

AMO and PDO decadal prediction skill

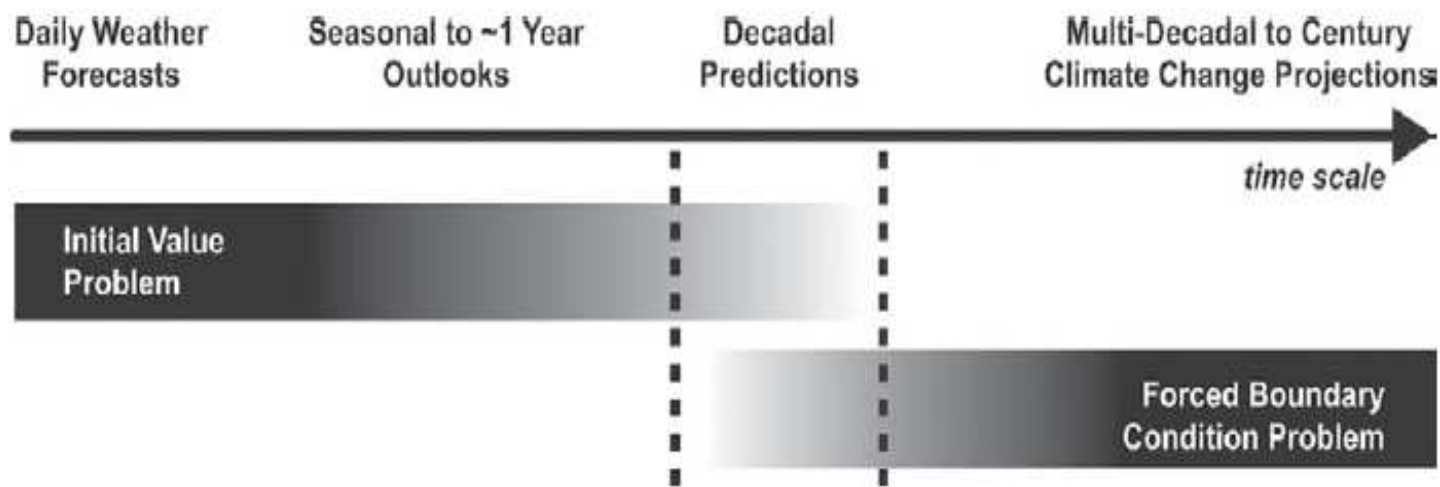
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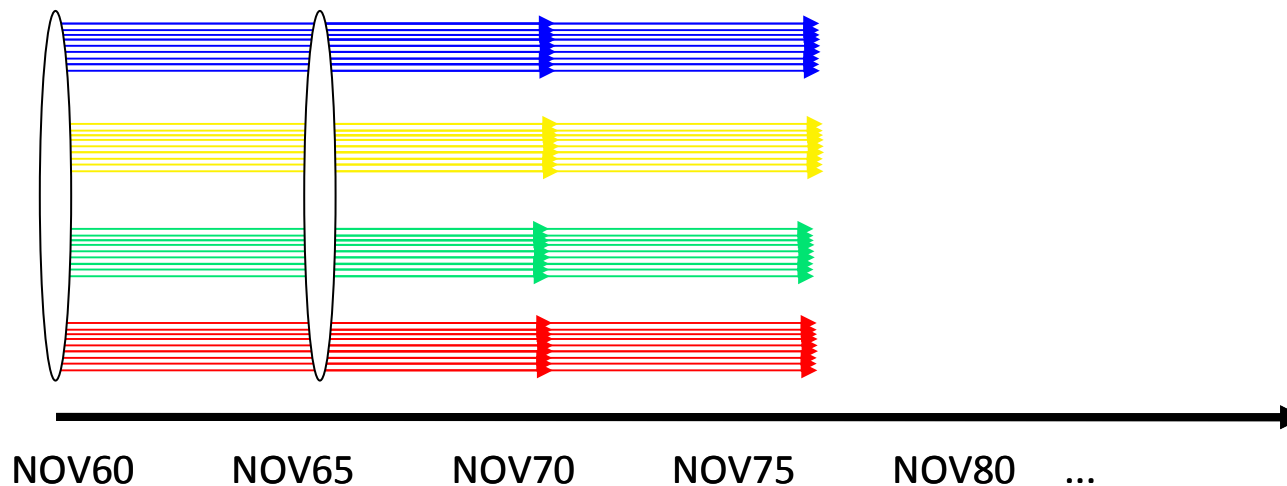
Contributions from F. Lienert (CFU/IC3) and C. A. S. Coelho (CPTEC, Brazil)

