Questions & Answers Part 1

Please type your questions in the Question Box. We will try our best to answer all your questions. If we don't, feel free to email Juan Torres-Pérez (juan.l.torres-perez@nasa.gov), Amber McCullum (amberjean.mccullum@nasa.gov), Sativa Cruz (sativa.cruz@nasa.gov), and/or Britnay Beaudry (britnay.beaudry@nasa.gov).

Question 1: In which parts of South America is there AVIRIS coverage? Is there a viewer where you can check the geographic coverage?
Answer 1: This is the data portal for AVIRIS classic: https://aviris.jpl.nasa.gov/dataportal/.
Here is the data portal for AVIRIS-NG: https://avirisng.jpl.nasa.gov/dataportal/.
At least until 2021 there doesn't seem to be data available from South America. We encourage the viewers to check directly with the AVIRIS team to verify this.

Question 2: I have a question about Slide 21: why is the data served in JPG format? Is this for illustrative purposes only and you should use the .dat file if you want to get the raw values, and what is in the .dat file?
Answer 2: The jpegs are usually the Quicklooks. Then, the researcher can place an order for the other types of datasets. The data is delivered orthorectified, calibrated for radiance and atmospherically corrected. A readme file is usually provided and describes the data product details. Please check this website for more details: https://avirisng.jpl.nasa.gov/data_processing.html

Question 3: With AVIRIS, are minerals detected on the surface, or at a deeper level? Is this information available?
Answer 3: Surface. AVIRIS is a passive sensor and collects reflected light from surfaces. There is some penetration into water, but only in the UV to VIS range. Beyond the VIS range, light scatters in aquatic environments. Mineralogy exploits the high spectral range of AVIRIS and is an excellent target for AVIRIS-C/NG and these sensors have their "roots" in mineralogy.

Question 4: For the biomass estimate, was ground truthing being done?
Answer 4: Field validation using field spectroscopy is an important, if not critical, component to validate and truth the airborne imaging spectroscopy. Here's a link with

more info specifically on the Louisiana example shown before: Delta-X: AVIRIS-NG L3 Derived Aboveground Biomass, MRD, Louisiana, USA, 2021, V2 (ornl.gov)

Question 5: Is PRISM data available for India/Asia/Europe? Are you going to cover how to submit "tasking requests'' for AVIRIS-NG?
Answer 5: PRISM data has been used to target aquatic environments and has not flown along with AVIRIS-NG in all campaigns. This also depends on the aircraft/platform size if both PRISM and AVIRIS-NG can fly together. Based on the PRISM data portal there does not seem to be data available for India, Asia or Europe: https://prism.jpl.nasa.gov/dataportal/. As mentioned, airborne campaigns are mission-specific.

Question 6: Can you address the importance of temporal analysis using EO for biodiversity, as this is a very important part of the analysis?
Answer 6: Temporal analysis is suitable and exciting for exploring seasonality in spectroscopy of vegetation targets, in particular, as well as surface features in aquatic environments. Therefore, seasonality of vegetation types can be seen in terms of biodiversity of vegetation species and timing of “green-up” and senescence. In aquatic environments, timing of algal blooms can vary by phytoplankton species prevalence and phytoplankton community structure/composition. The HyspIRI California campaign covered approximately 2013 to 2015 and within those years about 3 times per year in order to capture seasonality. This has transitioned to the Western Diversity Time Series airborne campaign (https://daac.ornl.gov/MASTER/guides/MASTER_WDTS_SeptOct_2020.html). Further, the recent, and super exciting SHIFT (Surface Biology and Geology High Frequency Time Series) campaign in the Santa Barbara, California area covered terrestrial and aquatic sites on a frequent basis (https://www.jpl.nasa.gov/images/pia25144-shift-campaign-research-plane-flight-area-map). This supports understanding the frequency needed for the upcoming SBG mission to capture seasonality and biodiversity.

Question 7: I have a question about Slide 39: how much spatial overlap is there between ARVIS-C/NG if you would like to compare a site, and what is the revisit time, if there is a revisit time?
Answer 7: There is some spatial overlap especially for some US sites. Since these are mission specific, there is no revisit time per se. Airborne campaigns are expensive and often AVIRIS-C/NG campaigns can be at one point in time, but there have been some

exciting efforts using AVIRIS-C. The HyspIRI airborne campaign in California covered seasonality over several years (~2013-2015) over targeted flight boxes.

Question 8: Are there any satellite hyper-spectral data available for the whole planet?
Answer 8: So far, Hyperion was the only hyperspectral-type satellite mission with close to global coverage. Here's the link to the Hyperion data portal to explore your region of interest and explore availability of data:
https://cmr.earthdata.nasa.gov/search/concepts/C1220567951-USGS_LTA.html

Question 9: Do the DAACs only have corrected satellite data from the United States or also worldwide?
Answer 9: The DAACs have corrected satellite data from all campaign locations. The location of the data (meaning which DAAC) may depend on the location of the campaign/flight. For instance, a flight over glaciers or icy terrain will likely have data hosted at the National Snow and Ice Data Center DAAC.

Question 10: The PRISM Campaign from 2012- 2018 that was carried out in South America-Chile, what areas and data were collected, and where is the data and its characteristics available?
Answer 10: You can view and download all PRISM data on the PRISM Data Portal (https://prism.jpl.nasa.gov/dataportal/). Looking at the map of collected data, it appears that data were collected around the coasts of Chile and Argentina.

