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Wind-driven freshwater fluxes in the Arctic Ocean and Subarctic seas from numerical experiments with passive tracers

Dmitry Dukhovskoy (1), Andrey Proshutinsky (2), Mark Bourassa (1,3)

(1) Florida State University, COAPS, Tallahassee, FL, United States (ddukhovskoy@fsu.edu), (2) Woods Hole Oceanographic Institution, Woods Hole, MA, United States, (3) Florida State University, EOAS, Tallahassee, FL, United States

Melting sea ice and glaciers, increasing river runoff and freshwater flux associated with the Bering Strait inflow result in growing freshwater content in the Arctic Ocean. In the subarctic North Atlantic, accelerating melt of the Greenland Ice Sheet has resulted in cumulative surplus freshwater flux exceeding 6500 km3 since the early 1990s. Increased freshwater content is well observed in the Arctic Ocean. For example, freshwater content of the Beaufort Gyre has increased by >34% since 2000. At the same time, there is no definite evidence of freshening in the subarctic seas that could be attributed to the increased freshwater fluxes in the Arctic – subarctic system. Where does the surplus freshwater end up in the subarctic seas? What freshwater sources are the major contributors to the growing freshwater content of the Arctic Ocean? How do freshwater fluxes between the Arctic Ocean and the North Atlantic change under different wind regimes? In order to address these questions, freshwater pathways and fluxes in the Arctic Ocean – subarctic seas are analyzed using numerical experiments with passive tracers tracking propagation of freshwater from different sources. The simulation is performed with a coupled 0.08-degree Arctic Ocean HYCOM-CICE. Several passive tracers are constantly released during the simulation at the major freshwater sources in the Arctic Ocean and along the Greenland coast. The simulations demonstrate substantial change in the freshwater pathways under different wind-driven circulation regimes. The presentation discusses freshwater pathways and their variability. The presented study also speculates on a possible impact of increased freshwater fluxes on the Arctic climate in the future based on the model results.