- Decadal prediction bridges seasonal forecast and climate-change projection
- The decadal timescale is a key planning horizon for adaptation
- Decadal prediction not only deals with anthropogenically forced variability, but also with natural (unforced) internal variability
- Decadal prediction opens the possibility of achieving skill in multi-year timescales, and in both regional and large-scale domains



ENSEMBLES (initialized) hindcasts:

- 10-year long
- ensemble forecast (3 members)
- starting once every 5 years
- start date: November 1st
- over the period 1960-2005





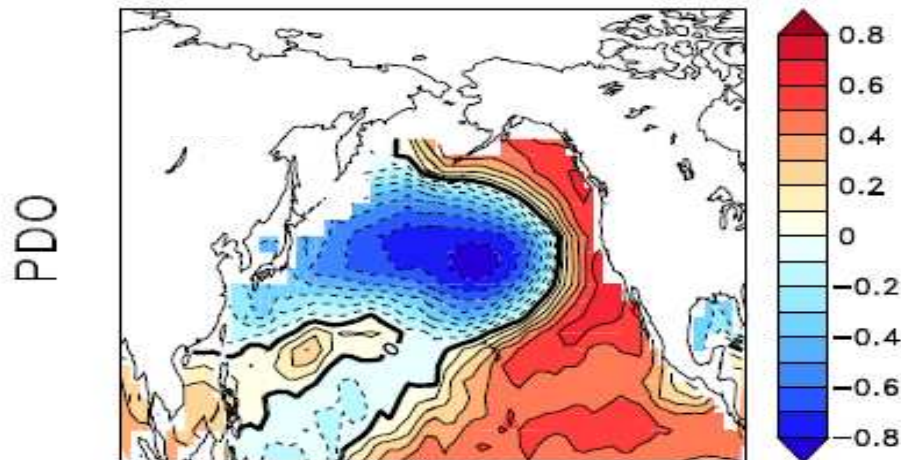
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DePreSys hindcasts:

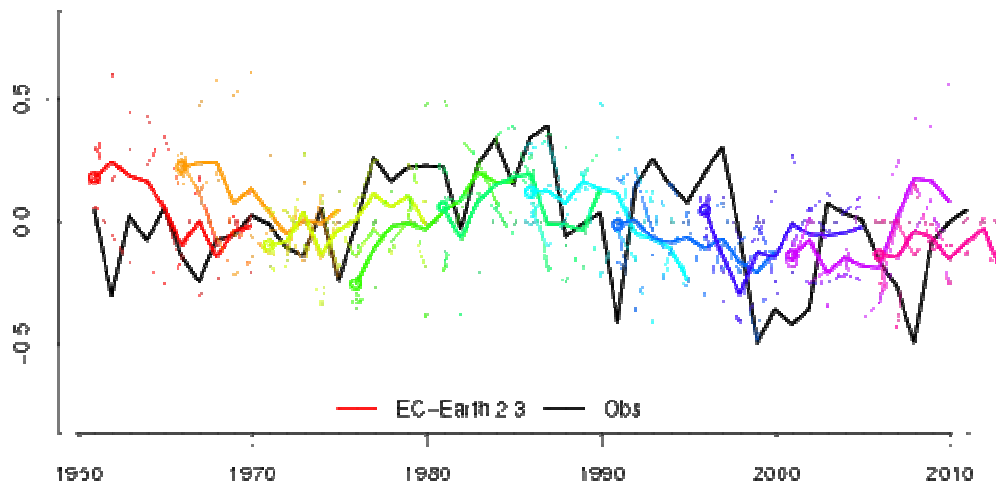
- 10-year long
- 9 model variants of HadCM3
- 1-year interval between start dates (vs 5-yr in ENSEMBLES)
- initialized (DePreSys) and uninitialized (NoAssim) re-forecasts

