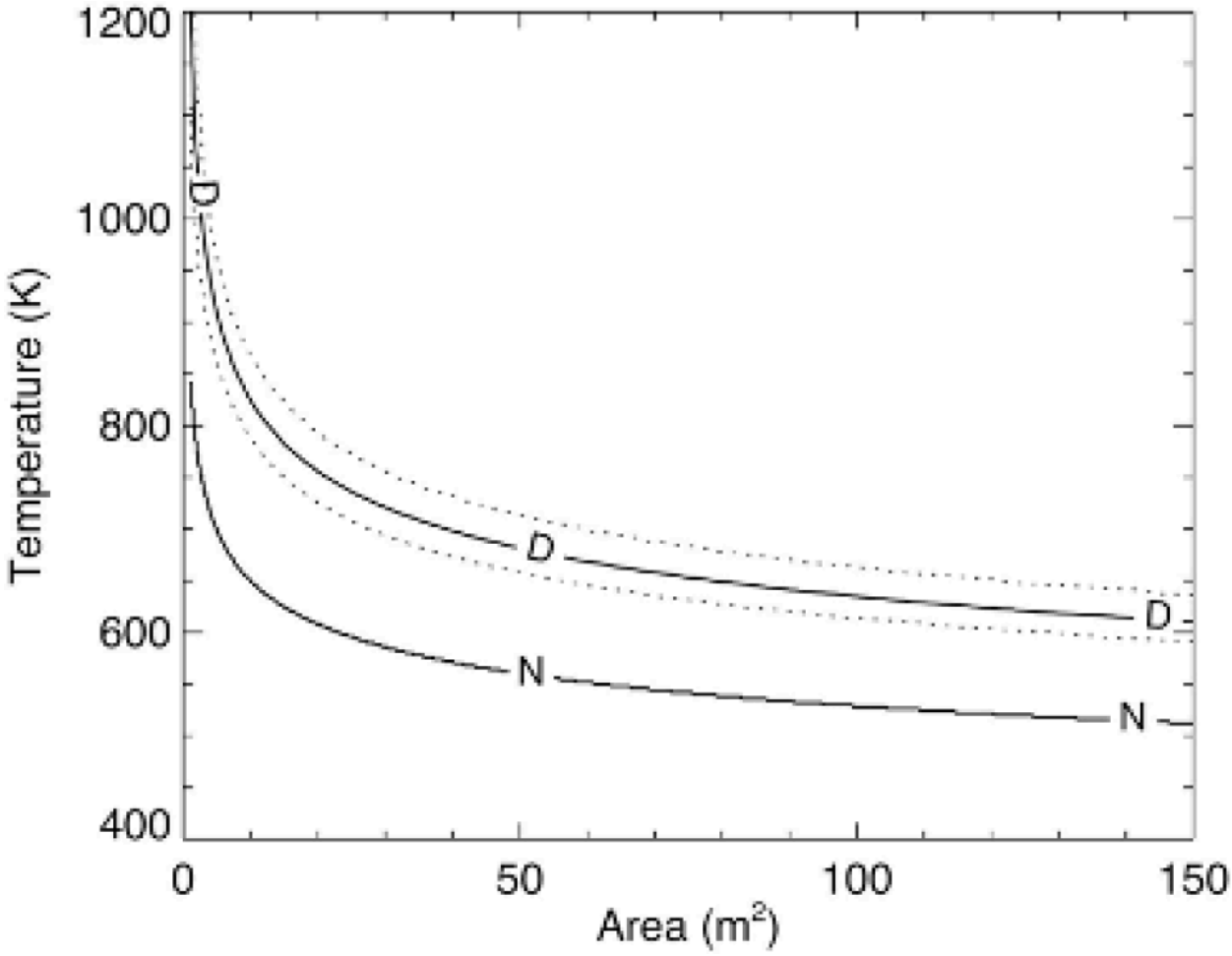


Image Caption
Schroeder, W., Oliva, P., Giglio, L., Quayle, B., Lorenz, E., & Morelli, F. (2016). Active fire detection using Landsat-8/OLI data. Remote Sensing of Environment, 185: 210-220. doi:10.1016/j.rse.2015.08.032

Please refer to the following papers by Louis Giglio and Wilfrid Schroder and the NASA Applied Sciences Program project summary for more information on the Landsat active fire algorithm and product.

