Questions & Answers Session Part 3

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 our trainers Pawan Gupta (pawan.gupta@nasa.gov), Melanie Follette-Cook (melanie.cook@nasa.gov) or Ana Prados (ana.i.prados@nasa.gov).

Question 1: Will the Global Fire Atlas (2003-2016) be reproduced for 2017-2021? Can MODIS be used now to recreate the workflow to make the Global Fire Atlas products? Thank you.
Answer 1: At this time, we are not sure about the plans for this product for other year but you can find details here - https://www.globalfiredata.org/fireatlas.html and Contact - Niels Andela (niels.andela@nasa.gov) for further information.

Question 2: Why are the RGB wavelengths for MODIS and VIIRS different?
Answer 2: The central wavelength of each band can vary from sensor to sensor, and it is typically decided by the sensor science team based on available technology and specific measurement goals. RGB can be created using the three channels which are roughly centered around the red, green and blue part of the solar spectrum.

Question 3: How do we distinguish clouds from smoke?
Answer 3: We use simultaneous measurements in multiple bands/channels and spatial variability in clouds and smoke to separate the two features in a satellite image. Typically, clouds respond very similarly to all the bands in the visible part of the solar spectrum whereas smoke has significant variability in its response to the same bands. This method works often but not always and there can be cases when smoke is misidentified as cloud and vice-versa.

Question 4: What is the level of accuracy of these fire datasets from the different satellites? How is accuracy assessment/validation done?
Answer 4: Both MODIS and VIIRS have larger than 90% accuracy and are often validated using sensors (Landsat/Sentinel, etc.) with higher resolution observations and through specific field campaigns . More details - Slide 21 and links

Question 5: What is the level of accuracy of these fire datasets from the different satellites? How is accuracy assessment / validation done?
Answer 5: Same as above.

Question 6: VIIRS fire detection is just so different in area from MODIS. I have to wonder - do we have an estimate of the false positive rate of VIIRS? Or, the false negative of MODIS? Like the MODIS fire data contain a confidence value, is there anything similar for VIIRS fire data too?
Answer 6: Yes, both MODIS and VIIRS data comes with a quality flag which tells the level of confidence in detecting particular fire. The false positives are very limited and often cleaned up during operational data set production but false negatives are more difficult to estimate. Typically it has been found that globally VIIRS detects 3-4 times more fires than MODIS due to its higher spatial resolution, this can vary depending on the fire size, type and part of the world.

Question 7: How does one download fire count data/forest fire data of a particular place at a particular time?
Answer 7: please follow along with the FIRMS demo presented earlier.

Question 8: Thank you Dr. Gupta for explaining differences in MODIS and VIIRS fire detection. I am wondering if both satellites carry the same instruments to detect temperature anomalies? That could explain large variations along with the spatial resolutions for MODIS and VIIRS.
Answer 8: MODIS and VIIRS are both sensors/instruments. MODIS is aboard Terra and Aqua satellites whereas VIIRS is aboard SNPP and NOAA20 satellites. Both sensors use similar bands and algorithms to detect fires. The major difference between the two comes due to their spatial resolutions but there are other factors which play a role too.

Question 9: The satellites usually have more than one spatial and temporal resolution (e.g. daily and every 16 days global coverage). Can we flexibly choose the resolution that we want for wildfire monitoring? Or only specific resolution is dedicated for wildfire monitoring?
Answer 9: The spatial resolution for each satellite/sensor and individual channel is often fixed. VIIRS has two fire detection channels with spatial resolution of 375 and 750 meter resolution whereas MODIS has one channel with 1 km spatial resolution. Each satellite makes two measurements per 24 hour (day/night) on a given location. While

analyzing the data, we can always average or accumulate over different temporal scales.

Question 10: The satellites usually have more than one spatial and temporal resolution (e.g. daily and every 16 days global coverage). Can we flexibly choose the resolution that we want for wildfire monitoring? Or only specific resolution is dedicated for wildfire monitoring?
Answer 10: Same as above

Question 11: When you are discussing a channel, what do you mean?
Answer 11: Channel or band or spectral band all refer to the wavelength (or wavelengths) at which a sensor is making measurements. These wavelengths correspond to certain parts of the electromagnetic solar spectrum. Each band is defined by centre wavelength, and has certain bandwidth. Energy captured by each band is defined by its filter function. Each sensor has any number of channels/bands.

Question 12: What is the percentage in one pixel required to be on fire to be detectable by the satellite?
Answer 12: A certain pixel is classified as a fire pixel depending on various spectral tests as discussed in the algorithm section. The fire intensity is defined by fire radiative power, which is measured by satellite. Fire Radiative Power is the rate of emitted radiative energy by the fire at the time of the observation. FRP depends on the amount of fuel and rate of burning. Higher the FRP of a fire, better chance detection by satellite and vice-versa.