Pacific Decadal Oscillation (PDO) Leading SST mode in the North Pacific – ERSST

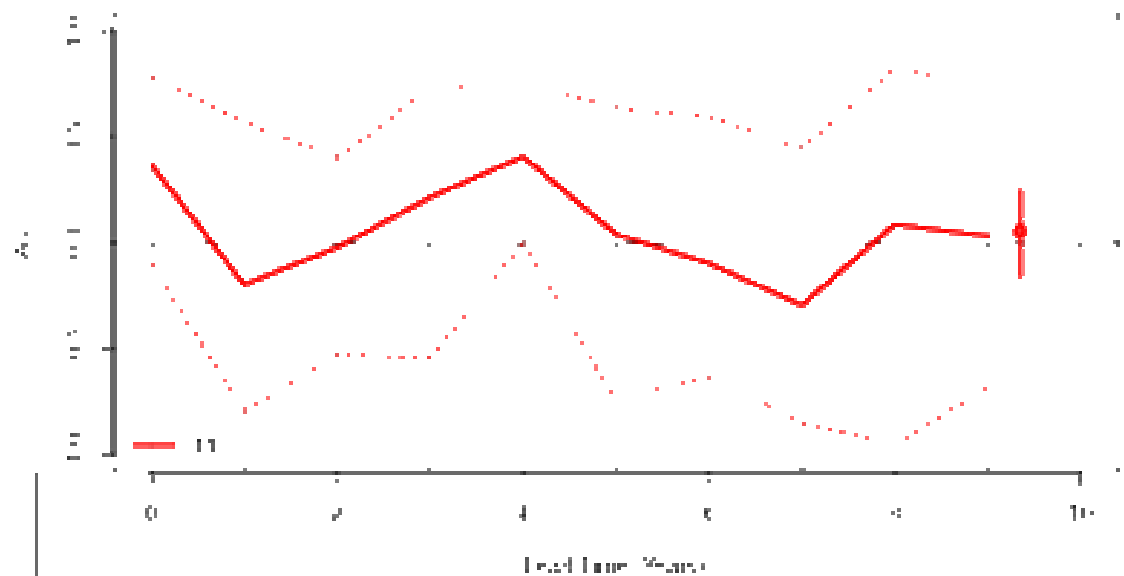


(Lienert 2011, PhD)

EC-Earth 2.3 PDO Forecast

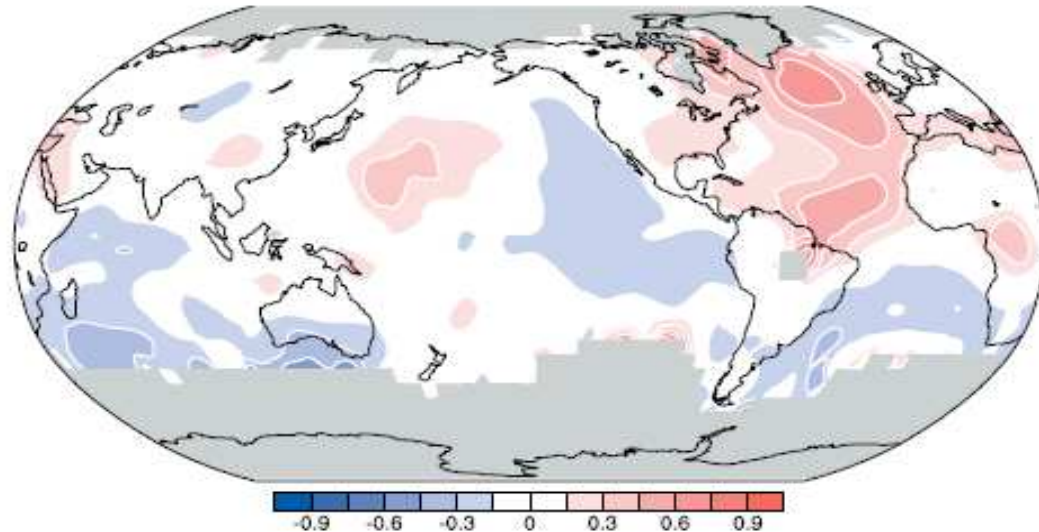


EC-Earth 2.3 AC PDO Prediction. 1960–2010



There is no skill in forecasting the PDO at interannual timescale

Atlantic Multi-decadal Oscillation (AMO)



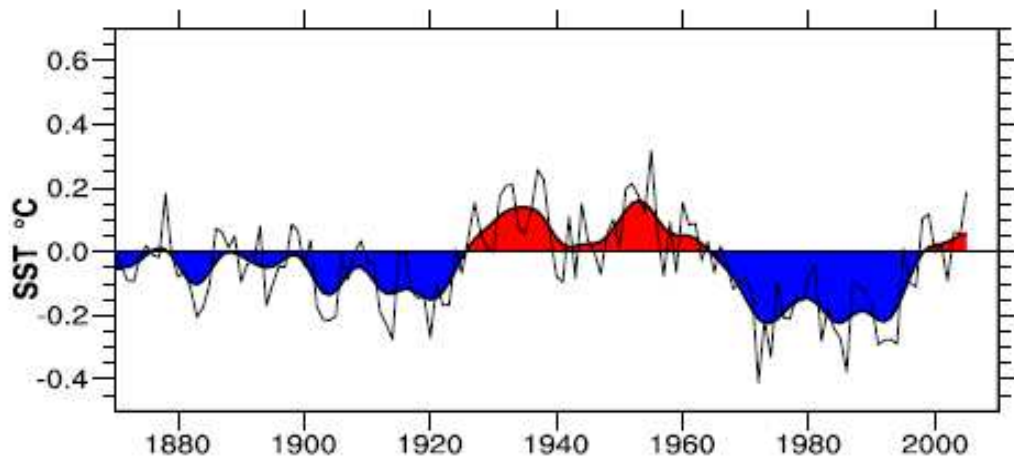
SST anomalies in the North Atlantic [EQ-60N/80W-0E] minus global SST anomalies [60S-60N]