Schroeder, W., Oliva, P., Giglio, L., Quayle, B., Lorenz, E., & Morelli, F. (2016). Active fire detection using Landsat-8/OLI data. *Remote Sensing of Environment,* 185: 210-220. doi:10.1016/j.rse.2015.08.032

Giglio, L., Csiszar, I., Restás, Á., Morisette, J. T., Schroeder, W., Morton, D., & Justice, C. O. (2008). Active fire detection and characterization with the advanced spaceborne thermal emission and reflection radiometer (ASTER). *Remote Sensing of Environment,* 112(6): 3055-3063. doi:10.1016/j.rse.2008.03.003

Question 4: What is the need of combining 15 different satellite missions' data? Is it for improving the temporal resolution, or any other purpose?
Answer 4: Yes, this is primarily for improving the temporal resolution but each mission has pros and cons. Different missions have different spatial and temporal resolutions so a user might consider their information needs. Multiple temporal observations can help monitor the progression of a fire.

Question 5: Is it possible to see the footprint of the satellite on the map in order to know which area was sensed (especially for Landsat, which has a small footprint/swath)?
Answer 5: Great question – the capability to view the footprints or the widths of the swaths for polar orbiting sensors is not currently available in FIRMS but is something we plan to add in the near future. For now, you can see the orbit tracks (see: https://firms.modaps.eosdis.nasa.gov/map/#m:advanced;d:today,today;l:fires_viirs_snpp,Landsat8_Orbit_Asc,Landsat8_Orbit_Dsc,Landsat9_Orbit_Asc,Landsat9_Orbit_Dsc,countries,viirs_crtc,earth;@-109.8,23.5,4.0z). Additionally, if you are visualizing acquired Landsat imagery for previous dates, you can display the "Landsat 8/9 Adjusted Reflectance HLS S30 Nadir BRDF (true color)" layer. With this layer displayed, you can see the swath of imagery that was collected for each of the Landsat OLI sensors as a true color composite. Each of these swaths are 185km wide and you can assess the extent of the coverage relative to features of interest.

Question 6: Can FIRMS also help in forecasting the fires?
Answer 6: FIRMS US/Canada includes daily updates of fire danger forecasts for Canada provided by the Canada Wildfire Information System (https://cwfis.cfs.nrcan.gc.ca/maps/fw) and significant fire potential forecast for the United States from the National Predictive Services Program at the National

Interagency Coordination Center (https://www.nifc.gov/nicc/predictive-services/outlooks).

Question 7: Is there any chance of clouds or other effects influencing the results?
Answer 7: Yes, the satellites used are optical instruments and cloud cover, heavy smoke, or tree canopy may completely obscure a fire. As shown in part two of this training, coincident corrected reflectance imagery can be displayed to indicate the presence of clouds and smoke.

Question 8: Does the past year's data from FIRMS only provide information on active fires that were detected or also the area that was affected as well?
Answer 8: The active fire detection data does not fully capture the temporal and spatial extent of fire activity over the duration of an event. The MODIS burned area product compiled at a spatial resolution of 500 meters is available in FIRMS and is a relatively better source for visualizing and assessing the extent of fire activity. The MODIS burned area product is compiled as a monthly product and uses a time series analysis of composited daily Terra and Aqua MODIS surface reflectance imagery and active fire detection data to identify areas of disturbance that are attributable to fire. The MODIS burned area product is available in the ADVANCED MODE and BURNED AREA MODE in FIRMS. The VIIRS burned area product will be integrated in FIRMS in the future.

The Harmonized Landsat Sentinel (HLS) false color composite imagery is available in FIRMS, with a 2-4 day lag and these data can be helpful in estimating burned area (see the FIRMS blog post New HLS False Color Composite Layer Added to FIRMS).

