

Satellite monitoring of oil pollution in the European Coastal Seas

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Each year ships and industries damage the delicate coastal ecosystem in many parts of the world by releasing oil or pollutants into rivers and coastal waters. Off-shore environments are also polluted by mineral oil mainly due to: tanker accidents, illegal oil discharges by ships, natural oil seepage. For example, increased oil exports from the Caspian Sea region to Russian and Georgian ports and across the Black Sea has led to increased oil tanker traffic (and risks of an accident) through the narrow, winding Turkish Straits (including the Dardanelles, Marmara Sea, and Bosphorus Straits). The result of this high level of traffic is a high risk of pollution and even ecological disaster in the Black and Mediterranean seas. According to Energy Information Administration (www.eia.doe.gov) around 50,000 vessels per year (nearly one every 10 minutes) now pass through Turkish Straits. Around one-tenth of these are oil or liquefied natural gas tankers. This increased congestion has led to a growing number of accidents; between 1988 and 1992, there were 155 collisions in the Straits, some of them resulting in spilling thousands tons of oil into the Straits.

After a tanker accident the biggest problems is to obtain an overall view of the phenomenon, getting a clear idea of the extent of the slick and predicting the way it will move. For natural and man-made oil spills it is necessary to operate a regular and operational monitoring. Oil pollution monitoring in the Mediterranean, North and Baltic Sea is normally carried out by aircrafts or ships. This is expensive and is constrained by the limited availability of these resources. Aerial surveys over large areas of the seas to check for the presence of oil are limited to the daylight hours in good weather conditions (ESA). Satellite imagery can help greatly identifying probable spills over very large areas and then guiding aerial surveys for precise observation of specific locations. The Synthetic Aperture Radar (SAR) instrument, which can collect data almost independently of weather and light conditions, is an excellent tool to monitor and detect oil on water surfaces. This type of instrument is currently on board the European Space Agency's ENVISAT and ERS-2 satellites, and the Canadian Space Agency's RADARSAT satellite.

The application of this technology to the investigation of oil pollution in the Mediterranean, Black and North seas was done in the OCEANIDES Project (2003-2005), which was an EC 5th Framework project and corresponded to the theme "Environmental Stress in Europe". The aim of OCEANIDES was to understand the number, location and impact of oil slicks deposited annually in European waters and to lay the foundations for a monitoring system that will provide this information in a continuous manner. In the Black Sea it was detected 200-250 oil spills yearly (2000-2002), in the Mediterranean Sea – 1700 oil spills yearly (1999-2002) and in the North Sea – 650 oil spills in 2000.

In June 2004 we organized daily service for monitoring of oil spills in the southeastern Baltic Sea based on the operational receiving and analysis of ASAR ENVISAT and SAR RADARSAT data as well as of other satellite IR and VIS data, meteo information and numerical modelling of currents required for identification of slick nature in the sea and forecast of oil spills drift. This work was initiated and financed by *LUKOIL-Kaliningradmorneft* (Kaliningrad) in connection with a beginning of oil production at continental shelf of Russia in March 2004. Using this modern technology we detected about 300 oil spills in the southeastern Baltic Sea in the period between June 2004 and October 2005, and showed that the main reason of pollution is shipping. Our experience could be easily transferred to the Caspian, Black, Mediterranean and other European seas.