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Towards improved forecast initialisations with an observation-informed ocean grid

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For climate forecasts it is crucial to initialise the ocean state from observations because they rely on the memory of the ocean. If, however, the initialised ocean state is far away from the model's own preferred mean state, predictive skill will suffer due to model drift. We are testing whether an ocean grid with variable resolution - designed to represent sparse and well-observed regions with appropriate resolution - has advantages over an ordinary grid with uniform resolution. The locally high resolution could lead to an improved mean ocean state through a better representation of mesoscale processes. The observation-informed grid will allow for high-resolution data assimilation in well-observed areas, which will potentially lead to improved initial conditions and predictive skill.

We developed such a grid for the ocean component of the coupled ICON model designed for seamless predictions (ICON-XPP). The grid resolution varies from 40 to 10km, depending on the observation density in the EN4 database from 1960 to 2023. The local refinement in well-observed areas leads to a better representation of ocean features such as fronts and western boundary currents. We assess the effect of these improvements on the mean climate state by comparing to a reference simulation with a uniform 20km ocean resolution.