Question 9: Is it possible to add a .kml file in the FIRMS map (or any other geodata)?
Answer 9: KML files are available for the instruments onboard the polar orbiting satellites from this page: https://firms.modaps.eosdis.nasa.gov/active_fire/. There are various options including auto-refresh FIRMS KML in Google Earth Pro.

Question 10: If I wanted to, for example, get all of the fires from 2020-2025 from the VIIRS NOAA-20 satellite for the entire African continent, would I be able to do this in a single query? Or would I need to make queries for each country? Moreover, is it possible to get archived data via an API?
Answer 10: FIRMS doesn't have an option to download data for the entire African continent and there is a size limit on the query output. So you could draw a polygon

around the continent in the archive download, and try to get one year's data in one go. If the number of fires returned exceeds our limit, you will get an error message. Alternatively you could use the country summaries but these are only currently available for VIIRS S-NPP.

Question 11: When selecting high-probability fire detections using VIIRS data, is it generally preferable to filter the results to include only detections with a "high" confidence level instead of "normal"? What are the implications of using each confidence level in terms of the probability of correct detection and the potential inclusion of false positives? Are there specific recommendations regarding the use of these confidence levels for different types of fire analysis?

Answer 11: This is another good question but not easy to answer…

The confidence value was added to help users gauge the quality of individual fire pixels included in the Level 2 fire product. The confidence field should be used with caution as it is likely that it will vary in terms of meaning in different parts of the world. Nevertheless, some of our end users have found such a field to be useful in excluding false positive occurrences of fire. The confidence values are attributed differently for MODIS and VIIRS.

For VIIRS, the confidence values are set to low, nominal, and high; they are based on a collection of intermediate algorithm quantities used in the detection process and are intended to help users gauge the quality of individual hotspot/fire pixels. Low confidence daytime fire pixels are typically associated with areas of Sun glint and lower relative temperature anomaly (<15 K) in the mid-infrared channel I4. Nominal confidence pixels are those that are free of potential Sun glint contamination during the day and marked by strong (>15 K) temperature anomaly in either day or nighttime data. High confidence fire pixels are associated with day or nighttime saturated pixels.

While the confidence value may not be very helpful for all users or applications, there is no way to establish an optimal cutoff a priori. Users have to adopt an empirical approach—what threshold works best for what I'm trying to do?

Question 12: What is the recommended optimal confidence threshold for MODIS fire detection data, considering the need to balance the detection of real events with the minimization of false positives? Are there specific studies or guidelines that define this threshold for different applications or regions?

Answer 12: The confidence value was added to help users gauge the quality of individual fire pixels included in the Level 2 fire product. The confidence field should be used with caution as it is likely that it will vary in terms of meaning in different parts of

the world. Nevertheless, some of our end users have found such a field to be useful in excluding false positive occurrences of fire.
For MODIS, the confidence value ranges from 0% to 100% and can be used to assign one of the three fire classes (low-confidence fire, nominal-confidence fire, or high-confidence fire) to all fire pixels. For some uses or applications, errors of commission (or false alarms) are particularly undesirable, and for these applications a user may consider trading a lower detection rate to gain a lower false alarm rate.

Conversely, for other applications missing any fire might be especially undesirable, and a user may be willing to tolerate a higher false alarm rate to ensure that fewer true fires are missed. Users requiring fewer false alarms may wish to retain only nominal- and high-confidence fire pixels and treat low-confidence fire pixels as non-fire, land pixels. Users requiring maximum fire detectability who are able to tolerate a higher incidence of false alarms should consider all three classes of fire pixels.

While the confidence value may not be very helpful for all users or applications, there is no way to establish an optimal cutoff a priori. Users have to adopt an empirical approach—what threshold works best for what I'm trying to do?

Question 13: Are there plans to increase the map key token limit? The WMS tokens disappear pretty quickly on a large scale. Additionally wondering if the FIRMS API will be updated to include more than 10 days worth of data.
Answer 13: The map key token is capped to try and ensure “fair use”. If you find it is insufficient for your application, please reach out to us (you can email earthdata-support@nasa.gov with FIRMS in the subject line) and let us know more about what you are trying to do. In some cases we can increase the map key token limit, but we might also be able to help you find an alternative option better suited to your needs.

