

Development of a European Multi-Model Ensemble System for Seasonal to Interannual Prediction

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Workshop on Re-Analysis



8 November 2001

The Idea behind DEMETER

- Demand for reliable seasonal forecasts
- Two main sources of uncertainty
 - X error in initial conditions
 - X error in model formulation
- ▶ Install a Multi-Model Ensemble System
- ▶ Evaluate the skill and potential utility

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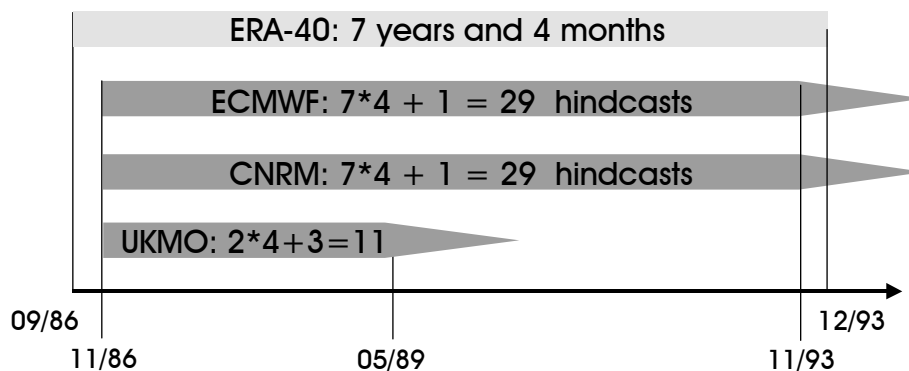
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DEMETER project

- Multi-model coupled seasonal forecasting experiment
- 9 member ensembles

Country	Atmosphere	Ocean
Int	ECMWF	HOPE
France	ECMWF	OPA
France	ARPEGE	OPA
Italy	ECHAM	OPA
Germany	ECHAM	HOPE
UK	UM	UM
- 6 month hindcasts
- 4 hindcasts per year
- ERA-40 initial conditions
- SST and wind perturbations
- Main focus: 1987-1998 (1969-1986)
- Downscaling, agriculture and health application
- <http://www.ecmwf.int/research/demeter/>

Status of DEMETER integrations



Production rates

DEMETER (ECMWF): 1-3 days / 6 month hindcast

ERA-40: 3 days / 1 month analysis

Status of partners integrations

- LODYC: model set up on VPP700
 - final tests of ORCA finished
 - waiting for ocean initial conditions (CERFACS)
- CERFACS: model set up on VPP700 (like Météo-France)
 - producing ocean initial conditions
- ING: model set up on NEC in Rome
 - working on ocean and atmospheric initial conditions
- MPI: model set up on NEC at MPI
 - installing at ECMWF (VPP5000)

Relevance of ERA-40 for DEMETER

- Atmospheric forcing for ocean analysis
 - ▲ ocean initial conditions
- Atmospheric initial conditions
- Validation data set for coupled hindcasts
- Test data set for end users

RESULTS

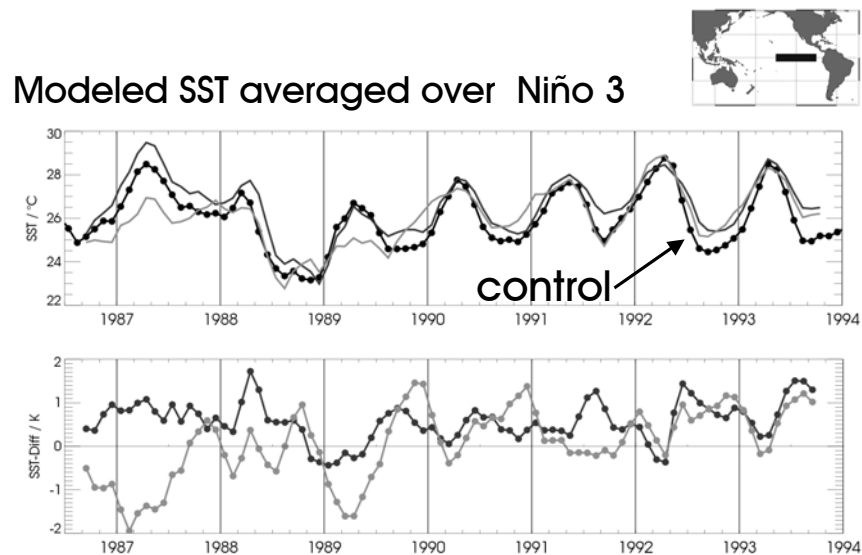
- Ocean only runs:
 - ▶ Test of ERA-40 vs. ERA-15 forcing
 - ▶ DEMETER ocean analysis
- DEMETER coupled hindcasts:
 - ▶ ECMWF vs. CNRM
 - ▶ 2dvar-SST vs. new OI-SST
 - ▶ ERA-40 vs. ERA-15 initialisation

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ERA-40 vs. ERA-15 forcing



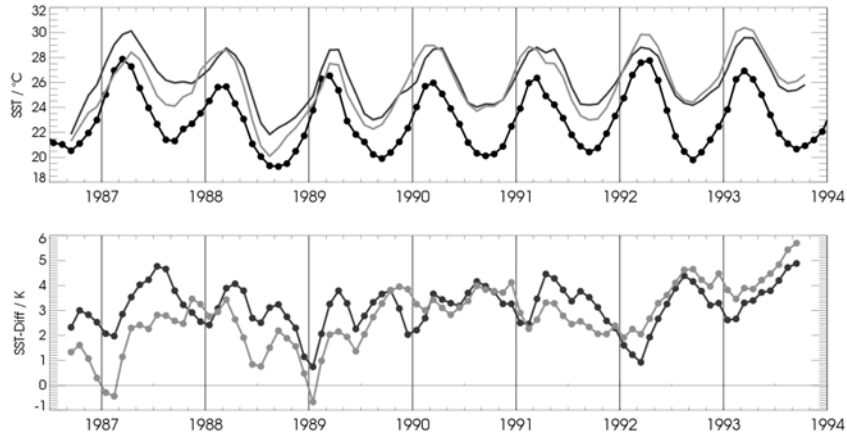
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ERA-40 vs. ERA-15 forcing

