Possibilities and difficulties of oil spill and ship detection from space

O. Lavrova, M. Mityagina, T. Bocharova, V. Pyrkov, S. Shcherbak, A. Zlatopolskiy

Space Research Institute of Russian Academy of Sciences, Moscow, Russia
(olavrova@iki.rssi.ru / Fax: +7 495-3331056)

Oil pollution of coastal zones is an almost daily event associated with offshore oil exploitation, pipeline seeps, routine tanker operations, and marine traffic in general. The long-term effects of this chronic pollution are arguably more harmful to the coastal environment than any single, large-scale accident. The ability to monitor it more reliably would thus represent a highly desirable contribution to any environmental information system. The best way of monitoring this chronic oil pollution would be a constant satellite-based system. Various satellites equipped with active and passive sensors working at microwave, infrared, and optical frequencies have been launched recently, and now provide numerous images of most parts of the world oceans. Among the many different sensors synthetic aperture radar (SAR) is possibly the most suited for oil spill monitoring, because of its high ground resolution and independence of cloud and light conditions. SAR is an excellent tool to monitor and detect oil on the water surface. Oil appears as dark patches on SAR images because of the damping effect of the oil on the backscattered radar signal. Nevertheless, detection based only on SAR data is still problematic because of the difficulty in distinguishing oil slicks, especially at lower wind speeds, from other phenomena known as oil "look-alikes". Phenomena giving rise to "look-alikes" include bioorganic films, areas of wind-shadow near coasts, rain cells, zones of upwelling, internal waves and oceanic or atmospheric fronts. The contrast between a spill and the surrounding water, and thus the probability of detecting pollution films, depends both on the amount and type of oil and on environmental factors such as wind speed, wave height, sea surface temperature (SST), currents and current shear zones. The difficulties commonly experienced when attempting to detect and monitor oil pollution can be solved by combining data from different sensors, first of all those mounted on ENVISAT, ERS-2, Aqua, Terra, NOAA satellites.

Ship detection problem is closely connected with oil pollution monitoring since ships are often responsible for illegal oil discharges and it is an important task to deduce the source of a particular oil spill. Moreover, reliable ship detection is necessary for global monitoring for environment and security, marine traffic and fisheries.

We present the results of monitoring campaigns conducted by Space Research Institute of Russian Academy of Sciences (IKI RAS) in coastal zones of the Black, Baltic and Okhotsk Seas. Instruments and techniques adequate for oil spill and ship monitoring

as well as typical difficulties encountered are discussed.

Development of special software for oil spill and ship identification in satellite images is one of the key issues. The tools available today aid human operators but cannot replace them entirely because of high false alarm rate.