Question 13: How can we differentiate real and fake fire detected by satellites?
Answer 13: It is difficult to solve completely, but three are ways in which we can detect fake fires. For example, if you see a spot on the earth, classified as fire every single day, then it may be an fake fire due to the presence of an artificial structure such as a solar farm. The use of high resolution land classification can also help identify some false fires and then finally compare with higher resolution visual maps.

Question 14: Is fire count really just the number of pixels identified as fire, or are they aggregated into true "events" where a single fire may be large and take up many pixels? is this what post-processing models do?

Answer 14: we don't do any pixel merging for large fires. Fire count is really just the number of pixels identified as fire. When people use this data, they may do additional processing to account for the size of the fire. Therefore a large fire can be counted as many fires in satellite detection depending on the size of fire.

Question 15: Is fire count really just the number of pixels identified as fire, or are they aggregated into true "events" where a single fire may be large and take up many pixels? Is this what post-processing models do?
Answer 15: Same as above.

Question 16: I suggest you change fire counts (slide 22) to hotspot counts because that is exactly what you are counting. A fire is a collection of hotspots over a contiguous area. Definitions and words matter particularly when the majority of your students have never been on a fire in a fighting or management role.
Answer 16: Great suggestion. We will look into it.

Question 17: Will there be a consolidated list of all satellites and links for all 6 sessions available at the end of session 6?
Answer 17: We have some of these after each presentation in the form of reference slides. We will look into adding more towards the end of the webinar. A good suggestion.

Question 18: On slide 21 hotspots were identified under the dense smoke. What method can be used to identify the hotspots under dense smoke in the image on slide 21 in California?
Answer 18: The current algorithm does not use any alternative method to identify hotspots or fire detection under heavy smoke conditions. Some fires can be missed, but with a high FRP the fire will be detected.

Question 19: Mr. Gupta said that VIIRS detects 3 to 4 times more fires than MODIS. Does this difference in detection refer to pixel count, total burned area, or both?
Answer 19: This is in reference to pixel count.

Question 20: I'm interested in identifying fire smoke from low level fog. The interest is in where there is overlap - it can produce dangerous transportation issues.

Answer 20: I am not sure what the question is. Send an email to Pawan Gupta with specifics.

Question 21: Thanks for sharing a wonderful tool, "Worldview". Is there any possibility to quantify the release of gases like CO2, NO2 during wildfires?
Answer 21: Thursday's session will cover various methods to calculate the emission of trace gases and aerosols from fires.

Question 22: Can Worldview data be freely downloaded? Also I want to know if it's possible to download data of a particular area or city of the world?

Answer 22: Data that is shown in Worldview is free to download, either through Worldview or one of NASA's Distributed Active Archive Centers (DAACs). Active fire detection data can also be downloaded through the NASA FIRMS website, as shown during the webinar. You can download spatial subsets by clicking the "Data" tab under the Worldview logo in the upper left corner. A note of caution: typically the data shown in Worldview is a NRT product. To download the standard product, you should go to the DAAC where the data are stored (you can use Earthdata search - https://earthdata.nasa.gov/)

Question 23: Is it possible to save California's 2020 wildfires as jpeg images to be used in a publication? And how do I cite it?
Answer 23: If you are referring to Worldview, you can save the image as a .jpeg, .png, .kmz etc. The following citation instructions is provided by Worldview:

For acknowledgment in scientific journals, please use: "We acknowledge the use of imagery from the NASA Worldview application (https://worldview.earthdata.nasa.gov), part of the NASA Earth Observing System Data and Information System (EOSDIS)."

Question 24: If we use satellite imagery in the case of forest/shrub fires, how do we know if the fire is accidental or on purpose (such as land clearing)?
Answer 24: It is not possible to determine the cause of a fire using only satellite observations. Local knowledge is required.

Question 25: Can we trace the propagation of the wildfire?

Answer 25: Using high resolution fire detections from VIIRS, you could view the day to day progression of the perimeter of larger fires. If not needed in NRT, you can look at progression in burned area products. If you are looking to monitor the diurnal progress of a wildfire, use a geostationary sensor.

Question 26: For me, the hardest part of using Worldview is the projection of the map. It is hard to look at the data at higher/lower latitudes even with the Arctic projections. Are there any plans to add more projection options to this tool?
Answer 26: Not sure about future Worldview features. Contact using 'send feedback' form available at Worldview website for submitting your suggestion.

Question 27: Is there a way to correlate fire regime to fires detected?
Answer 27: I am not sure about this question.

