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Numerical modeling of the consequences of "marine heatwaves" in the North Pacific for the Arctic Ocean

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As a result of the analysis of the NOAA surface temperature observational data (Huang et al., 2020), the periods corresponding to "marine heatwaves" in the northeastern Pacific Ocean (2013-2019) were identified. Marine heatwaves were defined as exceeding the 90th percentile threshold. The same analysis of the temperature in the Bering Strait's immediate vicinity showed anomalously warm waters in the same years. Analysis of the pressure field, which forms the atmosphere's dynamic state and affects the water circulation system of the Bering Sea, allowed us to assume the inflow of anomalously warm Pacific waters into the Chukchi Sea. To analyze the North Pacific heatwaves' consequences for the Arctic Ocean, we carried out two numerical experiments using the regional ocean and sea ice model SibCIOM (Golubeva et al., 2018) and NCEP/NCAR atmospheric reanalysis data (Kalnay et al., 1996). The first numerical experiment was carried out to calculate hydrodynamic and ice fields from January 2000 to November 2020 (Experiment 1). On the Arctic and the Pacific Ocean boundary in the Bering Strait, we used the monthly average climatic values of the transport, temperature, and salinity of waters coming from the Pacific Ocean. Experiment 2 was carried out from 2014 to November 2020. The calculated values of hydrological and ice characteristics obtained in Experiment 1 were used as the initial state for this experiment. In contrast to Experiment 1, a heat flux exceeding the average climatic values was set at the Bering Strait in Experiment 2. Its assignment was provided by using temperature values from observational data in the Bering Strait vicinity (Huang et al., 2020). Comparison of monthly average hydrological and ice fields obtained in two numerical experiments and analysis of numerical results showed that an increase in the temperature of the Pacific waters entering the Arctic shelf through the Bering Strait leads to an increase in the heat content of the Chukchi Sea waters, heat transfer by currents in the surface and subsurface layers, a gradual increase in the heat content of the Beaufort Sea, and the reduction of Arctic ice cover. The increase in heat content in Experiment 2 for the Beaufort Sea was obtained in both the upper 50-meter and 250-meter layers.

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