Modeled SST averaged over Niño 12



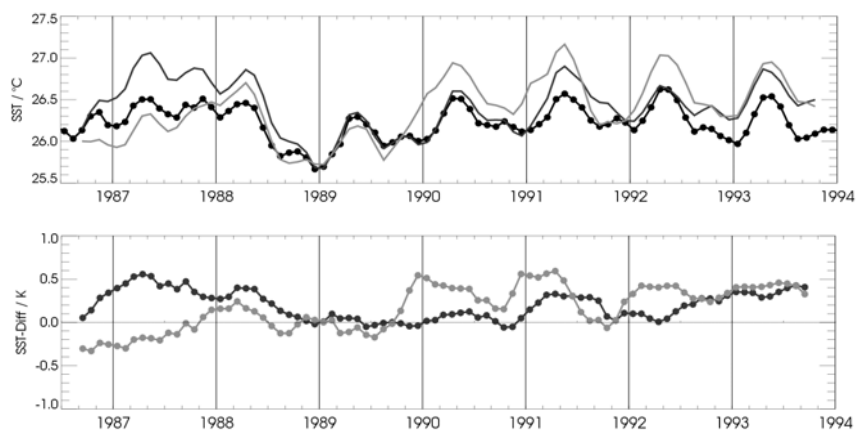
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ERA-40 vs. ERA-15 forcing

Modeled SST averaged over trop. Pac.



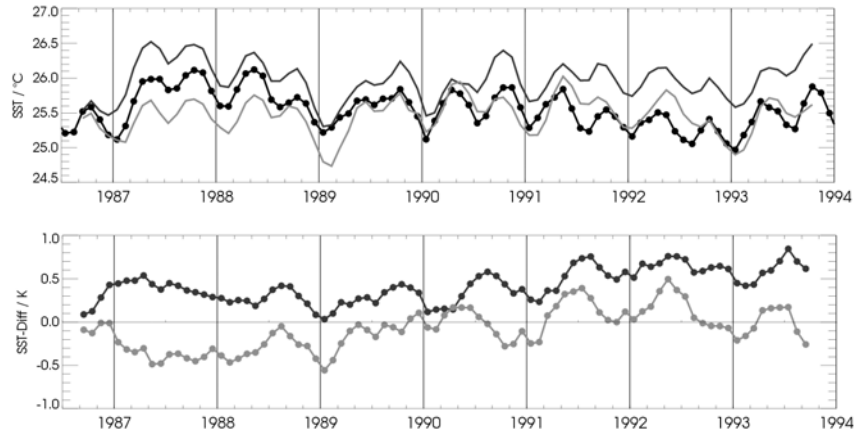
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ERA-40 vs. ERA-15 forcing

Modeled SST averaged over trop. Atl.



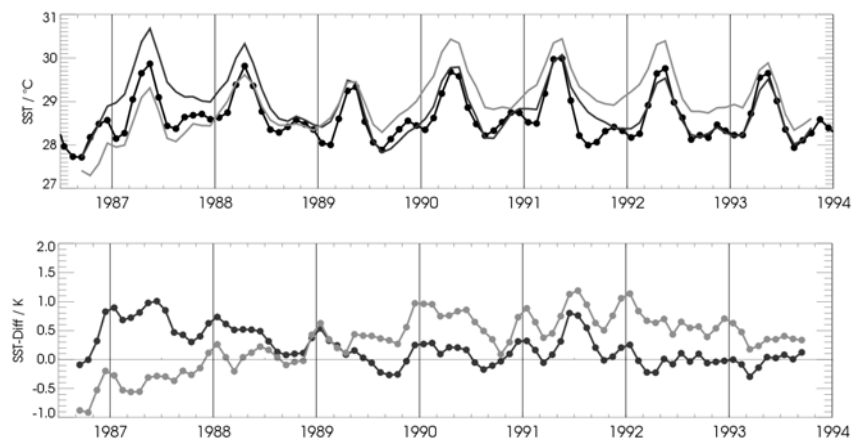
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ERA-40 vs. ERA-15 forcing

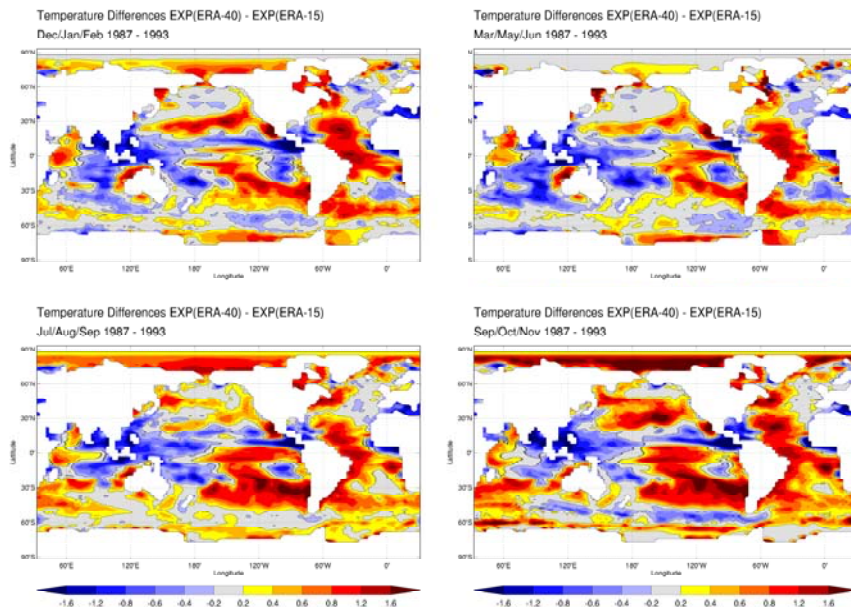
Modeled SST averaged over eq. Ind.