Trenberth and Shea (2006, GRL)

Due to the limited length in the observational record, a more proper denomination for the AMO-like variability is Atlantic Multi-decadal Variability (AMV)

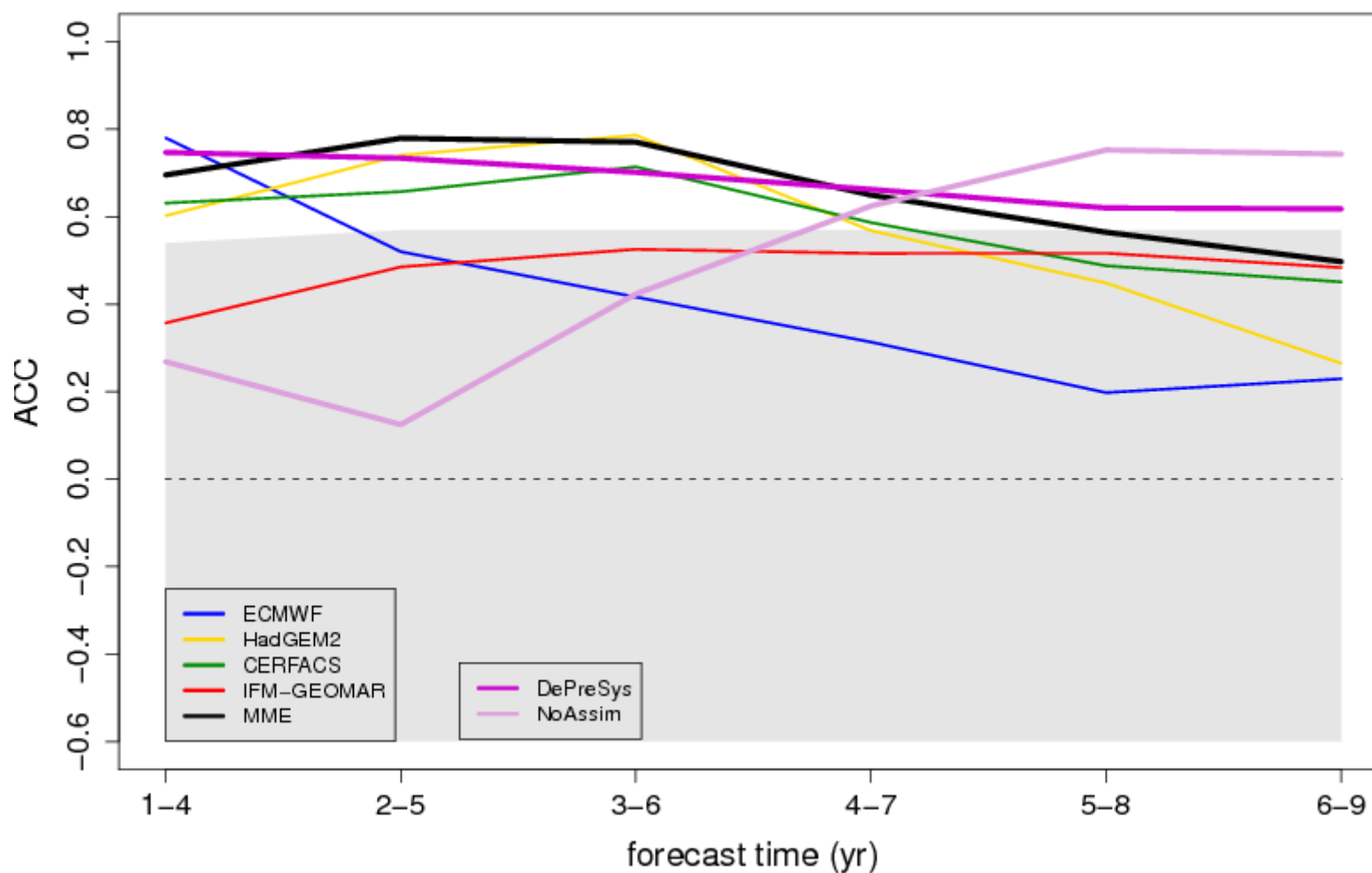
Ting et al. 2011, GRL)

(i.e.

