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

Question 1: I wonder if there is any related information about the lakes in the central part of Turkey which lies on the 36 - 42 degree northern parallels and 26 - 45 degree eastern meridians in the Middle East?
Answer 1: The OpenAltimetry tool is a great way to start exploring the availability of ICESat-2 data for your area of interest. You can learn more about and access the tool via the NASA National Snow and Ice Data Center Data Distributed Active Archive Center (NSIDC DAAC) at https://nsidc.org/data/icesat-2/tools. Direct link to OpenAltimetry is: https://openaltimetry.org/.

Question 2: Rivers with large surface areas, such as the Mississippi River, are significant "landscape" features. Unlike lakes and reservoirs, their surfaces have a shape. How are "sloped' water surfaces handled? How often is a river's surface "updated" along its length?
Answer 2: Currently, we only produce the ATL13 continuous along track products for each beam including along track slope. The ATL22 will eventually handle transect means. Please refer to the reference tracks for repeat frequency.

Question 3: How can you find the dates for which data is available? If no dates are available (as shown for Lake Eagle) does it mean no data is available?
Answer 3: The OpenAltimetry tool has a menu on the left where you can click on the 'Select date' option. More information can be found here: https://openaltimetry.org/documents/OA_ICESat2_guide.pdf. If nothing shows up in the browser, even if a date is listed, data is not available. Panoply is also a way to browse through the data.

Question 4: Are you aware of any Sentinel-3 processing steps to get inland lake height? Do you have in your previous repository, or do you intend to publish a webinar with that regard?

Answer 4: Please go to the Sentinel-3 website to see what is available. We are not aware of any at this moment. It's possible some of the NSIDC tools can be used for Sentinel-3.

Question 5: Can these datasets be used for dam monitoring?
Answer 5: Sure - if the transect crosses, you should get very accurate elevations. See papers by Yao LI/Huilin Gao from Texas A&M. They looked at many reservoirs:
https://ieeexplore.ieee.org/document/8738833
https://www.sciencedirect.com/science/article/pii/S0034425720302017

Question 6: Is this data available for the Indian subcontinent?
Answer 6: Yes - All ICESat-2 products including ATL13 are global. In mid-latitudes the mission uses systematic off-pointing to increase track density and optimize coverage over land. More repeats are found near the poles.

Question 7: Which start date of the ICESat-2 could we download?
Answer 7: ICESat-2 data is available from mid-October 2018. Temporal coverage for each product is available via the NSIDC: https://nsidc.org/data/icesat-2/data-sets

Question 8: How can we create a time series of the surface of a lake?
Answer 8: Amita's presentation laid this method out very well. Downloading the data for each date and compiling.

Question 9: Does water turbidity affect the bathymetry accuracy estimated by ICESat-2?
Answer 9: Absolutely. Best retrievals are in clear water along the coastal zone along calm waters. Poorest in rivers due to movement and sedimentation. 20-40 m in reservoirs, but in rivers you have to hunt around.

Question 10: Is the variable, bathymetry height, reliable? When I checked it before, it was not. Is there any way to use accurate bathymetry height? (I meant ATL 13.)
Answer 10: The current retrieval in ATL 13 can be affected by the amount of backscatter in the water. As you go deeper, the percent of photons processed are harder to retrieve. When we published this data product, we included a flag on data reliability.

Question 11: Maybe I missed it... what is the look geometry of the ICESat-2? Is it side looking or vertical to the target?
Answer 11: It points slightly forward - not directly nadir. There is an off pointing in the lower latitudes. Angle data can be found in the metadata. Refer to 'Orbit and coverage' in https://icesat-2.gsfc.nasa.gov/science/specs for information on off-pointing.

