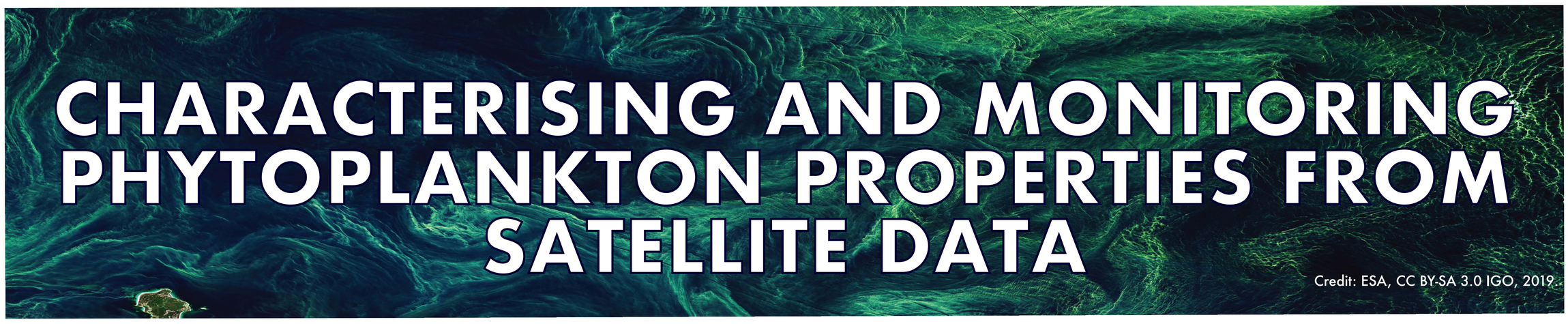
CHARACTERISING AND MONITORING PHYTOPLANKTON PROPERTIES FROM SATELLITE DATA



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Abstract

This study will draw on satellite sensors which differ in spatial, spectral, and temporal resolution: Sentinel-2 MSI and Sentinel-3 OLCI. The research will be focused on four optically diverse regions of interest; The Danube Delta and Black Sea Coastline (Romania), Galician Coast (NW Spain), Shandong Peninsula Coast (China) and the Northern-South China Sea (China). Here, the results from the Galician coast and other European waters will be presented. In-situ data such as hyperspectral Remote Sensing Reflectance, Chlorophyll-a concentration, phytoplankton abundance and taxonomy, along with fractionated chlorophyll-a and particle absorption properties will be used to test and develop HAB detection and Phytoplankton size classes (PSC) algorithms for near-shore and coastal waters. We focus on the detection of *Alexandrium minutum* from S-2 MSI and S-3 OLCI data. Existing PSC retrieval algorithms based on pigment cover, chloro-phyll-a abundance, and phytoplankton absorption for coastal and transitional waters were tested. In addition, atmospheric correction models will be tested against in-situ hyperspectral data and evaluated their performance over coastal waters.We will present results on the optical characteristics of A. *minutum* and the potential of MSI and OLCI for their remote detection. We will discuss our plans for the development of Super Learners for HAB indicators and PSC and the evaluation of the PSC algorithms.

