



## Questions & Answers Part 1

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](mailto:amita.v.mehta@nasa.gov)), Sean McCartney ([sean.mccartney@nasa.gov](mailto:sean.mccartney@nasa.gov)), or Caroline Williams ([caroline.williams@ssaihq.com](mailto:caroline.williams@ssaihq.com)).

### **Question 1: Do any of these databases work better for detecting water under vegetation?**

Answer 1: SAR has some capability to detect water under vegetation. So HYDRAFloods can be used for that. Here is a paper that may be useful for more information (<https://www.tandfonline.com/doi/full/10.1080/01431161.2017.1420938>).

### **Question 2: Will ARIA eventually have an in-window data viewer? (Instead of relying on external applications)?**

Answer 2: We have sent this question to the ARIA Team. If there is any plan for an in-window viewer, we will make that information available.

### **Question 3: Can we monitor volcanic lava flow mapping too like flood mapping?**

Answer 3: A great question! My conjecture is that yes, lava flow will show up in land cover detection (if high resolution images are used). But, the lava flow will be very hot - so looking at thermal images along with optical images would help in separating floods from lava flow.

### **Question 4: Do you apply an additional mask over urban areas, due to the possibility of over-calculating floods there with S1 data?**

Answer 4: Urban areas are tricky - no one mask would work but if you have lidar data, using that along with SAR would be useful. We will check with a SAR expert and answer the question about the mask. Here is a paper that suggests that using interferometric SAR coherence may help in urban flood detection. (<https://ieeexplore.ieee.org/document/8518060>).

### **Question 5: Please explain Edge Otsu threshold?**

#### **Can you use it for separate water bodies from other land use areas?**

Answer 5: There are research papers that explain these techniques in further detail and we will provide references. This paper on comparing Sentinel-1 Surface Water Mapping



Algorithms and Radiometric Terrain Correction Processing in Southeast Asia Utilizing Google Earth Engine by Markert et al explains the process of the Edge Otsu threshold algorithm as well as compare to the Bmax Otsu threshold algorithm (<https://doi.org/10.3390/rs12152469>). HYDRAFloods offers both Bmax and Edge Otsu threshold methods.

<https://servir-mekong.github.io/hydra-floods/thresholding/>

**Question 6: Is it possible to use HYDRAFloods for flood prediction and possible responses/interventions at small-scale resolutions (cities and neighborhoods)? Is such resolution (temporal and spatial) appropriate to study urban flash floods in developing countries? I see Caroline was showing some nice daily precipitation analysis in Central America. What would be the challenges to using hourly assimilated data from Precip and Soil moisture for early-warning detection of damaging flooding events?**

Answer 6: Prediction is not possible using HYDRAFloods, but is useful for near real time applications such as disaster response. Flash floods are hard due to the short length of time in which they occur. If you want to use hourly data for early warning you can, but it is dependent on the resolution of the data.

**Question 7: How can we generate any T-yr flood maps using these products? Do these models have capability to forecast floods in advance?**

Answer 7: If you are using forecast models, you can predict flooding in advance.

**Question 8: How well do your satellite-flood maps compare with those from hydrologic/hydraulic-modeled floods? What products did you use for your validation, and how do you account for satellite missed periods during active flood events?**

Answer 8: Satellite maps are not used for validation, rather in situ data is. When satellite overpass occurs outside of a window of a flash flood, it will not be included in the flood map.

**Question 9: Is there a flood-mapping algorithm by HYDRA that only makes use of SAR data or are SAR and optical used together by default?**

Answer 9: Looking at the Mekong site, they have SAR data and optical data, along with merged data as well. HYDRAFloods can use optical or SAR for the thresholding algorithms. The main differences would be in the preprocessing stages prior to inputting the optical or SAR imagery into the flood-mapping algorithm.



**Question 10: Is there any technique to identify the number of vulnerable populations of flooded areas captured by remote sensing?**

Answer 10: NASA SEDAC has population density maps, along with combining flood maps can tell you populations of flooded areas.

**Question 11: During a flood, is it possible to quantify the amount of soil lost through the turbidity of the flooded water? and is it also possible to determine along the flood which parts receive the highest amount of sediment?**

Answer 11: There are sediment flow models and we can provide references to them.

**Question 12: Can we monitor salinity in seas with the flood monitoring tool?**

Answer 12: You can see where the freshwater merges with saltwater, but monitoring is difficult.

**Question 13: Using HYDRAFloods (App) - why not use Ground Truthing Points for flood mapping?**

Answer 13: Ground truthing points could be used for validation if the data is available. The projects covered in the presentation were feasibility studies.

**Question 14: Why the assimilation of SAR and optical data? What is the purpose of it?**

Answer 14: Optical data is affected by cloud cover. In conjunction with SAR data, the combination of both will allow the imagery to see through cloud cover.

**Question 15: Is DEM used to obtain a better result in the HYDRA algorithm or in the other flood tools you mentioned? What would the advantages be?**

Answer 15: DEM is used in imagery such as MODIS and helps with interpretation.

