Part 1 Questions & Answers Session

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: Most of the satellite analysis is mainly focusing on examining the incident that happened already and satellite update intervals extend the damage further. Is there any possibility to predict or foresee the incident before?
Answer 1: There are no specific layers in FIRMS Global that enable users to predict fires. FIRMS recently added vegetation indices from HLS – these can be found in the Advanced mode and include Normalized Difference Vegetation Index and Normalized Difference Moisture Index that could be used locally to help monitor fuel conditions.

For FIRMS US/Canada, there are two relevant layers: US Red Flag warnings and a US Fire Weather Watch for the United States. These watches and warnings are issued by the National Weather Service (NWS) and their criteria varies for each NWS forecast area. A Fire Weather Watch is issued when there is a combination of dry fuels and weather conditions that support extreme fire danger. Red Flag Warnings are issued when these extreme conditions are anticipated in the next 24 hour period.

Question 2: Is the HLS product only available over US/Canada? Or with FIRMS Global, can we assess the dateset?
Answer 2: HLS imagery is available for the entire world and is provided in FIRMS Global and FIRMS US/Canada but please note the data are only available 2-4 days after satellite overpass. This product provides harmonized imagery at 30-meter resolution for the Operational Land Imager (OLI) sensor onboard Landsat 8 and 9 and the MultiSpectral Instrument (MSI) onboard Sentinel-2A, 2B and 2C. The revisit frequency for the Landsat OLI imagery is every 8 days while the temporal resolution for Sentinel-2 MSI imagery is every 4-5 days.

It helps to zoom out to see the imagery load on the screen.

The FIRMS map viewer now enables users to view the HLS true color composite imagery for Landsat and Sentinel-2 as rolling, global mosaics. Both of these image layers are available in the Dynamic Imagery layer group in ADVANCED MODE of the FIRMS map viewer and display the latest available Landsat and Sentinel-2 HLS true color composite imagery for the entire globe. Based on the date set by the user in the FIRMS map viewer, the Landsat rolling mosaic displays the last 8 days of Landsat OLI imagery for the entire globe while the Sentinel-2 rolling mosaic displays the last 5 days of MSI imagery. When users adjust the date in the FIRMS viewer, each of the layers will automatically adjust to display the imagery relative to the new temporal baseline.

By contrast, the active fire data from Landsat 8/9 is only available for the Continental US (CONUS), Southern Canada and Northern Mexico.

Question 3: Given that the FIRMS platform will not be updated temporarily as indicated in the notification, what alternative solutions can you offer us?
Answer 3: While updates and new enhancements to the website were not implemented during the lapse in Federal funding, the active fire detections and image products continued to be automatically ingested into FIRMS. Additionally, any outages or data anomalies were addressed if they occurred.

Question 4: Is there some technical documentation or ATBD regarding OMPS AI data? This is the ATBD for OMI https://ozoneaq.gsfc.nasa.gov/content/public/OMI/ATBDs/ATBD-OMI-03.pdf, but Chapter 5 pertains to the current S-NPP OMPS Aerosol Index product.
This is the official website: https://ozoneaq.gsfc.nasa.gov/products/aerosol/.

Question 5: I am working on generating a monthly time series dataset of burn severity metrics (dNBR) over large spatial scales using MODIS data (MOD09A1 + MCD64A1). My main challenge is identifying appropriate pre-fire and post-fire time windows for calculating dNBR for each month. Could you suggest an effective approach?
Answer 5: There could be multiple approaches to this analysis. Certain approaches may be better considering the biophysical setting of the area you are monitoring/mapping. You could perhaps use the MOD09A1 imagery to generate a NBR composite over the period of the month targeted for analysis. This composite could be designed to identify the minimum NBR value derived from each MOD09A1 image dataset for that month period. That NBR composite could be paired with the previous

month's NBR composite to generate a dNBR to map burn severity. You could use available QA/QC layers in the MOD09A1 imagery to exclude areas of cloud, shadows, etc. when computing your NBRs. Additionally, you could mask out pixels identified as burned from the previous month's analysis so they are not included in the analysis for the currently targeted month. Use of the MCD64A1 data could still be applied to constrain the analysis to ensure you are capturing detected changes that are due to fire, however, MCD64A1 can experience some omission errors due to various factors.

Question 6: Does the Aerosol Index correlate with the concentration of smoke plumes?
Answer 6: Yes, but there are many other factors that influence the aerosol index value as well (such as height and type of aerosol) so it's not a one-to-one correlation. In particular, for values above 5 the magnitude of the index is more closely correlated with altitude, with values of 10 or over more than likely caused by high-altitude smoke generated by pyroCbs.

