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Coarsening for an Efficient Simulation in the North Atlantic and Arctic

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Climate modeling studies are exhausting in terms of computational resources. The typical scale of the horizontal resolution and the integration time in their ocean compartments are usually limited to 1/4° – 1° and a few decades to centuries, respectively. Recent studies show that high horizontal resolution in ocean models is necessary to simulate correct local dynamics and global thermohaline circulation on climate scales. Hence, in global ocean simulations, the optimal mesh design for given computational resources is a prerequisite for the efficient and longer simulations with reduced oceanic biases.

The question we want to answer is whether the amount of computational resources can be reduced without sacrificing the model skill in the key ocean areas. We utilize the global multi-resolution ocean and sea ice model FESOM2.0 at a very high uniform resolution in the North Atlantic and Arctic as reference and investigate where and to what extent the mesh can be coarsened locally without deteriorating the simulation quality in the Gulf Stream and North-West Corner area. We discuss our results in relation to the simulated eddy kinetic energy field, Rossby deformation radius, and temperature and salinity biases.