

## Suitability of remote sensing for Coastal Monitoring

### Proposed Project:

Strategic coastal monitoring is essential in determining the long-term trends and changes in beach volume and morphology. However, restricted funding means that along low-risk coastlines, the frequencies of surveys are not high enough to directly link beach change to dynamic hydrodynamic conditions. Remote sensing technologies, including Lidar and satellite data products, are often suggested as alternative sources of data. The use of these technologies may allow higher temporal frequency, albeit at a lower spatial resolution. However, a systematic assessment of the data is required to determine its suitability.

**Aim:** To assess whether remote sensing data are of sufficient resolution to allow calculation of beach volume or morphology to sufficient certainty that they be used in conjunction with CCO monitoring data to allow higher temporal resolution beach volume calculations.

### Objectives:

- a) Literature review of potential technologies and their strengths and limitations
- b) Using suitable test areas in the SCOPAC region, perform an assessment of available remote sensing data, with comparison to CCO topographic data specifications.  
<https://gisgeography.com/how-to-download-sentinel-satellite-data/>  
<https://scihub.copernicus.eu/dhus/#/home>
- b) Calculation of beach volume from remote sensing data, and an assessment of accuracy using direct comparison to CCO derived beach volumes.
- c) Assessment of potential for increased temporal frequency of beach volume: is the data suitable, is the frequency high enough to make a significant difference, and what are the limitations of the approach.

**Deliverables:** Guidance on the suitability of remote sensing techniques for beach volume calculation.  
Development of methodology for combining the data sources.  
Case study within the SCOPAC region illustrating the use of these techniques.

**Duration:** 18 months

**Cost:** ~£4500 in analysis costs, with £1000 to be supplied by SCOPAC.

### Progress to December 2020:

- (a) Initial literature review and exploration of EO products and potential has led to an expansion of the original project, beyond assessments of beach volume, to a full investigation of all products which may have a benefit to coastal monitoring. This may delay final delivery of the project but should lead to a better overall outcome.
- (b) To maximise expertise in data/product assessment and take advantage of an increasing appetite for improving the uptake of EO products in the coastal realm, CCO have entered into collaborations with a number of research projects. These researchers will carry out the technical processing of the EO data into suitable products which will be validated against CCO data and assessed for their applicability to coastal monitoring needs. Areas within the SCOPAC area and wider have been chosen to ensure a wide spread of coastal types are assessed. Project summaries of the collaborations are provided, and along with their progress to date below.

In addition, CCO are supervising an MSci student, Dan Plewman, who will be specifically investigating the use of nearshore bathymetry EO data for informing the programmes bathymetry survey schedules.

## COASTAL CHANGE FROM SPACE

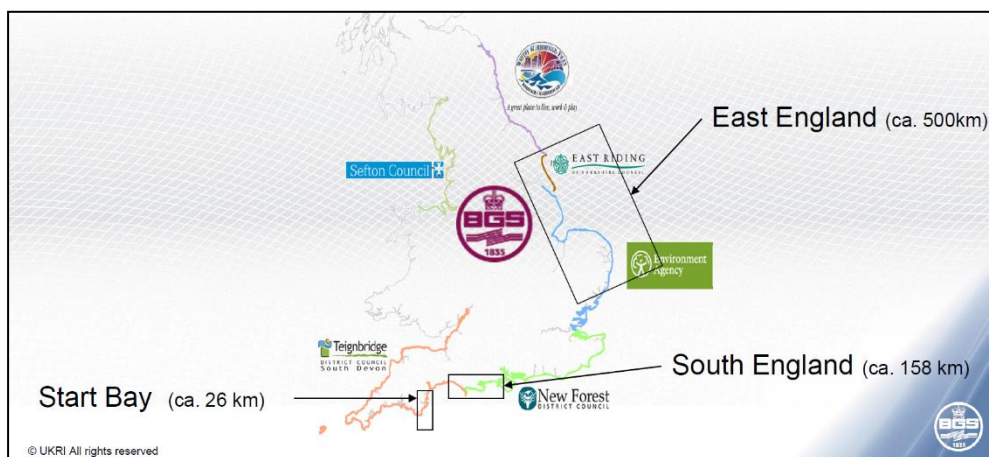
**Project Partners:** ESA (European Space Agency). Service Providers - Argans, advisEO, isardSAT