Question 7: Is there some way to use OMPS in a geostationary satellite?
Answer 7: OMPS is onboard NOAA 20 and 21, which are polar orbiting satellites. However, there is an aerosol index product (similar to the N20/N21 version) being generated by the TEMPO instrument, and it's in a geostationary orbit. You can access TEMPO AI data through NASA's Worldview website: https://worldview.earthdata.nasa.gov/?z=4&ics=true&ici=5&icd=6&l=Reference_Labels_15m(hidden),Reference_Features_15m(hidden),Coastlines_15m,TEMPO_L3_Ozone_UV_Aerosol_Index,TEMPO_L2_Ozone_UV_Aerosol_Index_Granule(count=1),OCI_PACE_True_Color(hidden),VIIRS_NOAA21_CorrectedReflectance_TrueColor(hidden),VIIRS_NOAA20_CorrectedReflectance_TrueColor(hidden),VIIRS_SNPP_CorrectedReflectance_TrueColor(hidden),MODIS_Aqua_CorrectedReflectance_TrueColor(hidden),MODIS_Terra_CorrectedReflectance_TrueColor&lg=false&t=2025-11-12-T17%3A58%3A06Z.

Question 8: Can we use this data to predict when First Nations communities should look at evacuation?
Answer 8: Some agencies use fire progression data to help inform decisions regarding evacuation. Typically, particular geographic lines or boundaries are identified where, if crossed by a fire, decision makers may issue an evacuation order. Due to its relatively coarse spatial resolution and limited number of daily observations, satellite fire detection data should not be used alone in monitoring fire activity at a local scale. Information on fire progression leverages higher resolution data gleaned from airborne

imaging and surveillance as well as intelligence acquired from on the ground observations to continuously monitor fire progression and identify and assess its current location.

Question 9: Are temperatures of the fires available?
Answer 9: The Fire Radiative Power (FRP) is available in the attribute information of the active fire detections and can be identified by clicking on the active fire detections which will bring up those attributes. FRP provides an estimate of the energy released by a detected fire and is measured in megawatts.

Question 10: Based on the workflow provided are there structured guidelines on how to properly reference the data acquired?
Answer 10: https://www.earthdata.nasa.gov/data/projects/lance – Under the tab on **Data Use Guidance and Disclaimer halfway down the page**, there is a data use guidance and disclaimers.

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Question 11: Are these layers only applicable in Google Earth Engine or can they also be used in ArcGIS Pro, as that is the main software used at my institution?
Answer 11:

- The burned area products are available in HDF, Geotiff, and shapefile format (Geotiff and shapefile formats can be used in ArcGIS). They can be accessed via the Download Archived Data page, Archive Download - NASA | LANCE | FIRMS.
- The active fire detections can be downloaded. These are available in multiple formats (csv, shapefiles) and can be used in ArcGIS. They can be accessed via the Active Fire Data page, NASA | LANCE | FIRMS - Active Fire Data.
- WMS and WFS services for the active fire detections are also available. These web services can be accessed under Web Services NASA | LANCE | FIRMS - Web Services and can also be consumed by Esri products.

Users are advised to verify the version (collection) of NASA datasets currently ingested in Google Earth Engine. The release of each new NASA collection for a particular dataset (e.g., fire and thermal anomalies, burned area, etc.) integrates updates/enhancements to the given product algorithm and can result in slightly different outputs from previous versions/collections.

Many of the satellite imagery layers shown in FIRMS come from NASA's Global Imagery Browse Services and you can find out more about integrating the images into a GIS here: https://nasa-gibs.github.io/gibs-api-docs/gis-usage/.

Question 12: Which sensor characteristics are essential for the accurate detection and retrieval of atmospheric aerosols from satellite observations?
Answer 12: That's a very broad question! It depends on what aerosol characteristics you are trying to determine. For example, the aerosol index uses sensors that have UV wavelengths; at these wavelengths the surface reflectivity is relatively low (even for

clouds and snow/ice), and because of that the wavelengths can separate out and detect the presence of absorbing aerosols easily over all types of land surfaces. However, they can't be used to determine the type of aerosol being detected. Sensors such as VIIRS use longer wavelengths (in the visible and near IR) to determine aerosol type or the amount in the atmosphere (differences in how different aerosols are absorbed by different wavelengths in this range can be used to help determine this). But they have difficulty over clouds and snow/ice because they are too bright at these wavelengths (note there are new algorithms for VIIRS that can retrieve over clouds). And sensors who look at the same atmosphere at different angles can do the same thing. Or you can use a laser sensor (such as CALIOPE), which bounces the laser light off the aerosol and, by determining the time of transit, can determine the aerosol altitude.

