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Ocean-Atmosphere positive feedback in the Barents Sea region with reanalyses data

Katrina Kalavichchi[1] and Igor Bashmachnikov[1,2]
[1]Saint Petersburg State University, Institute of Earth Science, Saint Petersburg, Russian Federation
(katrina.calavicci@mail.ru)
[2]Nansen International Environmental and Remote Sensing Centre, Saint Petersburg, Russian Federation

This study investigates the mechanism of positive feedback in the Barents Sea region, using the results of reanalyses from 1993 to 2014. Vertical heat fluxes, wind and pressure fields are obtained from OAFlux and ERA-Interim databases, the water temperature and currents from the ARMOR-3D database.

Oceanic heat transport was computed through three sections-at the entrance to the Barents Sea (BSO), in the southern part of the Norwegian sea and in the west of Spitsbergen. The results show that, during the study period, the oceanic heat flux through BSO was rapidly increasing, significantly faster than in the northwards heat transport in the Norwegian Sea. west of Spitsbergen, a negative linear trend was observed, indicating a redistribution of the increasing transport of the Atlantic Water into the Nordic Seas.

Based on reanalyses data, we show the tight relationship between the current velocities through the BSO and the change in the gradient of the zonal component of wind velocity. The variability of the atmospheric circulation and the variability of the convergence of atmospheric heat fluxes for the studied region was also assessed.

The results also show that, in winter, with increasing oceanic heat flux through the BSO, the turbulent heat fluxes in the southwestern part of the sea decreased, and the northern part of the sea and west of Novaya Zemlya increased. In the annual means, the increasing heat flux from the ocean to the atmosphere is due to a retreat of the ice edge and an increase in the ice-free area of the sea. The sea-surface atmospheric pressure also increased over the water area, with a maximum changes in the south-east of the sea.

For the years with the maximum oceanic winter heat fluxes into the Barents Sea, the atmospheric heat flux across the southern boundary increased, while it across the northern border weakened. The convergence of the atmospheric heat fluxes increased only at the sea surface (1000-975 hPa), whereas above (975-100 hPa) the convergence decreased, and the total atmospheric heat convergence varies out of phase with that of the ocean.

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