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Storm surges formation in the White and Barents Seas

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Investigation of storm surges in the Arctic seas are of high priority in Russia due to the active development of offshore oil and gas, construction of facilities in the coastal zone, as well as for the safety of navigation. It is important to study the variability of surges, to predict this phenomena and subsequent economic losses, thus including such information into the Russian Arctic Development Program 2020. Surges in the White and Barents Seas are caused mainly by deep cyclones of two types: "diving" from the north (88% of all cyclones) and western. The average height of the storm surges in the White Sea is 0.6-0.9 m. An average duration of storm surges is about 80 hours. Mathematical modeling is used to analyze the characteristics of storm surges formation in the Dvina Bay of the White Sea, and in the Varandey village on the Barents Sea coast. Calculating storm surge heights in the White and Barents seas is performed using the ADCIRC model on an unstructured grid with a step from 20 km in the Barents Sea to 100 m in the White Sea. Unstructured grids allowed keeping small features of the coastline of the White and Barents seas, small islands and shallow banks, and assessing their impact on the development and transformation of wind-generated waves. The ADCIRC model used data of wind field reanalysis CFSv2. The storm surges were simulated for the time period from 1979 to 2010 and included scenarios with / without direct atmospheric pressure forcing, waves and tides. Numerical experiments have revealed distribution of storm surges in channels of the Northern Dvina River delta. The storm surges spreads in the model from the north-north-west of the Dvina Bay. As storm surge moves from the wellhead to the seaside estuary of the Northern Dvina (district Solombala), its height increases from 0.5 to 2 m. We also found a non-linear interaction of the surge and tide during the phase of surge destruction. This phenomenon is the highest in the period of low water, and the smallest in the period full of water. Analysis of storm surges in the Varandey village (the southern part of the Barents Sea) showed that the maximum height of storm surge reached 2.9 m in this region in July, 2010. The work performed was supported by the RSCF (grant № 14-37-00038)