



Questions & Answers Session 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 Cynthia Schmidt (cynthia.l.schmidt@nasa.gov) or Amber McCullum (amberjean.mccullum@nasa.gov).

Question 1: What is the use of satellite data during leaf off season of rubber for plantation change detection?

Answer 1: Rubber plantations have distinct periods with leaf on and leaf off - which is different than the surrounding vegetation. So you can use that information to detect rubber plantations with the satellite imagery.

Question 2: For change detection analyses, is it necessary to have same spatial resolution of satellite data? Can we do analyses with spatial resolution of 20m and 30m?

Answer 2: You can do a visual analysis but you won't be able to do image subtraction or classification. Both images need to be the same spatial resolution.

Question 3: Does one have to select different bands for inspect different elements?

Answer 3: The selection of bands for visualizing the imagery is a personal preference. If you are looking at vegetation then using the near-infrared band in either the red or green color band is important. This is a great source for understanding how different band combinations work for different features:

<https://www.esri.com/arcgis-blog/products/product/imagery/band-combinations-for-landsat-8/>

Question 4: Can you share some guidelines on band stacking and color selection?

Answer 4: Similar to Q3. Color selection is personal preference.

Question 5: Does the data need to be atmospherically / radiometrically corrected for change detection?

Answer 5: It's best if the data can be corrected, but because you are looking at change between two images often you don't need to do the correction. But just be aware that you might be seeing changes due to differences in atmospheric conditions if you don't do the corrections



Question 6: Some of the raster bands are not showing in the calculator. Do you know why? first it was only band 7, but now I have tried again all the other apart from band 1 are missing.

Answer 6: Make sure you have all the bands loaded in QGIS. Also if you are having specific problems with the exercise, please email us the question and the exact issue.

Question 7: What are the equivalent bands in MODIS for this exercise?

Answer 7: Here are a few links for MODIS band information:

https://fsapps.nwcg.gov/imagery.php?op=modis_bands

<https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/modis/>

Question 8: Could you please provide information for AppEEARS?

Answer 8: https://lpdaac.usgs.gov/tools/data_access/appeears

Question 9: Which bands are useful for analysing urban change detection? In subtropical areas, there is a lot of commonality between urban reflectance and dry river beds etc.

Answer 9: Urban areas are very challenging because they are so heterogeneous- sometimes the SWIR band will help.

Question 10: Your area of interest happened to be cloud free. What if the area of interest had some cloud cover?

Answer 10: You will have to eliminate that data with a cloud mask. QGIS has a cloud mask plugin that you can use

Question 11: If I want to evaluate loss and gain annually this methodology allow me to do that?

Answer 11: This method works best for 2 time periods. If you want to do more, then it's often better that you use a time series approach. We will be doing a time series webinar in 2019 so stay tuned for that.

Question 12: Can we identify the tree types like big and small tree basis on Landsat data?

Answer 12: This is challenging. If different tree types are spectrally different, then maybe you can identify differences, but often they are too spectrally similar to distinguish them.

Question 13: How do you explain the use of severity of Fire for to make Change Detection?



Answer 13: This is one of many types of methods. Although NBR is used for analyzing burned areas it can also be used to identify vegetation changes. The NBR includes the SWIR, and this helps us look at moisture in the vegetation. You could use other indices, depending on your preference.

Question 14: How about masking cloud shadow? How can I go about that?

Answer 14: SR products have QA images, there is one for cloud masking. Also, QGIS has a cloud masking plugin. We may try to do a short webinar on how to do cloud masking in the future.

Question 15: On the base of NDVI classification, I want to extract the raster that contains lets say bare land. Are you going to talk about it using R in next session ?

Answer 15: No, we will only classify change (forest to non-forest). That is something different (need ground data, or aerial photography etc.) to identify what the changes are on the ground. Ideally, you will want to do a land cover classification to identify bare ground from other land cover types.

Question 16: Can you talk more about the subtle land degradation detection? If it is harder, what is a possible approach?

Answer 16: Subtle land cover change can be best detected when using a method that looks at a change in pixel values. Next week, classification approaches will allow you to look more at subtle changes.

Question 17: Is it possible make quantitative conclusions from values in NBR-difference raster?

Answer 17: This is a continuous image, so it is difficult to quantify. Next week, classification will be used to identify each change class, and that we can quantify.

Question 18: Could you explain more why you use NBR to detect changes, when the NBR is a calcination index?

Answer 18: This is similar to question 15. An index may give you more information than only looking at a single band. You could choose the NIR band and use subtraction, but if you use the index, you can do subtraction but it has more information (multiple bands). Using subtraction, you can do a single band or an index.

