Results of satellite monitoring of oil pollution in South-Eastern Baltic in 2006-2013

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Results





Materials and methods

Area of monitoring

For the purpose of monitoring SAR data from several satellites were used: Envisat (ESA), Radarsat-1 (CSA), Radarsat-2 (MDA), and Cosmo-SkyMed (ASI). These satellites are equipped with SAR which allow detection of spatial variability of small-scale wind waves, which are always observed at the sea surface, as the pattern of returned signal intensity distribution (SAR images). Films of different origin, such as oil pollution, algae blooms or ice fields, locally modify the roughness of the sea surface what detected by radar. The satellites provide coverage of the study area with a time interval of 12-48 hours. Advantages of the method are possibilities of all-weather and round the clock acquisition, and wide swath up to 500 km. Limitation of the method is the condition that near-water 18° wind speed should be in the range of 2-10 m/s.

The satellite data is distributed by Kongsberg Satellite Services (KSAT, Norway) (www.ksat.no).

Detected oil spill were digitized with ArcGIS 9.2 software.



Summary map of detected oil spills on radar images from 2006 to 2013 in the area of monitoring From 2006 to 2013 there are 1462 satellite scenes were received and analyzed, and 877 oil spills were detected, including 452 oil spills in the area of monitoring.

Satellite	Usage period	Scene size, km	Spatial resolution, m
ENVISAT	from 01.2006 to 04.2012	400x400	150x150
RADARSAT-1	from 01.2006 to 03.2013	300x300	50x50
RADARSAT-2	from 12.2008, currently	300x300 500x500	50x50 100x100
Cosmo-SkyMed	from 04.2013, currently	200x200	100x100

Main characteristics of SAR images

Exclusive Economic Zone

25°N

gal oil discharges

<0.80

0.81 - 2.00

5.01 - 10.00 >10.00

20°

Location and size of illegal oil

discharges observed during aerial

surveillance flights by HELCOM

Contracting Parties during 1998-2012.

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Introduction

During the last decade shipping has steadily increased around the Baltic Sea, reflecting intensifying international co-operation and economic growth. Both the numbers and the sizes of ships have grown and the trend is expected to continue. This leads to increased pollution and other pressures on the marine environment. Also, the dramatic rise in oil transportation significantly raises the risk of a large oil spill in the Baltic marine area [www.helcom.fi].







Oil leakage from the ship detected on RADARSAT-1 image on 24.07.2008 at 05:01 UTC. Ship-polluter is shown by red circle



Oil leakage from the ship detected on RADARSAT-2 image on 13.09.2013 at 05:09 UTC. Ship-polluter is shown by red circle



The average monthly density of ships in the Baltic Sea equipped with an AIS (Automatic Identification System) for 2011. ©HELCOM



Oil spill drift forecast

According to SeatrackWeb [https://stw-helcom.smhi.se/] the oil pollution in the area of port Baltyjsk could be a reason of oil pollution of Curonian Spit's beaches. Thus, modeling of the case on June-July 2008, showed that the oil slicks detected in 15-20 km westwards from the Sambian peninsula cost could be a reason of oil pollution of beaches of Curonian Spit - Russian-Lithuanian natural and cultural heritage by UNESCO. Model showed the possible places of wash-out of oil products to he beach - Taran Cape and root of Curonian Spit. According to the model, oil spill N1 reached the coast near Taran Cape on 30.06.2008 at 18:00 UTC and the sea shore near Pionerskyj on 01.07.2008 at 10:00 UTC. Oil spill N2 reached Curonian Spit shore on 02.07.2008 about 10:00 UTC. During the next months oil was observed along the all Russian part of Curonian Spit.





Tail-shaped oil pollution of the sea surface detected on ENVISAT image on 22.05.2006 at 09:09 UTC



Dynamics of received SAR images and detected oil spills for 2006-2013 Oil pollution along the Curonian Spit shore observed at 22.07.2008

Drift forecast for the oil spill N2 detected on 27.06.2008 at 09:03 UTC (ref. to red dashed line). Color gives information about the depth intervals where there is oil

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