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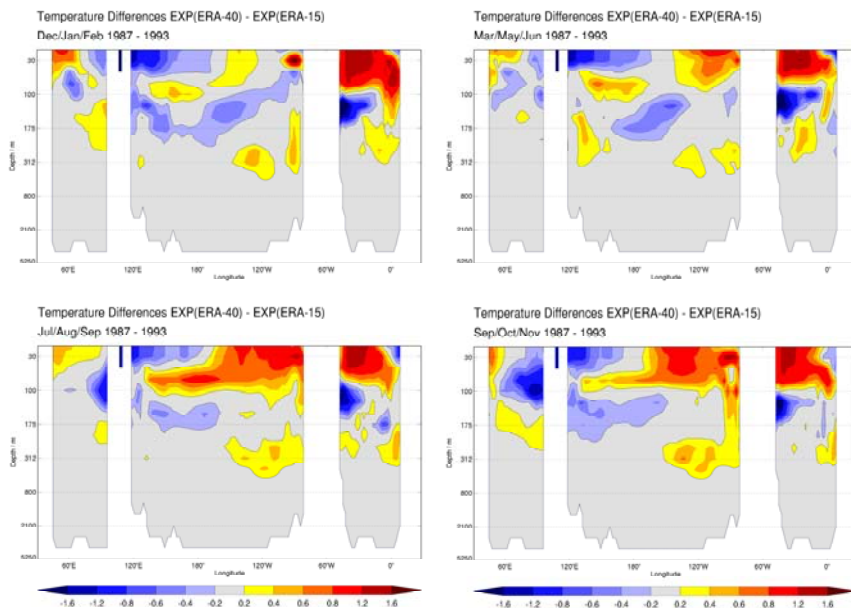
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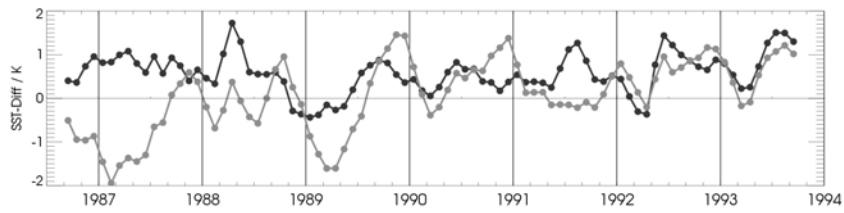


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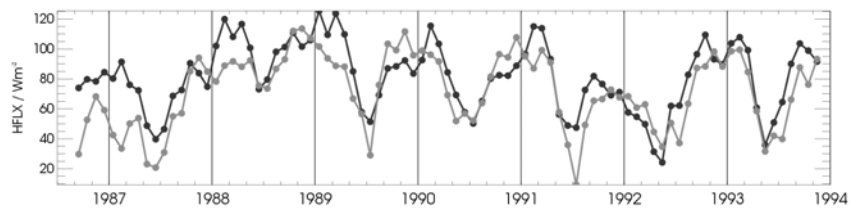
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ERA-40 vs. ERA-15 forcing



SST differences ERA - control

Net heat flux

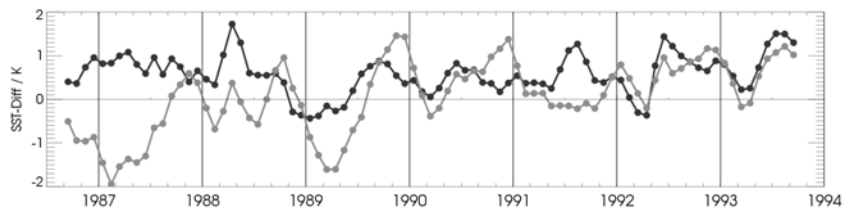


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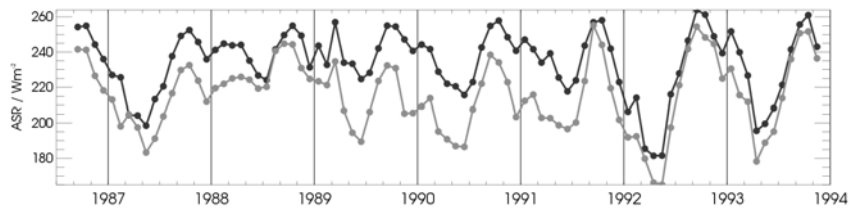
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ERA-40 vs. ERA-15 forcing



SST differences ERA - control

Absorbed solar radiation

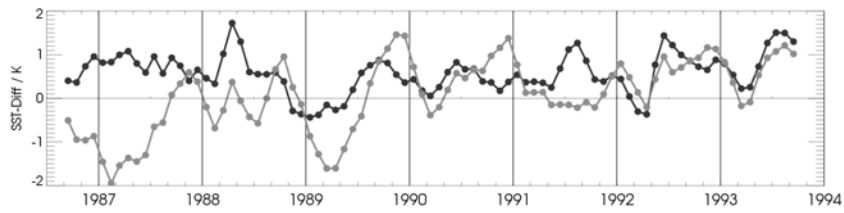


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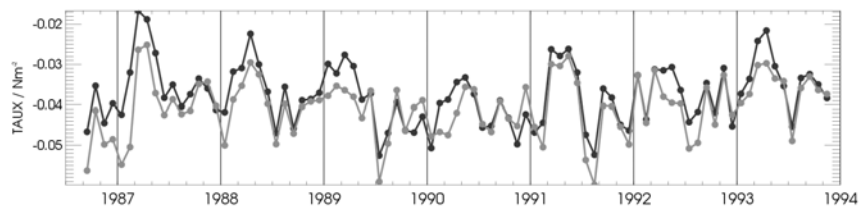
ERA-40 vs. ERA-15 forcing



SST differences ERA - control



U-wind stress

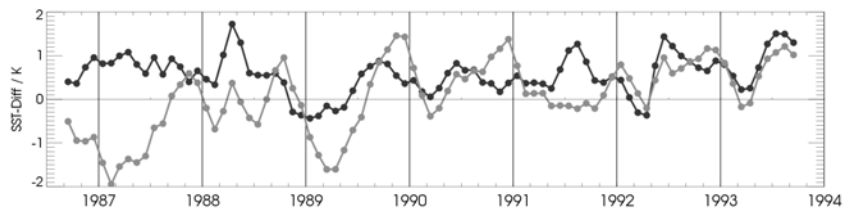


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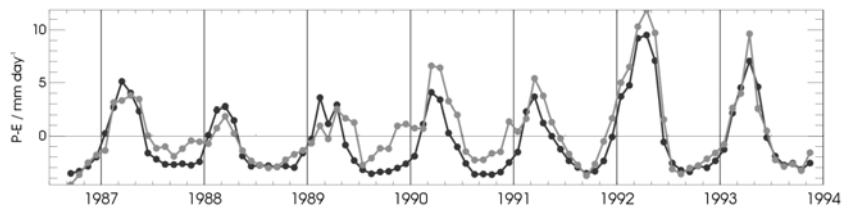
ERA-40 vs. ERA-15 forcing



