# Questions & Answers Sessions

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 Juan Torres-Pérez (juan.l.torresperez@nasa.gov) or Amber McCullum (amberjean.mccullum@nasa.gov).

Question 1: Do you mean that we don't have one shoreline?

Answer 1: Geologically there are two shorelines: at the high tide, usually marked by the deposition of some sort of marine vegetation or particular types of sediment, and then there is another one at the low tide mark.

Question 2: What are tombolos?

Answer 2: A tombolo is a strip of sand connecting two pieces of land together.

Question 3: Is coastal sand used for construction? Isn't that too coarse for that?

Answer 3: It is very common, particularly in areas where there are not other materials or are very limited. Sand beach or dune sand can be of different sizes depending on the origin and composition.

Question 4: I developed a watershed model giving me the nutrient and sediment loadings, and I have remote sensing products (suspended sediment concentration and Chlorophyll-A). I want to study the relationship between these two datasets. My question is, what would it be a reasonable distance to see or examine the sediment or nutrients loadings effect to the shore area from the watershed outlet? What would be the best buffer zone (5 km or 10 km) from the watershed outlet?

Answer 4: This depends on a number of factors such as size of the watershed, size of the sediment plume, types of sediments washing on the coastal zone, hydrodynamics within the coastal zone, coastal and ocean currents, longshore transport of suspended sediments, etc.

Question 5: In mapping shoreline changes, the use of different image spatial resolutions will result in different details and positional accuracy. How to decide the 'appropriate' image resolution for this application? Thanks.

Answer 5: That is true. The appropriate resolution will depend on your study site, the size of it, and very importantly your research question. I would recommend using imagery of 30m pixel size or higher resolution as some of these changes can be very subtle, again depending on the environment.

Question 6: What are the best remote sensing products for suspended sediment concentration and Chlorophyll-A?
Answer 6: This was covered in sessions 1 and 2. Please refer to these.

Question 7: How do I differentiate shoreline changes due to tides and sea level rise? Are there remote sensing techniques to remove the effects of tides in the sea level rise model?
Answer 7: As it was covered in the webinar there are different methods for obtaining topography information along the shoreline. I would think that in this particular case, the waterline method can be useful as it takes into consideration hydrodynamics and location of high vs low tide shorelines.

Question 8: Which software have you used to identify Shoreline and Watershed changes (though Landsat imagery)? Why did you use the particular software ?
Answer 8: Beach and shoreline changes can be estimated using typical image and geographical information systems software such as ArcGIS, ArcPro, QGIS, GEE, ENVI, etc.

Question 9: Is the resolution good enough to allow for remote sensing of coastline small islets, i.e. <100m diameter. Additionally, how accurate is satellite-based bathymetry as opposed to say MB-Sonar? Is there a tutorial/guide on how to map bathymetry from satellites?
Answer 9: Similar to above, I would recommend using imagery with 30m pixel size *or higher* resolution from Sentinel or WorldView. Multibeam sonar can be highly detailed and may provide much more information particularly of the seafloor as it has to be transported by a boat so there is that limitation.

Question 10: What are the most effective methods for remotely detecting and mapping coastal freshwater springs?
Answer 10: Honestly I don't know. Will do some research and get back to you on that.

Question 11: What sort of beaches come between a < 5 degree slope and >10 degree slope?

Answer 11: These are known as transitional beaches (between dissipative and reflective beaches. Slide 24, the first photo on the left is the transitional beach.

Question 12: Can the estuary be defined as a shoreline? And can you explain the connection between estuary and Gulf?

Answer 12: Geologically as the high and low tide shorelines. An estuary can be part of the coastline. Not defined as the coastline but part of it.

Question 13: Can remote sensing be used to determine the underlying sediment type, i..e sediment below the top layer? eg. perhaps a recent heavy rainfall event resulted in the deposit of muddy-terrigenous sediment across a beach which is normally covered by biogenic ocean based sediment?

Answer 13: Not sure about that as typically the information received by the sensor is basically what is reflected from the surface. In that sense, you only see the surface. Imagery before and after the event, the drastic diff in color can be detected.

Question 14: Can MSAVI be used as mineral identification/sand compositions in beaches/shores?

Answer 14: No. remember MSAVI is a vegetation index, not a sediment composition index. MSAVI is often used in areas that are vegetation sparse, as to limit the effect of bar ground.

Question 15: Is NDVI the same between different types of remote sensing image. Can I compare the value of NDVI from ALOS AVNIR and Sentinel to assess the degradation of mangrove forest?

Answer 15: NDVI is an index between Red and NIR bands. With Sentinel you can have the same ratio. Take into consideration atmospheric processing that has been done to each sensor itself as well as the wavelength range from different satellites.

Question 16: How to map the changes of the shoreline in heavy mangrove coastal areas where we cannot even see the shore line?

Answer 16: Good question! We had a similar situation in the project I mentioned in the presentation in southwest PR. In that case, we used mangrove extension as a proxy for shoreline changes. I would think that alternatively you can use a combination of historical

aerial photos, optical and radar imagery to separate the different components. I will look more into this and provide some references if I find any.

Question 17: For InSAR and RADAR altimetry for bathymetry, do they use specific bands dedicated for penetrating water?

Answer 17: I would refer the participant to our SAR Forest Mapping webinar where radar is explained in detail including the use of each band: https://appliedsciences.nasa.gov/join-mission/training/english/forest-mapping-and-monitoring-sar-data

Question 18: How do you classify wet/dry line, vegetated line, high water line using remote sensing with digital image processing techniques?

