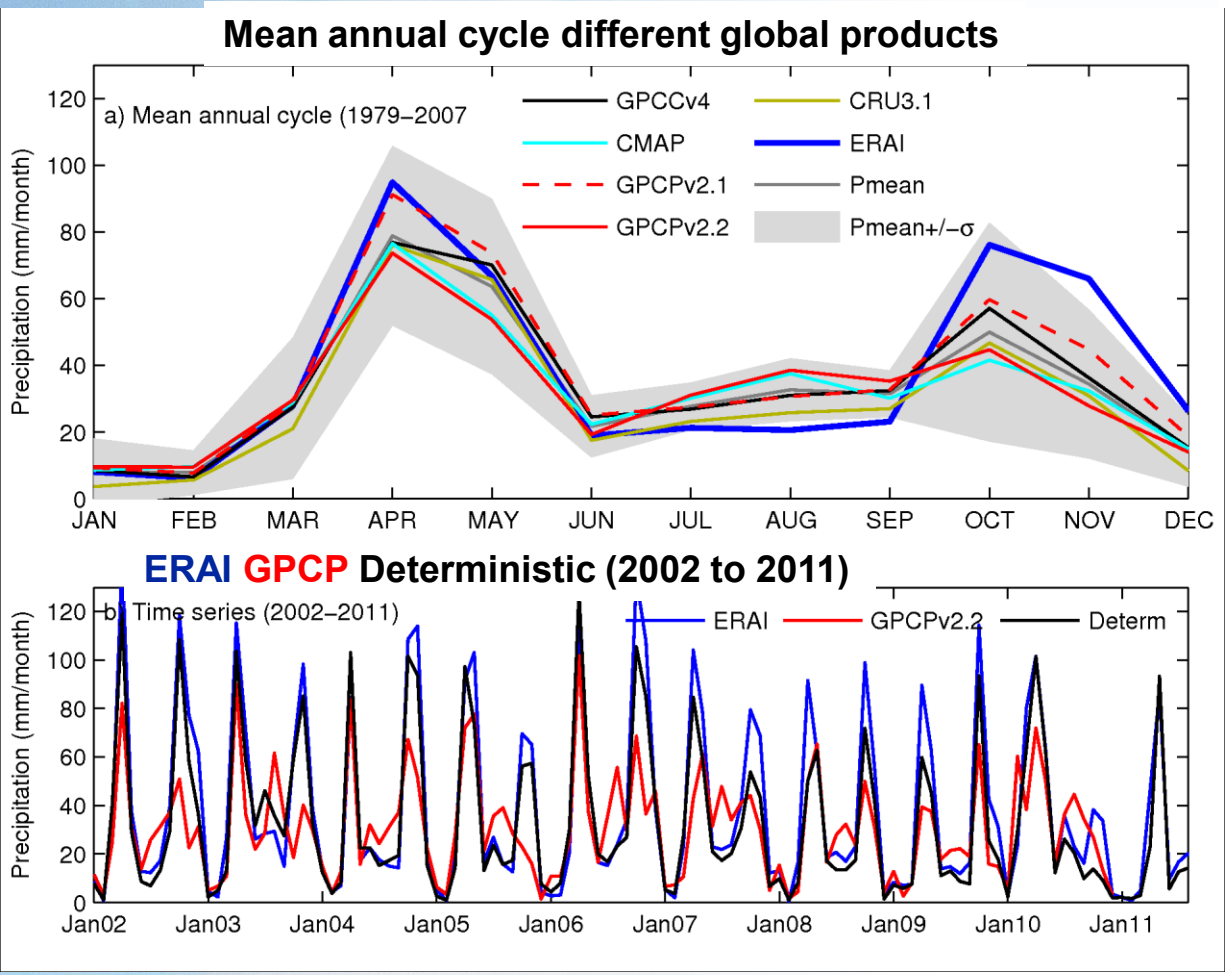
The 2010/11 drought in the Horn of Africa:
Monitoring and forecasts using ECMWF products

Emanuel Dutra
Fredrik Wetterhall
Florian Pappenberger
Souhail Boussetta
Gianpaolo Balsamo
Linus Magnusson

Comparison of precipitation products in the HoA



- **Large uncertainty between products;**
- **Significant differences between GPCPv2.1 and GPCPv2.2**

