Project: **1084**

Project title: **Applicate**

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Coupled, High-Resolution Arctic Simulations

Results from the control simulations with the high-resolution grid in the Arctic 'fArc' have been reported in APPLICATE deliverable D2.6 in February 2020. In this report an ensemble of simulations from different models with different resolutions was used to study the effect of horizontal grid resolution on the simulated Arctic Ocean.

It was shown that, in general, moving towards higher resolution improves the exchanges of volume and heat between the Arctic and the surrounding oceans. But despite the improved representation of the exchanges, the circulation within the Arctic is still difficult to capture realistically and higher resolution by itself does not always lead to improvements. The results showed that in addition to the horizontal resolution, also atmosphere-ocean coupling, vertical processes and vertical resolution are important.

Figure 1 shows a comparison of the simulated volume transports through the Arctic gateways for four contributing models on LR and HR grids for each model.

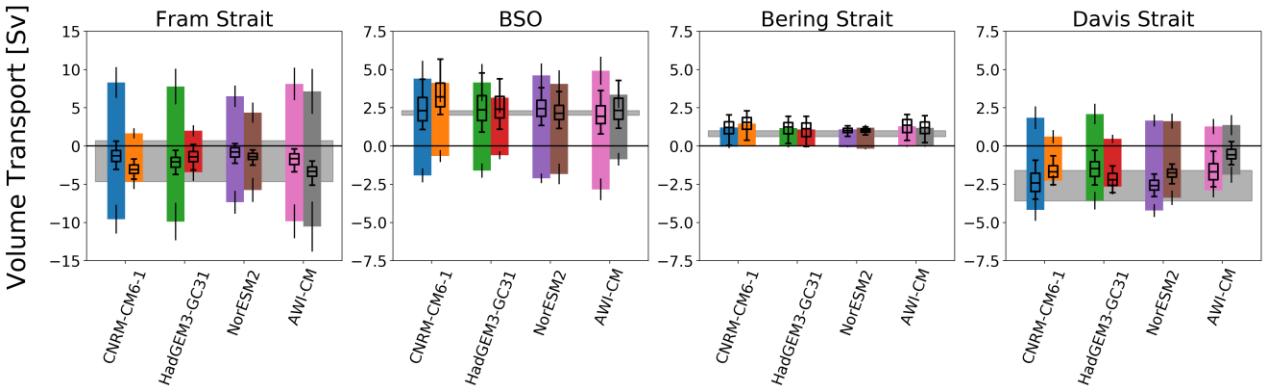

Figure 1: Net inflow and outflow through the Arctic Gateways. There are two bars for each model system, showing the transports for the high-resolution version (on the left) and for the low-resolution version (on the right). The coloured bar shows the mean exchange of water. The corresponding net observational estimates are shown by grey shading in the background.

Figure 2 shows the 400m temperature in AWI-CM simulations on the LR and HR grid compared to the World Ocean Atlas climatology, where the HR version shows a slightly improved temperature distribution at Atlantic Water depth.

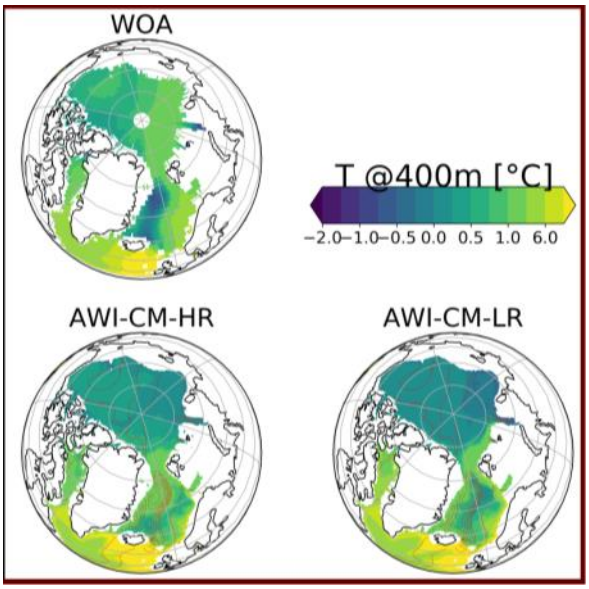

Figure 2: Comparison of mean 400m temperature in WOA climatology, HR simulation and LR simulation as indicator for Atlantic Water distribution in the deep Arctic Ocean

Implementation of Luepkes Parametrization in AWI-CM1

The results from simulations with the Luepkes parametrizations will be reported in APPLICATE deliverable 2.5 due November 2020. The parametrization of sea ice-air exchange of momentum and heat was amended to include form drag from sea ice topography as a dependency on sea ice concentration. The effect of the new parametrization scheme would be visible mainly in the marginal ice zone. Due to space constraints in this report, just one figure is shown here, that illustrates the effect of increased momentum transfer due to the added form drag contribution on sea ice drift speed.

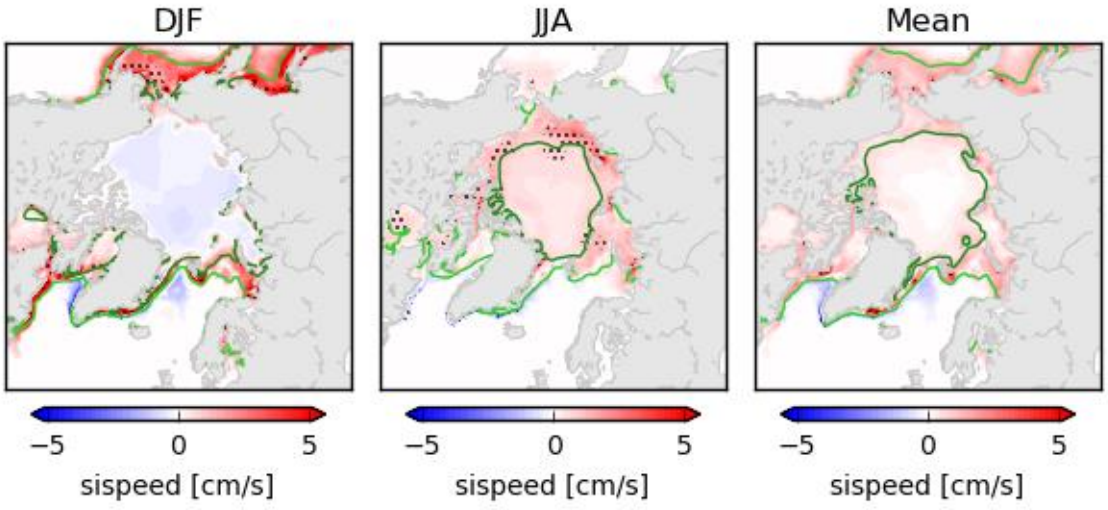

Figure 3: Mean difference (SENS-CTL) in sea ice drift speed [cm/s] in winter, summer, and annual mean. The isolines of sea ice concentrations 0.8 and 0.15 mark the marginal ice zone and are shown in darkgreen and lightgreen respectively. Dots indicate 95% significance computed from 10 ensemble members per experiment