Question 12: Hello - I have really enjoyed the webinar series - thank you! I am really interested in understanding what other remote sensing data we can use on lakes. I am aware we can look at algal blooms. Is it possible to get gaseous data (e.g. methane or CO2)? Any other datasets that might also be useful for studying lake dynamics?
Answer 12: Radar, Jason 1,2,3 and Sentinel data are great for altimetry. Water quality efforts using multispectral data (MODIS & Landsat) have been used. ARSET has conducted quite a few webinar series on water quality:
Processing Satellite Imagery for Monitoring Water Quality
Integrating Remote Sensing into a Water Quality Program

Question 13: Are there any resources you recommend with practice data and workflow recommendations/steps that one could use to learn to process data?
Answer 13: The NSIDC has a Knowledge Base with 'How To' documents and webinars that can help you get started with using ICESat-2. The University of Washington has hosted ICESat-2 hackweeks and the NSIDC provides a link to all of the material here: https://nsidc.org/data/icesat-2/tools. You can sign up to the NSIDC mailing list to get more information on upcoming trainings. There is also a community called icepyx open to the user community to develop a shared library of resources (new code, use cases/example). URL: https://icepyx.readthedocs.io/en/latest/

Question 14: How does one find out which coastal regions/reservoirs have bathymetry data available in ATL13 and ICESat-2 data products? Can we get bulk download of data for all bathymetry products for ATL13 and ICESat-2 for all times? We would like to be able to import it in our database and run queries so that we can merge this data with those from other sources (NOAA, USACE, etc.)?
Answer 14: An ICESat-2 early adopter created a tool called "Shallow Bathymetry Everywhere". URL: https://shallowbathymetryeverywhere.com/. Bulk access via the NSIDC API may be a possibility, especially if you were to work on pulling granules using temporal filters to get them month by month. The following is a link to an article which gives a high-level description of the API and the options to work with it:

https://nsidc.org/the-drift/2019/03/programmatic-access-to-nsidc-daac-data-now-available-using-spatial-and-temporal-filters/
Within that article, you'll find links to NSIDC specific help topics based on whether you wish to apply services or not:
https://nsidc.org/support/how/how-do-i-programmatically-access-data-spatial-temporal
http://nsidc.org/support/how/how-do-i-programmatically-request-data-services

Question 15: The new ALT22 product from ICESat-2 will have a mean of the transects - can you give a couple examples of the products and applications from these products?
Answer 15: The products and applications will be more in line with water resources applications. Being creative, one can find their own novel uses for the data.

Question 16: Are these data going to be available in Google Earth Engine (GEE) also?
Answer 16: We do not know at this time. One can contact GEE where you can make requests for data to be ingested on their platform. If enough requests come in for certain data, it may speed up the process.

Question 17: Hello, are there any other options in Panoply to do further data analysis or is this done in Python?
Answer 17: You can do further analysis in Panoply (compare data, time series, etc). We will post tutorials to do so here: Using python or other languages can be more flexible.
https://www.giss.nasa.gov/tools/panoply/help/

Question 18: After your experience with this satellite, how do you imagine an optimal satellite for the purposes described here?
Answer 18: As the technology improves, ICESat-2 will be a pathfinder for remote sensing of land surface as well as water, vegetation, snow, ice, atmosphere, etc.

Question 19: Can you give a sense of how effective ICESat-2 is in mountainous terrain, such as southeast Alaska?
Answer 19: It comes down to the reflectance of the surface. Variable topography can cause issues. See this as an opportunity to work with the data and improve the applications.

Question 20: I would ask about data processing and how to use deep-learning to get high resolution? And how to get data preprocessing for this operation?

Answer 20: The data is preprocessed at the level ATL03, (georeferenced photon heights). The user can then see how you can optimize the information you can get out of them.

Question 21: I opened OpenAltimetry.org/data/icesat and found many points on waters/sea have positive elevation. (example: ID 1186, Lat -5.77 Lon 105.479 elev: 14.266). That's on the strait. How do I actually read this information?
Answer 21: Inland water EGM2008 is used over land because that is the more practical data.

Question 22: How do I download and install javascript in using panoply software on my computer?
Answer 22: In Part 1 of this series, there was a Panoply link to download. https://www.giss.nasa.gov/tools/panoply/download/.

Question 23: Is it possible to process this information in PCI, ERDAS, or QGIS?
Answer 23: We tried to open the ATL13 file in QGIS but could not select/ load all the geophysical layers.