**Stakeholders:** End Users - British Geological Survey, Geological Survey Ireland, Government of Quebec, Ministerio Para La Transicion Ecologica (Spain)

**Project Summary, Aims and Objectives:** To develop applications to detect and track coastal erosion and accretion to inform coastal management plans. This will be done through volumetric analysis of sediment transport, as well as by analysing 25 years of ESA archive data to quantify historical coastal change. The team will do this using synthetic aperture radar (SAR) data from Sentinel-1 and optical data from Sentinel-2 and developing their own methodologies to address these problems.

**Aim:** To develop and demonstrate innovative EO products and services that enable smart decision making for coastal planning.

**Potential for Coastal Monitoring:** NNRCMP have provided areas of interest where the EO products can be demonstrated. Products include proxy tideline, datum tideline, seamless topo-bathy DEM and habitat mapping. Products have been created for 3 sites in the UK – Start Bay, Chesil and east, and East England.



**Project Status/Progress:** In Progress. Initial (unvalidated) data products were provided for review in November 2020. Feedback has been provided, and BGS are currently undertaking validation of the data. A workshop was held on the 7<sup>th</sup> December 2020 to ensure engagement with the project and both CCO and the Anglian Regional Monitoring Programme presented their perspectives on the potential uses of this data, on a panel which included the Environment Agency, UKHO and the Geospatial Commission. We expect to receive the final validated products early in 2021. A final workshop will be held on the 22<sup>nd</sup> January 2021.

### For More Information:

Project Website <https://coastalerosion.argans.co.uk/>

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## BLUE ECONOMY – ESA Atlantic Regional Initiative Application

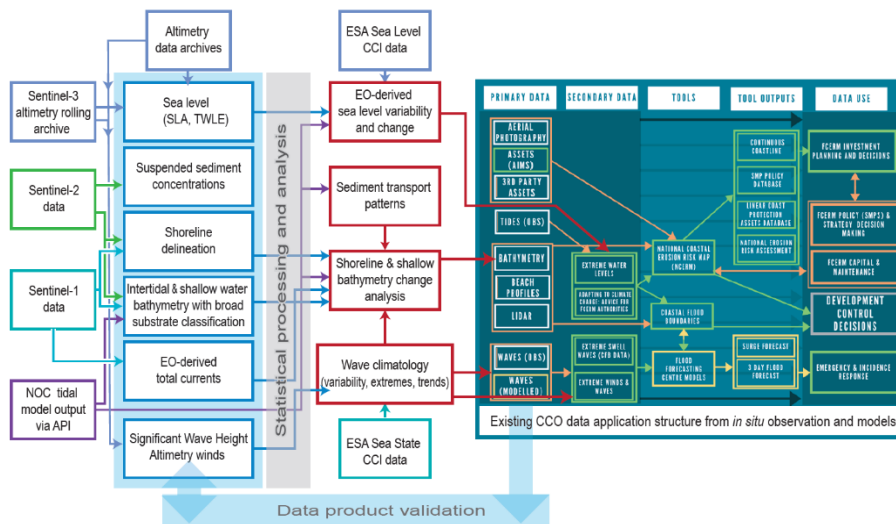
**Project Partners:** GMV (lead), University College Cork, National Oceanography Centre

**Stakeholders:** NNRCMP, EA, EMEC

**Project Summary, Aims and Objectives:** Part of the wider ESA Atlantic Regional initiative, the aim of Atlantic EO applications development is to embed EO-derived information into pre-operational regional monitoring, assessment and planning activities. Blue economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning aims to better anchor space users to the needs of territories and industries, fully exploiting the potential of EO applications for better-informed decision making and innovation processes.

**Aim:** Improve and integrate satellite Earth Observation data into a wider user base.

**Potential for Coastal Monitoring:** NNRCMP is a Use Case for the Blue economy project, which will assess the potential for EO data to fill knowledge gaps and increase observation capabilities in a cost-effective way.