Question 19: Can we subtract other changes to display only a change in one land cover type, e.g to show only vegetation with its statistics?



Answer 19: These methods look at all types of change. It would be difficult to separate out that change unless you did a classification and separated it out afterwards.

Question 20: If we want to observe, the changes of the surface of the soil, is it possible to do that with remote sensing data?

Answer 20: Possibly. It depends on the extent of the soil. If there is soil without vegetation, you might be able to identify changes. If the moisture content is changing, you might see a change. You likely need hyperspectral images to detect those subtle changes though.

Question 21: Pixels in landsat 8 images have different radiometric resolution than in the previous series, so how can we make image difference? Do we have to rescale one of the bands?

Answer 21: Landsat 8 images are 12-bit, Landsat 5 images are 8-bit. In this exercise, we used the surface reflectance imagery. The value range was made standard across both images in the surface reflectance products. If you do not have the SR products, you can use an index (like NDVI). No matter what the radiometric resolution of an image, the NDVI for example will always be from 1 to -1. But in this example, the SR products, have the same values.

Question 22: What should I do when I deal with change analysis in grassland which may be caused by delayed rainfall and not any thing permanent? How do i take control of that?

Answer 22: Grasslands are tough to do RS in those areas. Need to think about what you are looking at (e.g. overgrazing). You need to look at rainfall occurrence (or lack of it), and compare the imagery to that. Otherwise it's very difficult to separate out changes due to drought vs. changes due to overgrazing or something like that.

Question 23: Can you use Top of Atmosphere product for change detection?

Answer 23: Yes, but the radiometric values between L5 and L8 will be different, so it is best to get the surface reflectance values.

Question 24: Does SENTINEL-2 data give a better land cover change than LANDSAT?

Answer 24: Perhaps, it has a slightly higher spatial resolution, but it is dependent on the type of change you are interested in.



Question 25: Can this principle be used to around coastal vegetations to differentiate between aqua planktons and the land surface vegetation in that area?

Answer 25: Perhaps. There are similar indices that are used to detect vegetation on water (chlorophyll).

Question 26: What differences have you noticed with this method and that of Claslite?

Answer 26: Here is the link to the Claslite methods: <http://claslite.ciw.edu/en/>. We are not familiar with these techniques.

Question 27: I am intending to analyze the landslide scenario. Will the same band as used in this exercise be helpful?

Answer 27: Yes. Although I encourage you to try different band combos for different types of change. The SWIR is often useful for looking at soil differences, but every application is different.

Question 28: What is the best change detection method for detecting damage to crops such as maize from hail storms?

Answer 28: NDVI, any of the vegetation indices. NDMI, NBR, etc.

Question 29: What can machine learning techniques bring to change detection?

Answer 29: Next week we will use Random Forest to classify change. That is a great way to use a supervised classification approach and machine learning. It is actually easier (in our opinion) to identify change than doing a land cover classification.

Question 30: Is the conversion of rainforest into oil palm plantation well detectable with change detection methods ?

Answer 30: That was the example we used in the lecture. It depends on the study area. There are a lot of papers that address these issues. A review of those methods here:

- <https://www.tandfonline.com/doi/full/10.1080/10095020.2017.1337317>
- <https://newsroom.taylorandfrancisgroup.com/remote-sensing-technologies-key-to-the-future-of-the-oil-palm-industry/>

Question 31: Is the extensification versus intensification detection possible through change detection? (agricultural change, e.g. grasslands to crops)

Answer 31: To answer any question, you have to think about whether there will be spectral differences between the changes you're trying to detect. If you can't see a



spectral difference between one time and another in change, you won't be able to see that with satellite imagery. Oftentimes, grasslands (spectrally) look very different from crops. So without knowing the area you're interested in, it'll be most likely you'll be able to see a change from grasslands to crops. But I'd need to look at the area to determine that for sure. Also, both grasslands and crops often have green up periods. If they are different from each other, that may help you.

Question 32: Can we use a threshold to separate vegetated from non-vegetated areas in each year and then do image subtraction to get a quantitative assessment of changes in vegetation?

Answer 32: I'm trying to figure out exactly what you're asking - if you are saying you're trying to separate vegetative from non-vegetative, you'll have to do some processing to get to that point. Whether it's a land cover classification of two different years and subtract those, it's possible, but it's not preferred. The reason is, if you do a land classification on two different years and subtract those, you aren't getting at subtle differences between the two years and the changes between the two years. A better way is to use the raw imagery or do some kind of index like we did in today's exercise and subtract those. You could then separate vegetated from non-vegetated using that index (NDVI, NBR, etc...) The downside to that approach is that it's very difficult to quantify. Next week, when we do a land cover classification, we put both images together and then it's easier to quantify that change.

