Project title: REDOCCA (REgional DOwnscaling of Climate Change in the Antarctic)
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Report on achievements and results

In 2020 we have evaluated existing AWI-CM CMIP6 simulations from the DKRZ project DICAD (DKRZ project identifier bk0988) around the Antarctic to investigate how realistic these simulations are regarding water mass characteristics in this area. These simulations are to be used as baseline for the simulations planned in REDOCCA. The ocean resolution around Antarctica and in the Southern Ocean generally is between 10 and 20 km which is certainly better than in most CMIP6 simulations. Nevertheless, ice shelf cavities are not considered in these AWI-CM CMIP6 simulations. Having said this, the results of the AWI-CM CMIP6 simulations capture the main features of known ocean hydrography and circulation for example in the Weddell Sea (Fig. 1).

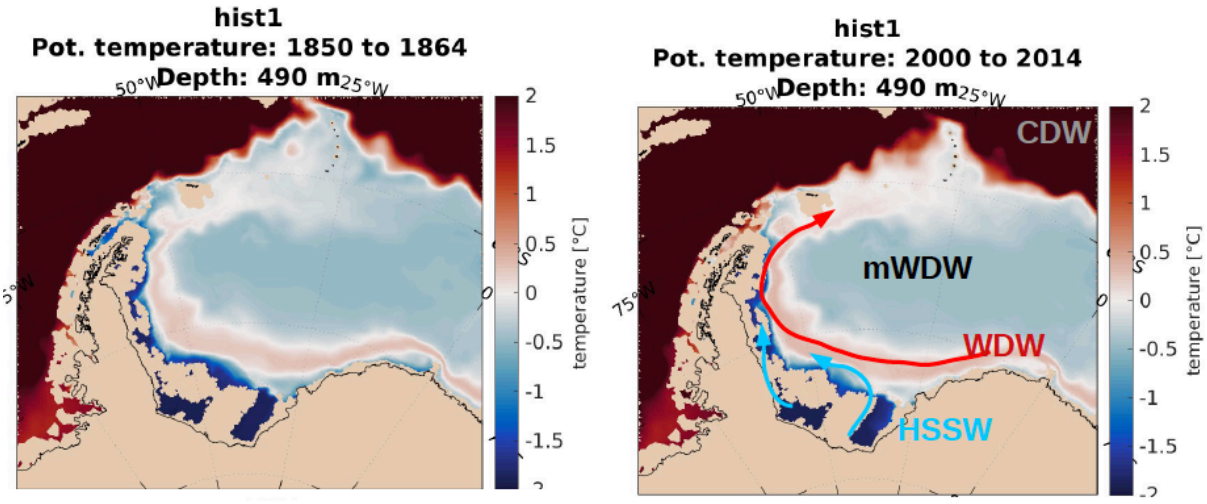

Fig. 1: Potential ocean temperature in the first ensemble member of the historical simulation of AWI-CM in 490 m depth averaged over (left) 1850 to 1864 and (right) 2000 to 2014

For the future, there is an increase in the intensity of the Weddell Gyre simulated according to the strong SSP585 emission scenario. Potential temperature around the coast increases compared to present-day conditions and the high salinity shelf water (HSSW) disappears towards the end of the century (Fig. 2). This may have implications for the ice shelf melting in this area. In the refined FESOM simulations (ocean component of the coupled AWI-CM) planned within this project with a higher horizontal resolution and with ice shelf cavities, it remains to be seen how the ocean circulation may be modified due to the different geometry with ice shelf cavities.

The limited computing time and work space in 2020 that we had applied for has been used for evaluating the AWI-CM CMIP6 simulations around Antarctica (postprocessing nodes) and for test simulations (compute nodes). While doing this, we have spotted a minor inconsistency in the bathymetry. Instead of having no water in the ice shelf region as should be in a version without cavities, a surface water layer of around 40 meters has been introduced around 20 km into the ice shelf. We are testing this at the moment and may conduct further test experiments

to investigate the local influence of this inconsistency with the remaining computing resources of 2020.

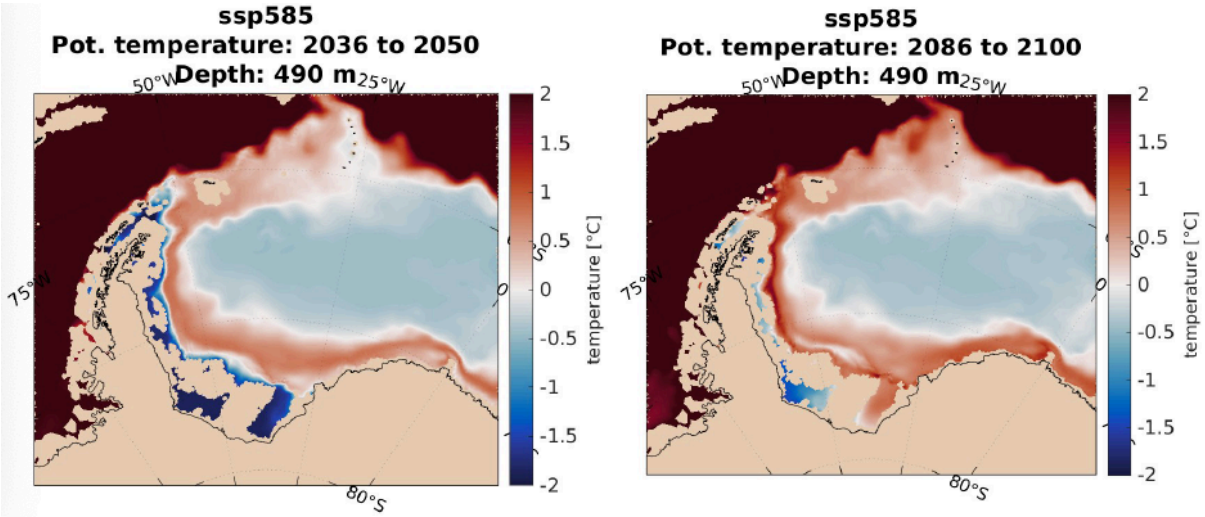

Fig. 2: Potential ocean temperature in the first ensemble member of the SSP585 simulation of AWI-CM in 490 m depth averaged over (left) 2036 to 2050 and (right) 2086 to 2100