Improved oil spill detection service over the French ZPE: developments and results

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Abstract

Oil slicks are known to be observable using SAR imagery. In particular, the use of satellite ScanSAR products is well adapted since it allows instantaneous coverage of wide areas. Although significant efforts have been made to describe the SAR imaging mechanism of oil surfactants, the detection of oil spills remains an ambiguous issue as a number of oceanic or atmospheric phenomena have similar SAR signature. Consequently, end-users are mostly concerned today with the necessity to keep false alarm rate at a low level. In 2004, the demonstration of an oil spill detection service using ENVISAT ASAR Wide Swath images was defined and implemented in close cooperation with CEDRE over the French Zone de protection Ecologique (ZPE) in the Mediterranean Sea. This service relies on a semi-automatic analysis of SAR images validated by a trained operator supported by ancillary information. First, the knowledge of local sea surface wind field derived from SAR images is used as a primary indicator to assess the feasibility of the detection as the sea surface roughness is primarily driven by the local wind conditions. Hence a sufficient wind speed is required to allow enough contrast between spilled and clean areas. In the case of the VV-polarised C-band SARs, this minimum wind speed is about 2.5 m/s. Moreover, oil detection becomes limited by the turbulence and waves, which drag slicks in the ocean sub-surface, for wind speeds greater than approximately 12.5 m/s. As a result it was shown that only 60% of sea surface observed by SAR images were actually usable over the ZPE. Additionally, ancillary remote sensing information (see surface temperature, ocean colour) has been introduced to help the trained operator in identifying ambiguous SAR signatures due to oceanic and atmospheric phenomena in order to reduce the false alarm rate. Eventually, ship detection was performed to help in the source identification that should be facilitated by the further comparison with Automatic Identification Systems (AIS) information. Applying systematic ship detection on all SAR images has also revealed to clearly identify the main shipping routes.