- **Two rainy seasons (March-June - high; October-December –low);**

- **ERA-Interim seems to "overestimate" the peck rainfall during the rainy seasons**

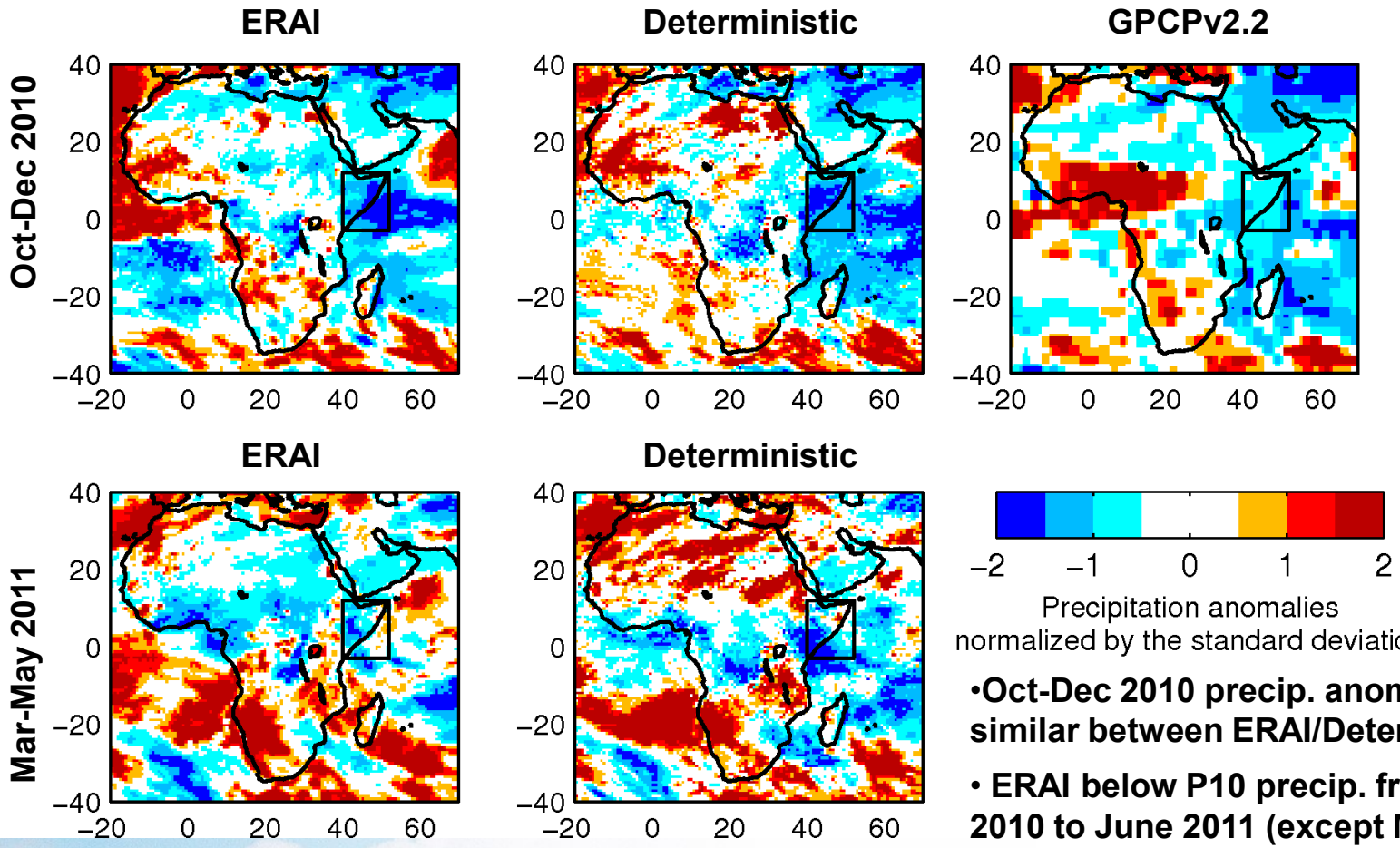
- **Good agreement between ERAI and deterministic, but determ. Is closer to GPCPv2.2**