SST differences ERA - control



Precipitation - Evaporation



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Ocean only runs

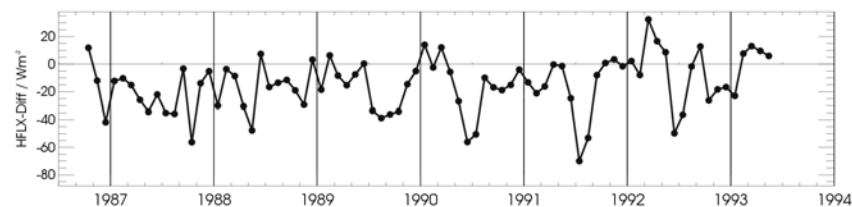
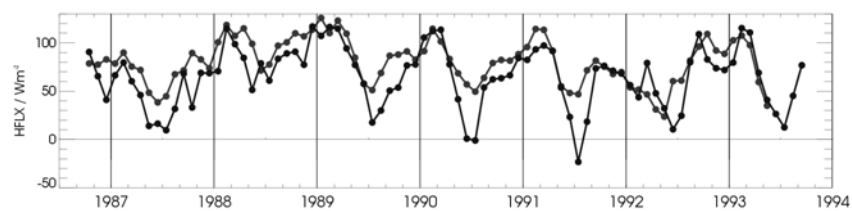
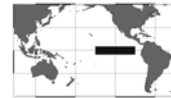
- Test of ERA-40 vs. ERA-15 with weak relaxation
- DEMETER: ocean analysis with stronger relaxation to address:
 - ▶ model error (HOPE)
 - ▶ windstress error (ERA)
 - ▶ heat flux error (ERA)

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ERA-40 vs. corrected forcing

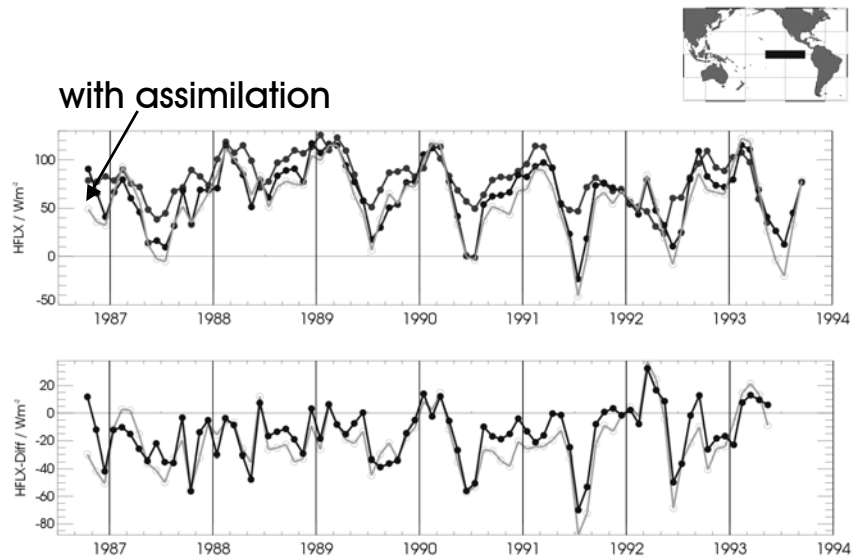


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ERA-40 vs. corrected forcing



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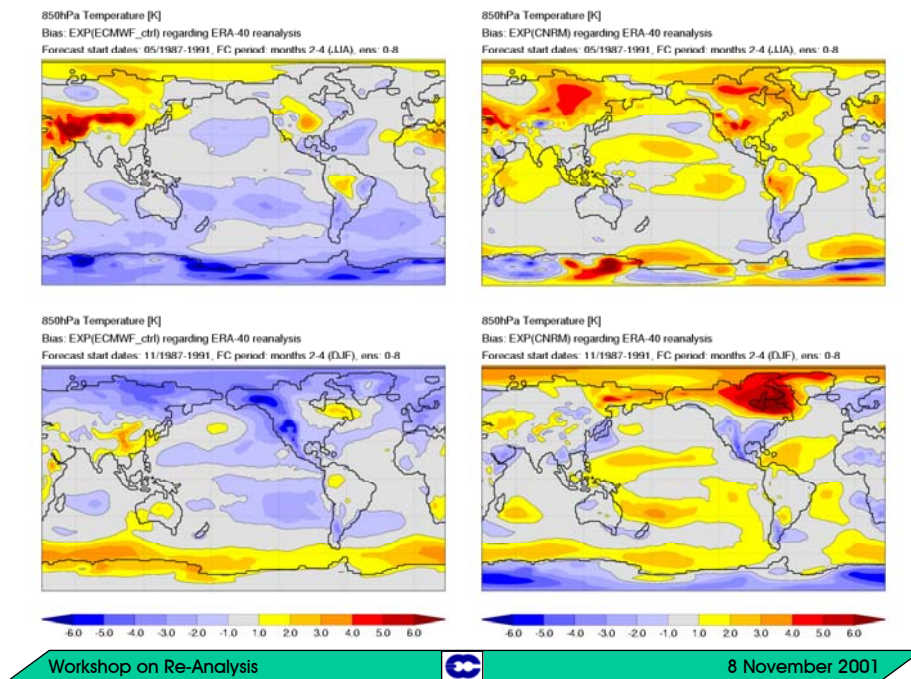
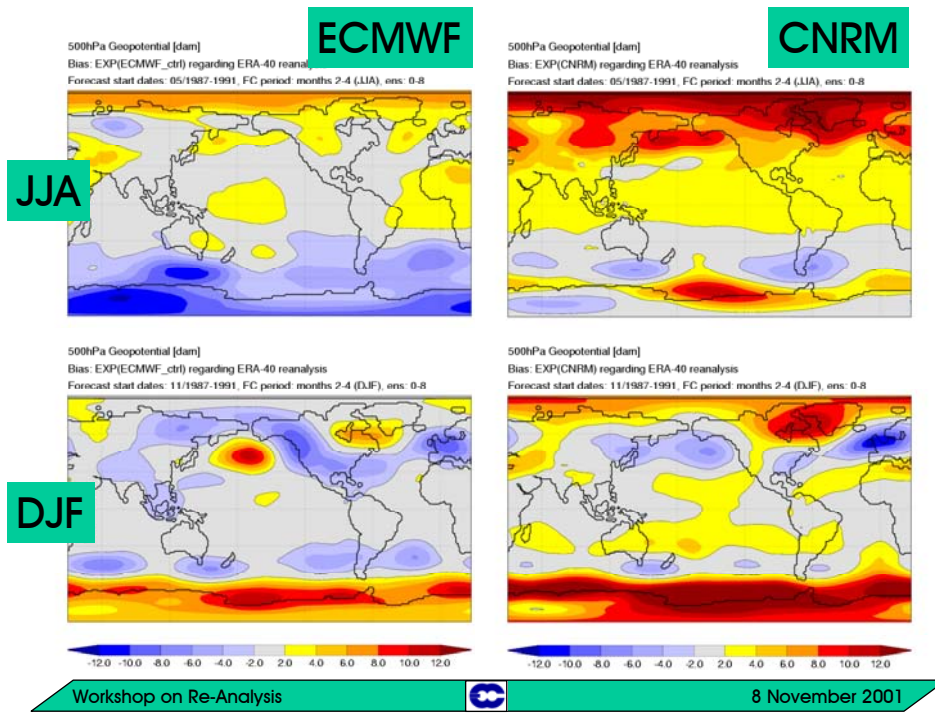
RESULTS