Question 33: More generic question is why is surface reflectance reduced in coastal areas? Is this due to water vapor?

Answer 33: Here's the information from the USGS website: Landsat atmospheric correction and surface reflectance retrieval algorithms are not ideal for water bodies due to the inherently low level of water leaving radiance, and the consequential very low signal to noise ratio.

Information on Landsat SR Products:

<https://landsat.usgs.gov/landsat-surface-reflectance-data-products>

Question 34: Hello, i have question regarding software. I have already downloaded QGIS but can i perform same process in arcgis as i am more use to it? coz later we are using R software for process? My another question is i have seen from Landsat 5 we merge certain bands and while for Landsat 7 certain bands, if we have Landsat 8 images then which i have to merge and keep as alone for process? or can i get list which i have to which i don't?

Answer 34: Yes, you can do this same process in ArcGIS. Next week the inputs into the R script is a shapefile, so again you can use ArcGIS. I'm not quite sure i understand



your second question. We are using Bands 1-5 of Landsat 5 and 1-6 of Landsat 8. We aren't using Landsat 7 at all. You just stack the bands that you need in the process.

Question 35: Does QGIS renumber bands if you don't include them all (e.g. band 7 from a L5 scene) when it "Merges" them, the way that some other software does

Answer 35: Yes, it renumbers the bands in order. So, if you're skipping band 6 (the thermal band) in L5, then you have to remember that Band 7 will be renumbered as B6.

Question 36: Does it matter if you clip the two dates (NIR band) and then merge, or can you merge the two bands, and then clip them, with the same results?

Answer 36: You can do it either way as long as you clip to exactly the same extent.

Question 37: Could you please clarify a little more on key points for change detection, from the beginning of the course? It was a bit too fast.

Answer 37: The recording will be available for you to view by next week so I recommend that you take a look at that. Also you can download the powerpoint presentation from our website.

Question 38: What imagery would you recommend if looking for localized change in forest cover of less than an acre?

Answer 38: Commercial imagery, DigitalGlobe imagery: Quickbird, WorldView-2. You can also use segmentation (object oriented).

Question 39: Were you using atmospheric corrected Landsat data? If not does it make a difference if we use Level 1 Landsat data for this exercise?

Answer 39: Yes, we were using the Surface Reflectance Products. It's best if the data can be corrected, but because you are looking at change between two images often you don't need to do the correction. But just be aware that you might be seeing changes due to differences in atmospheric conditions.

Question 40: can i use this process to identify how much bare soil turn into crop fields and how many images we can use to identify land changes

Answer 40: First part of Question: It depends on the study area, it might be possible. Those are very different spectrally, they are both distinct. Second part: You can use as many images as you want. Here we are just using 2-date changes, but later on when will do a Time Series analysis webinar which enables you to use multiple dates at once.



Question 41: So what are implications of using the panchromatic band from level-1 data to pansharpen bands that are atmospherically corrected?

Answer 41: Pansharpening increase the spatial resolution but changes the spectral pixels values. So if you are doing change detection you may lose some of the subtle changes by using this approach

Question 42: Why is the panchromatic band not included in Surface reflectance data?

Answer 42: The pixel sizes are a different spatial resolution (30 m vs 15 m for Landsat). While the spatial resolution is improved in the Panchromatic band, but it does not have good spectral resolution. Thus, it does not add any information when looking at change.

Question 43: so to detect vegetation changes is better to use NBR difference than NDVI difference?

Answer 43: You can use either, however the NBR includes the SWIR, and this helps us look at moisture in the vegetation. THE NBR thus gives additional information, but you can use NDVI if you'd like.

Question 44: Can I use this procedure to look at changes in water reservoirs? Which band do you recommend to look at water vs. land change?

Answer 44: Second question: There are some indices for moisture/wetness in land cover. NDMI (Normalized Difference Moisture Index) or NDWI (Normalized Difference Wetness Index). Looking at reservoir changes, it depends on the size of the reservoir, the amount of change. In small reservoirs, you might not be able to see much change, if it is a large reservoir, maybe.

Question 45: How can I choose NDVI value for specific raster cell?

Answer 45: In QGIS there in an option, Identify, that will tell you the value of a specific cell.

Question 46: When you use NBR for veg. change analysis, how do you deal with the fact that in an NBR scene, water also shows up as "burned" area?

Answer 46: Depends on how important the water is. You could do a water mask if you are not interested in the water, same as if clouds were in image. Otherwise, you would have to know ahead of time that the water features may look "burned". Depends on what you are interested in.



Advanced Webinar: Change Detection for Land Cover Mapping