operational service for coastal bathymetry to support littoral management and risk assessment.

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What Is the Potential of Satellite Data in Mapping Plastic Litter Hotspots?

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During the Atlantic from Space Workshop, Protecting the Ocean topic, I would like to present work on the evaluation of satellite data in mapping macro litter, especially polymers. It is estimated that there is going to be more waste plastic than fish in the sea by 2050 (The New Plastics Economy, 2016). Plastics account for almost 100% of floating litter. Fluxes of litter in the sea vary, depending on the proximity to urban activities, coastal uses, wind and ocean currents. These factors cause accumulation of marine litter in oceanic convergence zones and on the seafloor (Galgani et al., 2015). Due to the spatial and temporal variability of marine litter, it is important to develop a cost-effective, repeatable and fast method that can map plastic hotspots. Estimating plastic hotspots over time is needed for efficient monitoring programs, management and reduction measures. Although remote sensing data such as UAV imagery has increasingly been used to monitor litter, there is still a knowledge gap in the potential usage of satellite data for litter mapping. This research is a part of the CleanAtlantic project, which tackles marine litter problems in the eastern Atlantic region, involving 13 European institutes. The objective of this work is to assess the feasibility of open-source (Sentinel 1 and 2, possibly high-resolution data from SSGP) and commercial (WorldView-3) satellite data in automated identification of polymers in coastal areas and sea surface. To test this, average spectral signatures of different surface types are compared to polymers across time series. The study areas are carefully selected to allow for positional validation of polymer/litter objects visible from the satellite imagery. Results from the assessment of the polymer spectral signatures will serve as input data for the object based image classification, together with NDVI, surface roughness, RGB and hydrocarbon index (Garaba and Dierssen, 2018). The most suitable method of polymer identification is under development, therefore preliminary results and challenges will be presented at the workshop.

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Intertidal habitats monitoring using Earth Observation data and Machine Learning techniques

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This poster introduces ESA TEMITH project (Total Ecosystem Management of the InterTidal Habitats), starting in January 2018, involving partners from Deimos Space UK, University of Portsmouth and Deimos Engenharia.

Intertidal habitats rank amongst the most productive ecosystems providing bird habitat and feeding areas, commercial fish nursery grounds, as well as other ecosystem services including nutrient cycling and coastal protection. Seagrasses, mud flats and saltmarshes are some of the world’s most protected habitats. However, this protection has failed to prevent accelerating global loss due to over exploitation, direct damage and numerous other stressors including algal mats, pollution and marine litter. What is more, poor availability of relevant in-situ data, makes the monitoring of intertidal habitats challenging, costly and inefficient.

Within this project, high-resolution optical Earth Observation data (such as Sentinel-2, Planet, WorldView and UAV) in conjunction with Convolutional Neural Networks and Deep Learning based feature extraction tools will be applied to assess the threats that have significant impact on the function and quality of intertidal habitats. The main threats to be analysed within the project are: sediment disturbance caused by human activities, sewage plume characteristics, litter accumulation points and algal mats detection.

The project will focus on the Solent Region of the South of England. This region is one of the most protected and exploited intertidal regions in the world.

The TEMITH system will utilise proven elements of the architecture already existing in Deimos: the SIMOcean visualisation platform (System for Integrated Monitoring of the Ocean) and EO platform Service4EO.

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Marine litter modelling and hotspots detection in the Atlantic Area.

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Plastic production has increasingly grown for the last thirty years. One of the most accusable consequences of this tendency is its impact the plastic pollutants on the open ocean. The degradation process from macroplastics (sizes higher than 5 mm) into microplastics (sizes lower than 5mm), is faster than in other conditions due to the action of salinity, solar radiation and mechanical stress.

The detection of the main debris sources, and the location of the points where marine litter is accumulated (hotspots), are two fundamental issues in order to minimize this problem. We require the use of Lagrangian models to predict the macroplastic trajectories. However, many aspects can turn the tracking model into a difficult task, such as the absence of well defined initial conditions, the unknown descriptions for some dynamical process involved in the marine litter and the absence of real-time monitoring data.

In this way, the Non-Linear Physics Group from to the University of Santiago de Compostela has been working in this field along the last years. One of the most large-scale projects we take part in is the Interreg Clean Atlantic project, developing a modelling tool which included most of the dynamical processes as transport by currents, windage, Stokes drift, sinking and refloating between others. All these phenomena play an important role in marine litter transport, across the Atlantic area. This tool is intended to run large ensembles of simulations of millions of marine litter particles. Through this, we define regional maps of hotspots which represents the highest probability for accumulation, both on coastal and open ocean areas under different emission scenarios.

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Detecting Microplastics Pollution in the North Atlantic Using Sentinel-1 Sar Images

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Over the last 60 years the increase in chemical and plastic pollution have a significant pressure on the ocean health [1]. The present extent of plastic pollution according to several research papers has already filled all five subtropical ocean gyres - in the Indian, North Atlantic, North Pacific, South Atlantic and South Pacific oceans [2]. Plastic pollution signifies an enormous threat to marine life and ecosystems, because plastic fragments can be ingested by marine animals and fish and transferred via food chain to humans.

The aim of this research is to investigate the applicability of Sentinel-1 SAR data to detect and map ocean surfactants, with the hypothesis that they are related to microplastics pollution. The investigation areas for plastic (microplastics) pollution are across North Atlantic, including area of Hudson Bay in Canada as clean reference. The North Atlantic oceans are chosen because of high microplastics count, according to microplastics inventory mentioned in [4], [5], [6]. According to [7], the Hudson Bay has a low micro plastic count.

The radar images are showing distinct dark signatures in areas of North Atlantic oceans. These signatures show dependency on a certain range of winds, starting from 0.12 to maximum of 4.44 ms–1, measured by Aquarius and CERSAT scatterometer. No significance with presence of chlorophyll-a are found. The areas with dark signatures are located in areas of high concentrations of microplastics over the North Atlantic according to [7].

The research is still on-going, with the final aim to develop a machine learning algorithm (using a supervised classifier and convolutional neural network) able to separate the backscattering from surfactants, sea-slicks and bio-films. The machine learning algorithm will be aided by textual image analysis, results of modelling of the surfactants accumulation mechanism based on oceanographic processes (eddies) and knowledge on microplastics and surfactants behaviour from lab experiments.

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