



Oil spill disasters detection and monitoring by optical satellite data

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Marine oil spill disasters may be related to natural hazards, when storms and hurricanes cause the sinking of tankers carrying crude or refined oil, as well as to human action, as illegal discharges, assessment errors (failures or collisions) or acts of warfare. Their consequence has a devastating effects on the marine and coastal environment. In order to reduce the environmental impact of such kind of hazard, giving to local authorities necessary information of pollution entity and evolution, timely detection and continuously updated information are fundamental. Satellite remote sensing can give a significant contribution in such a direction. Nowadays, SAR (Synthetic Aperture Radar) technology has been recognized as the most efficient for oil spill detection and description, thanks to the high spatial resolution and all-time/weather capability of the present operational sensors. Anyway, the actual SARs revisiting time does not allow a rapid detection and near real-time monitoring of these phenomena at global scale. The COSMO-SkyMed Italian dual-mission (expected in the 2010) will overcome this limitation improving the temporal resolution until 12 hours by a SAR constellation of four satellites, but several open questions regarding costs and global delivery policy of such data, might prevent their use in an operational context. Passive optical sensors, on board meteorological satellites, thanks to their high temporal resolution (from a few hours to 15 minutes, depending on the characteristics of the platform/sensor), may represent, at this moment, a suitable SAR alternative/complement for oil spill detection and monitoring.

Up to now, some techniques have been proposed for mapping known oil spill discharges monitoring using optical satellite data, on the other hand, reliable satellite methods for an automatic and timely detection of oil spill are still currently missing. Existing methods, in fact, can localize the presence of an oil spill only after an alert and require the presence of a qualified operator.

Recently, an innovative technique for near real time oil spill detection and monitoring has been proposed. The technique is based on the general RST (Robust Satellite Technique) approach which exploits long-term multi-temporal satellite records in order to obtain a former characterization of the measured signal, in terms of expected value and natural variability, providing a further identification of signal anomalies by an automatic, unsupervised change detection step. Results obtained by using both AVHRR (Advanced Very High Resolution Radiometer) and MODIS (Moderate Resolution Imaging Spectroradiometer) data in different geographic areas and observational conditions demonstrate excellent detection capabilities both in term of sensitivity (to the presence even of very thin/old oil films) and reliability (up to zero occurrence of false alarms) mainly due to the RST invariance regardless of local and environmental conditions. Moreover, the possibility to apply RST approach to both MODIS and AVHRR sensors may ensure an improved (up to 3 hours and less) frequency of TIR (Thermal Infrared) observations as well as an increased spatial accuracy of the description of oil spills (thanks to higher spatial resolution of MODIS visible channels).

In this paper, results obtained applying the proposed methodology to events of different extension and in different geographic areas are shown and discussed.