Question 28: How did you differentiate between forest fire and agricultural fire?
Answer 28: Agricultural fires are fires set by humans for the purposes of crop/residue clearing. Forest fires are fires that take place in forested ecosystems (as opposed to crop fields), and can have both natural and human causes. Typically, agricultural fires tend to be smaller and less hot than forest fires, making them more difficult to detect from satellites. In addition, we often use land cover type data to separate different types of fires.

Question 29: What is the need of using MODIS data which has a coarser resolution as compared with VIRS data that has a better resolution?
Answer 29: The MODIS data represent a long-term stable data set to examine trends over time. VIIRS is only about 9 years old. For current observations you can use either instrument depending on your needs.

Question 30: How can we differentiate fire on the basis of higher degree of probability on the basis of satellite data?
Answer 30: Not sure. I am not clear about the Q.

Question 31: Gridded Fire Hotspots is showing actual count of fire pixels correct? And not groups of pixels that make up fires?
Answer 31: Yes, actual number of fires (i.e. satellite pixels detected as fire) within a grid cell defined by a box of latitude and longitude.

Question 32: How does FIRMS determine what constitutes one fire. In other words, what is its sensitivity threshold for one fire detected?
Answer 32: FIRMS, and worldview uses the same fire data. Using a fire algorithm as discussed in the first part of the talk.

Question 33: Is it possible to give real-world feedback to the database to exclude industrial exhaust? And give input from real wildfires events that were not detected?
Answer 33: I am not sure. If you are referencing the data processing center, we suggest you contact the data center for further information.

Question 34: Can the sensors detect hotpoints in the plume of the fire, and mark a hotpoint that isn't on the surface?
Answer 34: I am not sure of the correct answer. I think it should not be detecting fire in the hot smoke plume, but I am not for certain.

Question 35: What is the ideal threshold of confidence for fire detection? Also are there any ranges regarding FRP to classify strong and weak fires?
Answer 35: Yes there are a range of FRP's that can detect strong and weak fires. I am not sure of the thresholds themselves, but we reference them in the presentation.

Question 36: What does smoke from peat fires look like? How does it differ from other wildfire smoke?
Answer 36: Typically, peat fires are a smoldering type of fire, a slow burning fire. Wildfires are faster burning fires and burn over a larger area. Smoke from these types of fires might look similar in true color imagery, so more information would be needed to distinguish between the types of fire.

Question 37: How about utilizing Angstrom Exponent and single scattering albedo to differentiate dust and smoke?
Answer 37: Yes. We can use both parameters. We don't have good SSA estimates from satellites except some from OMI in UV channels. People do use Angstrom exponent as well in research.

Question 38: In the MODIS active fire data sets in which the confidence value varies between 0 and 100, are there generally-accepted thresholds used to help distinguish

between false alarms and real fires? Alternatively, what thresholds are applied to the numerical confidence values to classify low, nominal, and high confidence of fire detection in the MODIS data sets?
Answer 38: They are followings for MODIS:

0-30 % - low confidence
30-80% nominal
80-100% high confidence

Question 39: Can we do prediction studies of air quality or forest fires using NASA Worldview?
Answer 39: No, worldview does not provide any forecasted data. We will learn about some of the predictions in the next session.

Question 40: Will we see an example application to make fire products as a summary?
Answer 40: I am not sure. There are case studies we looked at.

Question 41: Could we calculate concentrations of aerosols (like NO2, CO2, SO3 by ppm or µg/m3) from satellites to compare with the concentration from the ground monitoring stations (chemistry models)?
Answer 41: Yes, Thursday's session will cover various methods to calculate the emission of trace gases and aerosols from fires.

Question 42: What did you design the TROPOMI loop with?
Answer 42: We used NOAA's JSTAR mapper.

Question 43: Can you give us a brief on how the thermal anomaly threshold values are determined? Are these the same worldwide?
Answer 43: I am not sure of this question.

Question 44: Could you please elaborate on false positives?
Answer 44: False positives are "fires" that are detected as such, but are not fires.

Question 45: Do you think that it is possible to use different wavelengths to detect the type of dust event (limestone, red sand, etc.)?

Answer 45: There may have been some research studies on this, but no data products as such.

Question 46: How much modeling accuracy can we attribute to PM2.5 data if we use it as our basis for predictive modelling for regional AQI?
Answer 46: We will cover modeling in the next session.

Question 47: How can we forecast the movement of fires? I am assuming that the variables to take into account are those used in pre-fire assessments, but how do we keep track of their spatial-temporal trends in relation to the presence of active fires?
Answer 47: It is a hard problem to detect the movement of fire on the ground itself. It depends on many factors (soil moisture, fuels, temperature, winds, etc.).