

# MPI-ESM for EUROSIP

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WG Seasonal Prediction

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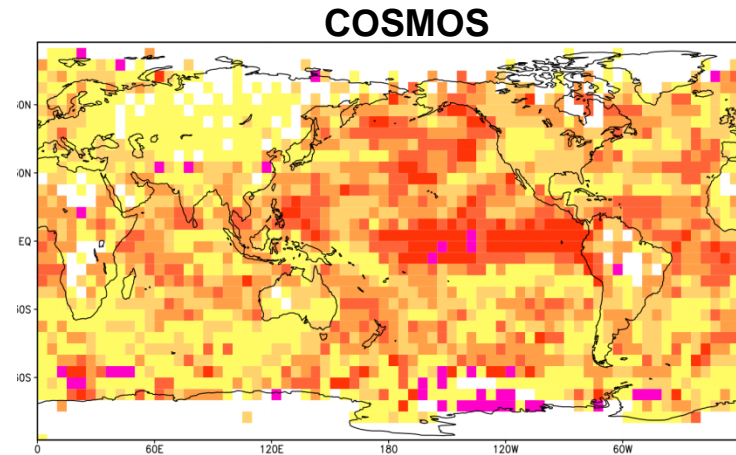


# Operational Streams and Prediction System Development

- MPI-ESM currently being installed at ECMWF for operational runs (K. Fröhlich, DWD)
  - T63L47/Gr15 (Echam6/MPIOM)
  - Atmosphere-ocean-ice assimilation
  - Generation of reference hindcasts in progress
- Prediction System Development
  - Transition from COSMOS to MPI-ESM (WG SP)
  - Implementation of breeding for initial ensemble perturbations (R. Piontek/J. Baehr)

# COSMOS to MPI-ESM

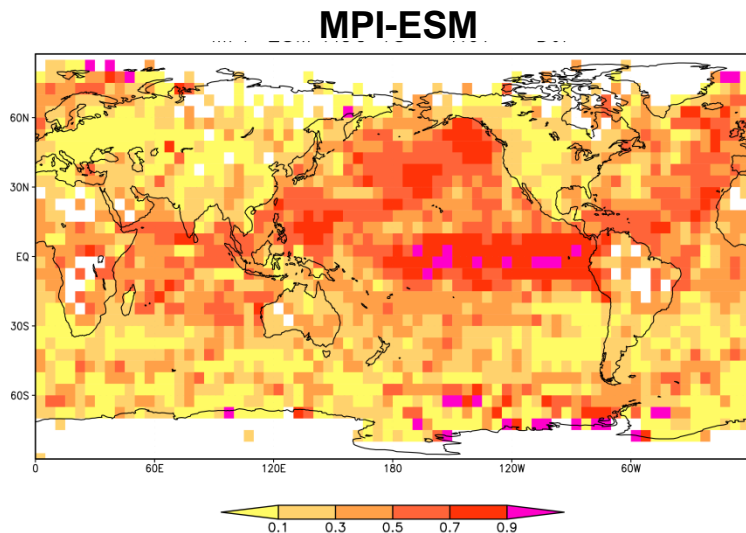
surface temperatures DJF lead 1m - anomaly correlations



