Simultaneous simulation of sea ice, water and sediments biogeochemistry in Kara sea area

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Siberia is the most vulnerable region to the climate change. Kara sea region with its great impact of Ob and Yenisei rivers runoff to the local conditions could undergone drastic changes last decades. Since the Arctic Ocean is a harsh region and it is hard to perform field studies there the model approach could be useful to investigate processes which can possibly impact climate.

1-D transport equation model coupled with ERSEM [1] and BROM [2] throught FABM [3] was developed to represent key biogeochemical processes in the changing environment of the Kara sea. Sea ice, water and sediments domains were incorporated to the model to investigate influence of ice algae on carbon cycle in conditions of increased income of inorganic and organic forms of carbon. Field data from this region collected on R/V Keldysh in 1993, 2007 and other years were used to validate the model.

Simulation program takes forcing and pelagic grid from ROMS [4] and builds up grid for sediments and ice domains. It is forced by time-series of water temperature and salinity, surface air temperature, ice thickness, snow cover, etc. Also it takes input of some nutrients as inflow in upper water layer.

Ice domain simulation was performed in dynamic multilayer style for better estimation of ice algae behaviour [5]. Sediment part was adapted from BROM model. All main biogeochemical transactions are the same for all domains and their behaviour differs only in the transport part of the model.

Model shows interconnection between biogeochemical processes in sea ice, water column and sediments, results could serve as a baseline condition for the predictions of climatic change effects (Arctic warming) and anthropogenic forcings (pollution, CCS leaks).

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[1] Butenschön et al. (2016) *Geosci.Model Dev.* **9**,1293–1339
[2] Yakushev et al. (2017) *Geosci.Model Dev.* **10**, 453-482.
[3] Bruggeman&Bolding (2014) *Env.Mod.&Soft.* **61** 249-265
[4] Moore et al. (2011) *Progress in Oceanography* **91** 34–49
[5] Duarte et al. (2015) *Journ. of Marine Systems* **145,** 69–90