Earth Observation for Energy and Climate

Earth Observation has been used successfully for planning and monitoring activities in response to climate change. This document presents case studies on the detection of tree planting as well as coastal, peatland and reservoir monitoring and indicates their ease of adoption.

Complexity

- Clear method and straightforward
- Clear method but complex
- Possible; needs research

Resource

- £ Low
- ££ Medium
- £££ High

Case Study I: Peatland monitoring

NatureScot use data from Sentinel-2 to map large extents of bare peat. The dataset is part of the Peatland Action project which, for the first time, produced a bare peat map that covers all of Scotland with a spatial resolution of 10 m. The map is made available in a dashboard and aims to help target site visits and more detailed analysis of an area. Currently, only a 2018 map exists with no information on future updates available.

The method is based on a machine learning classification of summer imagery to map patches of bare peat. Due to the limited resolution of Sentinel-2 imagery, only larger patches of bare peat can be identified. However, the approach is well understood and easily transferrable to other types of data. Smaller areas of bare peat could therefore be mapped with the same method if commercial, high-resolution satellite data is used. To assess the quality of the produced classification and make improvements to the method, a quantitative analysis of the outputs and error rates would be required.

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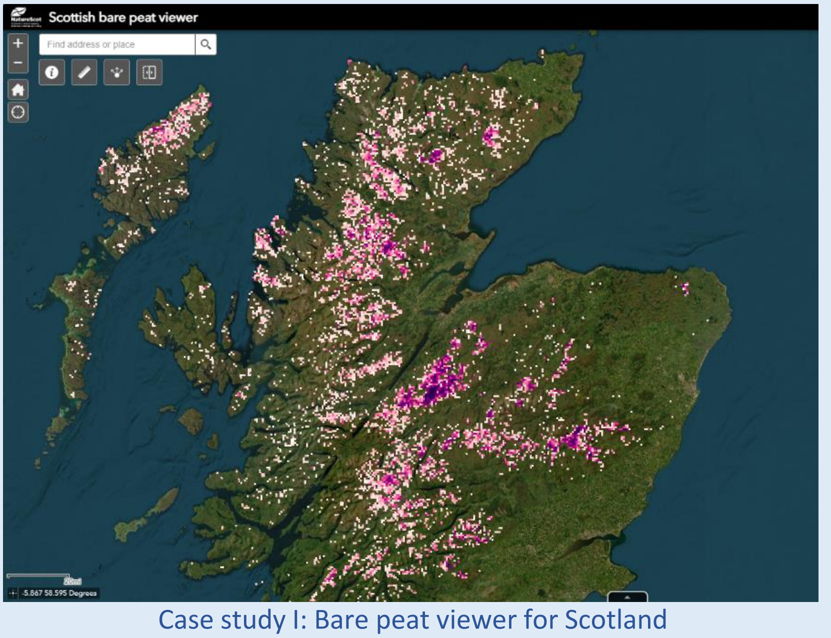
A workflow for processing the required data is already in place but would need a small expert team to improve and maintain, especially when outputs are to be produced more frequently. Data storage and processing is already taking place in the JASMIN cloud environment which comes with a small annual charge. Further charges occur from the ESRI license which is used to make the outputs available to users in an online dashboard. Costs would increase if data with very high spatial resolution is purchased for this work only or if more complex data processing (e.g. Sentinel-1 coherence) is required to further improve the method.



Case study I: Bare peat viewer for Scotland

Further products and applications

Peatland restoration/ Landscape Evaluation /Heat & drought mapping /Atmosphere monitoring

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Case Study II: Tree planting

Scottish Forestry
Coilltearachd na h-Alba

Forest Research use Sentinel data to map planting of trees. The product aims to help managers and policy makers with confirming tree cover on newly planted or restocked sites during the first five years. The National Forest Inventory (NFI) have provided a proof-of-concept product and are currently operationalising the method for a GB wide product. Scottish Forestry have commissioned a map of all sites restocked in Scotland within the last ten years.

The method is based on a machine learning classification of optical and synthetic-aperture radar (SAR) imagery which enables the detection of small trees that are not visible in aerial photography. With a Sentinel resolution of 10m, the generated product will provide plot level information but cannot detect individual trees. To assess the quality of the produced classification and make improvements to the method, a quantitative analysis of the outputs and error rates would be required. NFI are working on improving and operationalising the method to produce a GB wide product. Update rates are currently not known.

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A workflow for processing the required data is already in place and is improved and maintained by an expert team from Forest Research. Data storage and processing takes place in an Amazon Web Services (AWS) cloud environment and the operational service will be hosted by Forest Research in the future.

Case Study III: Reservoir monitoring

sepa

NatureScot and SEPA have developed pilot products for mapping the extent of reservoirs with Sentinel-1 and VHR time series data respectively. SEPA aims to develop this further to estimate the difference in water storage between summer and winter months.

Both methods are currently still in the development stage but are automatable and scalable. Frequent update rates are possible but certain types of reservoir might be difficult to monitor. LiDAR data would help to improve outputs.

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An operational platform would be straightforward to implement but would need a small team to build, improve and maintain. Storage and processing costs evaluated as medium but would be high if very high resolution (VHR) and LiDAR data is purchased for this purpose only, and not generically provided.

Case Study IV: Intertidal mapping

Dynamic Coast

The dynamic coast project uses a time series of tidally calibrated Sentinel-2 images to analyse water occurrence within the intertidal zones of the UK. Changes in the position of tidelines are captured on a national level which enables the monitoring and analysis of climate change impacts at the coast.

The method is based on thresholding of Sentinel-2 indices with subsequent pixel-based classifications. The prototype analysis used a Google based cloud-environment and some work would be required to establish the method on a different platform for future operational use. Analysis is severely limited by cloud cover which is common especially over the Scottish coastline. This could be improved with targeted acquisitions of satellite imagery by commercial providers.

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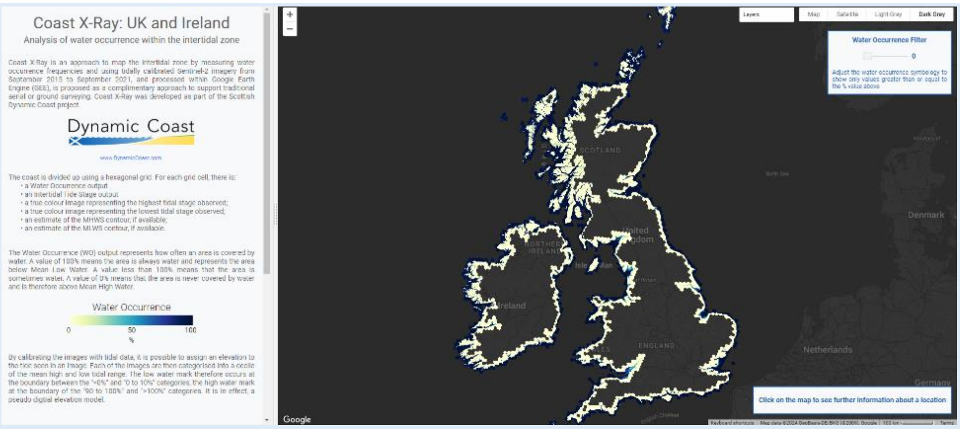
An operational platform would be straightforward to implement but would need a small team to build, improve and maintain. Storage and processing costs evaluated as low but would be high if further data is purchased for this purpose only, and not generically provided.



Case study IV:
Intertidal mapping and analysis in Scotland