- **COSMOS (ECHAM5/MPIOM): T63L31/GR15**
- **MPI-ESM (ECHAM6/MPIOM): T63L47/GR15**

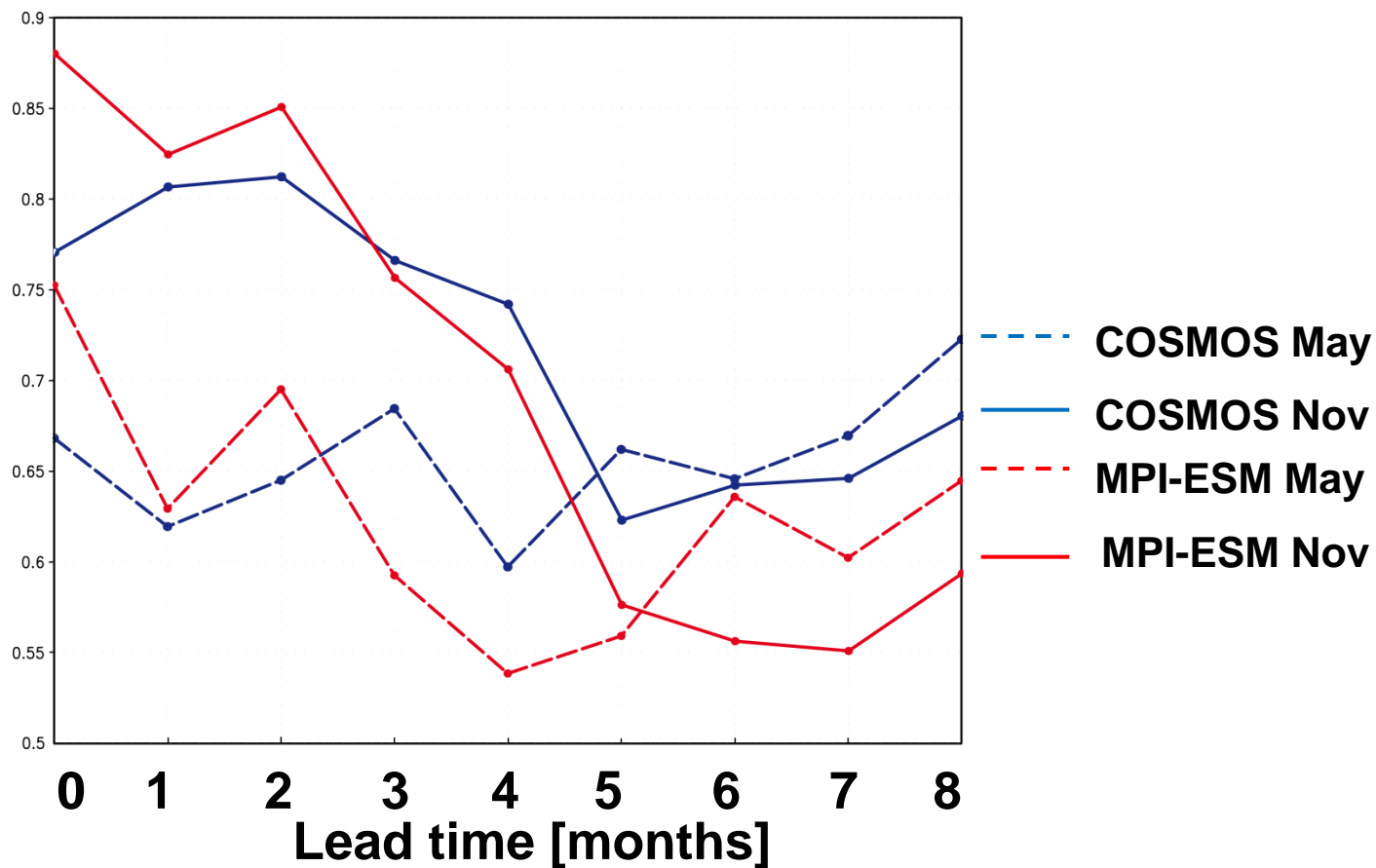
**For both systems, same set of hindcasts to establish skill**

- **Hindcasts 1989-1998 (May, Nov)**
- **6 members (initialized from lag 1-day)**
- **9 months lead**
- **Assimilation of ERA40 (div,vor,t,logp) and ORA (T&S); nudging of absolute values**