In the future, we may consider updating the FIRMS API to include more than 10 days of data but it is not something we are planning to do in the very near future. Again - perhaps get in touch and let us know why this would be helpful (what’s your use case?).

Question 14: Will the Sentinel fire detection data be added to FIRMS in the future?
Answer 14: This is something the FIRMS team is investigating. With MODIS Terra nearing end of life – there will be a need to find an alternative overpass for the morning detection. The NASA science teams are currently comparing Sentinel-3 active fire

detections with those from MODIS Terra. Our goal is to have the Sentinel-3 active fire data in FIRMS before MODIS Terra reaches end of life. We will also look at establishing operational access to the real-time/near real-time data stream for Sentinel-2 imagery.

Question 15: Will FIRMS have any collaboration with FireSat?
Answer 15: We have had a very positive initial discussion with FireSat so hopefully yes.

Question 16: Do the fire data points reported by FIRMS for MODIS and VIIRS represent detections accumulated over a 3-hour observation window?
Answer 16: When opening the FIRMS map viewer in BASIC MODE, MODIS, VIIRS and Landsat fire detections for the last 24 hour period are displayed by default. This 24 hour time period is defined as from 00:00 UTC yesterday to the present. You can also toggle the temporal threshold to display fire detections for Today and the last 7 days. Please see the controls in the FIRMS user interface at the top of the control panel on the right hand side of the viewer to change those settings as well as to access information on how those time periods are defined. In the ADVANCED MODE of the FIRMS viewer, you can customize the desired baseline date to any date you choose. You can also define the reach back period of time up to a maximum of 31 days before that baseline date. Additionally, in the ADVANCED MODE, you can use the SUB-DAILY tools to filter the display of fire detection data to a defined time period (hours and minutes) within the target date.

Question 17: For a live fire of a given size, does the likelihood of a GOES pixel being classed as containing a fire change as its nadir angle increases, given that its FRP value may decrease due to variations in pixel spatial coverage?
Answer 17: Yes. The instantaneous field of view, or pixel footprint, increases or becomes more distorted with increasing distance from nadir. For GOES, these distorted pixel footprints can be 2 to 4 times as large at extreme view angles compared to a pixel located at or near nadir (see the second presentation in Part 1 of this training for additional information). Given that, the overall radiance contributed to a distorted pixel footprint by a fire of a given size within it will be different for pixel at higher view angles than at nadir which can affect the ability of the algorithm to detect that fire. Additionally, this issue can also affect the geolocational accuracy of detections given the location of any detections will be the centroid of those distorted pixels.

Question 18: Can we predict future wildfires by using NASA observation data?

Answer 18: Currently FIRMS does not include any wildfire predictions. As you are probably aware there are a number of fire spread/prediction models being developed. It is something we may consider in future, perhaps in the 'experimental mode' depending on the confidence our science team members and end users have in these models/predictions.

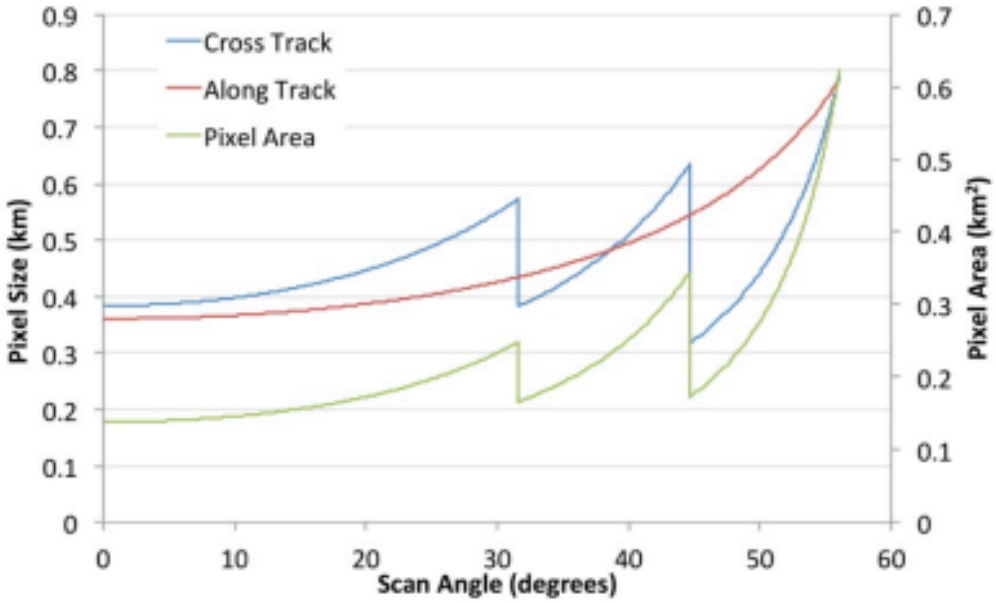
Question 19: Does the "Brightness" parameter reported by FIRMS refer to reflectance? If not, what exactly does this value represent, and how is it interpreted (for example, does a higher value indicate greater or lesser reflectance, or some other property)?

