Project: **921**
Project title: **ICE-ARC**
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Project acronym: ICE-ARC
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In the ICE-ARC project, we evaluated sea ice parameterisations in an Arctic ocean-sea ice model. In a second step we want to implement these sea ice parameterisations into the MPI-ESM-LR.

What have we done so far?

The MPI-ESM computes the sea ice surface temperature, tsi, by simulating the energy fluxes through sea ice. The sea ice thickness plays a crucial role in determining these fluxes. Originally, the MPI-ESM uses one ice thickness class per grid box. We implemented additional ice thickness categories, which distribution within the grid box is described by an observation-based probability density function (pdf) for the heat flux calculation. We found earlier, while implementing such a parameterisation into a regional Arctic ocean-sea ice model, that results are more realistic in the horizontal sea ice thickness distributions. Therefore, we implemented the same 15 categories in the MPI-ESM. For more details on the regional model experiment on ice thickness classes see Castro-Morales et al. (2014; Doi 10.1002/2013jc009342).
As recommended by MPI we implemented the improved parameterisation into the newer version 1.2.00p4 of the MPI-ESM-LR, which is intended to used for CMIP6. Figures 1 and 2 show the mean March to May distribution of sea ice surface temperature and sea ice thickness for a control run and a simulation with an adapted parameterisation (implemented are 15 ice classes) as well as their differences. We used the default historical set-up as control simulation. The impact is illustrated by one year, 1850. Due to the new parameterisation, the horizontal distribution of sea ice surface temperature shifts towards considerably colder temperatures by up to 9 °C over the Barents Sea. The sea ice extends further southeast and becomes thicker by up to 2.5 m. Furthermore, sea ice surface temperature increases along the Alaskan and Canadian coast of up to 4 °C, where the ice thickness decreases by up to 1 m, becoming more realistic.

Why have we not used so much of our allocated computing time?

As our colleague, who is responsible for the implementation of sea ice parameterisations in the MPI-ESM, went on parental leave for 9 months, the work had been suspended accordingly. Due to technical problems we are currently delayed further in starting our production runs with the newly implemented sea ice parameterizations, which we are confident to overcome soon. The Ice-Arc project ends in December 2017. Thus, we will finish our simulations on the HLRE-3 within the next year.

