Project: **1254**

Project title: **Global climate modelling on eddy-resolving scales with AWI-CM3**

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Report period: **2023-11-01 to 2024-10-31**

During the reported period the following simulations and tasks were performed.

1. We realized that it will be impossible to make AWICM3 simulations with its proposed setup (1km FESOM2 and TCO799 OpenIFS) with very restricted computational resources. Therefore, as the first stage, the coarser 2km FESOM2 setup (XR) coupled to TCO639 (ca. 15km resolution) OpenIFS was chosen (Fig.1). Having 13 million surface nodes (instead of 33 million in ER setup) but being still the most highest resolved setup doing long term climate simulations, it allowed us to reduce computational resources for ca. 4 times.

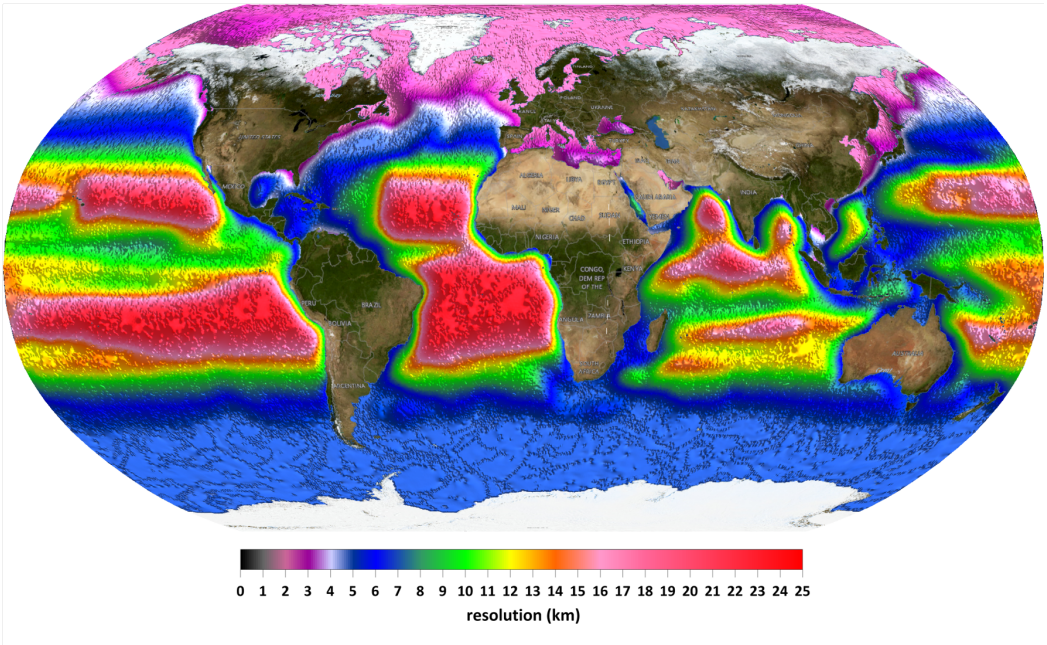

***Figure 1**. FESOM2-XR resolution*

2. One simulation using AWI-CM3-XR was carried out with OpenIFS TCO639L139 with ssp585 CMIP6 scenario forcing for 2015-2100

3. We compared AWICM-3 climate change simulations used eddy permitting (EP) and eddy resolving (XR) ocean model (FESOM2) setups coupled to OpenIFS atmosphere. In XR setup more moderate SST warming was obtained, e.g., in the region of Antarctic Circumpolar current this difference can reach 2-4K (Fig.2). Thus, the difference between two setups is in explicit ocean eddies representation only, we suggest, that there is a kind of atmospheric heat “pumping” by the eddies from the ocean surface to its deeper layers. Presently these results are analysed in more details and we prepare a scientific paper.

Unfortunately, the Arctic sea ice thickness was strongly overestimated in the model. Therefore, ice thermodynamics was completely revised (Fig.3) and future climate change ssp585 scenario has to be repeated.