Answer 19: The brightness temperature of a fire pixel is measured (in Kelvin) using the MODIS channels 21/22 and channel 31. Brightness temperature is actually a measure of the photons at a particular wavelength received by the spacecraft, but presented in units of temperature.

Question 20: How do you overcome the distortion related to the swath edges axis?

Answer 20: Great question. It depends on the sensor. With MODIS sensors onboard Terra and Aqua, there is not a technical or engineering solution applied with the sensor or collected data to overcome this issue. However, on a given day, a given geographic location that is a significant distance from nadir on a Terra MODIS observation will likely be at or relatively closer to nadir on the subsequent Aqua MODIS observation, and vice versa. The VIIRS sensor has an engineering solution applied to help mitigate the effects to the footprint size of pixels as view angles increase to outward from nadir towards the swath edges. This solution is called "constrained pixel growth" and is possible due to the fact that each pixel observed by VIIRS is the aggregate of one to three of the detectors. For the VIIRS 375 meter bands, each detector is 125 meters wide in the scan direction and 375 meters long along track dimension. The aggregation scheme changes across three distinct image regions. In the first region (nadir to 31.59° scan angle), three native pixels are aggregated in the along-scan (cross-track) direction to form one data sample in the Level 1 image. In the second region (31.59° to 44.68° scan angle), two native pixels are aggregated to form one data sample. Finally in the third and last region (44.68° to 56.06° - edge of swath) one native pixel will result in one data sample. Please see the figure below for a graphic representation of this aggregation approach applied with VIIRS data. All five 375 m channels are aggregated onboard the spacecraft before the data are transmitted to the ground stations, whereas

a subset of the VIIRS 750 m data (dual-gain channels only) are aggregated on the ground.



Spatial resolution of VIIRS imagery data as a function of scan angle. The three distinct regions represent unique data aggregation zones extending from nadir to the edge of swath.

Landsat OLI has a 15 degree field of view, so the maximum view angle either side of nadir is 7.5 degrees. Consequently, the effects of this view angle on Landsat OLI pixels is very minimal.

Question 21: To what extent can FIRMS satellite data, combined with multi-temporal analysis and AI-driven pattern recognition, predict wildfire behavior in the Arizona desert's unique ecological zones, such as near Pine or Congress? Additionally, could this technology be adapted to map historical fire scars and correlate them with genealogical records—like land ownership or oral histories from my ancestors since our roots go back so far—to assess long-term impacts on indigenous and settler communities? How far back do archival records go?

Answer 21: Yes, it would be an integral part for behavior analysis on a seasonal basis. Past records paired with additional info (weather, fuel, wind) to see patterns. You can state that there is a risk given the conditions. Using AI to pour through that data would be a good application. Historical records: old tree core samples, spatial mapping and sampling could potentially model this.

