



Questions & Answers Part 2

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 Sean McCartney (sean.mcartney@nasa.gov), Erika Podest (erika.podest@jpl.nasa.gov), Krištof Oštir (Kristof.Ostir@fgg.uni-lj.si), or Matej Račič (Matej.Racic@fgg.uni-lj.si).

Question 1: Could you please tell us more about the Harmonized Landsat Sentinel (HLS) availability on Sentinel Hub? How do we access it?

Answer 1: Yes, the Harmonized Landsat Sentinel-2 data is available on Sentinel Hub in the same way as other data (e.g., Sentinel-1, Sentinel-2, and Landsat). The description of the dataset is given here:

<https://collections.sentinel-hub.com/harmonized-landsat-sentinel/>

Sentinel Hub Landsat Sentinel-2 data collection is described here:

<https://docs.sentinel-hub.com/api/latest/data/hls/>

<https://docs.sentinel-hub.com/api/latest/data/hls/examples/>

Question 2: How do we classify crop types in tropical areas, especially in proximity to forests? I imagine that the NDVI fluctuations might be smaller, so we are more likely to misclassify crops?

Answer 2: NDVI changes with the vegetation that it represents, and crops would be misclassified if the signal would be similar. That can happen when we have phenologically similar crops. This is very dependent upon the quality of the training samples. Using the radar data in combination with optical helps with this process.

Question 3: Since the central wavelengths on Sentinel-2 A and B differ slightly, is that something we should take into account or somehow correct for when using images from both satellites, e.g., for classification purposes?

Answer 3: It usually does not represent bigger differences. Quite often, the atmosphere possesses a bigger variation in the captured values. The geometry between the two satellites is only slightly different.

Question 4: Do you normalize the crop time signatures by latitude or for seasonal weather? The growth curve for any crop will vary by the date planted, the weather, and the GDDs.



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Answer 4: This would play a big role when producing a crop type map for a continent. But this would also require us to predefine the calculation and adapt to areas where there are one and multiple seasons within a single year. That is why deep learning is very useful as we do not need to predefine features and can be inferred during training. If you are interested in the topic of generalization and model adaptation, take a look at knowledge transfer and concept shift.

Question 5: Is Sentinel Hub free to access? Is it possible for a student not to pay for that subscription?

Answer 5: The basic functionality of Sentinel Hub is free. Time series generation and analysis requires more computational power and is therefore not free. However there are many sponsoring opportunities available. Have a look at the ESA Network of Resources web page:

<https://eo4society.esa.int/network-of-resources/nor-sponsorship/>

All the ARSET participants can have access to Sentinel Hub through this sponsorship.

Question 6: Is the data from Sentinel Hub original data or somewhat downscaled?

Answer 6: The data on Sentinel Hub is original and not degraded in any way. The processing is being performed on original satellite data, both through Statistical API and even in EO Browser. The user has the ability to select data at different spatial and or spectral.

Have a look at the:

<https://docs.sentinel-hub.com/api/latest/api/statistical/>

Question 7: Are the points in the time series representative of each period (month)? Or is it the chosen area's mean?

Answer 7: The points in the time series generated with Sentinel Hub are representative on the polygon (area). We can compute different statistics for these polygons (mean, max, min, std ..., cloud coverage), for only the pixels in this polygon. This is being performed for a specific time (image date). In addition to this, we can make time aggregates, e.g. monthly, weekly, etc.

Question 8: Does Sentinel Hub support exporting .csv stats via the API or only through the browser as shown?

Answer 8: The use of EO Browser is the simplest and quickest way to get time series (and export them in csv). However, a much better way is to use the Statistical API, that has much more functionality:



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<https://docs.sentinel-hub.com/api/latest/api/statistical/>

Statistical API with the Python library enables obtaining time series for larger areas, polygons ...

<https://sentinelhub-py.readthedocs.io/en/latest/index.html>

Question 9: How important is the NDVI method for monitoring crops in the tropics area, because of the cloud cover?

Answer 9: The solution to monitor crops in the tropics is to use radar in combination with optical data. For areas where cloud coverage is high, this might be the only option. Radar can be used independently or to supplement optical data data. See:

<https://ieeexplore.ieee.org/document/9883707>

Question 10: In the Sentinel Hub EO browser, can we upload ground truth shape files of area of interest for getting time series and can we download the results of analysis or do we require a license?

Answer 10: You can upload vector data to EO Browser and compute the statistics for those polygons/points. The data can be downloaded, but we suggest to use the python API as described in the practical:

<https://github.com/EarthObservation/ARSET23>

See also answers to Q5 and Q8.

Question 11: Is maintaining the balance of the classes or the number of class-specific pixels in the mask essential when classifying something or making a mask necessary? For instance, 90 pixels for a woodland, 100 pixels for water, etc.