Question 11: What is the accuracy of AVIRIS-NG data for detecting and mapping environmental degradation, such as land cover change and soil erosion, in Somaliland, and how does it compare to other remote sensing techniques?
Answer 11: The accuracy will depend for example on the type of in situ data available for validation. Spectroscopy can reveal spatial variability that is invisible to multispectral sensors like Landsat and Sentinel. With adequate field calibration, it likely would be very useful. However, as mentioned above, field calibration is extremely important for interpreting airborne data and airborne-based data are limited for areas where specific missions have happened.

Question 12: Can you please say a few words on how the AVIRIS-C instrument works?

Answer 12: AVIRIS-C is a passive imaging spectrometer, which measures energy emitted or reflected from an object. You can learn more about passive sensors here: https://www.earthdata.nasa.gov/learn/backgrounders/passive-sensors
If you'd like some detailed reading on AVIRIS-C, it's website has several pages that review its calibration and validation, mission planning, sensor operation, and more: https://aviris.jpl.nasa.gov/aviris/aviris_task.html

Question 13: How does PACE compare to Sentinel-3?
Answer 13: Most notably, increased spectral resolution, and coincident spexOne and Harp instruments for polarization.

Question 14: Do we have any study which shows the area of plastic pollution in the ocean and hence impact on marine life using these airborne missions? Can we monitor the same?
Answer 14: This is still an area under development. There have not been many studies that have used airborne data to characterize plastic pollution. There have been some experimental studies with private hyperspectral sensors.

Question 15: With regard to spatial resolution of AVIRIS-3 (do you mean AVIRIS-C "Classic"?), AVIRIS-NG and PRISM, which one is the best for biodiversity monitoring and observation? How about real time data using ground based instruments being mapped to these observations?
Answer 15: This depends on your target. PRISM is ideally suited for aquatic targets. AVIRIS-C was designed for mineralogy and terrestrial targets originally, but some aquatic targets are suitable. The new AVIRIS-NG is such an improvement for biodiversity for terrestrial (including snow/ice), mineralogy, and aquatic targets.

Question 16: Looking back at the availability of data from both AVIRIS, AVIRIS-NG and PRISM, it seems there's almost none from the tropical forest ecosystem. Can you provide some insights on the current states and efforts on mapping tropical forests? What does it take to bring AVIRIS-NG and PRISM to tropical forests?
Answer 16: Again, these campaigns are mission-specific and are usually quite costly. Hopefully, future ones include tropical forest ecosystems.

Question 17: Who is the South African counterpart / organization partnering on the AVIRIS BioSCape mission to South Africa in October?
Answer 17: This will be covered in Session 2 of this webinar series.

Question 18: How does an agency apply for and submit a PRISM-SBG campaign? And is there a cost involved?
Answer 18: Researchers need to stay updated on upcoming airborne missions and refer frequently to the respective instrument portals. These campaigns are mission-specific. As a reminder, SBG is still under development and is expected to launch ~2028. SBG is not an airborne sensor.

Question 19: What are the radiometric resolutions of AVIRIS-C, NG, and PRISM?
Answer 21:
AVIRIS-C: 19 Mbps data rate through 1994, 20.4 Mbps from 1995 to 2004, 16-bit from 2005-present (source)
AVIRIS-NG: 14-bit (source)
PRISM: 14-bit (source)

Question 20: With PACE data, can we map the landscape change with climate variables?
Answer 20: PACE will be more focused on ocean/coastal applications as well as ocean/atmosphere exchanges, aerosols, detection of harmful algal blooms, among other parameters.

Question 21: Could you please explain how efficient it is to measure seagrass extents using Hyperspectral data rather than UAV data? What are the sources for Hyperspectral data to monitor blue carbon environments?
Answer 21: Hyperspectral data (as shown in slide #14 of the presentation) can help separating seagrasses from other shallow-water benthic components such as reef corals, bare substratum, etc. because of the availability of many more (and finer) spectral bands in wavelengths affected by the absorption of specific pigments. As with any remotely-sensed data, spatial resolution will be determinant on how these ecosystems can be separated by other adjacent ones. UAV data (usually in the form of RGB) has a very fine spatial resolution compared to sensors flown at much higher altitudes and therefore can complement these other types of datasets especially for mapping these ecosystems at very fine scales although most likely it will not have the high spectral resolution of some of the mentioned sensors. Blue carbon environments such as seagrasses or mangrove forests can be monitored with hyperspectral data but as mentioned airborne data can be limited.

Question 22: For how much time period data is valid for spectral images analysis? The geography of the earth is changing continuously.

Answer 22: Good point! This has been mentioned in previous webinars. It is essential to conduct in-situ spectral data collection campaigns simultaneous with airborne campaigns for validation of the remotely-sensed data. This is especially true for aquatic ecosystems but also needs to be considered for terrestrial ones as phenology may affect the results.

Question 23: My question would be whether the change in soil moisture content (in several soil layers) caused by natural flooding (or lack of water) can be monitored with any sensor? The trend of its change over time is important.
Answer 23:
Application of NASA SPoRT-Land Information System (SPoRT-LIS) Soil Moisture Data for Drought:
https://appliedsciences.nasa.gov/join-mission/training/english/arset-application-nasa-sport-land-information-system-sport-lis-soil

Question 24: Is any of the data presented here available on Google Earth Engine?
Answer 24: Currently, the only hyperspectral data available from Google Earth Engine's Data Catalog is from Hyperion:
https://developers.google.com/earth-engine/datasets/tags/hyperspectral
However, if you have downloaded data from the aviris-c or aviris-ng or prism data portals, you can upload it in GEE as a raster by following Earth Engine's guide here:
https://developers.google.com/earth-engine/guides/image_upload