Questions & Answers Part 1 (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 Amita Mehta (amita.v.mehta@nasa.gov) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: **If we perform spatial resampling, can we use all the bands of Sentinel-2A for analysis?**
Answer 1: Yes, this is a common process performed on remote sensing bands to normalize the spatial resolution of imagery. You have to be aware that the information in a given pixel can change when you resample from one spatial resolution to another (e.g., 10 m to 20 m). There are a number of methods to resample the bands of Sentinel-2A MSI imagery such as nearest neighbor, bilinear interpolation, and cubic convolution. It's good to be mindful that resampling always involves data loss and should be used judiciously.

Question 2: **How do we get vegetation height information from remote sensing?**
Answer 2: There are a number of methods of deriving vegetation height using remote sensing. LiDAR instruments flown on aerial platforms provide 3-dimensional point clouds that can be converted to digital terrain models using image processing software. NASA currently has a space-based LiDAR instrument on the International Space Station (ISS) named the Global Ecosystems Dynamics Investigation Lidar (GEDI) which provides for vegetation height at a coarse spatial resolution. There are a number of ways to use L-band SAR data to calculate vegetation height, many of which have used ALOS-2 data. NASA will be launching the NISAR mission next year which will also carry a L-band SAR instrument allowing for the calculation of vegetation height. For those who are interested in this application, we encourage you to refer to the SERVIR SAR Handbook for more information:
https://servirglobal.net/Global/Articles/Article/2674/sar-handbook-comprehensive-methodologies-for-forest-monitoring-and-biomass-estimation

Question 3: **What do negative values of NDVI mean in theory?**

Answer 3: This means (NIR-Red) reflectance is negative (NIR < Red or more absorption of NIR wavelength and less in red wavelength when vegetation is dry), a feature of dry (less green vegetation). Negative values are also indicative of clouds and water bodies.

Question 4: **Sometimes data isn't available in the Earth Engine catalog. For example, for some areas Sentinel-2 (S2) data isn't available for 15+ days, although temporal resolution of S2 is much lesser. Why is this?**
Answer 4: You may be looking at orbital gaps. If you see 15-day data are missing it could be a data outage for any reason. If recent Sentinel data are missing in Earth Engine, you can also consult the newsfeed on scihub for known outages.

Question 5: **May I ask for a preference point of view? Some variables were named firstLast and others were named FirstLast. I know it is not a catastrophic question, but may I know the developers' preferences in variable naming?**
Answer 5: Good question. It's a matter of style and preference on naming conventions for variable names. As long as you apply logic to naming conventions and try to be consistent throughout your script, everything else is personal preference.

Question 6: **How can these remote sensing data be used to develop a regression model to predict forest fires due to climate change?**
Answer 6: You can use remote sensing or model data (reanalysis or climate model) to relate past cases of fires with biophysical and atmospheric parameters.

Question 7: **Are there VIIRS products to make vegetation anomalies?**
Answer 7: Yes, VIIRS vegetation indices are available from the VIIRS land team at 500 m and 1 km spatial resolution.
https://viirsland.gsfc.nasa.gov/Products/NASA/VIESDR.html

Question 8: **What is the difference between a level 7 and level 9 sub-basin? And how do you choose?**
Answer 8: HydroSHEDS provides polygons of nested, hierarchical watersheds, based on 15 arc-seconds (approx. 500 m at the equator) resolution raster data. The watersheds range from level 1 (coarse) to level 12 (detailed), using Pfastetter codes. For more information, refer to the technical documentation:
https://hydrosheds.org/images/inpages/HydroBASINS_TechDoc_v1c.pdf

Question 9: **Can we use this script to assess the fire risk for any region around the world?**

Answer 9: Yes, in the demonstration you will see how to change parameters in the script to adapt the code for analysis in your own study area and study period. Please refer to slides 53–57 from the Part 1 presentation detailing which parameters in the script should be edited for your own analysis.

Question 10: **A lot of the sensors have a spatial resolution of greater than 30-meters. How accurate are these techniques for monitoring fires at smaller-scales?**

Answer 10: Even when the spatial resolution is low (for example MODIS has 250 m spatial resolution), a pixel will usually be affected by the presence of fire, if the fire is not very small or low intensity and of short duration. The accuracy of fire area estimation would be affected by the sensor resolution. The value of instruments with a coarser spatial resolution is they typically provide higher **temporal resolution** (i.e., daily global coverage) allowing detection of global fires in near real time. Once fires have been detected you can investigate the actual extent with finer granularity using Sentinel-2 or Landsat 8/9 once you have a clear overpass.

