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Ocean Eddy-rich Climate Simulation with IFS-FESOM

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Efforts to enhance climate model simulations by achieving higher resolutions to explicitly capture sub-grid scale processes constitute a central objective in contemporary climate modeling. In this pursuit, our focus is on resolving a pivotal element of the climate system—the ocean meso-scale eddies. At the Alfred-Wegener-Institute, we are working towards this objective by employing the ocean-sea ice model FESOM at approximately 5km horizontal resolution (NG5), coupled with the atmospheric model IFS at a 9km horizontal resolution (tco1279).

This presentation showcases preliminary results from the control simulations of IFS-FESOM under 1950 radiative conditions. Furthermore, we provide an initial glimpse into results from a historical simulation starting in 1950 with the same model configuration. Our analysis illuminates how ocean eddy-rich regions are portrayed in our simulations relative to observations. We delineate the changes and improvements in key climate components, encompassing North Atlantic/Southern Ocean temperatures, NAO, atmospheric blocking, midlatitude storm tracks, ENSO, Monsoon, ITCZ, Hadley/Walker Cells, MJO, meridional overturning, gyre circulations, as well as Arctic/Antarctic Sea ice dynamics under such high resolution.

Moreover, we endeavor to demonstrate how regional high-frequency weather and climate processes can be accurately represented in such simulations, including capturing the nature of regional extremes. In essence, our goal is to illustrate how advancing model resolution to resolve ocean eddies contributes to a more comprehensive representation of the climate system.