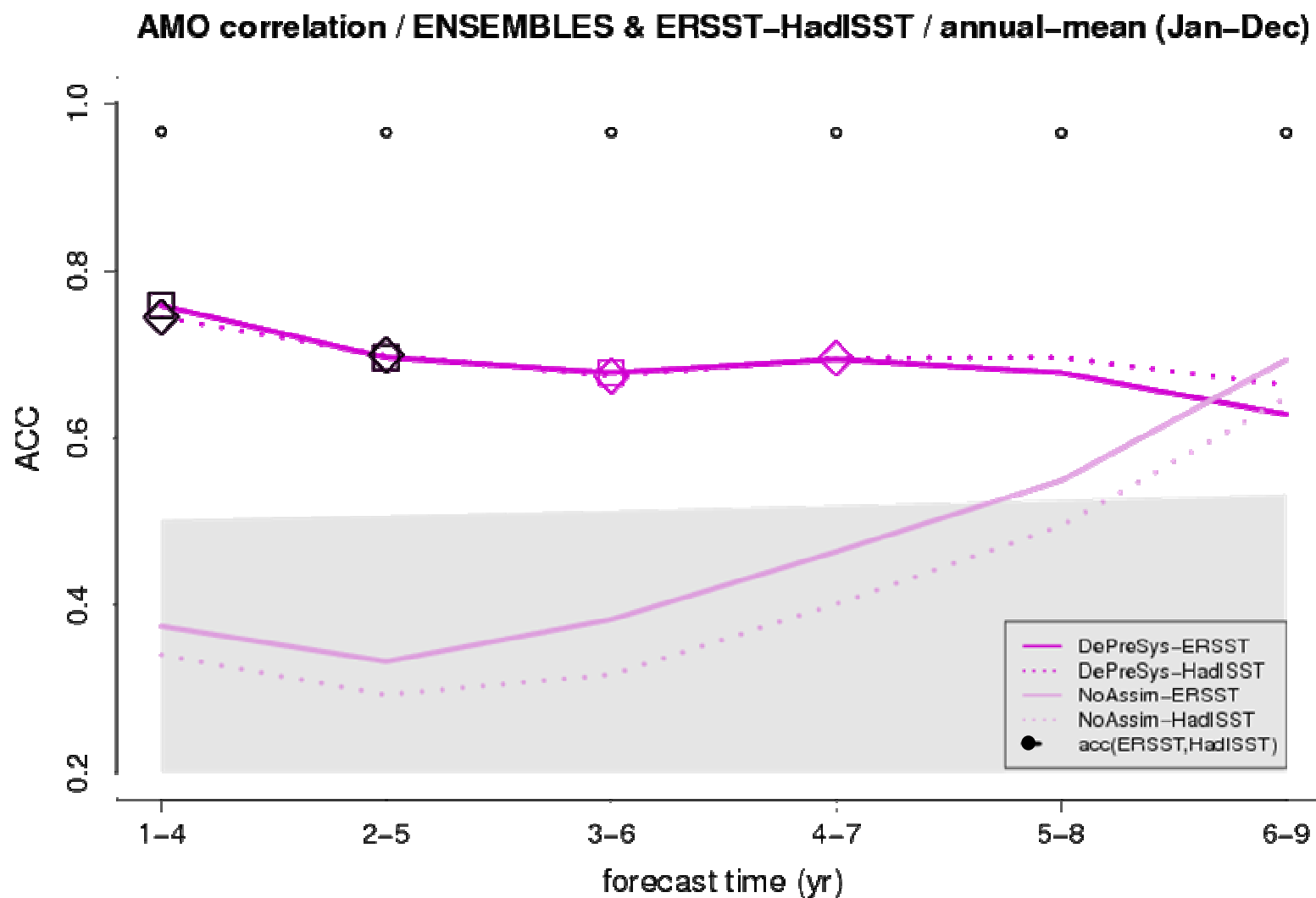


Ensemble-mean anomaly correlation coefficient for annual AMO between each single forecast system contributing to ENSEMBLES multi-model (thin lines), the multi-model (thick black), DePreSys (thick purple), NoAssim (thick pink) and ERSST