So it depends on what characteristic you want to determine.

Question 13: How can satellite monitoring help in estate management?
Answer 13: Burned area products can be used to help identify which areas have burned in the past (fire regime) in order to identify any changes or impacts resulting from fires. Vegetation Indices (VIs) can also provide information regarding vegetation conditions and likelihood to burn. More information about each VI available in FIRMS, including additional technical details about each VI, is available by clicking the layer information button to the right of each VIS in the HLS Imagery dropdown menu. Finally, current and historical active fire data can be analyzed to understand seasonal fire timing and identify fire patterns, and active fire alerts for a particular area of interest can be created via the Fire Alerts page, Fire Alert Subscription - NASA | LANCE | FIRMS.

Question 14: You mentioned a 2-6% difference in fire detection between MODIS and VIIRS. Does one tend to bias higher than the other?
Answer 14: For burned area, VIIRS tends to be higher than MODIS (for the period covered in the study, 2012-2023). Additional information is available in the Giglio et al paper which can be accessed here: The NASA VIIRS burned area product, global validation, and intercomparison with the NASA MODIS burned area product - ScienceDirect.

Question 15: Can FIRMS detect some greenhouse gases?

Answer 15: Active fire detections don't directly detect GhG but can be used in the calculation of diff GhG estimates.

Question 16: What are the strengths and limitations of OMPS aerosol index products for detecting low-altitude smoke versus stratospheric aerosols?
Answer 16: Smoke clouds in the stratosphere will usually be detected using the OMPS AI due to the fact that the value depends on the altitude; ***almost all stratospheric clouds*** have an AI value above 5, ***with most*** above 7 or 8. The only clouds that would not be detected would be very diffuse, low-density clouds.

Question 17: Is there any possibility to monitor post-disturbance regeneration prediction using satellite imagery?
Answer 17: Yes. Satellite imagery paired with other geospatial data and field observations are crucial components of monitoring the recovery of burned areas. Many studies and methodologies using satellite imagery for post-fire recovery monitoring are available in the literature.

Question 18: How does NASA's Normalized Area Interface improve the accuracy of satellite-based smoke and fire detection, especially in distinguishing active fires from other high-temperature anomalies such as industrial heat sources or sun-glint effects?
Answer 18: We're sorry. Could you contact us via an email submitted through the FIRMS feedback link to provide us with more details about your question?

Question 19: Is it possible to download tabular data to perform statistical analysis and statistical modeling across years, months, and regions?
Answer 19: The burned area products are available in HDF, Geotiff, and shapefile format. They can be accessed via the Download Archived Data page, Archive Download - NASA | LANCE | FIRMS. The product contains multiple attributes including the number of (500m) burned cells/month, the start date, the end date, etc. This information can be exported from, for example, ArcGIS and used for additional analyses.

Question 20: What is the technical difference between the Normalized Burn Ratio (NBR) and the NBR2 in remote sensing, specifying the spectral bands used in each formula?

Answer 20: The NBR and NBR2 indices are similar in that they both use the 2.1µm band and are relevant for post-fire applications. NBR calculates the ratio between the near infrared band and the 2.1µm shortwave infrared band. NBR2 calculates the ratio between the 1.6µm shortwave infrared band and the 2.1µm shortwave infrared band. The formulas for each of the indices are provided below, including the mappings to the relevant bands for Landsat 8/9 Operational Land Imager (OLI) and Sentinel-2 Multispectral Imager (MSI). Please also see the layer descriptions for NBR and NBR2 in the FIRMS interactive map for additional technical details about these indices (Click the layer information button  to the right of the Landsat or Sentinel-2 for the NBR and NBR2 layers in the FIRMS legend to access) .

