Question & Answer Session, Part 1

Please type your questions in the Question Box. We will try our best to get to all of your questions. If we don't, feel free to email Erika Podest (erika.podest@jpl.nasa.gov) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: Which method of water body extraction (pixel based, object based or water index) gives one the best results in case of using SAR?
Answer 1: I have not compared the methods. It would depend on the size of the water bodies. If small, object based may work better but I encourage you to explore.

Question 2: Is there a standardized correction for the effect of incidence angle variation? Is it applied to GEE's Sentinel image library?
Answer 2: There are many different ways of doing correction with mixed results. GEE does not apply the correction. You do not need to apply incidence angle correction to work with the data in GEE. If the incidence angle variation is very pronounced you may want to cut off edges and work with the data in the center of the image.

Question 3: What are the possible reasons for not forming a perfect interferogram in a low vegetation, high Bperp, and good temporal resolution terrain?
Answer 3: The next 2 parts of this webinar series will cover InSAR. We will have 2 experts that can answer your questions.

Question 4: By texture do you mean something like glcm/harralick measures?
Answer 4: Yes, exactly. The SNAP software has texture options you can generate for your image. ENVI also has texture measures.

Question 5: How does one detect vegetation inundation in densely populated urban areas? In this tutorial the brightness value for urban and vegetation inundation is the same.
Answer 5: It is difficult. This is a source of confusion between the 2 classes due to double bounce in both. You can detect inundation in urban areas without tall buildings such as open green areas. That is why radar is not totally effective for flood mapping in urban areas.

Question 6: How long does it take to get a Google Earth Engine account accepted? I have been waiting since the last webinar in early September and still they have not approved my account.
Answer 6: It should not take that long. 24 hours is typical. Maybe the confirmation email went to SPAM.

Question 7: Can you explain about Green Space Analysis?
Answer 7: Please explain further….

Question 8: Is it possible to overlay roads and other infrastructure data with your flood extent layer outside of the U.S. in GEE? For example using Open Street Map (OSM) data?
Answer 8: Yes, there is a database on what is currently in GEE but you can overlay your own vector files. You can also export the flood map results from GEE and import it into QGIS and then overlay your infrastructure dataset.

Question 9: Is it recommended to apply a speckle filter when a small area is assessed? I think that the resultant segmentation would miss data.
Answer 9: You should apply a speckle filter, even in small areas. You will want to play around with the size of the filter. This will make for a cleaner classification.

Question 10: Is there a possibility of integrating SAR data with other freely available data (i.e. Landsat 8) and other in situ data for better visualization?
Answer 10: Yes, in GEE, you have Landsat 8 data available. You can use many different layers and run the classification and compare the results using a combination of different input datasets. In situ data can be added too.

Question 11: (GEE) What to do if "roi" is not defined in this scope?
Answer 11: Please clarify.

Question 12: With editing the dates, can we use this code script for another area?
Answer 12: Yes, absolutely. This is just an example. The script can be applied and modified for any region of interest and dates. As long as there are images for your dates.

Question 13: Why are urban areas represented by a white colour in GEE?
Answer 13: Urban areas are dominated by double bounce, thus a high return.

Question 14: Can I add a new layer in order to overlay with my result? If so, how?
Answer 14: Yes, we showed this in the demo (for example the roads layer).

Question 15: Is SAR imagery as shown in this webinar useful for detecting and quantifying urban flooding too or just flooded vegetated areas?
Answer 15: As discussed above, it is more effective in vegetated areas. Less dense urban areas can be evaluated with SAR.

Question 16: For one class, how many samples should one use?
Answer 16: Keep in mind, you need to have a good statistical sample for each class. At least 500-1000 pixels. Try to select samples across the image.

Question 17: Do you need global SAR data or more local data?
I personally feel local data would be more useful for almost all kinds of SAR related applications.
Answer 17: This depends on your needs. GEE has a global database of Sentinel-1 data.

Question 18: During the merge of two or more images, I got some unexpected strips. How can I remove those small strips?
Answer 18: There is a code that can remove those strips. We will pass that along to you. Please email Erika Podest.

Question 19: Could you please let us know if the training sample size would affect the result? If so, how many training samples are ideal for selection?
Answer 19: 500-1000 pixels, in general. If too small, the classification could be off.