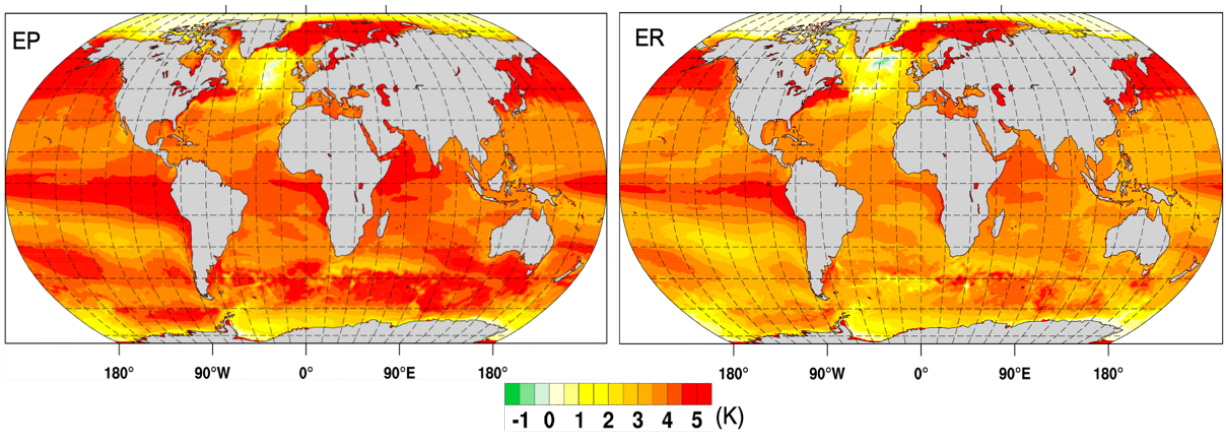

Fig.2 Mean SST change: 2091–2100 (SSP585 scenario) minus 2005–2014 (historical) for EP (left) and XR (right) simulations.

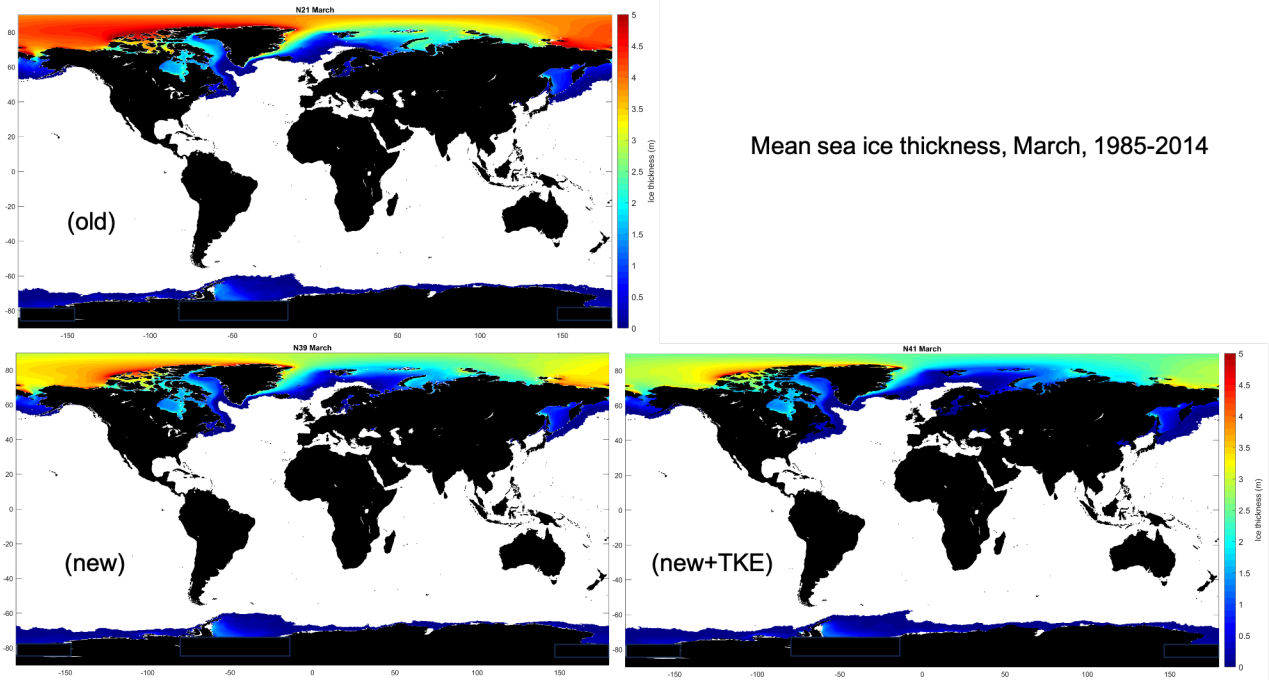

Fig. 3. Mean (march) sea ice thickness simulated with historical CMIP6 forcing.