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Thermal regimes in the Chukchi Sea from 1941-present

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The summer (June-October) temperature observations in the surface and subsurface (20m-bottom) Chukchi Sea layers collected from 1941-present have been analyzed using the self-consistent data recovery procedure based on correlation analysis and iterative empirical orthogonal function (EOF) decomposition. The analysis of the surface and subsurface EOFs identified “cold”, “normal”, and “warm” thermal states with variability of 2-4 years, and also 7-8 years. We found that the Chukchi Sea water temperature has gradually increased since 1941. Warming in the surface layer since 1941 has been minimal in the Bering Strait (0.8ºC) and maximalin Long Strait (2-2.4ºC). In the subsurface layer, the temperature increase is about half as much; minimal (0.2-0.5ºC) in Long Strait and rather uniform (0.7-1ºC) for the remaining Chukchi Sea. Analysis of the satellite sea surface height anomaly data shows that during the “warm” periods there is a stronger flow through the Bering Strait and intensification of the northwestward currents in the central Chukchi Sea. Extensive correlation analysis shows that the thermal state of the Chukchi Sea is strongly controlled by the flow of Pacific water through the Bering Strait and by an increase of the global atmospheric temperature. In addition, the typical circulation during the “warm” “warm” and “cold” periods was reconstructed using four dimensional variational (4Dvar) data assimilation into the ocean model, and estimates of volume and heat fluxes in the Chukchi Sea during “cold” and “warm” “warm” periods were derived which are consistent with EOF and correlation analyses.