



**SAXAVORD**  
UK SPACE PORT

# **SAXAVORD** **EDINBURGH UNIVERSITY** **EARTH OBSERVATION STUDENT** **CHALLENGE**

## CHALLENGE BRIEF

EARTH OBSERVATION CHALLENGE BY SAXAVORD

Develop a technique and programme for monitoring specific environmental characteristics using satellite images and data. On short-, medium- and long-term time scales.  
Decide which satellites would be appropriate to monitor different characteristics. For example depending on weather conditions (cloud cover etc) or coverage at certain latitudes and periodicity of images.  
How much would this service cost potential clients looking to monitor environmental effects?

Case Study:

Location - Faroe Islands

However, the monitoring should be developed in a way it can be rolled out to a range of locations globally.

### What is needing to be monitored using EO:

Salmon Farms and what environmental effects they have locally regarding algae build up  
Coastal land use change over time (sign of erosion, landslides, construction developments etc)

### Main Objectives:

Describe what satellites and combination of bands are appropriate to use for this type of monitoring

Provide an analysis of the data and suggest reasons for any trends or anomalies spotted.  
Manipulate the data to expose different useful characteristics.

If required obtain your own satellite data and analyse this drawing conclusions from the EO.

Suggest why this data is relevant for key players including salmon farmers, insurance companies, ecologist.

Provide and justify (where possible with EO data to use as proof) a monitoring program timeline stating how periodically images could be obtained and analysed. Consider any flaws to using EO (intermittency in data? Reliability of the satellite?)

Think about costs of this service to potential clients.

Describe the  
method

Obtain and  
Analyse Data

Conclusion



## OUR INSIGHTS: GETTING STARTED

### EARTH OBSERVATION CHALLENGE BY SAXAVORD

- How we access the data:  
Copernicus open access hub gives us access to Sentinel satellite data.
- How to collect reliable data:  
Weather and satellite dependent (reoccurrence of the satellite over the same location e.g. Sentinel passes over the same location every 5 days)  
Important to gather enough data to create a baseline for what is usual, then over time be able to pick out abnormalities.
- What to look for in analysis:  
Algae blooms – occurrence in specific locations and intensity.  
(Band 8, 3, 2 or 6, 7, 8)  
  
True colour image – band 4, 3, 2  
  
Oil – natural oils from fish. How do we know this?  
Human interaction at the coastline  
Seasonal changes?  
Combine different band combinations to pick out different features

- **Potential costs:**  
Satellite high resolution data costs (estimated per area required)  
Analytical time required  
Likely to be £1000's for EO monitoring service
- **How useful is the data:**  
Insurance companies – how to justify insuring salmon farms for loss. If algae is causing the salmon to struggle and die, by collecting the EO data, insurance companies can assess if the compensation claim from farmers should be honored or if more can be done to reduce algae.  
Ecologists – observe the environmental effects salmon farming is having on the local waters. How will this effect other ecosystems locally?  
Land management – where or how close to the coast is sensible to build on or susceptible to erosion.  
The frequency of data collection or the resolution may not be great enough to draw conclusions from.

## OUR INSIGHTS: ACCESSING DATA

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To get you started:

One Drive link to the data:

[Faroe Islands Satellite Data](#)

See given Faroe location in later slides to focus on


File Names:

S2A = Sentinel A

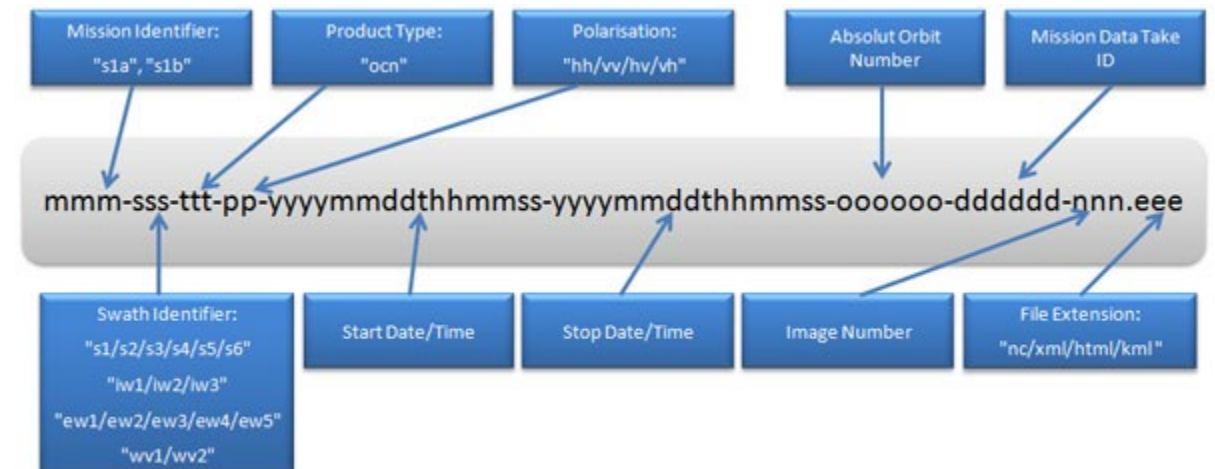
S2B = Sentinel B

We will be using Resolution 20m images which both S2A and S2B have.