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 - ▶ Test of ERA-40 vs. ERA-15 forcing
 - ▶ DEMETER ocean analysis
- DEMETER coupled hindcasts:
 - ▶ ECMWF vs. CNRM
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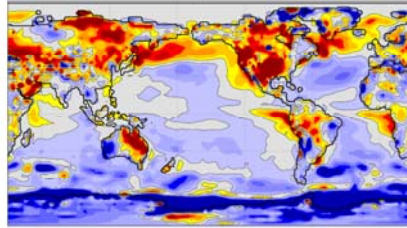
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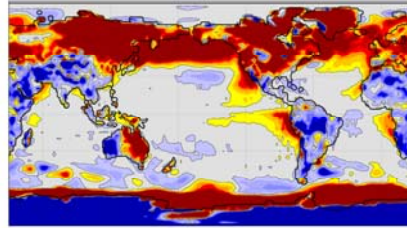
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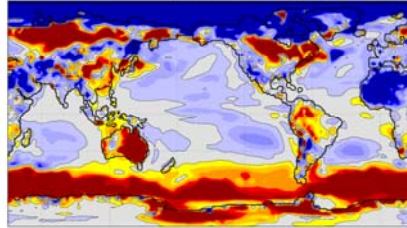
Surface Temperature [°C]
 Bias: EXP(ECMWF_ctrl) regarding ERA-40 reanalysis
 Forecast start dates: 05/1987-1991, FC period: months 2-4 (JJA), ens: 0-8



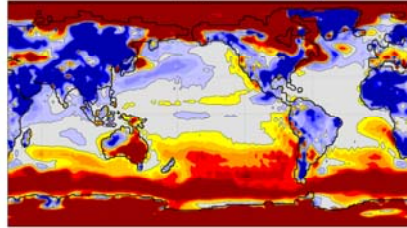
Surface Temperature [°C]
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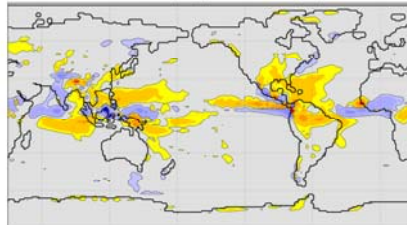


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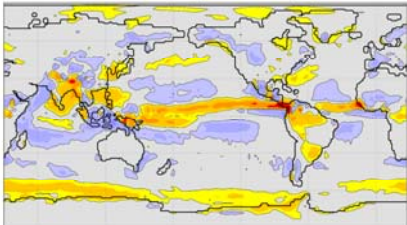


