EGU22-4836
https://doi.org/10.5194/egusphere-egu22-4836
EGU General Assembly 2022

Towards ocean hindcasts in coupled climate models: AMOC variability in a partially coupled model at eddying resolution.

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While forced ocean hindcast simulations are useful for a wide range of applications, a key limitation is their inability to explicitly simulate ocean-atmosphere feedbacks. As a consequence, they need to rely on artificial sea surface salinity restoring and budget corrections. Fully coupled models overcome these limitations, but lack the correct timing of variability due to much weaker observational constraints. This leads to a mismatch between forced and coupled models on interannual to decadal timescales and requires ensemble integrations.

A possibility to combine the advantages of both modelling strategies is to apply a partial coupling, i.e. nudging surface winds in the ocean component of a coupled climate model to reanalysed wind. Using an all-Atlantic nested configuration at eddying resolution, we show that partial coupling is able to simulate the correct timing of AMOC variability at all latitudes and timescales up to 5-years. Further, partial coupling excludes model drift caused by the artificial choices for restoring and simulates reasonable long term trends directly related to the applied momentum forcing. Owing to a higher impact of buoyancy fluxes, the timing of decadal variability differs between forced and partially coupled model runs.