Contribution of remote sensing data to oil spills monitoring. A pilot study in the Black and Azov Seas.

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Oil pollution belongs to the most widespread man-caused emergency situations considerably harming natural ecosystems and different types of economic activity: fishing, tourism and other. About 50 % of oil pollution of the World Ocean is on transportation, where 75 % is on the ordinary process of transportation (related to the illicit vessel discharges, such as, ballasts water, tank washings, flowing of engine-room and other). But this type of pollution can be considerably decreased due to the effective monitoring and penalty system.

For monitoring of marine pollution the state inspections, as a rule, use marine or aviation facilities, which are quite expensive, limited by a day light and weather conditions and cover only a territorial waters. The satellites SAR (Synthetic Aperture Radar) images, instead, can be used for studding the large equatorials and does not depend on cloud coverage, season and daytime. Oil, discharged in the water, damps gravity-capillary waves and changes the slope angle. Thus, oil spills could be viewed on the SAR images as black spots on an unpolluted sea surface.

However, one of the problems in odder to create an operational integrated space-based monitoring system is an absence of various pilot researches to develop methodological principles for the unified algorithm of monitoring on international level. To contribute to this need a pilot research on Oil Spills Monitoring in the Black and Azov Seas was conducted by SSPC Pryroda with a support of European Space Agency under the ERUNET project within the framework of collaboration of GMES. The objectives of the research were to: approbate SAR images for oil spills detecting; specify of the remote sensing needs for space-based monitoring of oil spills; create databases and schemes of oil spills dissemination in the Black and Azov Sea (in 2002 – 2004); provide the recommendations for future researches.

On the first stage of the research the physical-chemical characteristics of oil pollution and etalon characteristics of the oil spill were studied. The average size of an oil spill is about 0.5 km^2. Satellite images should have a proper resolution to detect it so ENVISAT and ERS-2 images with resolution 25 – 12 m were selected as a basis. Then every dark spot on the image was analyzed in detail. In particular, the following information was taken to the account: year period (probability of formation of ice); wind speed (required wind speed – 2-14 m/c); spot form and size (large areas are

either areas with low wind or natural oil); geographical location; ship presence nearby; etc.

However, the similar effect of dark spots on the SAR images can cause the row of other ocean and marine phenomena, such as atmospheric front, wind shadow, currents, calm zones, rain, topography, sewerage flowing, ice, internal waves and other. Therefore, the synergetic analysis with visible and infrared images consideration was conducted as a second stage of the project to confirm the results of the research.

AVHRR (NOAA) images and SeaWIFS data was selected as reference data. The complex information was studied, such as, temperature of water of marine surface, concentration of chlorophyll, marine flows and meteorological parameters. The features of oil spill presence were the following: temperature and vapor minimum; absence of chlorophyll concentration maximum; sea surface albedo minimum; etc.

As a result, the scheme of oil spills dissemination was designed. It shows high correlating with the scheme of transportation roads.

Recommendations for further researches:

1. Developing the algorithms of automatic classification of remote sensing information for oil spills detection.

2. Improving the method of determination of oil spills quantity and recognition of oil type.

3. Determing the policy of information exchange and access to it.

4. Improving the legislative aspects of oil spills monitoring and penalty system.