**Question 16: What could be the best option to use for monitoring or assessing the flood impacts, especially in case of cloud cover during the flood period?**

Answer 16: SAR data is useful to see past cloud cover in a flooding event.

**Question 17: Can we use HYDRAFloods to monitor debris flow?**

Answer 17: If the river channel is wide enough, it can show when turbidity has changed in cloud free imagery.

**Question 18: How can I model floods using HEC-RAS in ungauged basins? Any suggestions? I mean when channel geometry and other data is not available.**



Answer 18: HEC-RAS does need channel geometry information as input. You may want to contact [hec.ras@usace.army.mil](mailto:hec.ras@usace.army.mil) for more details.

**Question 19: Which metrics and/or validation procedure is recommended the most for satellite-derived maps validation? ROC (and AUC) or others?**

Answer 19: Stream flow data is necessary for validation. We will look into this further.

**Question 20: Do you know if there is any resemblance between HYDRAFloods algorithms and SNAP algorithms?**

Answer 20: HYDRAFloods use both SAR and Optical data so the algorithm is somewhat different than SNAP. The SAR data processing would conceptually be similar to SNAP (e.g. speckle filtering, terrain correction).

**Question 21: Can we use HYDRAFloods to monitor flash floods on a daily basis?**

Answer 21: There is daily data from VIIRS, but due to the nature of flash floods, it can be difficult to track.

**Question 22: Coastal estuaries are complicated because of the combined effects of regular, daily tides and downstream, riparian flooding. Will this course cover such circumstances?**

Answer 22: We will be covering this in next week's presentation on HyMap.

**Question 23: Can we apply this to measure melting of glaciers?**

Answer 23: Optical imagery is used to measure the melting of glaciers.

**Question 24: How valid could the satellite data be without in-situ data? Can researchers use the satellite data without in-situ data for validation?**

Answer 24: In-situ data is important for validation. Using the example of NASA missions, validation on the ground using in-situ data is an integral part in collection data.

**Question 25: What tool(s) might be the best choice to analyze how flood extent and duration has changed over time?**

Answer 25: There is no one tool that can do this analysis. MODIS provides data for long term flood extent and optical data is used for near real time flood extent.



**Question 26: Is there a way to determine flood inundation depths?**

Answer 26: It is possible using routing models, and we will be covering this in next week's presentation.

**Question 27: Is there any way to integrate machine learning or artificial neural network for flood modeling and HYDRA for mapping?**

Answer 27: It is possible, but this is more of a research question.

**Question 28: Can satellite data quantify the amount of water in flood affected areas?**

Answer 28: Satellite data in tandem with hydrologic models can help with that.

**Question 29: How can we forecast flooding?**

Answer 29: SWAT / HEC-RAS or LIS types of models can be used with inputs from weather forecast models – and can be used for flood forecasts.

**Question 30: Is there a way to conduct flood risk assessment using DEM and LULC?**

Answer 30: There are many papers presenting case studies of flood risk assessment using DEM and LULC. Here is an example: <https://link.springer.com/article/10.1007/s11069-022-05347-2>

**Question 31: Can satellite data determine the speed of flooding waters?**

Answer 31: If you use hydrologic models, those are outputs of said models.

**Question 32: What are the limitations of using SWAT?**

Answer 32: We found this review paper:

[https://www.card.iastate.edu/research/resource-and-environmental/items/asabe\\_swat.pdf](https://www.card.iastate.edu/research/resource-and-environmental/items/asabe_swat.pdf)

About the most recent SWAT version you may want to join the SWAT users group to find out more about model strength and limitations (<https://swat.tamu.edu/support/>).

**Question 33: Can Lidar data be integrated with optical and SAR for better flood assessment?**

Answer 33: Yes, they can. When using flood modeling, LiDAR does help.

**Question 34: Can HYDRAFloods be used for flash flood monitoring and forecasting or is it only dedicated to river floods?**



Answer 34: It cannot be used for forecasting as it is observation based. Flash floods are hard to capture due to their fast nature.

**Question 35: Will we have a training specifically on LIS?**

Answer 35: This is an intermediate webinar, so it is mostly the concepts being taught. LIS will not be explicitly taught in this webinar series.

**Question 36: The example of Honduras, where do I find the summary? Can I adapt it to other areas?**

Answer 36: Yes you can! You can download HYDRAFloods and work within your region of choice. You may also consult the HYDRAFloods Team for more information (<https://www.climatelinks.org/blog/connecting-space-village-reduce-flood-impacts>).

**Question 37: Can similar methods be used to identify streamflow droughts? Like, for example, several events that hit Europe in August?**

Answer 37: For looking at drought, you do need additional information before using these methods to identify streamflow drought.

**Question 38: How is SMAP utilized for flood mapping?**

Answer 38: If soil moisture is high, there is less infiltration of runoff and more runoff going to the stream.

***Question 39: SWAT, se puede adaptar con cierta facilidad para áreas de Sudamérica? Hay que poblar muchos datos para que pueda predecir el impacto en medio ambiente por cambio climáticos..?***

**(Eng) Can SWAT be easily adapted to areas of South America? Do you have to populate a lot of data so that you can predict the impact on the environment due to climate change?**

Answer 39: Yes it can be used in South America. If you want to look at climate change impact, you do need data related to climate change in order to observe effectively.

