Seasonal forecasts with the German Climate Forecast System (GCFS1)

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and further members of the joint working group on seasonal prediction

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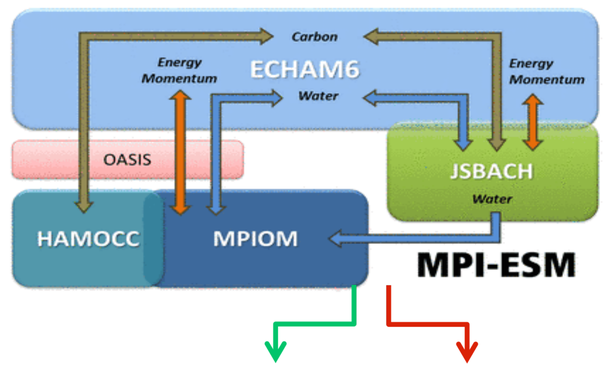
1. Summary

We present current forecasts and hindcast skill from the seasonal German Climate Forecast System (GCFS1). GCFS1 is jointly developed by the Deutscher Wetterdienst (DWD), the Max-Planck-Institut für Meteorologie (MPI-M), and the Universität Hamburg (UHH). The forecast system is based on the coupled earth system model MPI-ESM-LR in a CMIP5-near version, with the oceanic, atmospheric, and sea-ice components initialised from re-analyses.

The scientific development of GCFS in its current and next version takes place in Hamburg. GCFS1 is operated by DWD in near-operational mode at ECMWF, and is expected to produce operational seasonal forecasts in 2016.

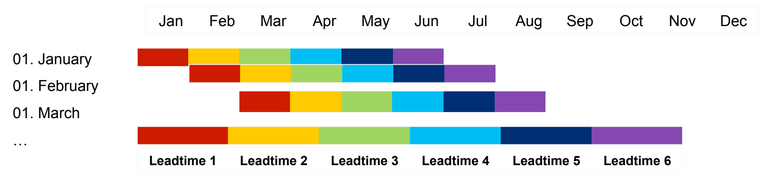
2. Model Setup



Assimilation: Nudging			Ensemble generation	
Atmosphere	Ocean	Sea-Ice	Atmosphere	Ocean
Vorticity, Divergence, Temperature	Tem-perature Salinity	Sea-Ice concentration	Perturbation of diffusion coefficient	Breeding with vertically dependent norm
ERA-Interim	ORA-S4	NSIDC Nasa Team		

3. Work Flow GCFS1

„Hindcasts“: set of re-forecasts to assess hindcast skill of forecast system
- **12 start months**
- **15 ensemble members each**
- **Hindcast period: 1981 – 2014, for one year each**



„Forecasts“: current forecasts
- **Starting every month**
- **30 Ensemble members**
- **Forecast period: 1 year**
- **Forecasts analysis focuses on forecasts for 2 - 4 months ahead**