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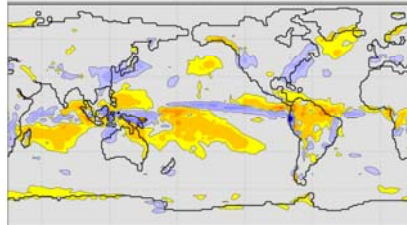
Total Precipitation [mm day⁻¹]
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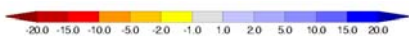
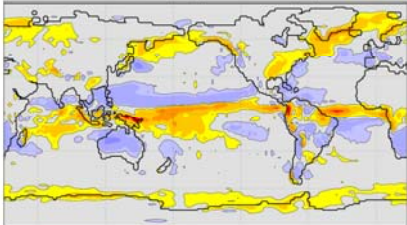
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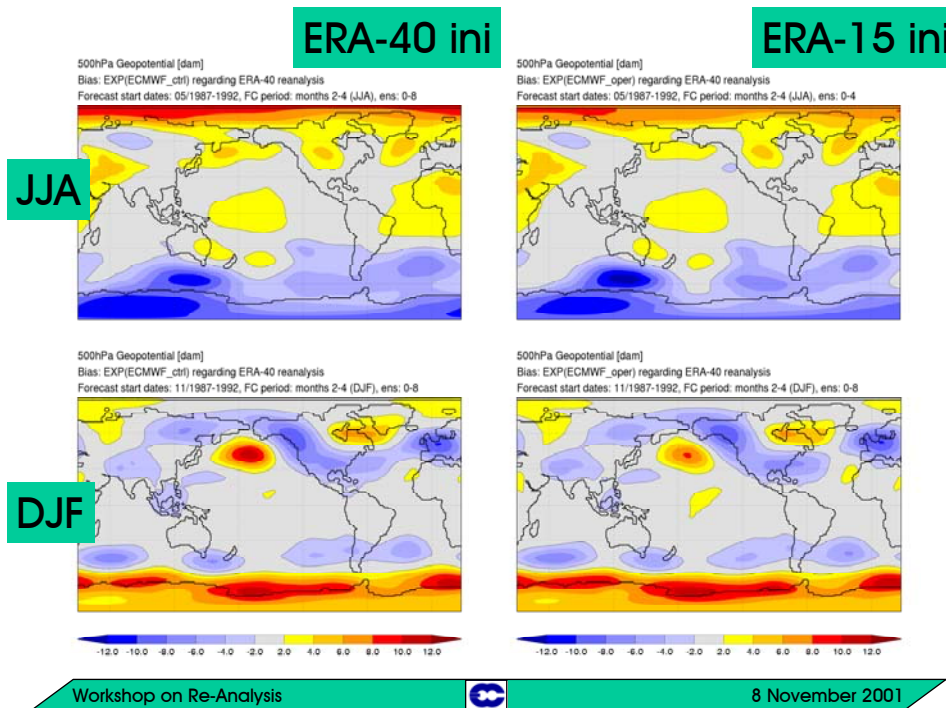
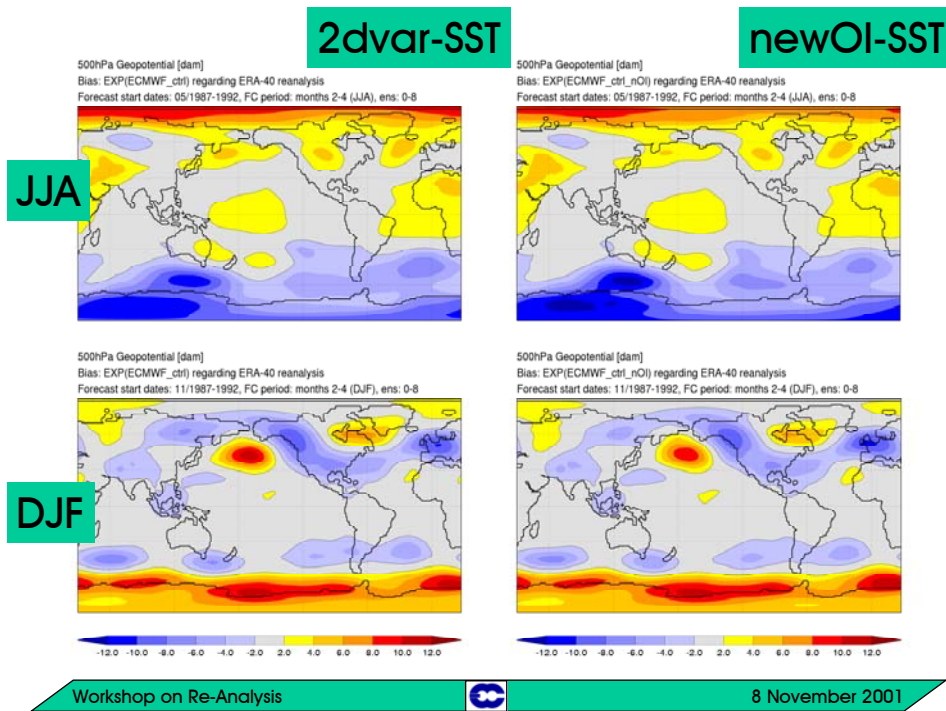
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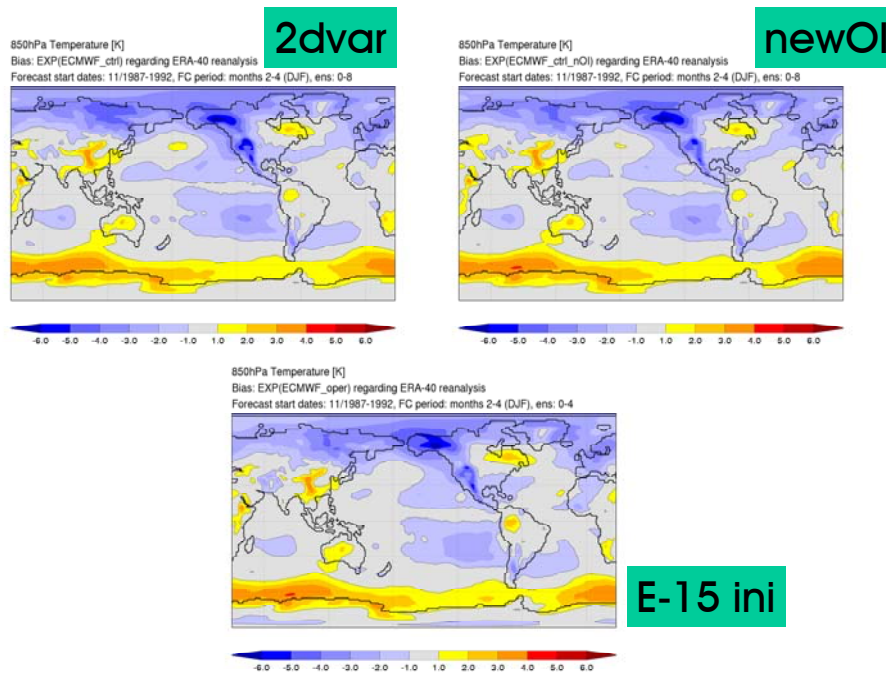