Answer 18: If you have high resolution data, you can either do a manual delineation of all these features or do a supervised classification. Additionally, indices like NDVI can help separating vegetated vs non-vegetated areas.

Question 19: Could you recommend any reliable research on using satellite data to map marine debris?

Answer 19: The topic is fairly new. Please find at the end of this document, the links for the Garaba and Dierssen (2018) and Acuña-Ruz et al (2018) papers for reference.

Question 20: Which are the free satellite imagery portals to download decades old data for time series analysis? Are they preprocessed and free from atmospheric and other noises? Which would be freely available image analysis software to analyse the spectral images to extract the endmembers (preferably from hyperspectral imagery sources)?

Answer 20: All NASA data are open and free. Please refer to the many portals referenced in our fundamentals courses.

Question 21: My question is how river discharge affects the shoreline?

Answer 21: Depends on how big or frequent the discharge is. A beach can change within a month after heavy rainfall events and sedimentation. Erosion from currents or wave action can affect shorelines as well.

Question 22: Do beaches stay either dissipative or reflective forever or fluctuate between the two?

Answer 22: Depends on the site. Some beaches where the conditions are fairly constant and can stay dissipative or reflective. Others will fluctuate.

Question 23: Were the beach sediments in slide 23 sampled in one place?
Answer 23: Yes, they were collected at the same waypoints in those beaches.

Question 24: How do wetlands stabilize shorelines?
Answer 24: Wetlands are very coastal ecosystems. The root systems (mangroves, etc) actually serve as a means to retain the sediment that flows through the coastline during any event. Can be very stabilizing. Coastline and inland protection is a service of these systems.

Question 25: We know that tidal changes could change the profile of coastline for a given time. Is there any procedure to distinguish between the actual coastline changes and the tidal changes?
Answer 25: The waterline method might be the best method as it includes hydrodynamic modeling with remotely-sensed imagery.

Question 26: How SONAR data can be helpful for ocean bathymetric studies?
Answer 26: SONAR has been used for decades to study the ocean floor and fishing industry.

Question 27: Are there good models to model the nutrient/sediment runoff from land to the water in the coastal area?
Answer 27: Here's a recent paper by Nguyen et al (2019) that used different models for sediment and nutrient runoff into the coastal areas:
https://doi.org/10.1016/j.scitotenv.2019.01.286

Question 28: Any advice on how to identify paleo-mangroves? Mangroves that have been killed by sand input and are covered or partially covered by sand.
Answer 28: Not certain on that. This type of study may require combining historical aerial photos with satellite imagery to follow changes in time.

Question 29: Why can't there be a commercial small hyperspectral CORAL camera be developed that is designed to work with a particular sensor?

Answer 29: Some development of hyperspectral sensors has been done for drones and land use but it remains to be seen whether they can be applied to coral reef ecosystems.

Question 30: There are a lot of clouds in the tropical area, any suggestions or algorithms that you can recommend for cloud removal from the satellite imagery?

Answer 30: Here's a paper particularly aimed at removing thin clouds from remotely-sensed imagery by Shen et al (2014): https://doi.org/10.1016/j.isprsjprs.2014.06.011

Here's a paper from Martinuzzi et al (2007) about cloud removal from tropical sites with Landsat 7 ETM+: https://doi.org/10.2737/IITF-GTR-32

Question 31: I am carrying out studies on the morphodynamics of the beaches. What kind of satellite images are best suited for this type of study?

Answer 31: That would depend on the extent of the beach. Traditionally, moderate resolution data such as that of Landsat or Sentinel have been used, but you may also want to integrate high resolution data if the site is relatively small or narrow.

Question 32: Can you explain it a little bit more about the combination of aerial and high resolution RS data to analyse the shoreline change?

Answer 32: There is only satellite data available from the 1970's so to go even back in time, historical aerial photos can be used. These can be combined in a GIS analysis software like ArcGIS or similar, but it is important to identify ground control points to use them as reference during the georeferencing process.

Question 33: Is it possible to identify (plastic/metal/thermocol/wood/etc.) the coastal debris through remote sensing techniques?

Answer 33: Like I mentioned, the detection of marine debris with remotely-sensed techniques is still in development. Based on the papers I presented, it is still fairly difficult to distinguish different types of debris with multispectral data even at high spatial resolutions. Maybe in the near future, hyperspectral data can aid distinguishing these materials more easily.

Question 34: is there an archive/database with openly accessible aerial images that can be used for comparative work to pre/post high res satellite imagery?

Answer 34: I believe most of these images were collected by the local governments through different efforts. In that sense, it would be a matter of reaching out to the local agencies to find out about their availability. Also, a good source, at least for the US can be the USGS portals.

Here are some of the references used for this seminar:
1. Mann and Westphal (2014)
2. Klemas (2011)
3. Almeida et al (2019)
4. Lee and Ryu (2017)
5. Salameh et al (2018)
6. Salameh et al (2019)
7. Capo et al (2014)
8. Lee et al (1999)
9. Goodman et al (2020)
10. Acuña-Ruz et al (2018)
11. Garaba & Dierssen (2018)
12. Schroeder et al (2019)
13. Torres-Pérez et al (2007)
14. Torres-Pérez et al (2012)
15. Torres-Pérez et al (2015)
16. Thorhaug et al (2007)
17. Bernardo et al (2017)
18. Lodhi et al (1998)
19. Slonecker et al (2016)
20. Purkis et al (2019)