

## SESSION: (B2) Modelling issues in S2D prediction

(B2-11)

### **Can decadal climate predictions be improved by ocean ensemble dispersion filtering? Any impact on seasonal predictions?**

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Decadal predictions by Earth system models aim to capture the state and phase of the climate several years in advance. Atmosphere-ocean interaction plays an important role for such climate forecasts. While short-term weather forecasts represent an initial value problem and long-term climate projections represent a boundary condition problem, the decadal climate prediction falls in-between these two time scales. The ocean memory due to its heat capacity holds big potential skill on the decadal scale. In recent years, more precise initialization techniques of coupled Earth system models (incl. atmosphere and ocean) have improved decadal predictions. Ensembles are another important aspect. Applying slightly perturbed predictions results in an ensemble. Instead of using and evaluating one prediction, but the whole ensemble or its ensemble average, improves a prediction system. However, climate models in general start losing the initialized signal and its predictive skill from one forecast year to the next. Here we show that the climate prediction skill of an Earth system model can be improved by a shift of the ocean state toward the ensemble mean of its individual members at seasonal intervals. We found that this procedure, called ensemble dispersion filter, results in more accurate results than the standard decadal prediction. Global mean and regional temperature, precipitation, and winter cyclone predictions show an increased skill up to 5 years ahead. Furthermore, the novel technique outperforms predictions with larger ensembles and higher resolution. Our results demonstrate how decadal climate predictions benefit from ocean ensemble dispersion filtering toward the ensemble mean.

More informations about this study in the AGU Journal of Advances in Modeling Earth Systems: DOI: 10.1002/2016MS000787 <https://doi.org/10.1002/2016MS000787>

This study is part of MiKlip (fona-miklip.de) - a major project on decadal climate prediction in Germany.

We focus on the Max-Planck-Institute Earth System Model using the low-resolution version (MPI-ESM-LR) and MiKlip's basic initialization strategy as in the published decadal climate forecast from 2018:

<http://www.fona-miklip.de/decadal-forecast/decadal-forecast-for-2018-2027>

In addition to the workshop focus, we add some new(!) results of the ensemble dispersion filter and its impact on seasonal near-surface air temperature prediction of the first winter (DJF). The reference prediction system shows low correlation values over Europe. The ensemble dispersion filter shows positive and significant values over Europe. As the reference system already lost the initialized signal on the seasonal scale in the first months of the prediction, the ensemble dispersion filter keeps the forecast on track and shows a significant improvement over Europe in the winter prediction (DJF).