Question 20: How will the classifier algorithm differentiate between open water from flooding and permanent open water? They have the same DN values. They all appear dark.
Answer 20: You will be using the 2 images, before and after. So checking the change will allow you to differentiate. You train the classifier with these classes. The final result will characterize the open water from flooding.

Question 21: How do you define urban area, hard surface, and paved area?
Answer 21: I define urban by very bright backscatter areas that I know are in an urban environment. If really bright, before and after, and it is not changing, it is likely urban.

Question 22: Can we download these data using google earth engine (e.g. NDVI, LU/LC raster)?
Answer 22: Yes. The last step in the demo showed this.

Question 23: Can we use this data for our Ph.D. Research (publications)?
Answer 23: That depends on your advisor. Make sure that proper credit is given to ESA, Copernicus, and GEE.

Question 24: What is the role of SAR in River Modelling studies (e.g. simulation)?
Answer 24: One thing you can do with SAR is generate a DEM, and that can be used in modeling. Changes in elevation and water routing.

Question 25: Does Sentinel-1 also provide DEM? If so, what is the resolution?
Answer 25: Sentinel 1 data on GEE is analysis ready. All you need to do is apply the speckle filter. Terrain correction in GEE uses SRTM or ASTER. You can download the DEM, it is part of the GEE database. The DEM can be a layer in your classification.

Question 26: Is sentinel data available frequently in the Indian region?
Answer 26: It depends on your definition of frequent. Each Sentinel satellite has a 12 day repeat. If both Sentinel-1A and -1B are acquiring data, then the interval is 6 days. All of Europe is imaged every 6 days with Sentinel-1. Other areas are usually every 12 days or every 24 days, due to the satellite system limitations. Sentinel-1 is a global dataset and there should be a large number of multi-temporal images over India.

Question 27: Is it possible to have free local SAR data for a specific place for example here in Madagascar?
Answer 27: Yes, this database is global. Query in GEE to see the coverage in Madagascar. All is free and you can process in the cloud.

Question 28: What are different classifiers? Which one performs the best? I know we are using Cart here.
Answer 28: There are many, but supervised gives you great results. Random forest too.

Question 29: Can the classification by SAR images be improved using classification by optical images?
Answer 29: Possibly it can improve. Play around with the radar data and test with various optical datasets. Optical can help with the confusion in areas that look similar such as open water with wind and low vegetated areas.

Question 30: How many classes would be enough for training in order to get the best results?
Answer 30: The number of classes depends on the variability you are seeing. You can always merge later on. Use the histogram to see the overlap between the classes you identified.

Question 31: How does one export the imagery to use in another image processing software?
Answer 31: Please see the demo, at the end we exported a GEOTIFF which can be used in a GIS.

Question 32: How to decide on the number of classifications for the study area?
Answer 32: This will depend upon what you want to classify. You will want to cover all the variability.

Question 33: I'm not clear on what data were used for the accuracy assessment. Usually you'd use an independent dataset. How would you input independent data?
Answer 33: Good point. You want to do your accuracy assessment in areas independent of the data used to train the classifier. You want to define a second set of defined classes to validate. To do so, when you run the validation, call the independent classes the validation dataset.

Question 34: For classification, is it mandatory to use polygons or can you actually use point data? For instance, if you use the point data from a survey like LUCAS for landcover.
Answer 34: You can use point data. But it is just a point. A lot of point data will be needed in order to represent each class in a statistical meaningful way.

Question 35: Are the tiger roads map and the population density only for the USA?
Answer 35: Population is global, TIGER roads is just US (from US Census).

Question 36: Will it be correct if I use a mosaiced average values of all the S1 images in a month to estimate flooding in that month?

Answer 36: You do not want to use mosaiced average values for an entire month. Flooding is dynamic so the monthly average may not give you an accurate measure of flooded extent.

Question 37: Could you send us the polygons so we can have the same dataset, especially for the landcover?
Answer 37: Yes, Please email Erika Podest.

Question 38: Did you use training samples for validation? How do you use validation samples in this case?
Answer 38: See question 33.

Question 39: Is it recommended to apply a speckle filter when a small area (14 ha) is assessed? I think that the resultant segmentation would miss data.
Answer 39: Run it both ways, filtered and not and compare the results.

