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Offshore Oil Spill Characterization using Space-Borne Fully Polarimetric X and C Band Synthetic Aperture Radar

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The use of fully polarimetric SAR data for oil spill detection is relatively new and shows great potential for operational offshore platform monitoring. Greater availability of these kind of SAR data calls for a development of time critical processing chain capable of detecting and distinguishing oil spills from 'look-alikes'. This paper describes the development of an automated Near Real Time (NRT) oil spill detection processing chain based on quad-pol RADARSAT-2 (RS-2) and quad-pol TerraSAR-X (TS-X) images, wherein we use polarimetric features (e.g. Lexicographic and Pauli Based features) to characterize oil spills and look-alikes. Numbers of TS-X and RS-2 images have been acquired over known offshore platforms along with some near coincident (spatially and temporally) acquisition. Ten polarimetric feature parameters were extracted from different types of oil (e.g. crude oil, emulsion etc) and 'look-alike' (e.g. plant oil, met-oceanic phenomenon etc) spots and divided into training and validation dataset separately for TerraSAR-X RADARSAT-2. Extracted features were then used for training and validation of a pixel based Artificial Neural Network (ANN) classifier. Initial performance estimation was carried out for the proposed methodology in order to evaluate its suitability for NRT operational service. Mutual information contents among extracted features were assessed and feature parameters were ranked according to their ability to discriminate between oil spills and look-alikes. Polarimetric features such as Scattering Diversity and Pauli-based features proved to be more discriminative than other polarimetric features.