Question 24: Which data level is for direct user processing? I found many levels of ICESat-2 products.
Answer 24: The lowest level of data that may be of interest to users is the ATL03 data, which is the geolocated photon data. That is the starting point for all the additional geophysical products. The surface specific height data (ATL06-ATL13 and above) is aggregated data for inland water, vegetation, etc. Then you have the gridded products, the processed data from ATL03. Also, please visit the link below where different levels of data are described:
https://nsidc.org/data/icesat-2/products

Question 25: Is there any documentation on how many water bodies are covered through ICESat-2 data?
Answer 25: You can find all documentation for the inland water data product via the NSIDC: https://nsidc.org/data/atl13 (under user guide and technical references). The user guide has the table with the number of lakes and technical reference documentation is available. The HYDROLakes database has ~1.4 m lakes greater than 0.1 km^2.

Question 26: If I wanted to get code for data preprocessing for ICESat-2, where could I get it?
Answer 26: You can ask NSIDC through the 'Support' feature on https://nsidc.org/data/atl13

Icepyx community: https://icepyx.readthedocs.io/en/latest/

Question 27: Does depth have to be modified because of the slower speed of light in water?
Answer 27: Yes, for ATL03. But for ATL13 Inland water, depths have already been depth corrected for refraction. As far as the bottom depth data product.

Question 28: Is this data available for rivers in Senegal?
Answer 28: Yes, cloud permitting. Probably the Senegal (the largest), Casamance (the shortest), and possibly the Gambia rivers. These might be good cases since they flow east to west.

Question 29: Is this case study only for lakes and rivers?
Answer 29: No, see slide 7 in our presentation. It includes mostly lakes & reservoirs (HYDROLakes database at 0.1 km^2) and also rivers, bays, estuaries and a 7 km coastal buffer.

Question 30: Is there any application of ICESat-2 data on managing floods in urban regions?
Answer 30: Not at the moment. We invite you to share with us how you would use ICESat-2 data for this application.

Question 31: You mentioned that TCARTA has mapped a large portion of the bathymetry of coastal regions. Since the majority of archaeological features and wreckage lie near coastal regions, has anyone looked into the ability of ICESat-2 to detect these?
Answer 31: We have an applied user that is looking at archeology in Micronesia (PI: Doug Comer, Cultural Site Research and Management).

Question 32: I was searching about the remote sensing techniques to know the height of the floods in urban regions - in my research I found that the most effective way to know the height of water flood is by using radar Imagery. but there is always a problem when we are talking about urban regions, the results are not correct. Is there any solution or technique to solve this problem?!
Answer 32: A combination of radar and other sources (optical, lidar) would be the best approach.

Question 33: Does trying to convert the data format from .hdf to say .tif affect the data in any way?
Answer 33: There are tools to convert data formats but we are unaware of any issues affecting the data through this conversion.

Question 34: Can we derive tree height from the ATL08 data?
Answer 34: Yes. It is a separate data product: Global Tree Height. ATL08.

Question 35: What kind of geophysical data are correlated with ICESat-2 data? Seismic for example, electric, GPR, or what?
Answer 35: Higher level products from LiDAR retrievals: ATL02, 03 ATBDs.

Question 36: When I search ICESat-1 or -2 ATL13 for my interested area from openaltimetry, I see data as nodata in the region where there is an orbit trace (line without dots)? What does it mean?
Answer 36: It likely means there was no data processed due to cloud cover or other anomaly. You can check that by looking at ATL03 to see if photon data were collected there.

Question 37: Why do we see pairs of “Strong” & “Weak” energy beam points in the map of OpenAltimetry?
Answer 37: This has to do with the basic design of the mission. The pairs were designed to get the local cross slope of the terrain. There is a 4:1 ratio between the strong and weak beams. Saturation can occur with the strong beam and that will give an incorrect result.

Question 38: Is this data available for rivers in southeast Mexico?

Answer 38: The OpenAltimetry tool is a great way to start exploring the availability of ICESat-2 data for your area of interest. You can learn more about and access the tool via the NASA National Snow and Ice Data Center Data Distributed Active Archive Center (NSIDC DAAC) at https://nsidc.org/data/icesat-2/tools. Direct link to OpenAltimetry is: https://openaltimetry.org/. If the rivers are wide enough (100 m) you have a good chance it is included.

