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OIL SEEPAGE POLARIMETRIC CONTRAST ANALYSIS IN A TIME SERIES OF TERRASAR-X IMAGES

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Natural hydrocarbon seeps are broadly distributed across the Gulf of Mexico. Such seeps emit oil and gas into the water column, increasing the phytoplankton biomass and impacting regionally the productivity, carbon and nutrient cycling [1]. A fraction of this oil reaches to the sea surface and can be detected by SAR data. Although the ability of SAR data to detect oil features present in ocean's surface is wide exploited in the literature, it is known that the detection of those features is also a challenge. The SAR image interpretation became more difficult when the meteorological and oceanographically data are unavailable, the wind speed is too high or oil look-alikes are present (these features, e.g. low-wind conditions and algal blooms, can be misinterpreted as oil by conventional oil spill detector). In order to improve the SAR capability in detection oil seepages, the potential of the multi-polarization SAR data have been successfully exploited [2]. The latter have been shown to provide also a rough estimation of oil damping properties.

In this study we address a contrast analysis exploiting a large time series of multi-polarization SAR measurements collected in the northwest of Gulf of Mexico (region where the presence of oil seepage is reported in the literature [3]). The time series consists of approximately 110 TerraSAR-X images acquired between June/2011 and April/2016.

Our primary aims is to investigate the contrast between the oil seepages and the background using single-polarization channels by grouping the dataset according to incident angles and sea state conditions. The latter are available trough in situ buoy measurements. The purpose of the first part of this study is to analysis the time variability of the oil/sea contrast and its spatial variability across the slicked area. In the second part we deal with multi-polarization techniques to analyze the oil seepage from a polarimetric viewpoint. Those analyses are undertaken exploiting polarimetric entropy, degree of polarization, co-polarized phase difference and also at addressing spatial/temporal variability of the damping properties of the surfactant. Even this case, the dataset is grouped according to incident angle and sea state condition.

Finally, single-polarization results are critically contrasted with the multi-polarization ones to understand the benefits of inter channel phase to observe the sea oil seepage.

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