Effect of initialisation within a 20yr multi-annual climate prediction system

André Düsterhus¹ and Sebastian Brune²

¹Maynooth University, ICARUS, Department of Geography, Maynooth, Ireland (andre.duesterhus@mu.ie)
²Institute of Oceanography, Center for Earth System Research and Sustainability, Universität Hamburg, Hamburg, Germany

Decadal climate predictions use state-of-the-art climate models and combine them with initialisation procedures to create information about our future. Their development has proven successful in the past years and offer a wide range of applications. One of them is the option to learn about the used climate models. With predictions usually aiming at time periods up to ten lead years it is often assumed that initialisation will wear off over time and the model will regress to results comparable to uninitialised simulations.

This contribution investigates decadal predictions over lead times of up to twenty years. The decadal prediction system is based on the Max Planck Institute Earth system model (MPI-ESM), uses atmospheric nudging and an oceanic Ensemble Kalman filter for initialisation and is applied for periods from 1960 onwards. We demonstrate that the effect of initialisation within the prediction can be found for long lead years and does not necessarily regresses back to the uninitialised simulation.

We show that in some areas the prediction skill varies over time, while in others it persists or drops quickly. Examples are a consistently increased prediction skill compared to historical simulations in the North East Pacific or decreased prediction skill for lead years longer than ten in the South Atlantic. We also take a look at the Atlantic Meridional Overturning Circulation (AMOC) and its development over time. We show that the AMOC drifts on short time scales towards a new state, which is reached after about ten lead years. For decadal predictions with MPI-ESM we find that for large areas of the globe the correct determination of future developments of external forcings plays an important role. This asks the question whether the current approach to hindcasts is appropriate to determine our capability to predict the future.