Question 40: We took to analyze images with resolution 10x10 meters. But exports to Google Drive result image with resolution 100x100 meters. Why?
Answer 40: It may be the way the export was defined. Also, the resolution will be reduced after applying the filter.

Question 41: What about doing the same for drought?
Answer 41: ARSET has had some webinar series that involved bringing in soil moisture to address this.

Question 42: How do you remove the wave/wind effect on the large open water surface?
Answer 42: Use HV (or VH), which is less sensitive to roughness on water due to wind or waves.

Question 43: Are datasets used in the demonstration global?
Answer 43: Almost all the datasets are global. Population and Sentinel data are global. The TIGER roads is only US.

Question 44: Is there any possibility to import external shapefiles for training?
Answer 44: Yes, GEE has an option to import your own files.

Question 45: Do I need to learn coding to use this data, or are there already precoded things I can just follow?
Answer 45: You can use this code, modified to your area and period of interest.

Question 46: How can I differentiate between urban areas and flooded vegetation? Both are represented by white colour.
Answer 46: See a previous answer for this. -- Question 5

Question 47: How successful have attempts to automate these disaster mapping analysis processes (as opposed to on a case-by-case basis) been? Is each situation far too variable to allow automation?
Answer 47: There are efforts to do this. A good example is the ARIA project that provides information on flooding. Some automation is used.

Question 48: If I include 'VH' in my band selection, it fails. I'm assuming that polarisation isn't available?
Answer 48: Revisit your code. Grammatical errors or misplacing a comma will result in the code not working. Make sure you copy the code exactly as you find it in the tutorial for this presentation.

Question 49: How to separate out smooth land areas (high specular reflectance) from those of surface matter in GEE?
Answer 49: Please expand.

Question 50: Is there any method offered by the GEE for mapping flood based on an automatic comparison between the before/after images?
Answer 50: There may be, but I am not familiar.

Question 51: Is SAR imagery better for agricultural crop classification? Which band is good for this purpose?
Answer 51: Yes, please see the 2019 ARSET SAR for Landcover series (recordings available). See Part 2 of that series.
https://arset.gsfc.nasa.gov/disasters/webinars/2019-SAR

Question 52: Is the Overlapping of the inundation output from supervised classification with a DEM possible in the Google Earth Engine to get the depth of inundation in flooded areas? If so how?
Answer 52: You can overlap a DEM. But depth is not available.

Question 53: I have seen most of the demonstration lectures in flat areas. How do we remove the shadow effect when dealing with flooding classification in the mountainous areas?
Answer 53: The best way to deal with shadow is to create a mask and treat it as areas of no data.

Question 54: What would be an acceptable SAR Data latency for real time disasters?
Answer 54: It depends on the disaster. Floods are very dynamic and you will want images with as low latency as possible. An earthquake on the other hand is a single event and low latency may not be as critical.

Question 55: What does the confusion matrix use as observed data?
Answer 55: The confusion matrix used the training data to do the validation. However in order to do a proper validation of your classification results you need to define a set of classes that are independent of your training classes, which should be validation classes. Run the validation against your validation classes.

Question 56: I read that RadarSat and ALOS data have been released for free recently. Can we access on these database on GEE nowadays?
Answer 56: ALOS has two satellites ALOS PALSAR and ALOS-2 PALSAR-2. ALOS PALSAR is available through the Alaska Satellite Facility, however, I do not know of any plans to upload it to GEE. You can find yearly 25meter global PALSAR and PALSAR-2 mosaics on GEE. I do not know the status of the Radarsat data.

Question 57: When integrating different data sets is it possible to perform radiometric and geometric calibration using google earth engine?
Answer 57: The Sentinel-1 data on GEE is already radiometrically and geometrically calibrated.

Question 58: How do you differentiate between hillshade and open water?
Answer 58: It is difficult to differentiate shadow and open water and these two are often a source of confusion. The best way to differentiate them is by using a DEM and masking according to elevation or slope.

Question 59: Instead of using training samples from the image itself, can we use ground GPS or other data by exporting?

Answer 59: Yes you can use your own data for training and import it into GEE.

