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Wind Wave Climate of the Baltic Sea

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Storms in the Baltic Sea in autumn and winter are very frequent. In this research the goal is to estimate decadal and interannual changes of the wave fields for the entire Baltic Sea. The wave parameters, such as significant wave heights and periods, were simulated for the period 1979-2015 years based on NCEP/CFSR Reanalysis data fields and for the period 1948-2010 years based on NCEP/NCAR Reanalysis data. For accuracy estimation of the model the statistical characteristics, such as correlation coefficient, bias, scatter index and RMSE were calculated. Also two computational meshes were compared: rectangular and triangulated.

In this study the third generation spectral wind-wave model SWAN was used for simulations. For wind input data two types of wind reanalysis were chosen: NCEP/CFSR with 1-hour time step and NCEP/NCAR with time step of 6 hours. The final computational grid for rectangular mesh for the Baltic Sea is $0.05 \times 0.05^{\circ}$. The simulated data were compared with instrumental data of the Sweden buoys and of the acoustic wave recorder fixed at the Russian oil platform. The results reveal that for the Baltic Sea it is more efficient to use rectangular mesh for the deep open area and irregular mesh near the coast. Simulations using wind data from NCEP/NCAR significantly decreases the quality of the results compared with NCEP/CFSR wind data: Bias increases in 10 times (-0.730), RMSE - in $2-3$ times (0.89).

The following results of numerical modeling using NCEP/NCAR the storm situations, when the significant wave height exceeded 2 meters, were identified for the 63-year period. An average of about 50 storms per year happened in the Baltic Sea in this time period. The storminess of the Baltic Sea tends to increase. The twenty-year periodicity with the increase in the 70-s and 90-s years of XX century was revealed. The average yearly significant wave height increases in the second part of the century too and differs from 2.4 to 3.3 m. Storm cyclones are connected with the global atmosphere circulation patterns. According to similar research of the other west seas of Russia by the analogous methods, such kind of twenty-year periodicity was identified for the Caspian Sea and the Sea of Azov, but the storminess there for the period from 1948 to 2010 decreases.