Satellite data available through FIRMS only goes back as far as November 2000. The date ranges by instrument are as follows:

LANDSAT 30m: Temporal Coverage: 20 June 2022 - Present

MODIS Collection 6.1: Temporal Coverage: 1 November 2000 - Present

VIIRS S-NPP 375m: Temporal Coverage: 20 January 2012 - Present

VIIRS NOAA-20 375m: Temporal Coverage: 1 April 2018 - Present

VIIRS NOAA-21 375m: Temporal Coverage: 17 January 2024 - Present

Question 22: How would you distinguish between a fire and a thermal vent, I assume there is a temperature difference. Is this an issue the FIRMs team had to resolve?
Answer 22: It is not possible to distinguish the source of fire or thermal anomaly from the signal alone. FIRMS has been working on distinguishing some types of thermal anomaly by identifying persistent sources of heat (factories, fuel burning plants) and taking an inventory of these locations and comparing them with thermal anomalies to identify those that are ”not a wildfire or prescribed fire”. These “ Static thermal anomalies” are available in the experimental mode in FIRMS. You can find out more about the static thermal anomalies and view these in FIRMS in this NASA earthdata article. Check out the blog!

See question 7 & 8

Question 23: Can FIRMS satellite data, particularly from MODIS or VIIRS, detect abandoned campfires in Arizona’s desert regions, such as near Congress, where fuel loads might be low? If not, are there other online mapping systems—like NOAA’s Hazard Mapping System or NIFC tools—that can identify these smaller heat signatures, and how might their resolution or detection thresholds affect accuracy in sparse vegetation areas? (If you want an example of an abandoned campfire to examine - how about a current one Buck Fire Incident - AZTNF-406-Pine, Arizona - Reported 4-11-25 to help clarify a specific to above question about

other ways to determine the campfire location matching to their reported GPS location BUCK FIRE_ 34.361655, -111.43556.)

Answer 23: The size of the fire and intensity should be considered. In these arid environments, it can be challenging to detect fires due to the relatively higher brightness temperatures associated with bright, relatively non-vegetation surfaces. The spatial resolution of the particular sensor and daytime vs. nighttime conditions are also a factor. Based on validation exercises performed with MODIS, VIIRS and Landsat active fire detection data, the best chance to detect a fire of this size burning at a relatively significant intensity would be at night with Landsat, possibly VIIRS. Below is a summary of the general detection performance of MODIS, VIIRS and Landsat relative to fire size, fire intensity and observation conditions.

- MODIS (1,000m)
  - ~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)

Question 24: Please describe how to use FRP information.

Answer 24: Fire Radiative Power, or FRP, is an estimate of the energy released or emitted by a fire and measured in megawatts. FRP has been extensively used as a proxy of fire intensity to characterize intensity fire types and is related to the rate of biomass combustion and rate of emissions. FRP estimates are provided for active fire data from MODIS, VIIRS and geostationary sensors used in FIRMS. In addition to being an indicator to the level of fire intensity and fire behavior, it is used with land cover data to estimate biomass consumption for emissions modeling. Sensor spatial resolution, saturation temperature of thermal bands, satellite view zenith angle, time of satellite observation, etc. can affect the accuracy and variability of FRP estimates. Users should consider these factors when comparing FRP information from a specific sensor or multiple sensors. This is used for modeling and estimation of fire emissions.

Question 25: Are there plans to include data and imagery from the many recent missions such as the FireSat constellation once available?
Answer 25: We have had a very positive initial discussion about FireSat through the Earth Fire Alliance, and we hope to integrate those data in the future. FireSat is a public/private effort. Microsats could potentially monitor for fires every 20 minutes.

Question 26: If additional satellite data becomes available with a quicker revisit time than the current satellites utilized, are there plans to add the data into the FIRMS program and be able to update the detections and imagery quicker in a more real-time format?
Answer 26: Great question – yes, this is something we would like to do and will actively pursue.

Question 27: How would you distinguish between a fire and a thermal vent? I assume there is a temperature difference.
Answer 27: (Also see Answer 22.) Different types of thermal anomalies are not currently attributed in the NRT MODIS or VIIRS data. An active fire represents the center of a pixel flagged as containing 1 or more actively burning hotspots /fires. In most cases hotspots/fires are vegetation fires, but sometimes a hotspot/fire is a volcanic eruption or the flare from a gas well or it could be a thermal vent.