AMO ensemble-mean correlation vs ERSST / annual (Jan-Dec)

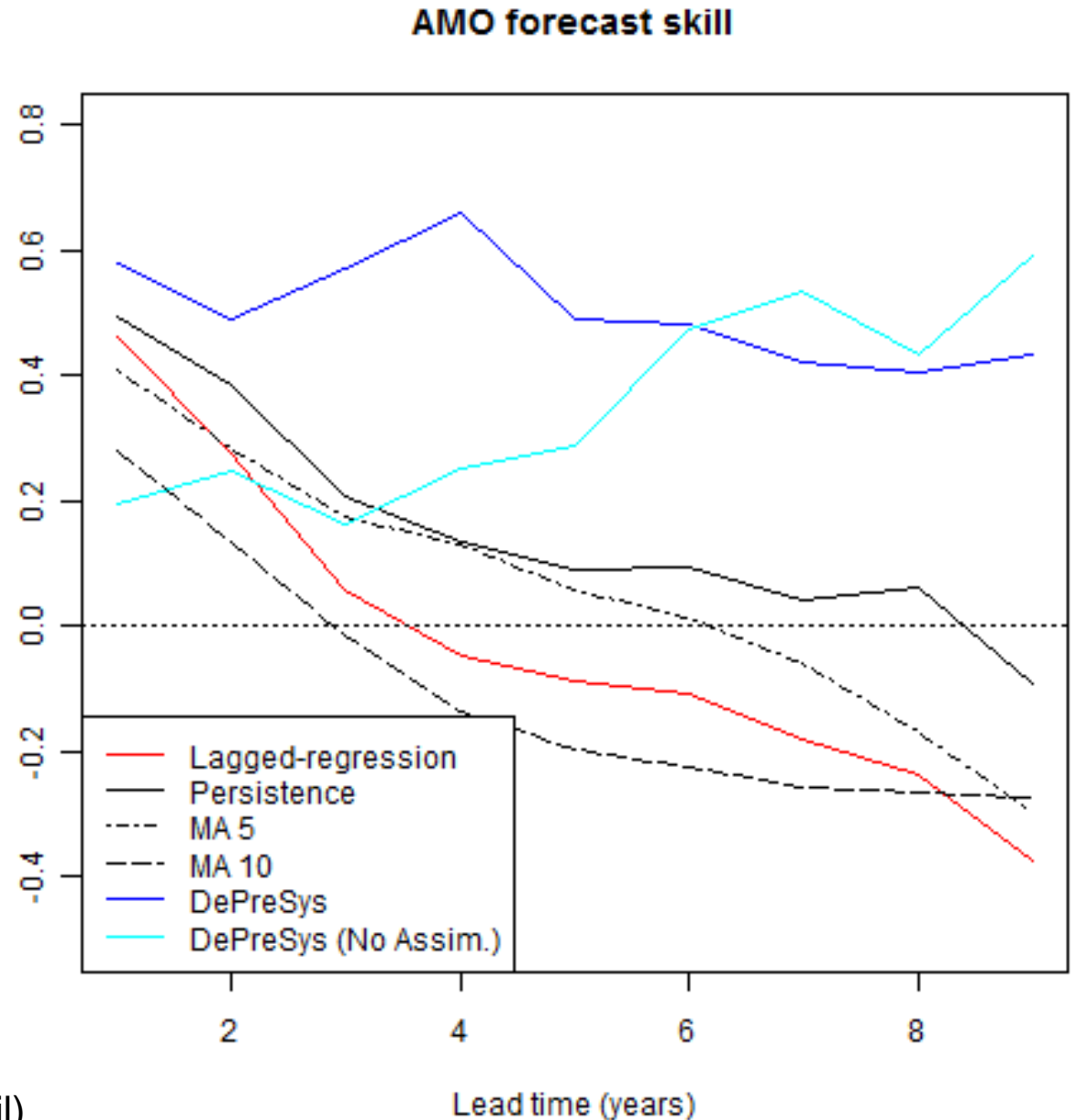


Multi-model ensemble-mean anomaly correlation coefficient for annual AMO between DePreSys (purple) and NoAssim (pink) against ERSST (solid) and HadISST (dotted); 1-yr interval between start dates vs 5-yr as before