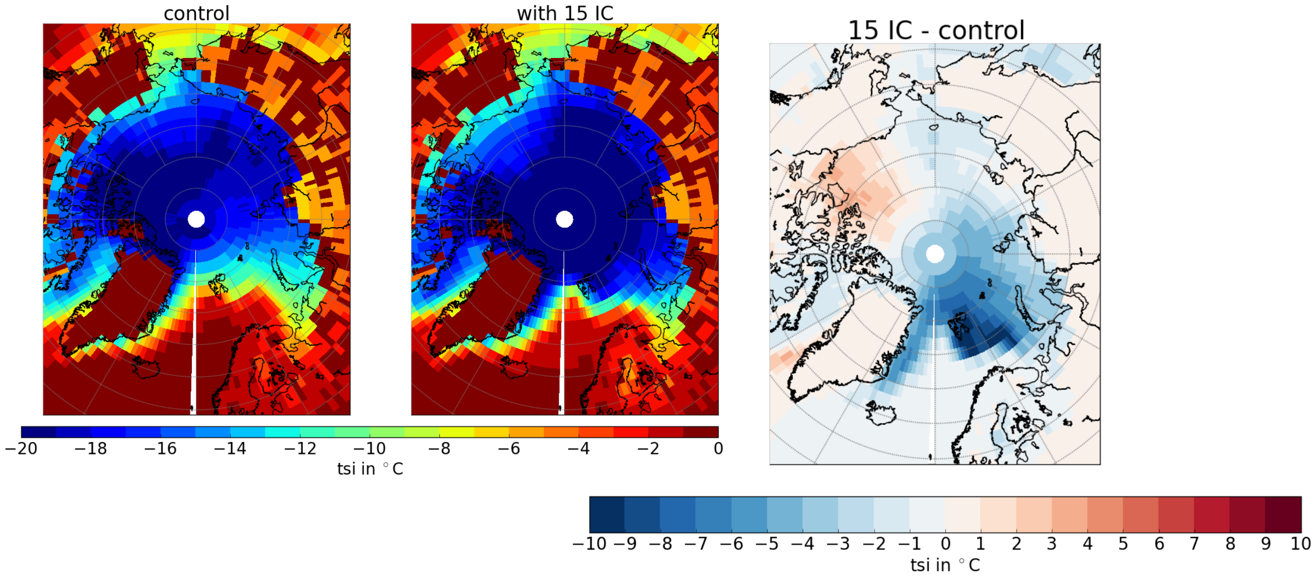

Figure 1: Temperature of sea ice surface (tsi) in °C for control simulation (left), with implemented 15 ice classes (middle) and the differences between 15 ice classes minus control simulation (right). Mean over March, April and May 1980.

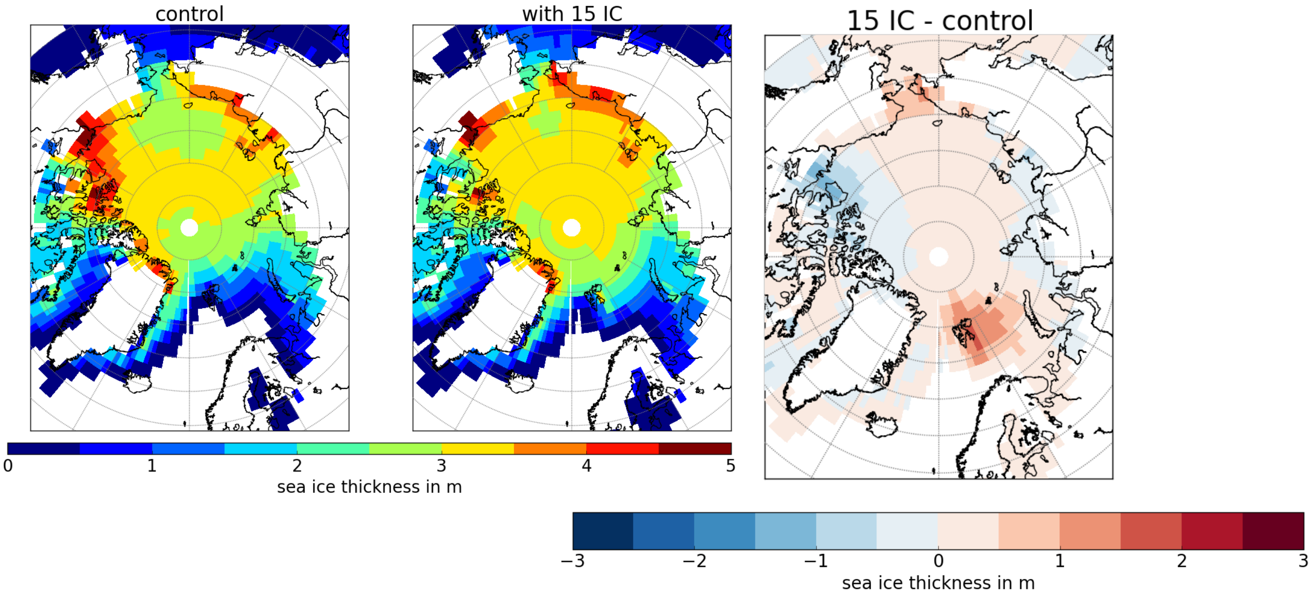

Figure 2: Sea ice thickness in m for control simulation (left), with implemented 15 ice classes (middle) and the differences between 15 ice classes minus control simulation (right). Mean over March, April and May 1980.