4. Hindcast skill for 2m Temperature

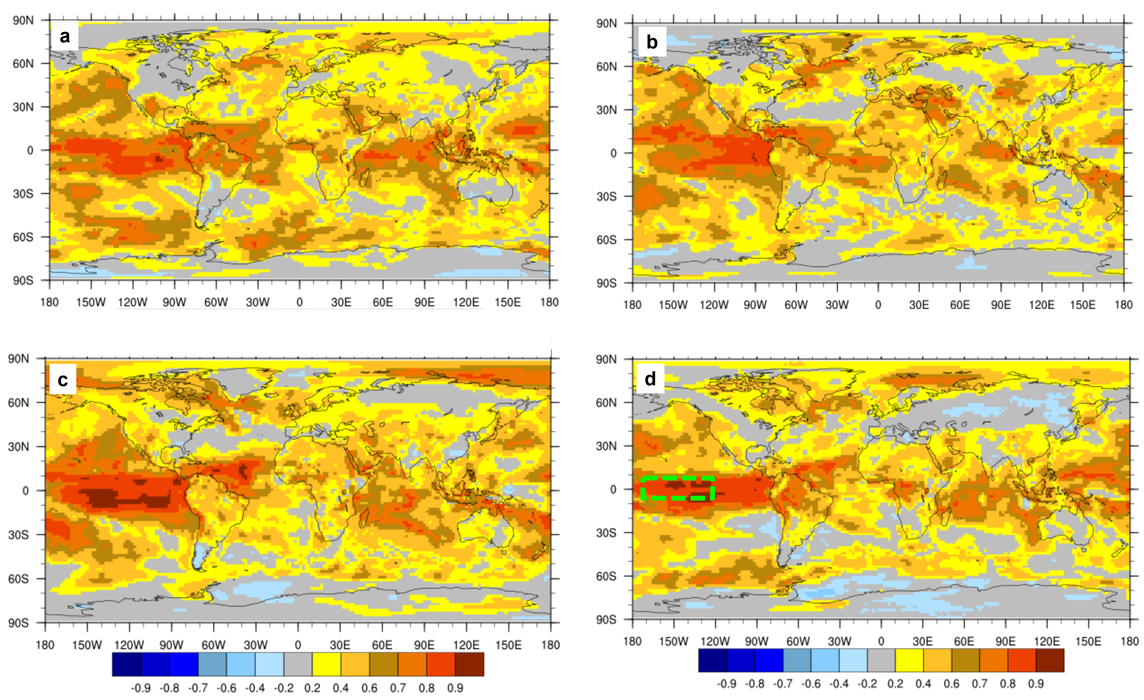


Figure 1: Anomaly correlation coefficent between 2-4 months ensemble mean hindcast and ERAinterim for hindcasts starting in (a) February, (b) May, (c) August, (d) November. The green box in (d) indicates the Nino3.4 region analysed in ENSO forecasts in Fig. 4.

5. Spread-Error-Ratio for 2m Temperature

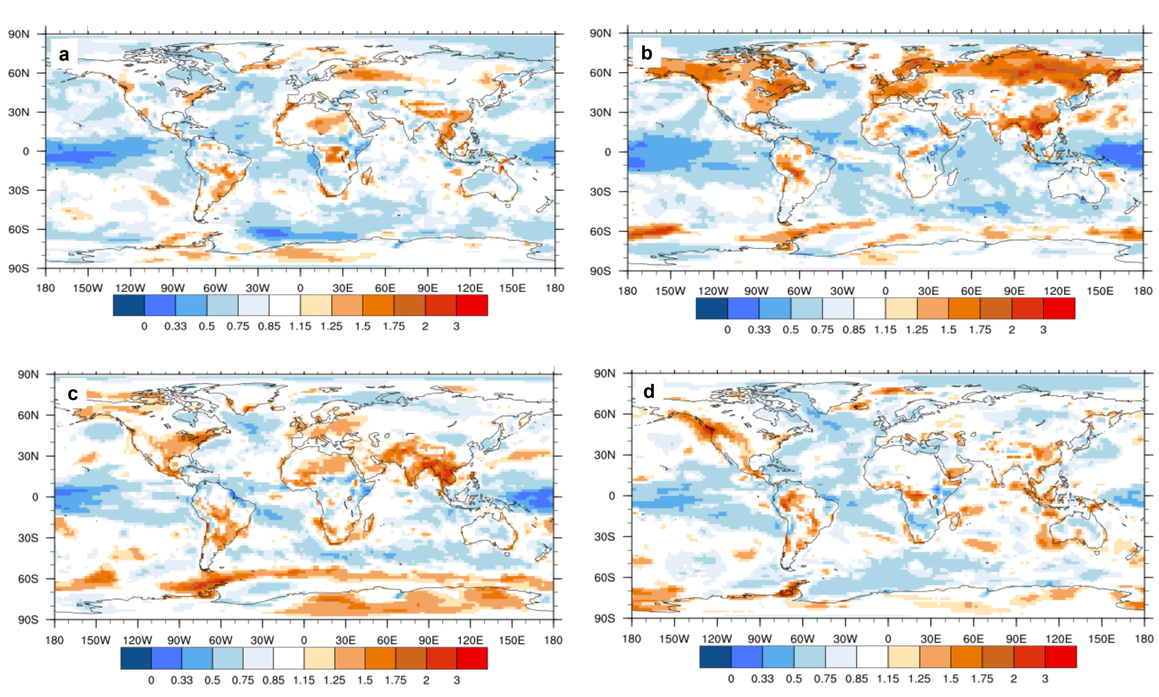


Figure 2: Spread-error ratio for 2-4 months ensemble mean hindcast against ERAinterim for hindcasts starting in (a) February, (b) May, (c) August, (d) November.