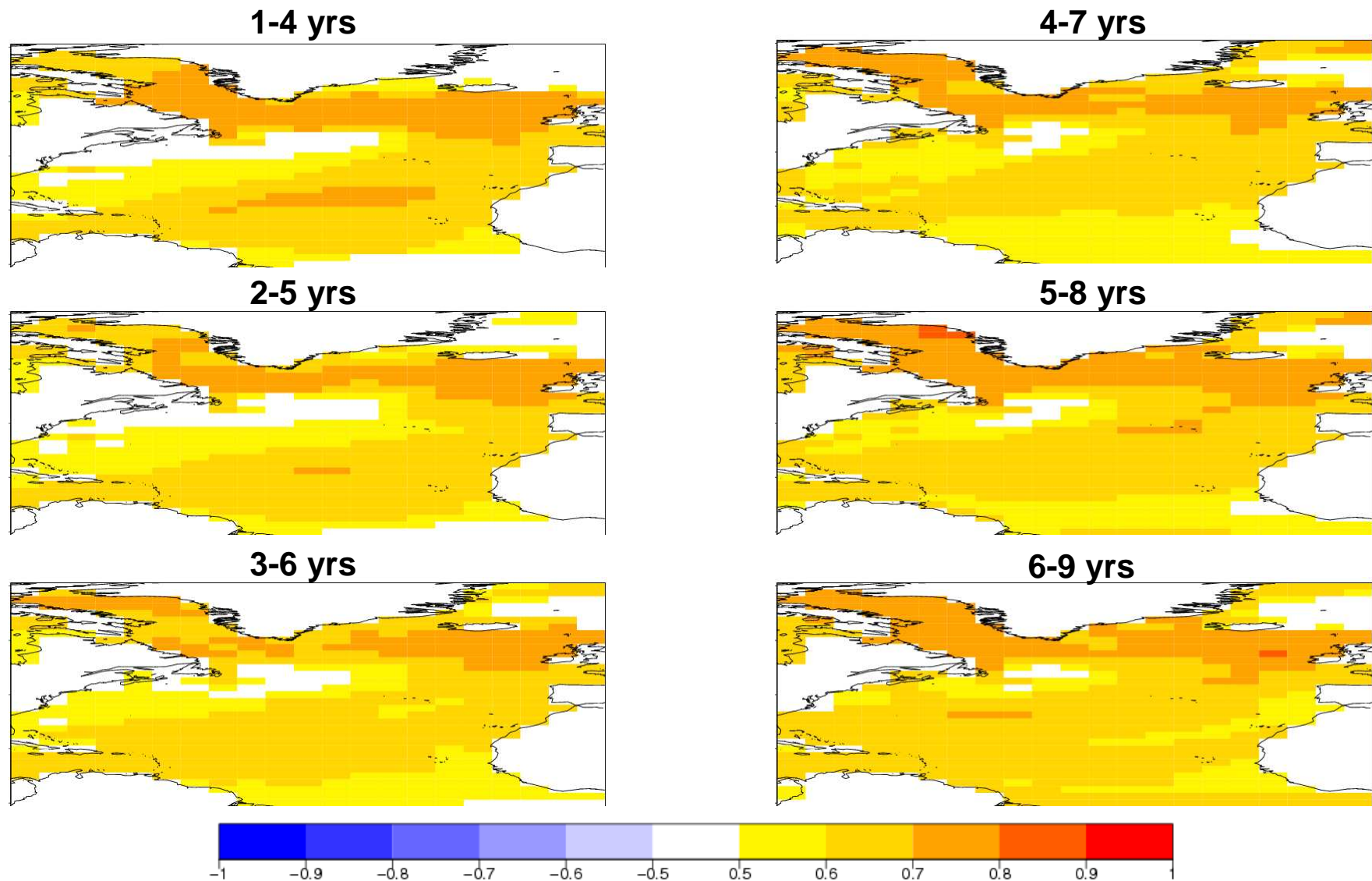


- Initialized dynamical forecast, DePreSys, shows better multi-year prediction skill of the AMO than regression-based statistical model (red) and persistence (1, 5, 10 yrs)

