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Statistics of hydroclimatic extreme events in the Baltic Sea in present and future climate RCP8.5 projection.

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This study aims to assess the impact of climate change on the frequency and magnitude of marine extreme events in the Baltic Sea, which is under increasing pressure of maritime activities. Estimates of extreme events are derived from some current global and regional eco-hydrodynamic models. The simulations based on 20th century CMIP5 Max Planck Institute Earth System Model (MPI-ESM) data for the period 1920-2005 and based on RCP4.5 and RCP8.5 IPCC scenarios for the period 2006-2099 were performed with regionally coupled ESM ROM (Sein et al., 2015). The results of these simulations were used to prescribe boundary conditions and atmospheric forcing for regional eco-hydrodynamic sea model of the Baltic Sea (St.Petersburg Baltic Eutrophication Model, SPBEM, Ryabchenko et al., 2016). Two versions of SPBEM (with the horizontal resolution 9 and 3.6 km) were used to perform the simulations for the period 1961-2100. The frequency of occurrence of extreme events in the modern and future climate has been assessed for indicators describing the ecological status of the Baltic Sea. These indicators include: 1) the temperature of the photic layer, 2) the surface winter concentration of nutrients, 3) the surface chlorophyll-a concentration, 4) the area of hypoxic and anoxic zones in deep layers. Comparison of the calculated probabilities for the different areas of the Baltic Sea in the anomalies of the average winter temperature showed that the frequency of occurrence of extremely warm winter conditions in future climate will increase compared to the current climate. The probability of occurrence of extreme values of hypoxic areas in the future climate will decline. However, the area occupied by the hypoxia will increase, which apparently is due to a decrease in the winter mixing depth with climate warming. The frequency of occurrence of extreme blue-green algae blooms in the future climate will increase in the Gulf of Bothnia and decline in the Bornholm and Arkona basins.