To access Band 8 use the 10m resolution folder. This may be the case for other band combinations. Bands can be combined from different resolutions.

S2A_MSIL2A_20220531T120411_N0400_R066_T30VUQ_20220531T183212.zip		
Name	Date Modified	File Size
 S2A_MSIL2A_20220531T120411_N0...	2022-05-31	

Sentinel 2A (points to S2A)      Processing Level 2A (points to MSIL2A)      Date of data collected (points to 20220531)



## OUR INSIGHTS: ACCESSING DATA

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Each folder represents a different month (therefore we have provided one day each month for 6 months in total)

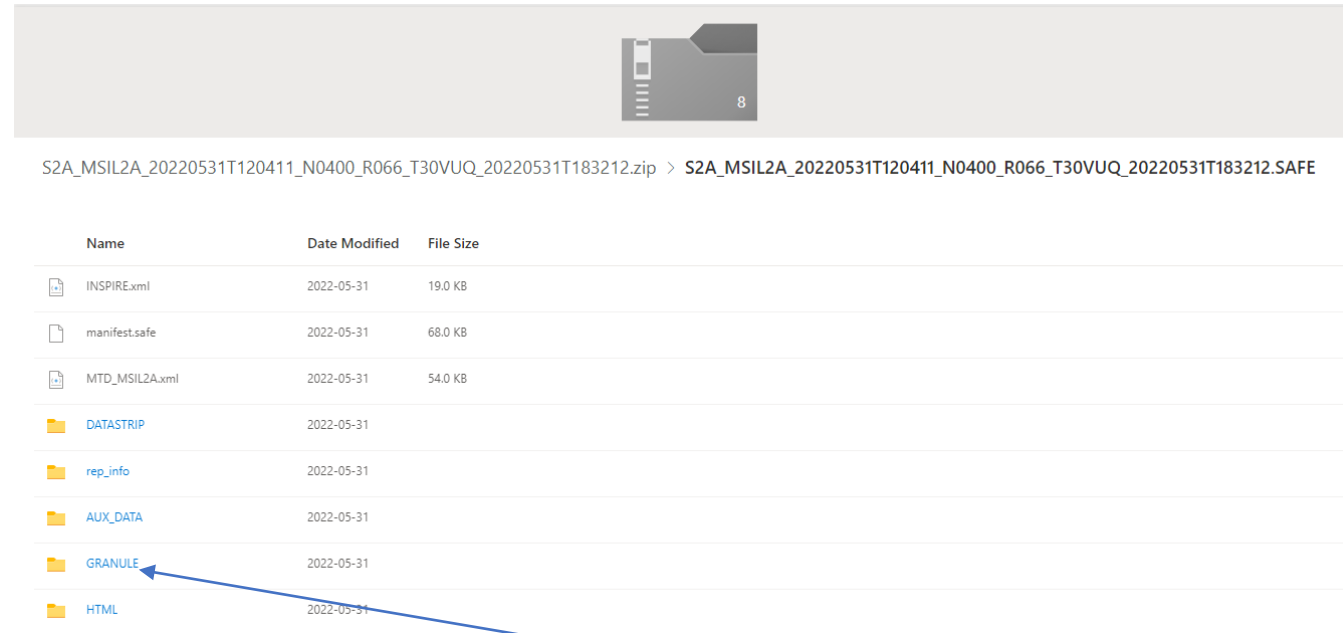
Download each zip file to enable extraction of the data

Open the folder and go to the GRANULE folder

Then click into the next folder and access the IMG\_DATA

Choose the R20m (resolution 20m)

