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Testing surface initialisation strategies for decadal projections in a perfect model framework

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Initialization of climate models is one of the key points for decadal projections because internal variability at those time scales is responsible for a large part of climate variability as compared to anthropogenic forcing. One method to initialize a climate model is to restore the model to the observed climate, at the surface and/or in depth.
In this study, we test different initialization protocols in a perfect model framework with the IPSLCM5A-LR Earth system model (Dufresne et al., 2011). We use surface variables only to explore the initialization method used in a recent study on decadal predictability with the IPSL model (Swingedouw et al., submitted). The hypothesis is that the ocean will integrate this surface signal, and that it will spread in depth with time. We selected a 150-yr long period in a long control simulation as surrogate observations (referred to as the target). Starting from a different initial state as the target, we restore the model to the Sea Surface Temperatures (SSTs) and/or Salinities (SSSs) of the target. We test different extent for the restoring area, especially to try to overcome problems in the sea ice border area. We address the three following questions: does the initialisation with nudging of surface variables improves with time? Until which depth the nudging influences the state of the ocean (temperature and salinity)? Do we initialise the AMOC only with nudging of SST and SSS?