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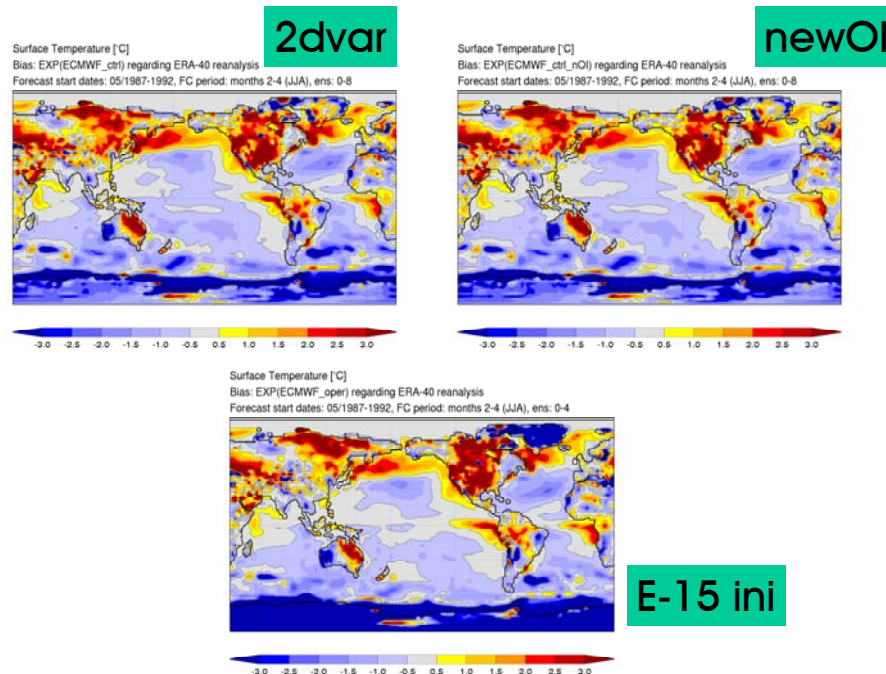


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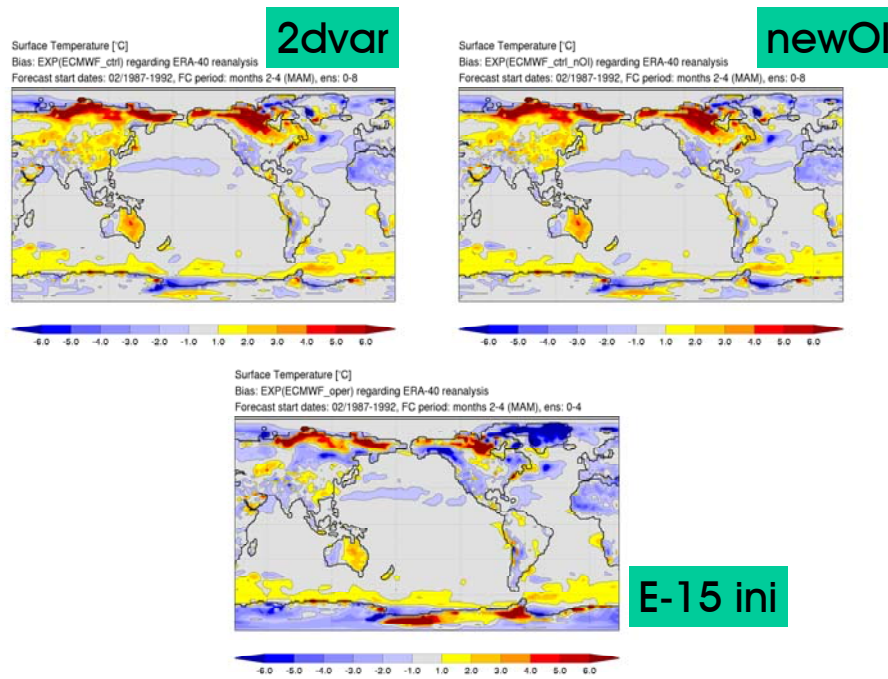




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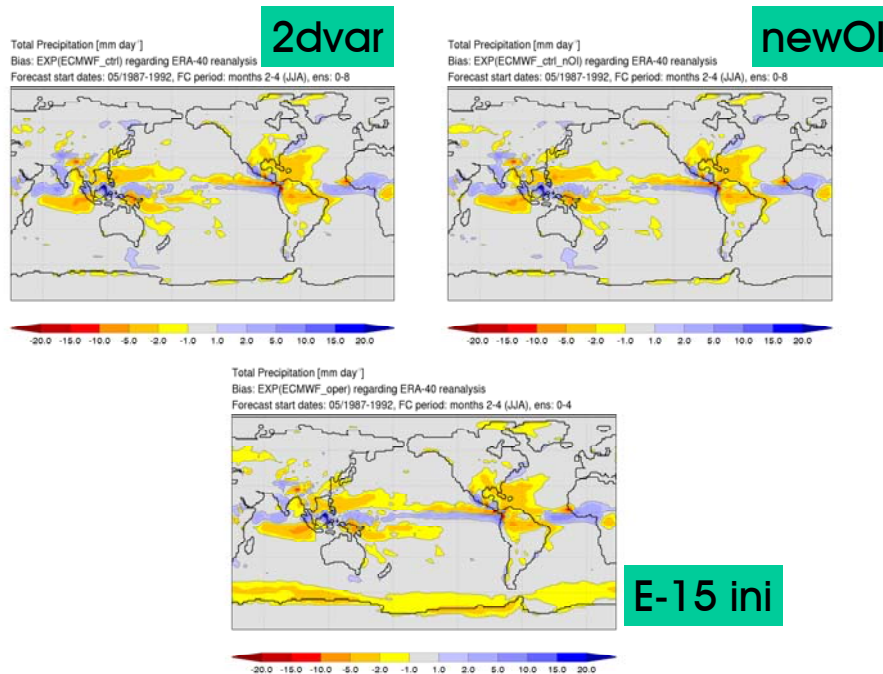
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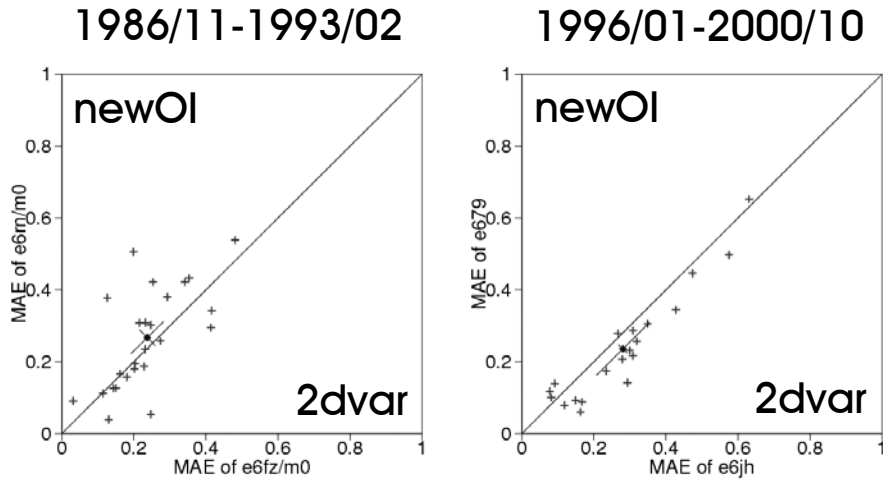