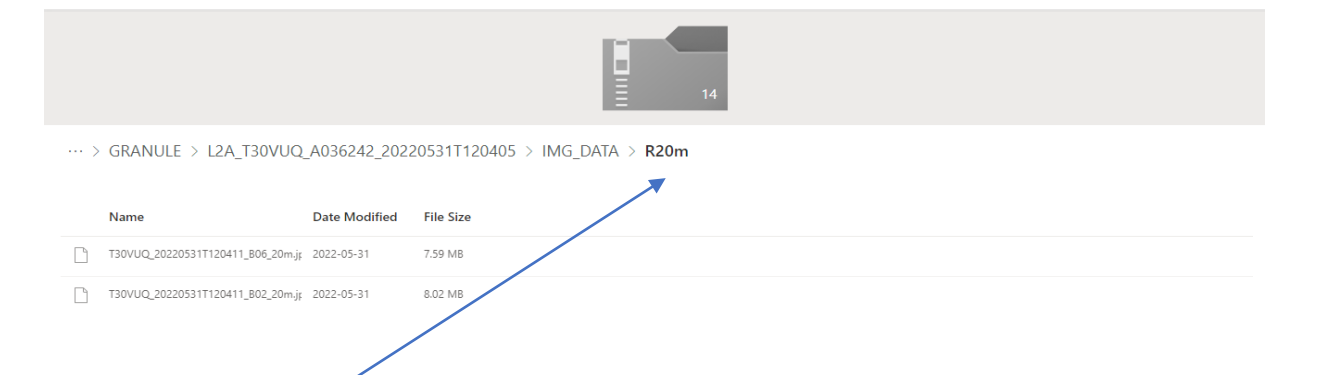
Listed in this folder are the variety of bands available  
The following slide will provide some more info



S2A\_MSIL2A\_20220531T120411\_N0400\_R066\_T30VUQ\_20220531T183212.zip > S2A\_MSIL2A\_20220531T120411\_N0400\_R066\_T30VUQ\_20220531T183212.SAFE

Name	Date Modified	File Size
INSPIRE.xml	2022-05-31	19.0 KB
manifest.safe	2022-05-31	68.0 KB
MTD_MSIL2A.xml	2022-05-31	54.0 KB
DATASTRIP	2022-05-31	
rep_info	2022-05-31	
AUX_DATA	2022-05-31	
GRANULE	2022-05-31	
HTML	2022-05-31	

Open folder, click on next folder then see the GRANULE folder



... > GRANULE > L2A\_T30VUQ\_A036242\_20220531T120405 > IMG\_DATA > R20m

Name	Date Modified	File Size
T30VUQ_20220531T120411_B06_20m.jp2	2022-05-31	7.59 MB
T30VUQ_20220531T120411_B02_20m.jp2	2022-05-31	8.02 MB

Accessing the R20m folder

## OUR INSIGHTS: PROCESSING DATA

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Use resolution 10m & 20m when possible but combine with other resolutions if other band numbers are needed.

ESRI ARCGIS: (Helpful tip for first time users)





- You can combine separate band images using, Composite Bands Function. This tool can be found under the → Analysis Tab → Raster Functions → Composite Bands Function.
- Load bands in the correct order, true colour images = 4, 3, 2
  - Image/band 4 should be first, followed by, 3, then 2.

QGIS:

- Helpful Plugins: Semi-Automatic Classification ([LINK](#))

To the right, the image gives an overview of the area for analysis algae, all the satellite data provided is for this specific area of the Faroe Islands and one of the 3 areas should be visible.

There are plenty of online resources for how to use both GIS tools for manipulating satellite images and providing classification analysis.

	T30VUQ_20220531T120411_B06_20m.jp	2022-05-31	7.59 MB
	T30VUQ_20220531T120411_B02_20m.jp	2022-05-31	8.02 MB
	T30VUQ_20220531T120411_B07_20m.jp	2022-05-31	7.59 MB
	T30VUQ_20220531T120411_B03_20m.jp	2022-05-31	7.83 MB

Band classification



## USEFUL LINKS / RESOURCES

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The following section provides you with helpful links to online resources for analysing the data being manipulated or where to access further satellite data to help with the challenge

### Access Satellite Data: ESA Copernicus Open Access Hub

- You will be required to register and login to the platform for downloading and accessing satellite data. This can be done via the web url below.

<https://scihub.copernicus.eu/dhus/#/home>

### Sentinel Satellite Bands

- The Sentinel satellites, for example 2A and 2B provide open access earth observation data using the multi sensor instruments onboard providing users with 13 bands to work with for further analysis. The following link below gives you a brief overview of the bands, wave lengths and description for combining.

[Sentinel 2 Bands and Combinations - GIS Geography](#)

### QGIS: Semi-Automatic Classification Plugin

- The Semi-Automatic Classification Plugin (SCP) allows for the supervised classification of remote sensing images, providing tools for the download, the preprocessing and postprocessing of images.