It will assess the benefits of integrating the following EO derived datasets into the NNRCMP web service:

- Wind and Wave Climatology (trends, Interannual and seasonal variability)
- Sea Level (trends, interannual and seasonal variability of mean sea level; tides; surges; extremes)
- Intertidal and shallow water bathymetry
- Shoreline and Intertidal Zone Mapping

**Project Status/Progress:** The project began in June 2020, with an investigation of potential satellite data sources and data products. Initial work has focussed on the Medmerry and Selsey Bill

areas (Figure 1), but site selection is being expanded Nationally. This project will run over two years, and will investigate the widest range of EO data.

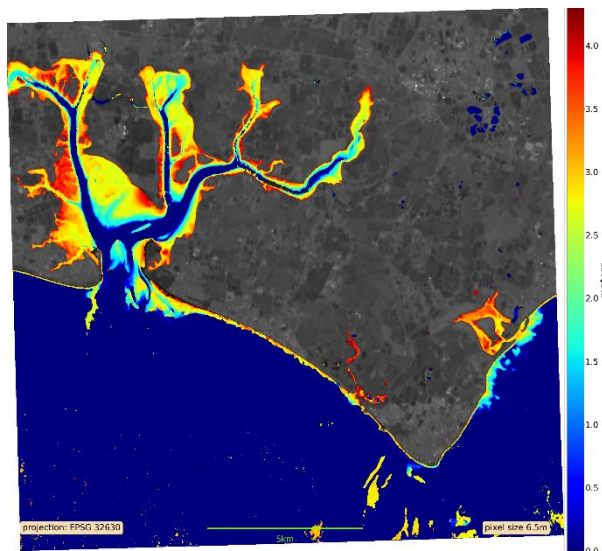


Figure 1 (left) Total Water Level for Medmerry area, based on 70 Sentinel-1 images from 2016. (right) Shoreline Change rate from Sentinel Optical imagery, from 2016 – 2020. For illustration only - not validated.

For More Information:

<https://eo4society.esa.int/regional-initiatives/atlantic/>

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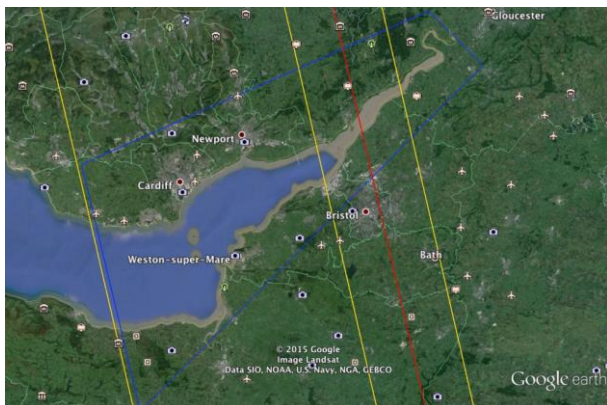
## SWOT-UK – Surface Water and Ocean Topography (SWOT) satellite calibration and validation (cal/val).

**Project Partners:** National Oceanography Centre, University of Bristol, Bangor University

**Stakeholders:** NNRCMP, WCMC, EA, ABP

**Project Summary, Aims and Objectives:** A NERC and UK Space Agency (UKSA) funded project to use the intense data collection calibration/validation phase of the upcoming SWOT mission to model estuarine water flows and inform coastal flood management. Daily passes of the mission over the Severn Estuary in addition to swath altimetry will provide observations of water-surface elevation, slope, inundation extent and discharge.

**Aim:** To improve estuarine water flow modelling and inform coastal flood management.



**Potential for Coastal Monitoring:** The products from this project are hoped to directly inform flood management and incident response. While the initial project will be spatially restricted, the potential products derived from the technology will be applicable nationally.

**Project Status/Progress:** The start of the project was delayed due to COVID-19 related impacts on the satellite launch (now scheduled for 2022). The kick-off meeting will be held on the 10<sup>th</sup> February.

**For More Information:** <https://nerc.ukri.org/research/funded/programmes/surface-water-and-ocean-topography-swot/>

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