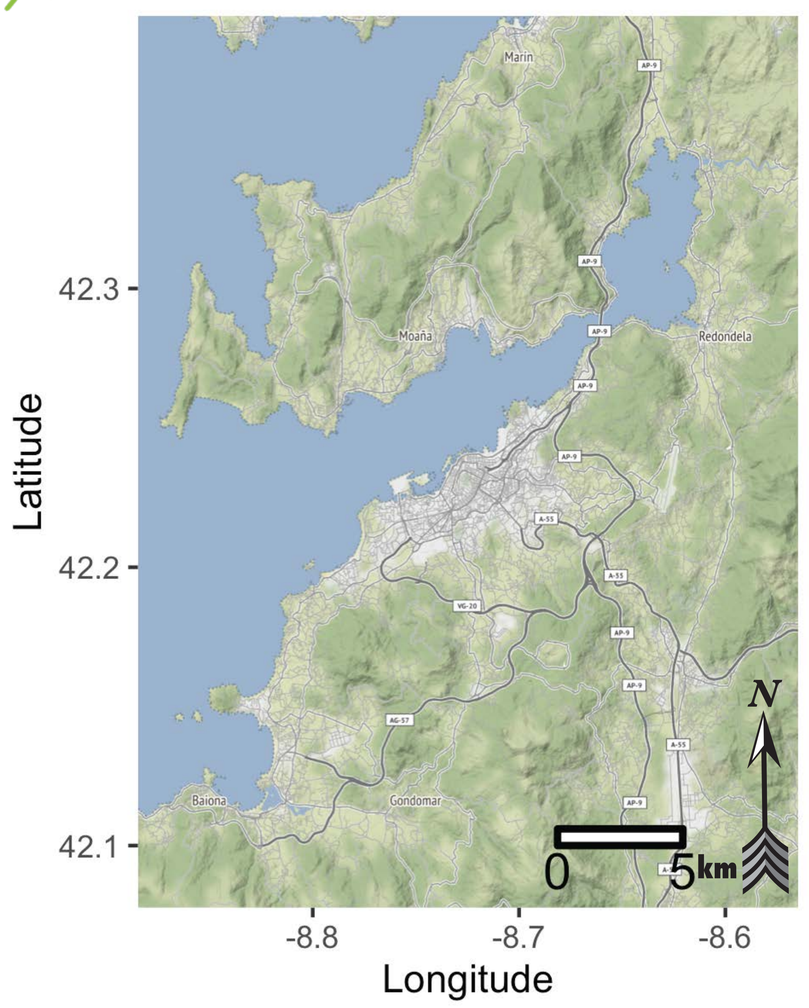
Introduction

Harmful Algal Blooms (HABs) pose a great threat to human and animal health, their occurrence also has a significant impact on a variety of socio-economic and environmental factors. HAB events are now a global problem which affect food production, tourism, and ecosystem health. It is expected that the occurrence of HABs is likely to grow significantly with the increase in the human population coupled with climate change. Phytoplankton size class (PSC) is suggested to be a good indicator of cell size, and considered to reflect the ecological and biogeochemical functional role of the phytoplankton present in the water column. Thus, it is important to be able to monitor PSCs, particularly in dynamic coastal waters where there are frequent changes in nutrients and phytoplankton community structure.

Objectives

The objectives of this study are to develop and validate HAB detection and Phytoplankton size classes (PSC) algorithms for near-shore and coastal waters. With better generalisation capability and lower computational overload that could improve the identification of the optical characteristics directly associated with phytoplankton properties.

Study Area(s)



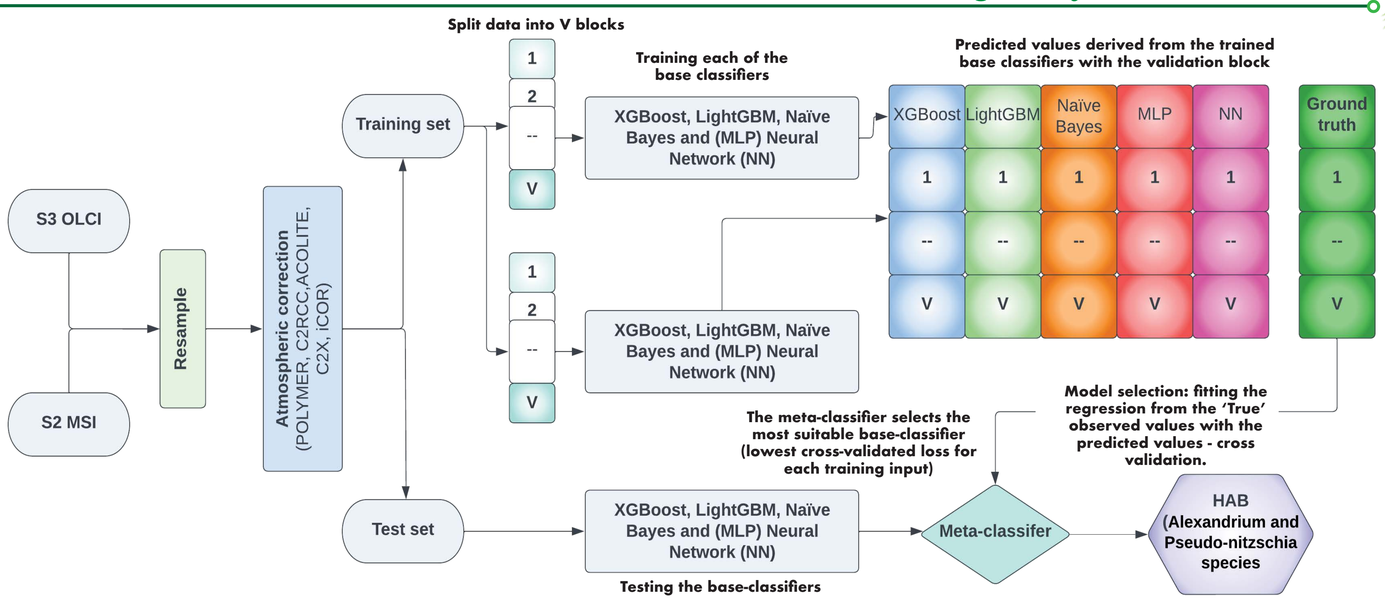
Initial work will be conducted around the Iberian Peninsula on the Galician Coast, Spain. This is a highly important region for shellfish production which is an industry that has many socio-economic and environmental factors depending on it. With overpopulation and overexploitation of natural resources around the world, HABs are now frequent in this area which results in lengthy closures during harvesting and threatens food security, jobs, and human/ animal health.

