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Simulation of interannual variability of overflow transport through the Denmark Strait

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Peculiarities of water exchange through the Denmark Strait during the period from 1958 to 2006 was investigated using ocean circulation model developed in the Institute of Numerical Mathematic of the RAS with a resolution of 0.25 degrees by latitude and longitude at 27 vertical levels. Realization of the ocean fields prepared for the North Atlantic (from 20° S) including the Arctic Ocean and Bering Sea. At 66° N, the width of the strait is about 650 km, the depth is about 550 m. We simulated fields of temperature, salinity, density, and overflow velocity components across the strait. In this period, the dense water (σ > 27.70 kg/m3) transport in the North Atlantic was 3.84±1.31 Sv on the average. These estimates correlate with the observation data and with the calculation results using other models. Maximum values of the overflow transport through in the strait were observed in 1962, 1972, 1983, 1990, and 2000. In these years, exactly, the maximum values of the North Atlantic oscillation were recorded. This fact confirms predominance of decadal variability of hydrological processes in the North Atlantic.

The velocity model profile across the strait provides evidence that at least four jets exist. They occupy the whole section from the bottom to the surface. The currents in two are directed to the south. In the center of the strait they are divided by the jet directed to the north. In order to investigate the water exchange in the strait, we used the weekly average data of absolute dynamic topography of the ocean surface (AVISO project) in 1992 – 2010 and CTD data from WODB 2009. The results confirm the existence of the most stable jets of the East Greenland and Iceland currents. According to the simulation all other jets mentioned above based on the altimetry observations are caused by the eddy motion of different time (1 – 2 months) and spatial (10 – 60 km) scales, which propagate in different directions. This work was supported by RFBR grant 10-05-00144a and contract G.34.31.0007.