Question 60: Can we calculate GLCM or some similar texture index for SAR image in GEE?
Answer 60: Yes you can by either coding up your own texture or adapting a texture code in the literature. Here is an example of such: https://stackoverflow.com/questions/57633820/convert-rgb-image-to-single-band-grayscale-image-within-google-earth-engine-usin

Question 61:How could we decide the scale to export geotiff files?
Answer 61: It is primarily a matter of your local disk space when exporting the file onto your computer.

Question 62:Using Sentinel SAR data for classification, sometimes the forest or tall trees gets classified as an urban (settlement) area. So, is there any way to minimize that or what band would be good for the urban classification?
Answer 62: Only inundated forests will be confused as urban areas. The reason for this is because the signal in urban areas and inundated vegetation is dominated by double-bounce scattering. The best way to separate them is to mask out urban areas through time series analysis - given that urban areas will always be bright. Another way to help separate them is to apply a texture filter.

Question 64: Why did we assign 100 m rather than 10m (Sentinel-1 resolution) in the export session?
Answer 64: See question 61.

Question 65: Regarding Q25, I think they meant that is there a DEM retrieved from the Sentinel-1 data?
Answer 65: There is no systematic DEM retrieved from Sentinel-1 SAR data. The Sentinel-1 data is not optimal for DEM extraction for a number of reasons. It is possible to calculate a DEM from Sentinel-1 pairs using the SNAP software, but it can have large errors. The Google Earth Engine cannot extract a DEM from SAR data.

Question 66: Is it advisable to add DEM to classification?
Answer 66: In some cases it might be especially when classifying wetlands. A DEM helps constrain areas where wetlands are most likely to be (given that you do not find

wetlands and steep slopes). I suggest you try using a DEM in your classification and seeing whether it improves your results.

Question 67: Whether we can get database for all the regions on Earth or not?
Answer 67: Sentinel-1 has global coverage.

Question 68: In SNAP, we should conduct preprocessing firstly. How about in GEE? What is the level of Sentinel-1 image we used?
Answer 68: In GEE the images have been radiometrically and terrain corrected. They are analysis ready and the only thing that you need to do is to apply a speckle filter. The only Sentinel-1 images available on GEE are the ground projected (GRD) images. They are amplitude images and are in dB.

Question 69: When I run the code of load images, I get an answer "ROI" is not defined in this scope. What should I do?
Answer 69: Make sure you have defined your region of interest (ROI). Also, sometimes small grammatical errors or coding mistakes can cause errors when running your code.

Question 70: For training, what is more important? More different areas sampled [for a given type] or a smaller number of sample areas with more total number of pixels?
Answer 70: Both are important. You should sample each class with representative areas across your image. The number of pixels should be statistically significant (500-1000 for each class).

Question 71: How can we export a SAR image that can easily or automatic grid system in GIS?
Answer 71: You need to modify the code at the end of the tutorial so that instead of exporting the flood map created, you export the SAR image/s as geotiff. You can then import the geotiff image into a GIS software like QGIS, for example.

Question 72: There are several basic preprocessing steps such as: + Applied Orbit File + Thermal Noise Removal + Calibration + Speckle Filter + Terrain correction. Can we do all of these things to preprocess SAR data in GEE?
Answer 72: You do not need to process the Sentinel-1 data that is in GEE. The data is already processed. All you need to do is apply a speckle filter.

Question 73: How to calculate the flooded area in sq. km in GEE itself?

Answer 73: Tabulate the number of pixels that are flooded and multiple it times the spatial resolution of the pixel. In the case of Sentinel-1, each pixel is gridded to a spatial resolution of 10m (10mx10m=100 square meters).

Question 74:There was an error message that the ROI is not defined when I wanted to display the image data. What was the cause and how to correct the mistake?
Answer 74: Check your code and make sure it matches the one provided with the tutorial.

Question 75: We used the final image for classification which holds both images, before and after flood image. Is it a good idea to use both images for classification? Because in one image there is flooded vegetation but in before flood is just vegetation and we used both types of backscatter values for classification. Is it helpful in classification? Can you explain? Thank you
Answer 75: Yes, both before and after images were intentionally used in order to identify areas that were flooded permanently and temporarily.

Question 77: Is it possible to extrapolate the data from Google Earth and simulate that in Google Earth?
Answer 77: I am unclear about the question, however, you can export the image as a kmz and overlay it on Google Earth.