RESEARCH OF DYNAMICS AND THERMOHALINE STRUCTURE OF WATER IN THE BALTIC SEA ALONG THE COAST OF THE KALININGRAD REGION ACCORDING TO CTD SENSING AND SATELLITE ALTIMETRY DATA

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The water area of the Baltic Sea has been well studied. However, most comprehensive works focused on its opened part. Arrays CTD-probe measurements in the twelve miles zone of the Russian sector of the south-eastern Baltic databases HELCOM and ICES are not represented. However, in recent years members of BFU staff and AO IO RAS accumulated a large amount of CTD measurements off the coast of the Kaliningrad region, which is the basis of work. Other sources of field data become arrays of altimetric measurements of the satellite JASON-2 for the period from 2009 to 2014 as well as data tide gauge measurements in Kaliningrad and Wladyslawowo (Poland), distributed by Permanent Service for Mean Sea Level (PSMSL).

The aim of the on-going comprehensive studies of the Baltic Sea waters along the coast of the Kaliningrad region is to study the variability of their thermodynamic parameters.

Data. In the shallow waters in the Baltic Sea from 2003 to 2015 measurements were done using modern probes: CTD90M, Idronaut 316, STD-2a and YSI 600XLM.Total 1278 hydrological stations have been received and processed. For the external border of the coastal zone has been accepted isobath of 30 m. Using small boats allowed to start measurements with a depth of 3 m. Analysis of the variability of coastal waters was carried out based on the comparison of profiles of the vertical distribution of temperature and salinity, the averaged by the method of stratified median filtering. Selecting archives of the satellite Jason-2 was due to a significant time interval of his work and high precision position determination of the sea level.

TS structure of coastal waters. Analysis of CTD soundings arrays in the coastal area has shown that there is an inverse thermal stratification in the vertical distribution of temperature at winter. In the spring raising the surface temperature is caused by just started spring heating, due to the mixing the whole water column is gradually warms. Maximum temperature due to the warming water from the surface is observed in summer - up to 20-22°C at the end of July - mid-August. Autumn cooling of the surface activates the processes of the autumn-winter convection, gradually forming a well-stirred mixed layer to a depth of 30 m. The temperature of the surface water in December is within 7-7,5°C, at a depth of about 27 m thermocline is distinguishable , in the bottom layer temperature reaches 8,2°C. The vertical distribution of salinity halocline is at depths of stirring wind (5-15 m) regardless of the season. The maximum values are observed at the bottom, the minimum - at the surface. From the perspective of the seasonal variability of the thermohaline structure the most interesting are spring and autumn, when there is an active restructuring of the water column of coastal waters. As it turned out, in the spring, from April to June the surface temperature rises by about 8°C, while in the bottom layer - at 5°C. The salinity in the bottom layer from April to June, rises to 0.45 psu, but on the surface first increases to 0.55 psu, and then (due to the June rainfall) reduced by 0.25 psu.

The surface salinity in the spring-summer season is in the range from 6.2 to 6,8 psu. At bottom this index is higher and varies from 7.15 to 7.6 psu between April and June, respectively. In the autumn, in October the water temperature throughout the thickness varies slightly, dropping up to

~9°C in November. Salinity in October, November and December in the surface and bottom layers slightly increases, reaching, respectively, values of 7.05 and 7.2 psu.

Altimetry. The calculation of linear trends of annual variability values abnormalities level of the coastal waters off the coast of the Kaliningrad region showed the presence of the change of growth / decrease. The observed effect of the change of growth / decrease is can not allow to draw any conclusions about a trend or a hidden periodicity for now.

Completed standard procedures of statistical analysis of time series of coastal water level anomalies values showed asynchrony and inconsistency of the sea level fluctuations on tide gauge measurements in Kaliningrad and Wladyslawowo (Poland), as well as at points of satellite measurements.

The analysis of time series variability level of the Baltic coastal waters anomalies showed that the winter season is characterized by negative values of sea level anomalies for all years of study, except in 2012. Spring time is also characterized by depressive anomalies in sea level relative to the average long-term level. Summer - the only season in which the sea level anomalies are almost entirely positive, which may indicate a seasonal "surge" level the South-eastern part of the Baltic Sea. Autumn period was characterized by the highest dispersion of the distributions of sea level anomalies.

Conclusions. Our study allowed us to refine intra-annual ranges of the Baltic shallow water fields of temperature and salinity variability. The seasonal variation of the temperature and salinity are generally consistent with the known climatic descriptions.However, they contain quantitative indicators for the spring period and they were too low (at 1-3°C) for the temperature and too high in the top (15 m) layer for salinity.

Comparing time series of sea level anomalies in the region showed strong geographic differentiation of the results of tide gauge and satellite measurements, it is not possible to make a general conclusion about the presence of any trends of changes of the level in the period which is under review.

An analysis of interannual progress level of the sea surface anomalies in the temporal part of the study (2009-2014 gg.) allowed to assume the existence of long-period fluctuations of the studied parameter.

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