**Question 40: I have a question for Caroline - during the process of mosaicking imagery, did you have any study regions where imagery to cover the entire region was not available on a single day/satellite overpass (so you had data from multiple different days)? If so - how did you handle the analysis of that data (did you break down the study region and analyze the different dates separately - etc.?)**



Answer 40: Optical data does have daily data. HYDRAFloods offers an “aggregate\_time” function that can be applied to an image collection, SAR or optical. The function aggregates several images into one based on time periods and the reducer user input. This is for mosaicing images from the same date or time period.

Documentation on this function can be found here:

[https://servir-mekong.github.io/hydra-floods/datasets/#hydrafloods.datasets.Dataset.aggregate\\_time](https://servir-mekong.github.io/hydra-floods/datasets/#hydrafloods.datasets.Dataset.aggregate_time)

**Question 41: With Rapid urbanization, more built up land leads to more stormwater runoff and little percolation and causes local flooding. What tool will best suit the mapping and analysis of stormwater management at small regional scales?**

Answer 41: There are urban flood models. You do need in situ data in relation to your specific urban area such as building types, etc. We will cover this more in detail next week.

**Question 42: Can HYDRAFloods be used for urban flooding, or just regional flooding? Also, is there an option to consider land use change?**

Answer 42: For HYDRAFloods, you can use it in an urban area, but the data does require validation due to the complexity of the type of area you are observing.

**Question 43: Apart from areal inundation coverage, are there any other parameters that can be derived for flood development through remote sensing observations?**

Answer 43: Using remote sensing data (precipitation, terrain, soil moisture, land cover) in hydrologic and routing models can provide runoff and streamflow information.

**Question 44: Is calibration of models possible using data of ATLAS/Icesat-2?**

Answer 44: This is beyond the scope of this webinar.

**Question 45: Are there any new tools or significant upgrades to the current tools that are in the works/you are excited for?**

Answer 45: HYDRAFloods is a relatively new tool that is great for flooding applications. MODIS near real time flood tools are also exciting.

**Question 46: What is the best tool suitable for hydraulic modeling in poor/non recorded-regions (ungauged rivers/stream) between HEC-RAS and SWAT when runoff data are derived from an rainfall-runoff model?**



Answer 46: HEC-RAS and SWAT provide documentation on how to run this type of analysis. Both also require validation of data.

**Question 47: Can we use remote sensing data to supplement missing rainfall or runoff data and use it to validate flood models?**

Answer 47: GLDAS provides runoff information. Using remote sensing data to validate models is not certain.

**Question 48: Any ideas comparing HEC-RAS Vs SWAT capacity with respect to 3D flood modeling, which is better?**

Answer 48: Both the models have different approaches and may have to be tested for the region of your interest. Please see an example:

<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1041.5435&rep=rep1&type=pdf>

**Question 49: Are there hydro models that you recommend for urban flooding?**

Answer 49: We will be covering HyMap in next week's presentation, which has been used for urban flooding.

**Question 50: Can we set up information from the ground like a lidar survey of a river basin?**

Answer 50: Yes, you can.

**Question 51: What is the major difference between terra MODIS and aqua MODIS? Is it related to the time of observation or the region that it observes?**

Answer 51: Terra is 10:30 and Aqua is 14:30 (local time).

**Question 52: Is it possible to downscale coarse resolution rainfall remote sensing data with higher resolution for runoff modeling at higher spatial scale?**

Answer 52: There are methods available for downscaling, but additional data is needed.

**Question 53: ¿Qué tipo de información rápida entrega ARIA? Y cual es su tiempo de respuesta ?**

**(Eng.) What kind of fast information does ARIA deliver? And what is the response time?**





Answer 53: There can be latency in ARIA products. Please contact [aria-urgent-response@jpl.nasa.gov](mailto:aria-urgent-response@jpl.nasa.gov) for more information about emergency response and scientific rapid response.

**Question 54: Maybe I misunderstood a previous statement that SWAT online is for downloading climate data to be used in SWAT. I am having a look at the description, and it says SWAT-online is a Tethys App for visualizing and sharing inputs/outputs of any SWAT Model project. Please clarify how to use SWAT online to pull climate data.**

Answer 54: It does not pull climate data, as you have to provide it.

**Question 55: What is the band and sensor used in ARIA? Also, what is the level of the data that is being used in this project?**

Answer 55: Synthetic Aperture Radar data from Sentinel-1 and ALOS are used in ARIA. A number of publications with details are available here: <https://aria.jpl.nasa.gov/publications.html>

**Question 56: How best can we deal with areas under cloud cover, under conditions of flooding, using optical remote sensing data for flood extent mapping? Or do we have to always resort to radar data?**

Answer 56: SAR imagery is best suited for flooding events heavily covered by cloud cover. Optical imagery cannot penetrate through clouds, so there is potential for missing areas impacted by flood using optical imagery alone.