

Project: **1108**

Project title: **MiMeMo**

Principal investigator: **Ute Daewel**

Report period: **2019-07-01 to 2020-06-30**

Text: maximum of two pages including figures.

During the reporting period, one of the key personell for the planed simulations unexpectedly left the project why we face a delay in the planed simulations for this period and could not use the resources as originally planned. The current status is that we finalized the configuration of the SCHISM model centered on Barents Sea/Fram Strait and validation exercises of the physical model components has been performed. Additionally necessary model developments were conducted in a 1d model configuration targeting the implementation of sea-ice biogeochemistry and a related manuscript has recently been submitted to a peer-review journal. We are now at the point where the necessary model developments are finalized and we realize the coupling between the SCHISM and the ecosystem model (as this is realized through the generic coupled framework FABM we do not anticipate any problems) and start with the planed simulation using the fully coupled model system.

Model validation and analysis of physical model components

The tidal process was validated in the model. Four stations located in the Scandinavian coast and one on Svalbard was tested and model results show good agreement with the observations. Tidal amplitudes seem to be slightly underestimated (Figure 1).

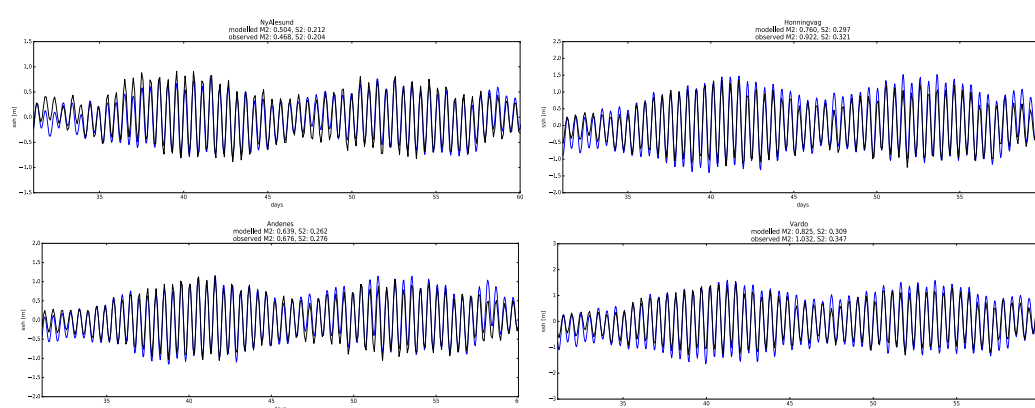


Figure 1. Times series (blue: observed, black: modelled) for stations in Ny Alesund, Honningvag, Andenes and Vardo.

Surface temperature and salinity have been compared with observations available from the ICES data base (ices.dk) and shows generally good agreement in the central Barents Sea. Temperature and Salinity uncertainties at the entrance of the Barents Sea are most likely caused by the boundary conditions, which in this example have been taken from the World Ocean Atlas.

Further, we evaluated whether the model captured the major transport pathways of Arctic waters in the Barents Sea, finding that the currents are well captured by the model, however the model seems to underestimate the Svalbard current. The deep-water transport pathways captured the distinct path of the Fram Strait and along the Greenland shelf break.

Finally, the model estimates of the maximum and the minimum extents of the sea-ice cover could be shown to represent observed sea ice extent very well, especially in the eastern Barents Sea. The model results were compared with observations of sea ice cover taken from ESACCI satellite data (Figure 2).