Answer 11: This is important when you are training your ML model. When working with minor differences between the classes, there should be little difference. The problem is more apparent when working with majority classes that represent 90% of the dataset. There are various ways you can address this undersampling, oversampling, adapting the loss function...

Question 12: How small was your sample?

Answer 12: The sample for demonstration on EO Browser was small (0.5 km²), just one field. However, you can use larger areas, multiple polygons.

You can monitor the usage of the Sentinel Hub on its dashboard:

<https://apps.sentinel-hub.com/dashboard>



Question 13: How do you classify those crops which have very similar phenology cycles (e.g., barley and wheat or sorghum and pearl millet)?

Answer 13: To be able to classify crops that are very similar is indeed difficult or even not possible. It is critical to have enough/good training data, if the crop is rare in the training dataset the classification accuracy will be low. We usually select the dominant crops, since we expect higher accuracy. It is also important to have dense time series, also multiyear data.

Question 14: Can we work with all the 13 bands of Sentinel-2? And how seamless is it to use this to estimate biomass?

Answer 14: Yes, you can work with all the 13 Sentinel-2 bands. From Sentinel hub you can get raw band values for all bands. We are usually using 10 m (4 bands, R, G, B and NIR) and 20 m data only. See:

<https://docs.sentinel-hub.com/api/latest/data/sentinel-2-l1c/>

<https://docs.sentinel-hub.com/api/latest/data/sentinel-2-l2a/>

There are some studies on estimating biomass using Sentinel-2 but the results depend on the quality of the reference, to achieve the best results you would require LiDAR, RADAR or similar sensors.

Question 15: How can we set a specific range of each band to display a satellite image? E.g., band 4 in the red channel with a limit of 0 to 0.5% reflectance likewise for other RGB bands.

Answer 15: You can use custom scripts for this purpose. Select the band combination to be used, then select the custom script below. Javascript is used for computation.

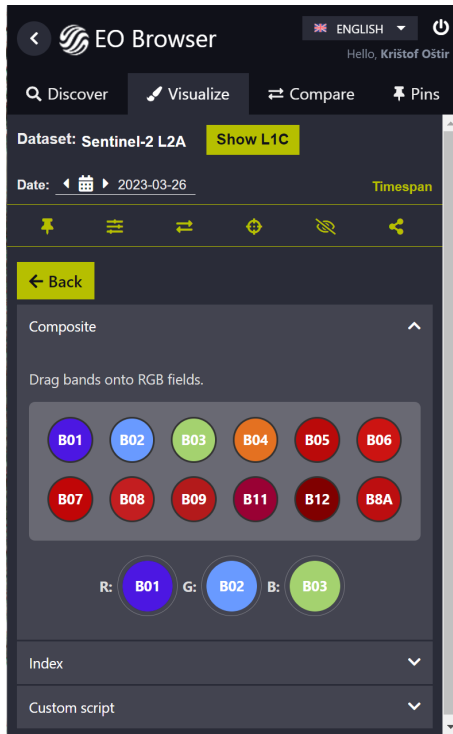
There are many examples of custom scripts available here:

<https://custom-scripts.sentinel-hub.com>



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Question 16: How do you generate interferograms from Sentinel-1 data?

Answer 16: We are using ESA SNAP to generate interferograms and coherence. To generate interferograms SLC data is needed, and this must be downloaded and processed locally.

Link to SNAP download:

<https://step.esa.int/main/download/snap-download/>

A tutorial is here:

https://step.esa.int/docs/tutorials/S1TBX%20TOPSAR%20Interferometry%20with%20Sentinel-1%20Tutorial_v2.pdf

CreoDIAS (not free) is generating coherence data:

<https://creodias.eu/advanced-data-processors-on-creodias>

Question 17: Where can I find the information I need to fill the INSTANCE_ID, CLIENT_ID, and CLIENT_SECRET fields in the sentinelhub.id file?

Answer 17: This information can be found in the Sentinel Hub Dashboard.

<https://apps.sentinel-hub.com/dashboard/#/account/settings>

INSTANCE_ID: Configuration Utility > Id

CLIENT ID: User settings > Oauth clients > ID (Client credentials)

CLIENT_SECRET: Is shown after creating a new OAuth client



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Question 18: Will there be a change on the use of Sentinel Hub as the parent company is being bought by Planet?

Answer 18: The company will continue to provide access to all services and on all platforms. There are only plans on expanding the services.

Question 19: How to generate training patches for Deep learning algorithms?

Answer 19: In the last notebook there is an example on how to generate time series for machine learning. This can also be adapted to provide patches.

Question 20: Can you tell us where we can learn more about machine learning for a beginner?

