Distinctive features of surface circulation in the southeastern part of the Baltic Sea by subsatellite oceanographic experiments held in 2014-2017.

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1. Introduction

During the period 2014-2017 in summer months Space Research Institute held oceanographic experiments in the southeastern part of the Baltic Sea along the coastline of Kaliningrad Region of Russia. The main aim of the work was to provide comprehensive in situ oceanographic data to describe spatial and temporal features of the surface circulation patterns determined by remote sensing data.

2. Data

The work is primarily based on remote sensing data being a first step to determine circulation patterns on the sea surface. Figure 1 shows a color composite image by Landsat-8 OLI on July 07, 2014 showing an array of dynamic processes clearly seen by satellite data (Lavrova et al., 2016).

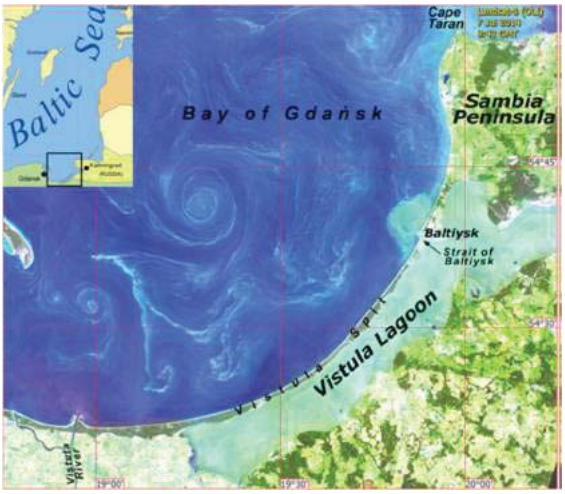

Figure 1. Landsat-8 OLI color composite image with an array of different processes determined on the sea surface.

During the work we could analysis different types of remote sensing data including color composite images from Terra/Aqua MODIS, Landsat-7,8; MSI Sentinel 1,2 and radar images from Radarsat-2.
Oceanographic experiments included different methods to determine ocean currents: more than 20 ship mounted ADCP (Acoustic Doppler Current Profiler) transects were done in the coastal zone of the Baltic sea to the depths up to 80 m. 9 lagrangian drifters with GPS positioning kit and GSM telemetry channel were launched offshore Kaliningrad region simultaneously with ADCP survey. Thermohaline structure was determined with the use of modern CTD instrument with additional turbidity and CHL-a fluorescence sensors. Meteorological conditions during experiments were determined with the use of a ship mounted meteorological station.

3. Results

The influence of wind and hydrodynamic processes on the spreading of turbid waters from the Vistula Lagoon into the Baltic Sea was studied. We found out that in certain wind conditions, the lagoon waters can propagate long distances from the Baltiysk Strait mouth both northeast. We managed to track from ocean color data the spreading of the lagoon water over the Bay of Gdansk for over two weeks in late July—early August 2014 in almost cloudfree weather conditions. Because optical properties of the lagoon water were quite distinct from those of the open sea due to intense cyanobacteria blooming, the outflow stream was very well visualized even in satellite Terra/Aqua MODIS images of 250 m pixel size. Along with satellite observations, in-situ measurements were conducted aimed at verifying satellite data as well as deducing the three-dimensional structure of the stream.

In 2014, we managed to detect and describe a complex dynamic vortex structure near Cape Taran (figure 2). An eddy propagated to the depth of 20 m and had a linear scale of ~ 25 km. This vortex structure was identified using Radarsat-2 images and optical data, obtained by OLI Landsat-8, ETM+ Landsat-7, Modis Terra/Aqua and confirmed by ADCP data (Lavrova et al., 2016).

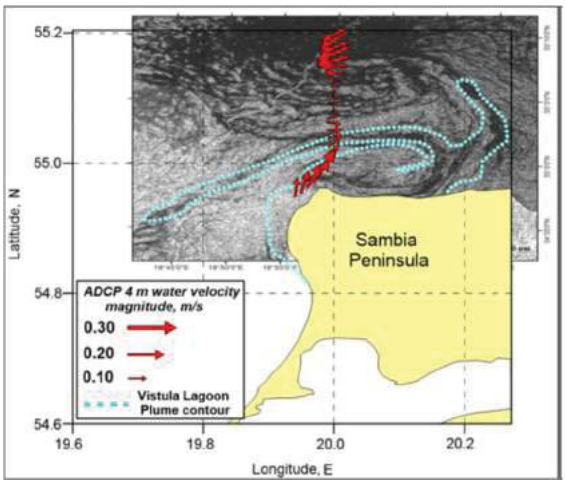

Figure 2. Vortex dipole formed in the coastal zone at the Cape Taran.

Set of lagrangian drifters launched in the study area showed the variability of surface circulation from year to year and could determine main physical processes influenced the nature of this variability. Drifter trajectories got in 2016 showed that circulation during the oceanographic experiment was primarily formed by winds. During the campaign drifter travelled long distance and its trajectory was complicated with inertial oscillations, sharp turns.

In 2015 drifters launched in the same area travelled within a very localized region during a week. As it was shown the drift was influenced by a vortex dipole structure formed offshore and clearly determined on Landsat and MSI remote sensing data (Golenko et al., 2017).

Acknowledges

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References

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