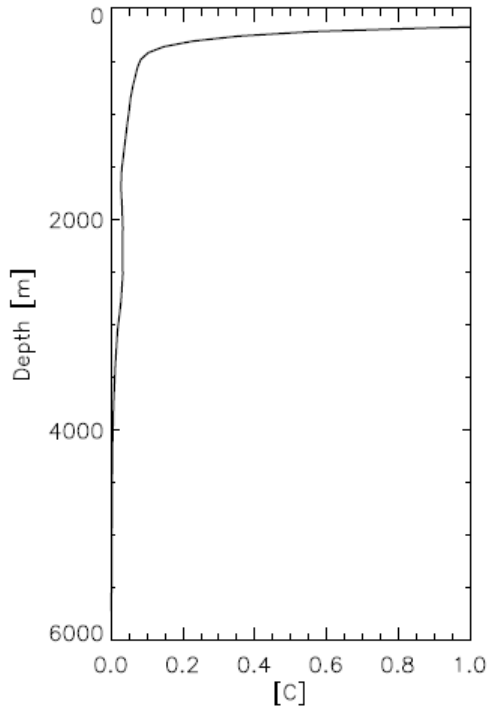
# COSMOS to MPI-ESM

## Nino3.4 – anomaly correlation



# Ensemble Perturbations

## Breeding Method

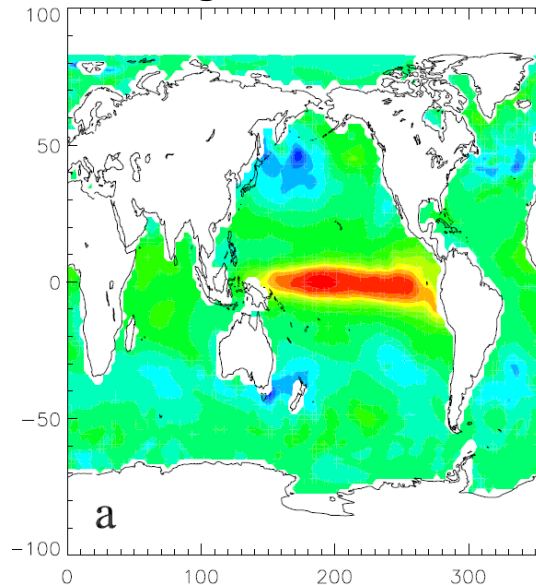


**1. Depth-dependent Norm for T&S, to rescale bred Vectors**

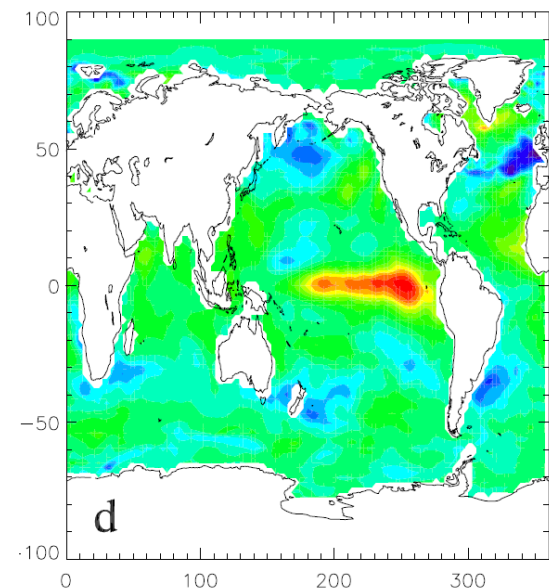
**Aim: to perturb forecast by fastest growing modes**  
**Here, focus is on perturbing the ocean.**

**2. From control experiment, bred vectors with 1 year cycle and depth-dependent norm are most beneficial**

**SST regressed on Nino3.4**



**Bred Vectors**



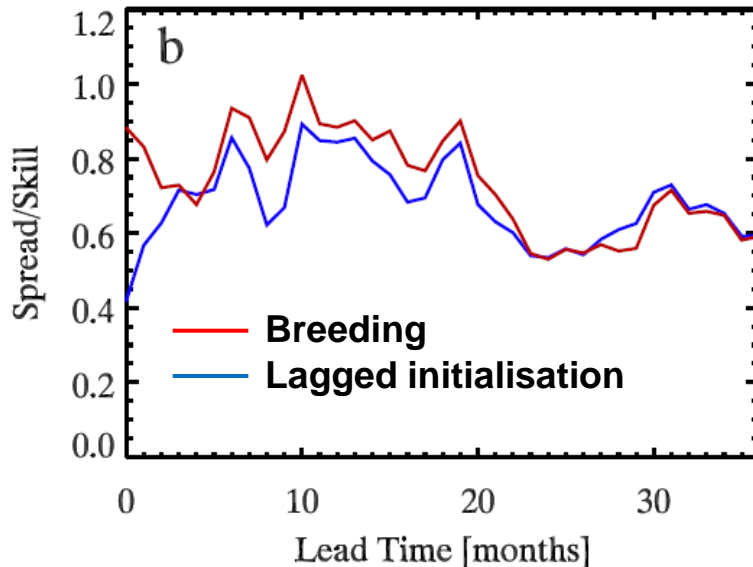
# Ensemble Perturbations

## Breeding vs. Lagged initialisation

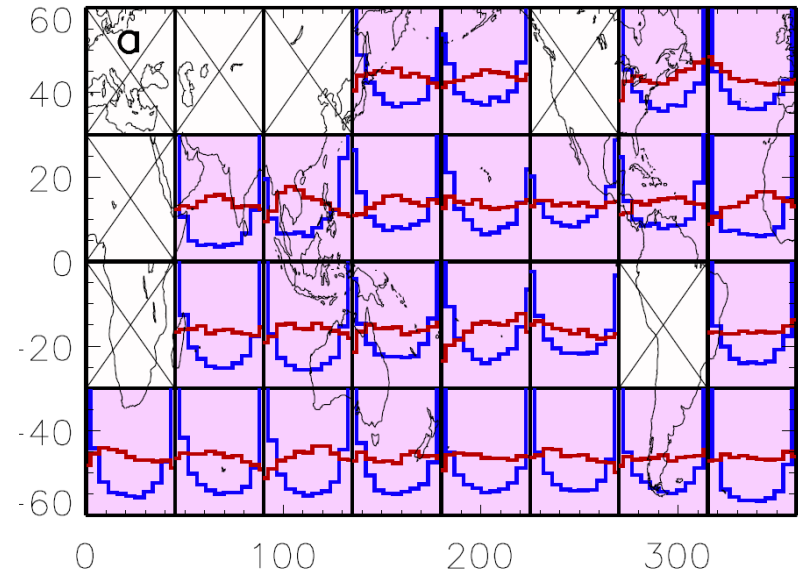
### Application to seasonal predictions

- COSMOS (uninitialized)
- six start dates (started 1.1.1973 , yearly after)
- 10 members
- Currently: apply breeding in MPI-ESM seasonal prediction system

Spread-skill score – Temp. 0-700m



Rank Histogramm 2-4 – Temp. 0-700m



# Outlook

- Need for higher resolution
  - Ocean  $1.5^\circ$   $\rightarrow$   $0.4^\circ$  (MPI-ESM-MR T63L95/GR0.4)
  - Atmosphere (unknown, ? T127 MiKlip, ? T255 STORM)
- Need for land surface initialisation
- Cross-support by other projects
  - SPECS (FP7): diagnostics, land surface init., improved breeding
  - CliSAP (DFG): initial breeding implementation, ocean diagnostics
  - MiKlip (BMBF): higher atmospheric resolution, initialisation and perturbation (3DVAR/EnKF, breeding)