[How to Download and Visualize Sentinel Data in QGIS \(geodose.com\)](#)

### Algae monitoring

- Reference useful articles regarding EO and algae monitoring

[https://www.researchgate.net/publication/353986878\\_Automatic\\_Detection\\_of\\_Algal\\_Blooms\\_using\\_Sentinel-2\\_MSI\\_and\\_Landsat\\_OLI\\_Images](https://www.researchgate.net/publication/353986878_Automatic_Detection_of_Algal_Blooms_using_Sentinel-2_MSI_and_Landsat_OLI_Images)





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## EXAMPLE IMAGE

EARTH OBSERVATION CHALLENGE BY SAXAVORD

Image obtained September 2022

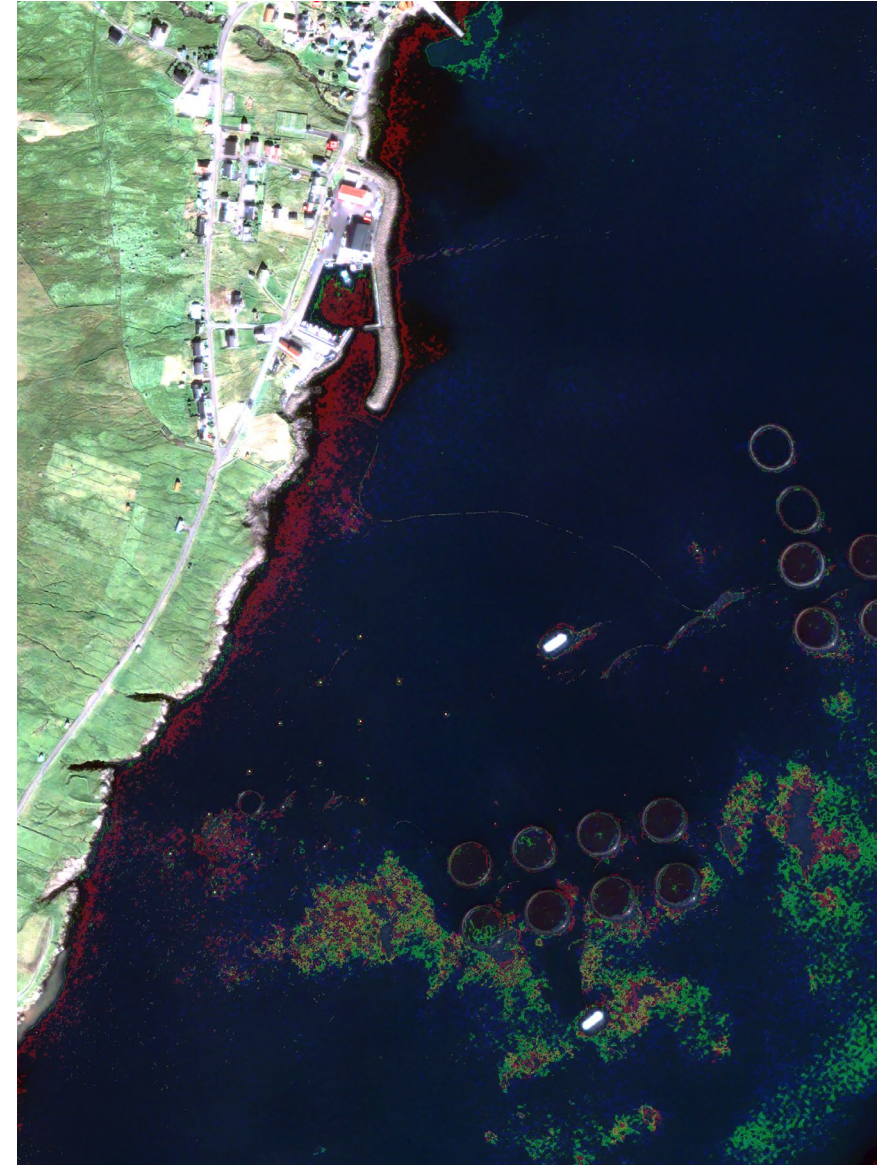
Red and green high reflectance

This image was interesting – it is a true colour image but has false colour qualities such as the red and green.

What does the red represent?

What does the green represent?

Why is it distributed the way it is?





## RECOMMENDATIONS

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We would recommend that you download and process the data on day one.

This will provide you with at least 6 images of the location to work with in analysis. Try and get a true colour image and then a false colour image for each month.

Be adventurous and combine different bands.

A variety of band combinations for one month will be interesting to look at too.

There is likely to be cloud over the area of interest, don't be discouraged by this, algae can be anywhere and though not in the specific area of interest, being able to refine the detection and classification of it is also interesting.

Think about the limitations – if nothing is showing up, what does this mean? Has the image been affected by cloudy weather?

An example of EO presentation by Jacques at SaxaVord is on the right-hand side. Try and find creative ways to present findings.



# *Thank you!*

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