6. GCFS1: current forecasts (start: 01. October 2015)

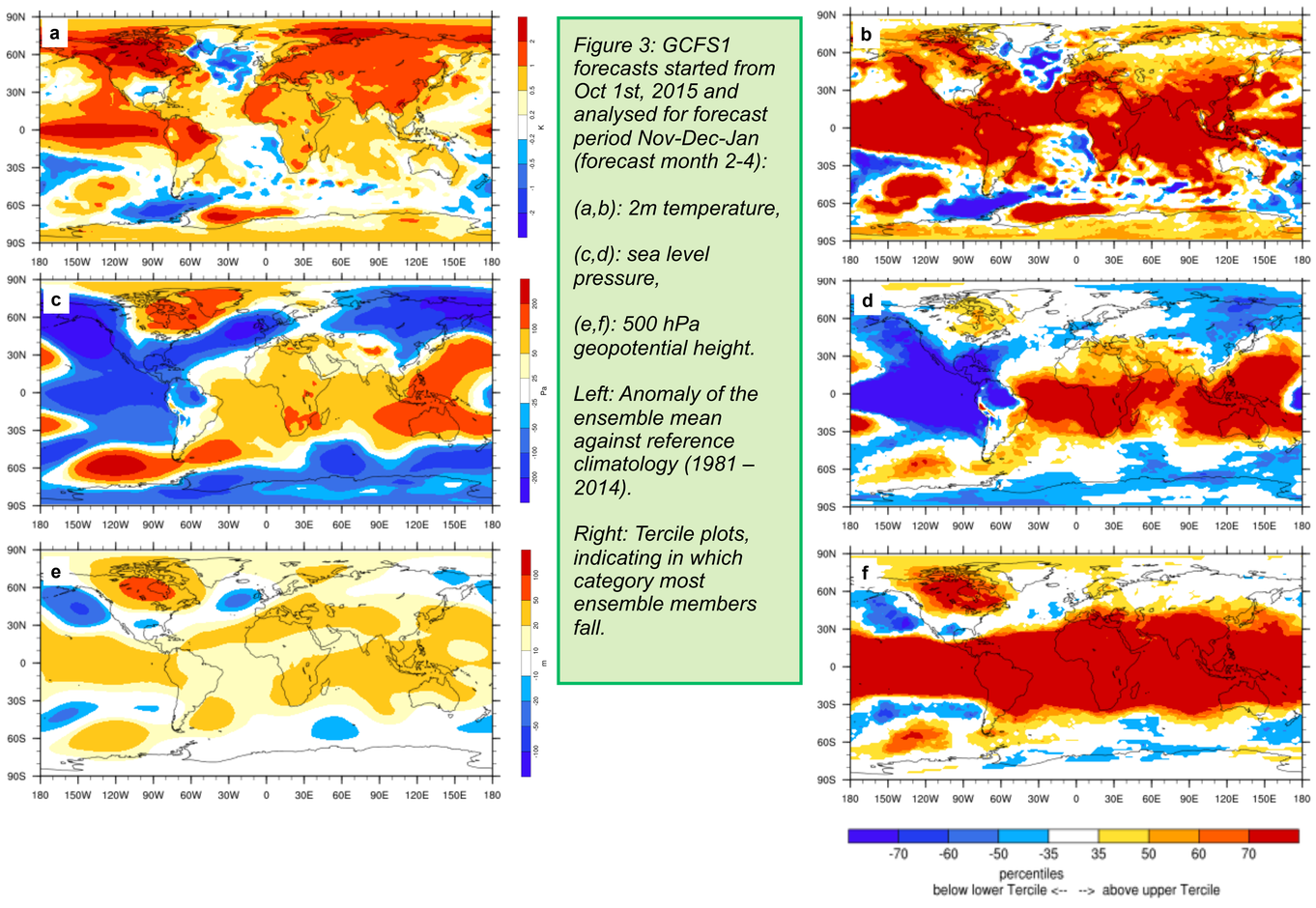


Figure 3: GCFS1 forecasts started from Oct 1st, 2015 and analysed for forecast period Nov-Dec-Jan (forecast month 2-4):

(a,b): 2m temperature,

(c,d): sea level pressure,

(e,f): 500 hPa geopotential height.