Answer 20: Fundamentals of Machine Learning for Earth Science:

<https://appliedsciences.nasa.gov/join-mission/training/english/arset-fundamentals-machine-learning-earth-science>

Question 21: Is it possible to read the images as a rasterio dataset and convert to numpy arrays?

Answer 21: Yes it is possible. Once you have loaded the image you can use the `ReadAsArray()` function to create a numpy array.

Question 22: Can you provide more information on the Harmonized Planet and Sentinel-2?

Answer 22: The Harmonized Planet Sentinel-2 data is a standard product provided by Planet. Planet operates three generations of Doves (Dove Classics, Dove-R, SuperDove) that have different spectral responses. In order to use images from all Doves interchangeably they need to be normalized to a single target so all images' spectral responses align closer to each other. If all the images are not normalized, this can lead to inconsistencies between scene-to-scene observations over an area for a given day.

The harmonization tool allows you to reduce inconsistencies between data across these sensors and provide temporally and spatially consistent data approximately matching a Sentinel-2 spectral response. The methodology behind harmonization is described here:

https://assets.planet.com/docs/scene_level_normalization_of_planet_dove_imagery.pdf



Question 23: Is it possible to use machine learning or deep learning in the case of wildlife biodiversity? If so then can you cite any example?

Answer 23: In connection with satellite images this could be observed more as a proxy based on how the vegetation changes. But I'm not aware of any tracking wildlife or similar objectives.

Question 24: In the condition of monitoring intensive grazing of grassland in summer when the vegetation is fully senesced/turned brown: is it still possible to use NDVI in this situation?

Answer 24: In that case NDVI alone might not be enough by itself indeed. We suggest using coherence here, as coherence is able to detect changes in grazing due to different structure of grassland.

Question 25: Could you please tell us how Sentinel-1 data can be used to develop a model to identify crop damages due to hail? Do we have data of previous years containing surveyed information parcel wise damage category (low, moderate, high, severe)?

Answer 25: For the detection of crop damages there Sentinel-1 is appropriate, since it provides information about the three dimensional structure that is changed by hail. However, optical satellites (NDVI) are also appropriate, as the vegetation can recover from hail, even in the same growing period.

Depending on the intensity of the hail, we can also change detection to detect areas that have been destroyed. Learning data, if available, enables classification and the damage category (traffic lights) is appropriate.

Question 26: Can you explain what you mean by all ARSET participants can have access to Sentinel Hub through this sponsorship?

Answer 26: Please create a Sentinel Hub login, send the registered email from Sentinel Hub to matej.racic@fgg.uni-lj.si and you will receive credits for processing and advance use.

See also:

https://appliedsciences.nasa.gov/sites/default/files/2023-03/Sentinel%20Hub%20Credits_instructions.pdf

Question 27: Can you please share the link to the Statistical API?

Answer 27: <https://docs.sentinel-hub.com/api/latest/api/statistical/>



Question 28: How does Sentinel Hub API compare with Google Earth Engine API?

Answer 28: A comparison of platforms for big Earth Observation data management and analysis is given here:

<https://www.mdpi.com/2072-4292/12/8/1253>

A summary is given in Table 1. Capacities of the platforms for big EO data management and analysis.

Question 29: We want to classify types of crops, for example wheat and barley or soybeans and corn. How can we know the right time of data aggregation, for example on a monthly level, apart from the fact that we can get basic statistical data? Can we, for example, measure Jeffries-Matusita distances in a sentinel hub or something similar?

Answer 29: The right time of aggregation depends on the availability of time series data. E.g. Sentinel-1 with several images within one week, can be aggregated to 10 or even 7 days. For optical, this can be two weeks or even a month.

You can not compute Jeffries-Matusita distances in Sentinel Hub. However, we usually process time series data in Python, and you can use JM there, see:

<https://mortcanty.github.io/src/zfl2019.html>

Question 30: What can we interpret from the interferogram? If possible please share some resources/papers

Answer 30: Here are some resources about the interferometry and the interpretation of interferograms:

<https://www.nature.com/articles/s41467-020-17587-6>

<https://site.tre-altamira.com/insar/>

<http://sincohmap.org/>

<https://www.usgs.gov/centers/land-subsidence-in-california/science/interferometric-synthetic-aperture-radar-insar>

For vegetation mapping, coherence and different polarisations are important:

<https://www.mdpi.com/2072-4292/11/6/720>

<https://www.mdpi.com/2072-4292/13/16/3300>

Question 31: Can we create, for example, a spectral class signature in the Sentinel Hub?



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Answer 31: Generation of spectral class signatures is not possible at the moment. However, we expect it will be added in the future, as also data from hyperspectral satellites will be included.