NBR:
NBR = (NIR - SWIR) / (NIR + SWIR)
NBR (Landsat OLI) = (Band 5 - Band 7) / (Band 5 + Band 7)
NBR (Sentinel-2 MSI) = (Band 8A - Band 12) / (Band 8A + Band 12)

NBR2:
NBR2 = (SWIR1 - SWIR2) / (SWIR1 + SWIR2)
NBR2 (Landsat OLI) = (Band 6 - Band 7) / (Band 6 + Band 7)
NBR2 (Sentinel-2 MSI) = (Band 11 - Band 12) / (Band 11 + Band 12)

Question 21: Can data for a specific region be uploaded to analyze the changes within it, or do we need to download the map and work on it using GIS software?
Answer 21: You cannot upload data but active fire detections and other layers can be compared. The burned area products can be visualized and assessed in the FIRMS interactive fire map, along with the active fire detections, and different image composites. The burned area products can also be downloaded (see the Download Archived Data page, Archive Download - NASA | LANCE | FIRMS) for further assessment in a GIS of choice. Additionally, a GeoTIFF of the map that the user is viewing can also be downloaded using the CAPTURE tool (located at the bottom of the screen).

Question 22: Data on FIRMS are area-based or worldwide?
Answer 22: Most of the data products on FIRMS are global in extent. Some exceptions include the Landsat active fire detections, which are available for CONUS (continental US, southern Canada and northern Mexico); the ultra real-time MODIS and VIIRS active fire detections, which are available for most of the US/Canada; and the geostationary

active fire detections and imagery, which are available for the area of the earth covered by the satellite disk. But all the other data products will be global.

Question 23: Is the Ozone Mapping and Profiler Suite (OMPS) representative of all aerosols or only smoke-related aerosols? Do we assume that what is visible in the OMPS index is smoke-related if it aligns with an active fire?
Answer 23: If you want to find out more about OMPS, go to https://ozoneaq.gsfc.nasa.gov/omps/.
OMPS Aerosol Index is useful for mapping aerosols (not just smoke). It is a fair assumption that if the OMPS AI aligns with the active fire data, it is likely to be smoke but there are times that you see smoke from fires and dust. Using the corrected reflectance imagery is also useful for enhancing our understanding of the type of aerosol.

There are areas that are complex. In Asia, for example, you have forested areas close to deserts, so there are instances where you can get dust storms and fires intermingling. In Africa, there are times when fires are burning south of the Sahara and Sahel mixing with dust storms.

Question 24: Is Aerosol Optical Depth (AOD) used in the calculation of the OMPS index value?
Answer 24: No. AOD is a physical quantity of density. AI is a much simpler calculation. It is an index and not directly related to a physical quantity.

Question 25: Are OMPS, TROPOspheric Monitoring Instrument (TROPOMI), and Ozone Monitoring Instrument (OMI) the most suitable sensors for detecting and characterizing atmospheric smoke plumes (aerosols and trace gases), or what other widely used wide-swath sensors are employed for smoke monitoring?
Answer 25: It depends. AI from UV sensors (such as OMPS and TROPOMI) are excellent for looking at the extent of smoke from fires and dust, and for tracking their movement over time. This is because UV wavelengths can be detected over a variety of landscapes and types. But, for assessing: combustion of the aerosols; how much aerosol; calculation of the aerosol extinction index, etc, (any physically-based calculations) other sensors need to be used (MODIS and VIIRS). A combination of sensors are needed to look at the altitude of an aerosol (OMPS and VIIRS, for example; or NASA's CALIOP, a space-based laser that bounces a laser off the surface of the aerosol). Again, OMPS is ideal for detection and tracking of aerosols.

Question 26: Where can I see the values to know if I need to use PyroCb AI?
Answer 26: In FiRMS the standard AI product has a cut off at 5. The PyroCb AI goes from 5-50. You can use the option to change the opacity, and threshold the values that show up (it is the icon next to the “i” information on the Aerosol index layers). Alternatively if you look at the OMPS AI and AI PyroCb values in NASA’s Worldview, and hover over the layer to get the values. To identify the standard aerosol Index, anything above 5 is blacked out.

Question 27: Is there a possibility to download those products for any area in the world?
Answer 27: Active fire detection data for Terra MODIS, Aqua MODIS, SNPP VIIRS, NOAA-20 VIIRS, NOAA-21 VIIRS and Landsat 8/9 OLI can be ordered and downloaded from FIRMS. These data can be downloaded by a user-specified date range. The user can also specify if data is desired for the entire world, selected countries or selected protected areas (please note that Landsat active fire detection data is only available for CONUS, southern Canada and northern Mexico). Users may also define their own custom area of interest, if desired. The data are provided in Esri shapefile, comma separated value or JSON format. Please see https://firms.modaps.eosdis.nasa.gov/download/ to submit an order for this data. Instructions for how to access burned area products are available on this page on FIRMS as well.