The Fire Radiative Power (FRP) measures the rate of radiative energy emission per time unit from all fires within a pixel and potentially this might be helpful – FRP has been extensively used as a proxy of fire intensity to characterize fire types and is related to the rate of biomass combustion and rate of emissions. FRP estimates are provided for active fire data from MODIS, VIIRS and geostationary sensors used in FIRMS. But it is worth noting that sensor spatial resolution, saturation temperature of thermal bands, satellite view zenith angle, time of satellite observation, etc. can affect the accuracy and variability of FRP estimates.

As a reminder fire detection is performed using a contextual algorithm that exploits the strong emission of mid-infrared radiation from fires. The NASA MODIS algorithm examines each pixel of the MODIS swath, and ultimately assigns to each pixel one of the following classes: missing data, cloud, water, non-fire, fire, or unknown. More information can be found in: Giglio, L., Descloitres, J., Justice, C. O., & Kaufman, Y. (2003). An enhanced contextual fire detection algorithm for MODIS. *Remote Sensing of Environment,* 87: 273-282. doi:10.1016/S0034-4257(03)00184-6

Question 28: Building on Ramita's question, how can FIRMS data—using MODIS or VIIRS sensors—differentiate an abandoned campfire from a thermal vent in Arizona's desert, given potential temperature overlaps? Are there specific spectral signatures or temporal patterns (e.g., rapid heat spikes vs. steady emissions) that could be analyzed, and could this be cross-referenced with other online mapping tools like NOAA's Hazard Mapping System for improved accuracy in low-vegetation areas like Congress?

Answer 28: This is a great question. Please see the answer to Question 23 above. In addition we have recently started cross-referencing "persistent" or "semi-persistent" thermal anomalies with locations of industrial/anthroprogenic heat sources (power plants, gas flares, steel mills, etc.) and natural heat sources (e.g., volcanoes). These data are obtained from authoritative sources that provide global coverage and are updated on a routine basis. I realize this doesn't answer your question but it is an example of how we are starting to distinguish vegetation fires from static thermal anomalies. You can find out more about the static thermal anomalies and view these in FIRMS in this NASA earthdata article.

Question 29: What are the main factors that can cause a wildfire to be missed by satellite-based detection systems, and how can FIRMS users plan for such limitations when monitoring active fires?

Answer 29: Excellent question. One or more factors can affect the ability of a satellite sensor to detect fire activity. Some of these factors include:

- Size and intensity of the fire(s) at the time of satellite overpass/observation
- Timing of satellite overpass/observation
- Clouds or heavy smoke occluding fire activity
- Fire activity under the forest canopy
- Effects of satellite view angle
- Shadowing as a result of steep terrain relative to the location of the sensor
- Land cover heterogeneity

This topic will be discussed extensively in the second session of this webinar on April 23rd.

Question 30: Does NASA/FIRMS incorporate municipal/district level fire data or rely mostly on data from satellites for short time frames (for example, the polygons shown earlier that were from ground truthed data)?

Answer 30: Currently all active fire data displayed in FIRMS are derived from satellites. Municipal/district level fire data are not ingested. However we do include fire

perimeters for the US - these are pulled from data provided by the Wildland Fire Interagency Geospatial Services (WFGIS) Group (Current Wildland Fire Perimeters).

Question 31: Does FIRMS have an archive to get data back from 2019 for the fires from August 17 in Las Palmas Gran Canarias Island?
Answer 31: Yes. The active fire detection data available in FIRMS can be viewed for that event by visiting this shared FIRMS map link: https://firms.modaps.eosdis.nasa.gov/map/#m:advanced;d:2019-08-16..2019-08-17,2019-08-16;l:fires_modis_aqua,fires_modis_terra,fires_viirs_noaa20,fires_viirs_snpp,country-outline,terra_crc,earth;@-15.49,27.92,10.69z.

Additionally, the active fire detection data in FIRMS from each of the satellite sensors can also be requested and downloaded in a desired GIS form from FIRMS at https://firms.modaps.eosdis.nasa.gov/download/.