Question 39: Can you please provide the software used to build the elevation profile of the Madeira River Profile?
Answer 39: OpenAltimetry is the web application used for the Madeira River example. You can access OpenAltimetry and find tutorials via the NSIDC: https://openaltimetry.org/data/icesat2/

Question 40: Thank you for your presentation. Is there data available for water bodies in India, specifically the Brahmaputra River for flood related problems?
Answer 40: If the rivers are wide enough (100 m) you have a good chance it is included. You may not get as many repeats as you would if your region of interest was further north. Swath spacing goes out as you get close to the equator. Please see the research being conducted by Kuo-Hsin Tseng (Early Adopter), using ICESat-2 ground and water level elevation data towards establishing a seasonal and flash flood early warning system in the lower Ganges-Brahmaputra-Meghna River Basin: https://icesat-2.gsfc.nasa.gov/early_adopters/early-adopters-7

Question 41: Can we use altimetry data for a landslide (such as crip)?
Answer 41: We have one Early Adopter that was looking at using ICESat-2 for monitoring pyroclastic density currents, so there may be a possibility for landslides. It may depend on what you are looking for - an exact repeat profile over an area may not get that (landslides are not typically large enough). One can propose to the mission to off point at a particular location.

Question 42: What are the red lines in openaltimetry.org? And why are lakes that have a good length don't have information (e.g., Grand Lake, CO USA)?
Answer 42: The red lines represent the reference ground tracks. OpenAltimetry has a great guide to help you get started: https://openaltimetry.org/documents/OA_ICESat2_guide.pdf

Question 43: How do we filter the day and night data from ICESat-2?
Answer 43: You will have to do that yourself based upon local time.

Question 44: Thank you for your presentation. Is there data available for West Africa?
Answer 44: If the bodies are large enough, yes. But keep in mind, you may not get as many repeats as you would if your region of interest was further north. Swath spacing increases as you get close to the equator.

Question 45: How accurate is the data for small reservoir bodies or rivers? In African regions, surface water bodies are not big enough. And how accurate is the data for regions with an intense climate (like arid climates)?
Answer 45: Accuracy is not dependent on the size of the body. Cloud cover and retrieval . Less than 1 km2 at low latitudes you may ot see that in a pass. Use Hydrolakes to see what lakes are in your ROI.

Question 46: Can we perform biomass estimation from ICESat-2 data?
Answer 46: While the design of the instrument is optimized for the cryosphere, one of the four science objectives of the mission is to measure vegetation canopy height as a basis for estimating large-scale biomass and biomass change. Biomass is often estimated with tree height. The vertical profile of the photon cloud provided by ICESat-2 is conducive to this. There are a couple of ICESat-2 Early Adopters looking at biomass with ICESat-2, including for example to inform estimates of aboveground biomass to quantify carbon, fuel loads, and monitor change in semiarid regions (see: https://icesat-2.gsfc.nasa.gov/early_adopters/early-adopters-14). You may also be interested in the following NASA ABoVE project: https://above.nasa.gov/cgi-bin/inv_pgp.pl?pgid=3994

Question 47: Thank you for the presentation and the information. I am working on the Rio Grande River. Is it possible to find height data for a specific point of time (in summer) for the whole stream?
Answer 47: Using the tools shown today, Panoply and Open Altimetry, draw a bounding box and see what you get.

Question 48: Having heard your responses for Mexico and India, is there data available for Ghana which is much closer to the equator with no snow?

Answer 48: If the bodies are large enough, yes. But keep in mind, you may not get as many repeats as you would if your region of interest was further north. Swath spacing increases as you get close to the equator.

Question 49: Are there any geometric distortion effects like foreshortening and layover for example in processing the data from ICESat-2 like in Sentinel-1?
Answer 49: Not in LiDAR altimetry.

Question 50: Can we export this data to other applications like GIS software or hec-ras/hec-hms?
Answer 50: The data format is HDF, so if you are able to import that into your software, then yes.

Question 51: For any given lake or river, can we use data from open altimetry to determine the various components of water quality?
Answer 51: No, water quality efforts typically use multispectral optical data (MODIS, Landsat, etc.). ARSET has conducted quite a few webinar series on water quality. Sentinel-2 and -3 have also been used.

Question 52: How much do weather conditions such as clouds affect laser altimeter quality?
Answer 52: They have a major impact. They will prevent obtaining a surface. The number of photons that return to the telescope depends on surface reflectivity and cloud cover (which obscures ATLAS's view of Earth).