Efficient and cost-effective detection of HABs in this area along with understanding the characteristics of phytoplankton will have a positive impact on the Galician coast, allowing management strategies to be deployed to mitigate the impacts.

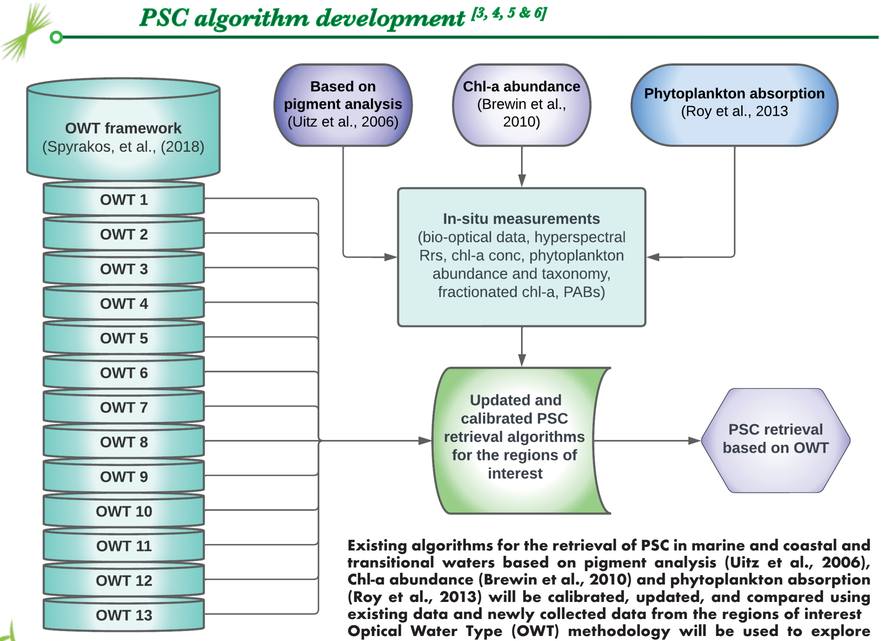
The Danube Delta and Black Sea coastal region in Romania will also be studied along with Shandong Peninsula Coast and the Northern-South China Sea. All of which provide essential services to both humans and animals. Testing and validating the algorithms across the different regions is essential to understand the different aquatic systems and further our understanding in the characteristics of phytoplankton on a global scale.

Proposed methodology

Ensemble algorithm for HAB detectionn [1,2]



PSC algorithm development [3, 4, 5 & 6]



Existing algorithms for the retrieval of PSC in marine and coastal and transitional waters based on pigment analysis (Uitz et al., 2006), Chl-a abundance (Brewin et al., 2010) and phytoplankton absorption (Roy et al., 2013) will be calibrated, updated, and compared using existing data and newly collected data from the regions of interest Optical Water Type (OWT) methodology will be used to explore broader application of the algorithms

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