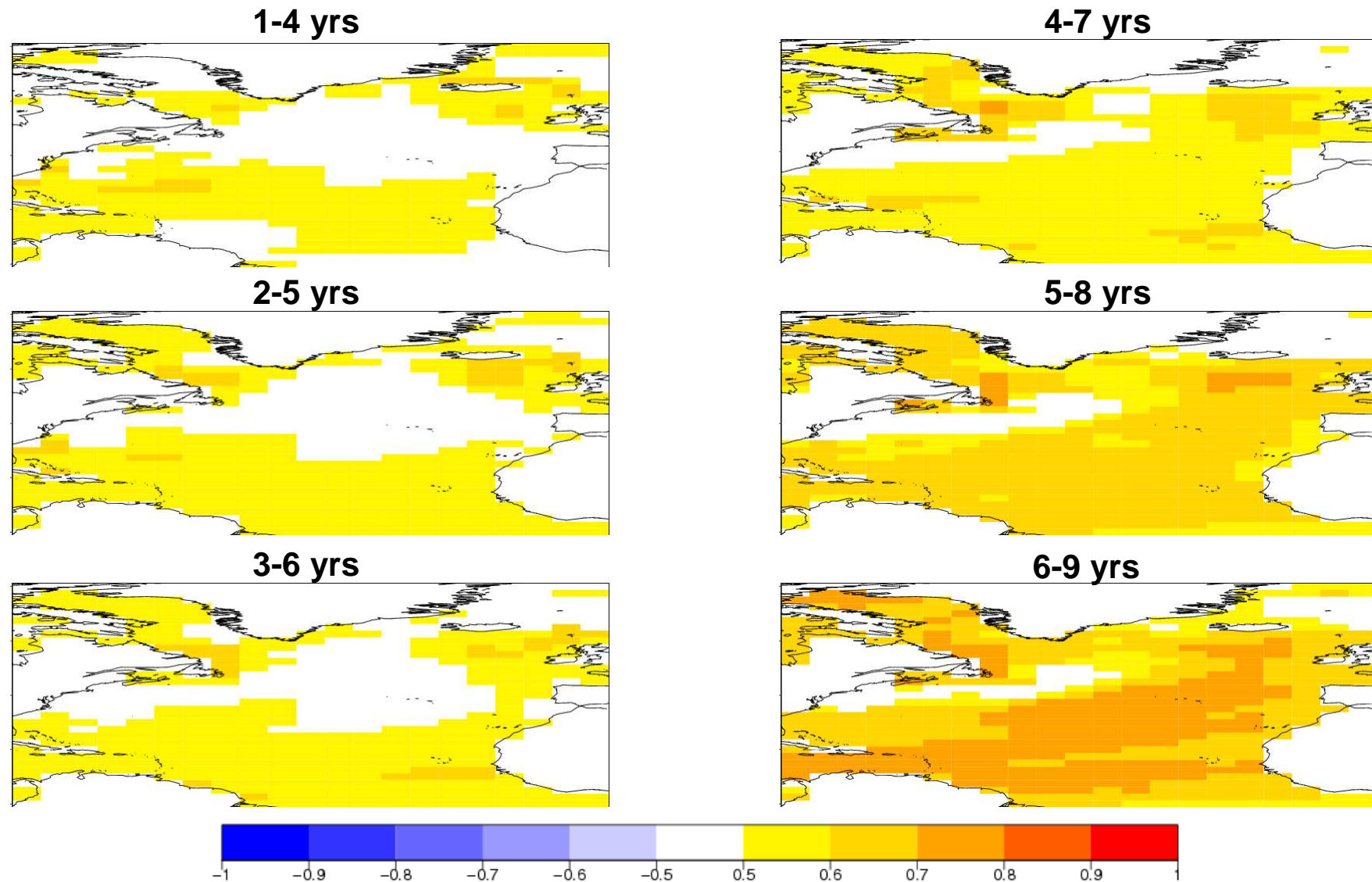
- Distinct behaviour in DePreSys (dark blue) vs NoAssim (light blue)



Correlation-based skill maps of multi-model ensemble-mean SST anomalies in DePreSys onto observed AMO index in ERSST; 4-year running-mean



Correlation-based skill maps of multi-model ensemble-mean SST anomalies in NoAssim onto observed AMO index in ERSST; 4-year running-mean



summary

- PDO prediction skill appears to be restricted up to the seasonal timescale; EC-EARTH does not yield skillful predictions at annual-decadal timescale
- The ENSEMBLES multi-model and DePreSys perturbed-parameter ensembles have significant AMO prediction skill over the whole decadal re-forecast
- The comparison between initialized (DePreSys) and uninitialized (NoAssim) re-forecasts shows that initialization significantly improves the AMO skill up to half of the decadal integration
- Multi-year AMO prediction skill from internal variability (initial conditions) appears to be related to North Atlantic subpolar latitudes; while the skill from external forcing (boundary conditions) appears to be related to North Atlantic subtropical latitudes (Ottera et al. 2010, Nat.Geosc.; van Oldenborgh et al. 2011, ClimDyn)

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thank you !!

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García-Serrano and Doblas-Reyes 2011, *Climate Dynamics* (under review)