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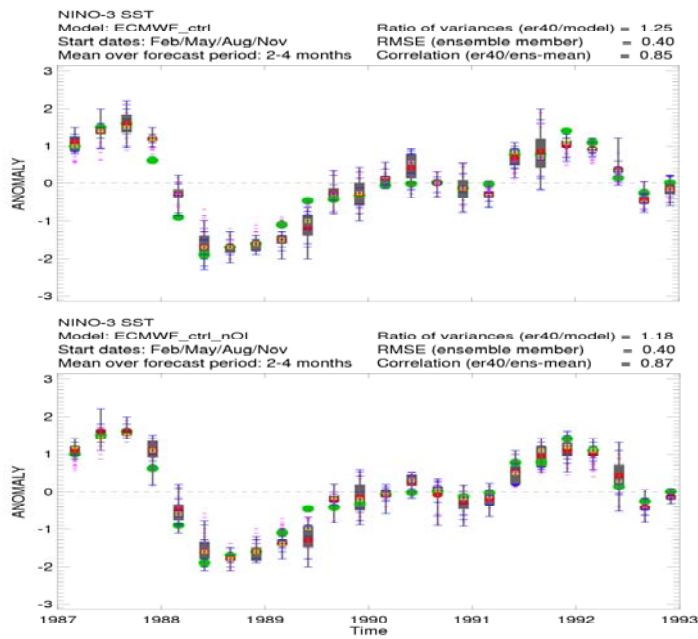
Niño4 error comparison



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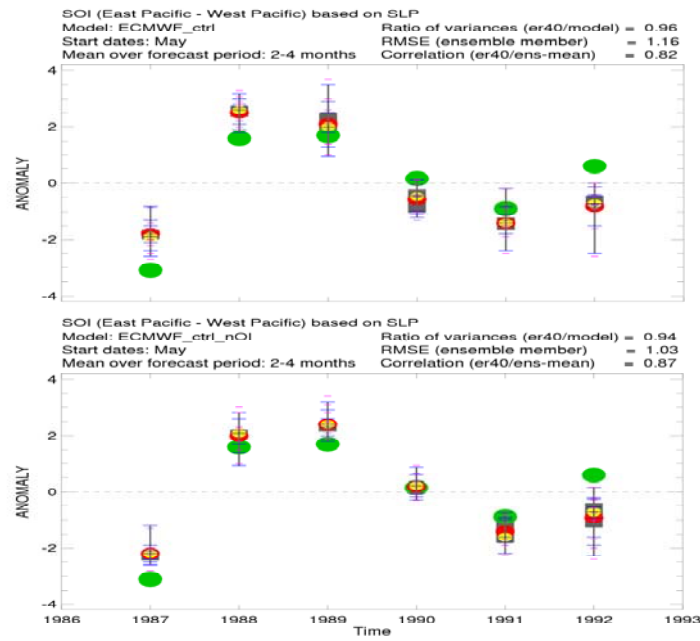
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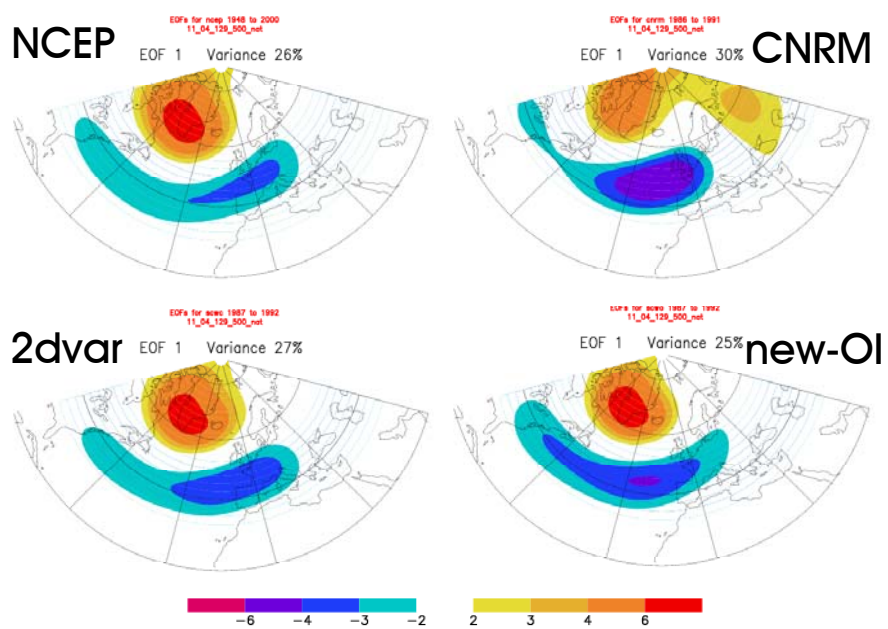
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Summary

- DEMETER hindcast production follows closely ERA-40
- Test of ERA-40 vs. ERA-15 forcing shows overall an improvement in ERA-40, BUT: still deficiencies in fluxes
- First results from DEMETER coupled hindcasts show:
 - ▲ Bias is very “robust”
 - ▲ New OI SSTs are of minor importance (for DEMETER)
 - ▲ Impact of different soil initialisation (ERA-40/15)