MPI-ESM for EUROSIP

W. A. Müller¹, J. Baehr², K. Fröhlich³, and
WG Seasonal Prediction

¹Max Planck Institute for Meteorologie, Hamburg
²Institute of Oceanographie, University of Hamburg
³Deutscher Wetterdienst, Offenbach
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
- 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

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

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

SST regressed on Nino3.4
Bred Vectors

Piontek and Baehr (submitted)
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**

![Graph](image1)

**Rank Histogramm 2-4 – Temp. 0-700m**

![Graph](image2)

Piontek and Baehr (submitted)
Outlook

- Need for higher resolution
  - Ocean 1.5° -> 0.4° (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)