2020_03: Investigating shoreline changes using freely available archives of satellite image data

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(a) Motivation for the project

The coasts, including the location of the shoreline are a dynamic, variable location, with storms, sea level rise and erosion meaning that they evolve at a variety of timescales - a single storm can completely change the area, volume and geometry of a beach for example. A variety of (very cheap to extremely expensive) monitoring techniques have been utilised to collect data which can be used to study this problem. Satellite imagery represents a valuable and growing data source to evaluate when trying to create a system for monitoring the coastline.

This project will develop the computational and data science underpinning required to interrogate archives of freely available satellite image data. It will investigate the use of automatic image processing and machine learning techniques to obtain relevant data with minimal human intervention required. The overall goal will be to obtain data the can be usefully combined with numerical models of the coastal ocean.

(b) Context and background

This project combines the NERC science areas of: Remote Sensing and Coastal Processes/Change with the cross-disciplinary topics of Machine Learning, Data Science, Modelling. It is a good fit for the REP scheme as it is envisioned that the successful applicant with have a background in computing or computational physics, but perhaps not have previously had any exposure to the environmental sciences.

(c) Objectives and methodology

The project will involve the following steps:

- Literature Review of the use of satellite image data in monitoring of the coastal zone [in part to address the question of wider context].
- Compilation of sources of data, e.g. Google's Earth Engine [https://earthengine.google.com/].
- Familiarisation of the interfaces (APIs) to access this data [partly to address the data collection element].

- Integration with appropriate image processing and machine learning frameworks [e.g. this code project represents a potential starting point: https://github.com/Coastal-Imaging-Research-Network/CoastSat].
- Application to a geographical location of interest.
- Time-permitting, correlation study of major changes to coastline features with recorded storm events.

Project length: 10 Weeks