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Towards an automatic algorithm for natural oil slicks delineation using Copernicus Sentinel-1 imagery

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Radar imagery, and specifically SAR imagery, is the preferred data type for the detection and delineation of oil slicks formed following the discharge of oil through human activities or natural occurrences. The contrast between the dark oil surfaces, characterized by a low backscatter return, and the rough, bright sea surface with higher backscatter has been exploited for decades in studies and operational processes.

Despite the semi-automatic nature of the traditional detection approaches, the workflow has always included the expertise of a trained human operator, for validating the results and efficiently discriminating between oil stained surfaces and other ocean phenomena that can produce a similar effect on SAR imagery (e.g., algal blooms, greasy ice). Thus, the process is time and resource consuming, while results are highly subjective. Therefore, automating the process to reduce the time for processing and analysis while producing consistent results is the ultimate goal.

Addressing this challenge, a new algorithm is proposed in this presentation. Building on state-of-the-art methods, the algorithm makes use of the latest technological developments for processing and analyzing features on the ocean surface using a synergistic approach combining SAR, optical and ancillary datasets.

This presentation will focus on the results that have been obtained by ingesting high-resolution open SAR data delivered by the Copernicus Sentinel-1 satellites into the algorithm. This represents a significant advancement over traditional approaches both in terms of utilizing contemporary SAR mission imagery instead of that from the heritage missions (ERS, ENVISAT), and in deploying both conventional classification and artificial intelligence techniques (e.g. CNNs) .

The scope of this study also involves highlighting the strengths and shortcomings of each type of technique in relation to the scenario to help make recommendations on the appropriate algorithm to utilize. The full architecture of the SAR component of the algorithm will be detailed, while the case study results over a set of known seepage sites and potential candidate sites will be presented, demonstrating the reliability of this new method.