Left: Anomaly of the ensemble mean against reference climatology (1981 – 2014).

Right: Tercile plots, indicating in which category most ensemble members fall.

7. ENSO hindcast skill and current forecast

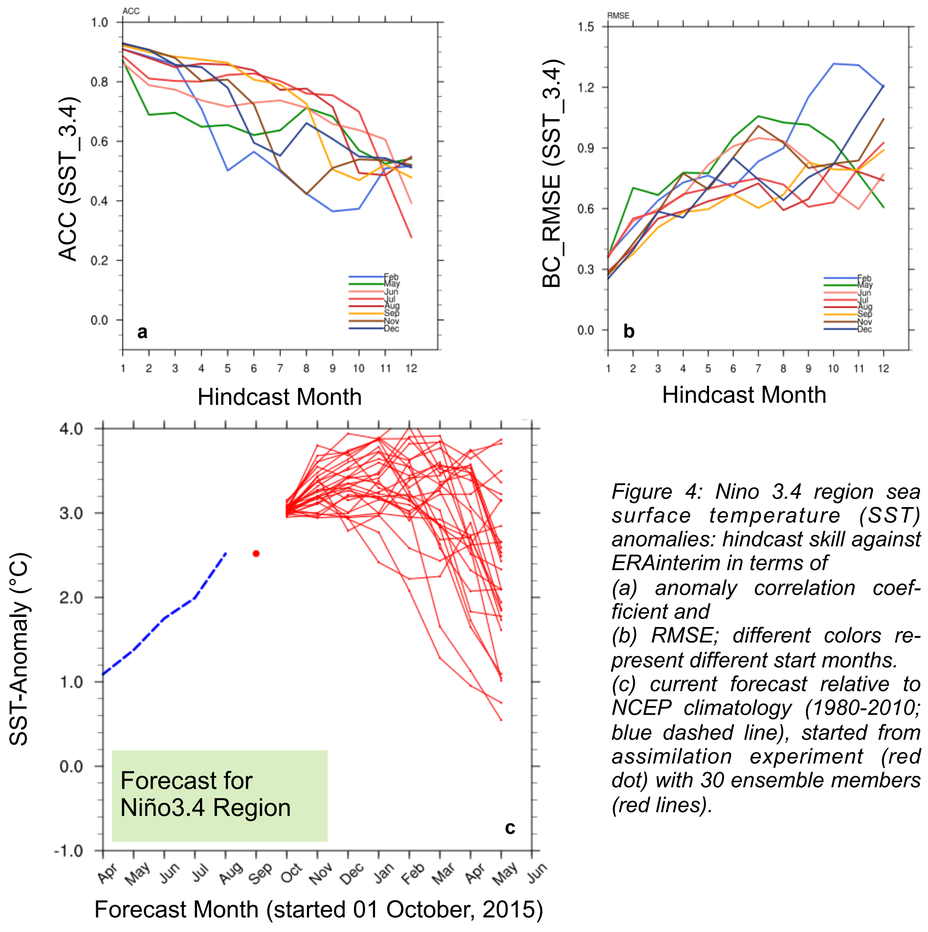


Figure 4: Nino 3.4 region sea surface temperature (SST) anomalies: hindcast skill against ERAinterim in terms of
(a) anomaly correlation coefficient and
(b) RMSE; different colors represent different start months.
(c) current forecast relative to NCEP climatology (1980-2010; blue dashed line), started from assimilation experiment (red dot) with 30 ensemble members (red lines).

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Wetter und Klima aus einer Hand