Question 11: **Why and when do we need to normalize the bands?**

Answer 11: This really depends on what type of analysis you are undertaking. One example for normalizing bands would be to make a consistent data set from multiple sensors by normalizing measurements from those sensors using a consistent data set as reference. This idea has been used for normalizing reflectance data from different sensors to create a time series of NDVI from multiple platforms/sensors.

Question 12: **To detect any impact of the forest fire on water quality (anomalies), what is the best period of time to consider (number of days or months before and after the fire occurrence)?**

Answer 12: Stay tuned, this will be covered in Part 2 of the webinar series when we cover water quality monitoring using the Soil & Water Assessment Tool (SWAT).

Question 13: **How can we measure the exact area/resources lost or vulnerable due to fire?**

Answer 13: This is two different questions. To assess vulnerability pre-fire, you can use the methods presented in today's webinar to evaluate biophysical and meteorological

conditions that increase the risk of fire in a given area. To measure the exact area of resources impacted and/or lost, post-fire, stay tuned for Part 3 of the webinar series when this will be covered by other members of the ARSET team.

Questions & Answers Part 1 (Session B)

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 Amita Mehta (amita.v.mehta@nasa.gov) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: **Precipitation is a cumulative variable?**
Answer 1: Yes, the CHIRPS data used in the demonstration is in units of mm/day. We then summed the daily cumulative values to monthly to calculate the Standardized Precipitation Index (SPI). To learn more about the CHIRPS product please refer to the link below:
https://www.nature.com/articles/sdata201566

Question 2: **Is there a list that categorizes the flammability of trees?**
Answer 2: There are a number of government websites that provide this information. We are including a couple links below, but encourage you to search for species that are native to your geography.
https://www.sciencedirect.com/science/article/pii/S0048969721047008
https://www.ashland.or.us/Files/FlammablePlantList_al.pdf

Question 3: **How do you go about deciding on a color palette/spectrum and generating the array? Are there any built-in methods for programmatically generating it, whether a linear color map or otherwise?**
Answer 3: This is as much an art as a science. Determining appropriate color palettes for generating an array has been a topic of research for the cartographic community for years. The Google Earth Engine community has actually created a repository on GitHub with a module for generating color palettes in Google Earth Engine to be applied to mapped data. We are including the link to the repo below:
https://github.com/gee-community/ee-palettes

Question 4: **How can I download the images from the image list to Drive?**
Answer 4: Instructions for downloading the images to your Google Drive are commented in the bottom section of the script.

Question 5: **How difficult or time-intensive would it be for folks to adapt this code for use in Python? (Or is it not feasible at all?)**
Answer 5: It is entirely feasible to adapt the code from JavaScript to an Earth Engine Python API. We did not go into detail for doing so, but if you have experience with Python it should not be too difficult or time intensive. If you do so we hope you will share the code with the user community!

In addition, programs such as Geemap or Leafmap library can also assist in adapting the JavaScript code to Python for use in Colab or Jupyter Notebook. Thank you to the participant who shared this information.

Question 6: **Is there an algorithm inside Google Earth Engine (GEE) that works as an early warning before the fire seasons happen?**
Answer 6: I am unaware of an app generated using GEE that works as an early warning before the fire season, but local and national governments typically have websites that provide different outlooks and forecasts for fire risk.
Below are a couple examples:
https://www.weather.gov/fire/
https://www.usgs.gov/fire-danger-forecast
https://www.noaa.gov/noaa-wildfire/fire-cycle/before-fire

Question 7: **Have soil moisture, vegetation stress, and other maps been calibrated? If so, how did you calibrate them?**
Answer 7: The soil moisture products, NDVI products, and precipitation products demonstrated in today's webinar have all been calibrated using sources including in-situ, airborne, and spaceborne instruments. Each of the products have associated product manuals detailing how the products were calibrated and validated. We encourage you to explore each product on your own.

Question 8: **When using datasets from various sources, does google earth engine automatically convert the CRS to match?**
Answer 8: There could be a dataset from GEE and that reference system may not be a global one. It is best to double check before use of data. Today, we used datasets from the same CRS.