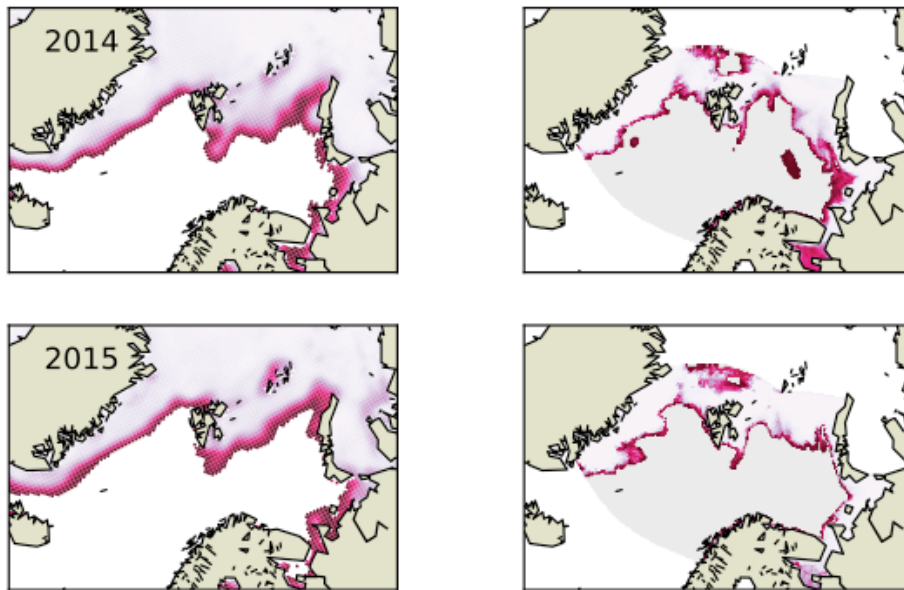


Figure 2. Comparison of simulated ice concentration (right panels) with satellite observations (left panels) for averaged ice concentration in April for 2 selected years.

Model development required for simulations in Arctic regions

The ECOSMO-E2E including sea-ice biogeochemistry was implemented and run in different Barents Sea locations in a 1D model set-up coupled with the physical model GOTM. The results showed that the model-simulated sea-ice components spatial, seasonal and inter-annual patterns were realistic when compared with the current knowledge on this system. The model reproduced processes at the ice-ocean interface and the interaction between the two systems (sympagic and pelagic ecosystem), which highlight the importance of implementing the sea-ice system for the timing and the amplitude of the pelagic primary and secondary productions underneath.

Further was the implementation of the ECOSMO E2E fish groups including fish migration strategies tested in a coarser model setup for the full North Atlantic region using the physical model HYCOM. This exercise was done to test the parameterization of fish functional groups in the area for simulations on longer time scales and offers an opportunity to provide boundary conditions at the open boundaries for the SCHISM-ECOSMO E2E simulation.

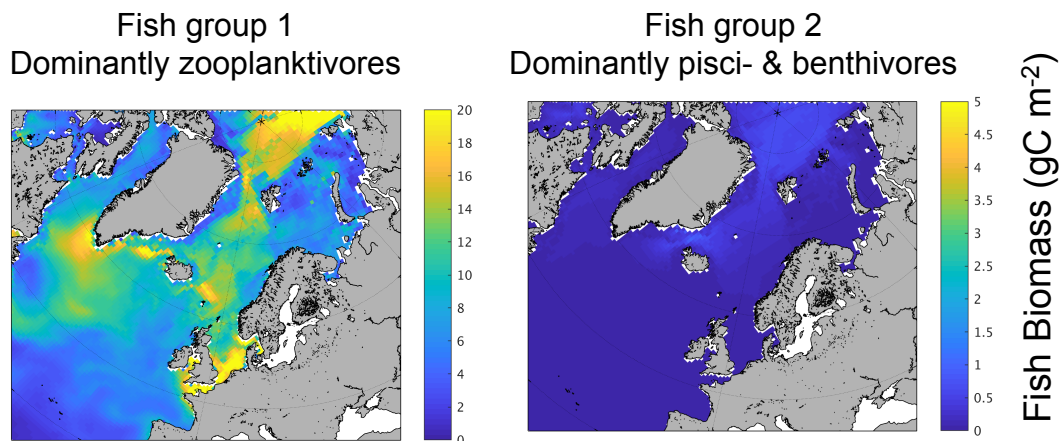


Figure 3. Model estimated, annually averaged, depth integrated biomass of fish group 1 (left) and fish group 2 (right) for the year 1993 using HYCOM-ECOSMO E2E after 13 years of simulation. in and experiment with fish active migration for fish group 1.