- **Stronger Oct-Dec 2010 anomaly in determ. Than in ERAI**

- **What should be used as ground true ?**

Averages over the HoA

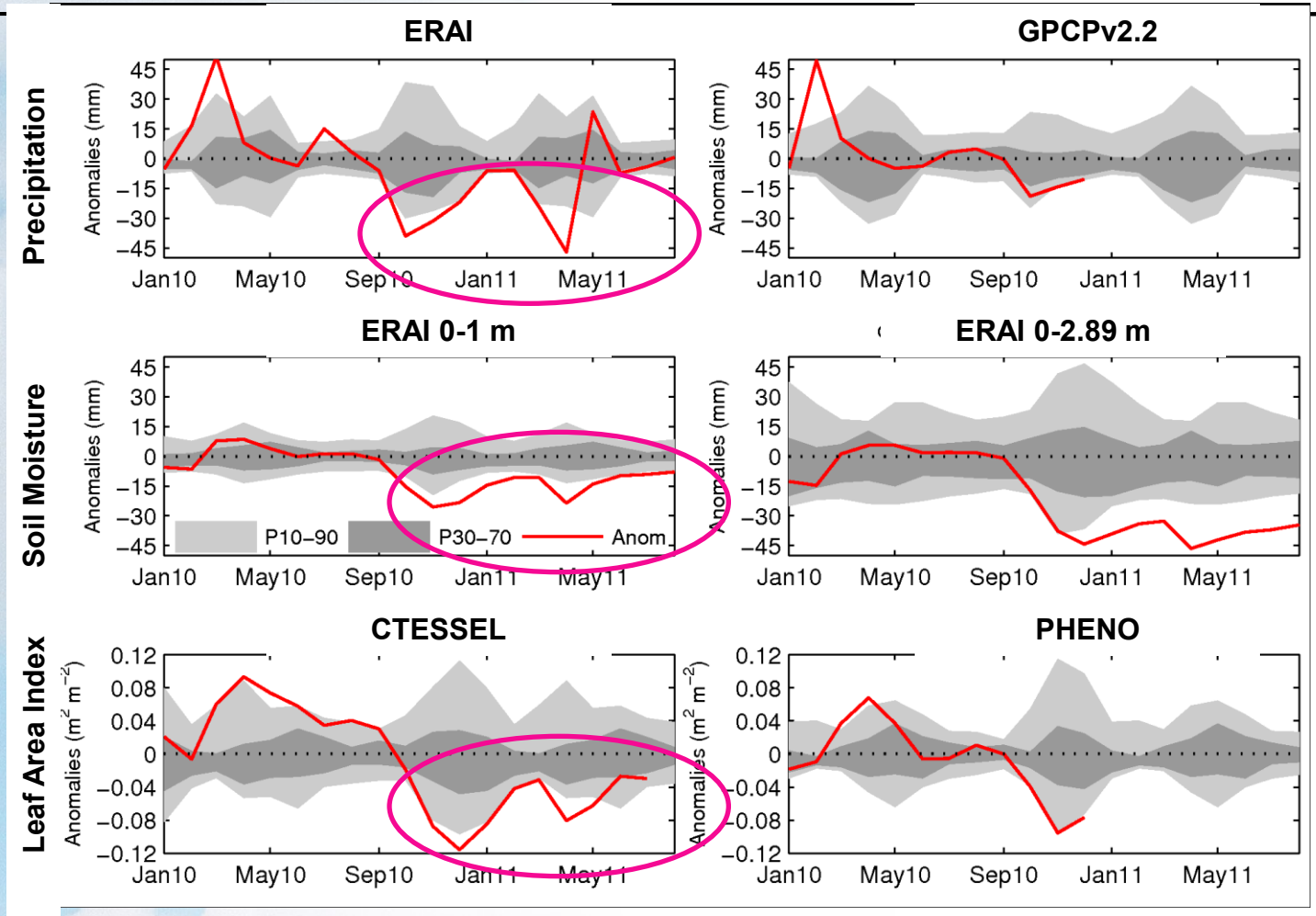
ERA-Interim/deterministic forecasts monitoring (precipitation)



- **Oct-Dec 2010 precip. anomaly pattern similar between ERAI/Determ and GPCP**
- **ERAI below P10 precip. from September 2010 to June 2011 (except May 2011, also in deterministic)**
- **2010/2011 accumulated precipitation (Aug– Jul) was the lowest in the 32 years record of ERAI.**

Averages over the HoA

ERA-Interim monitoring (soil moisture, LAI)

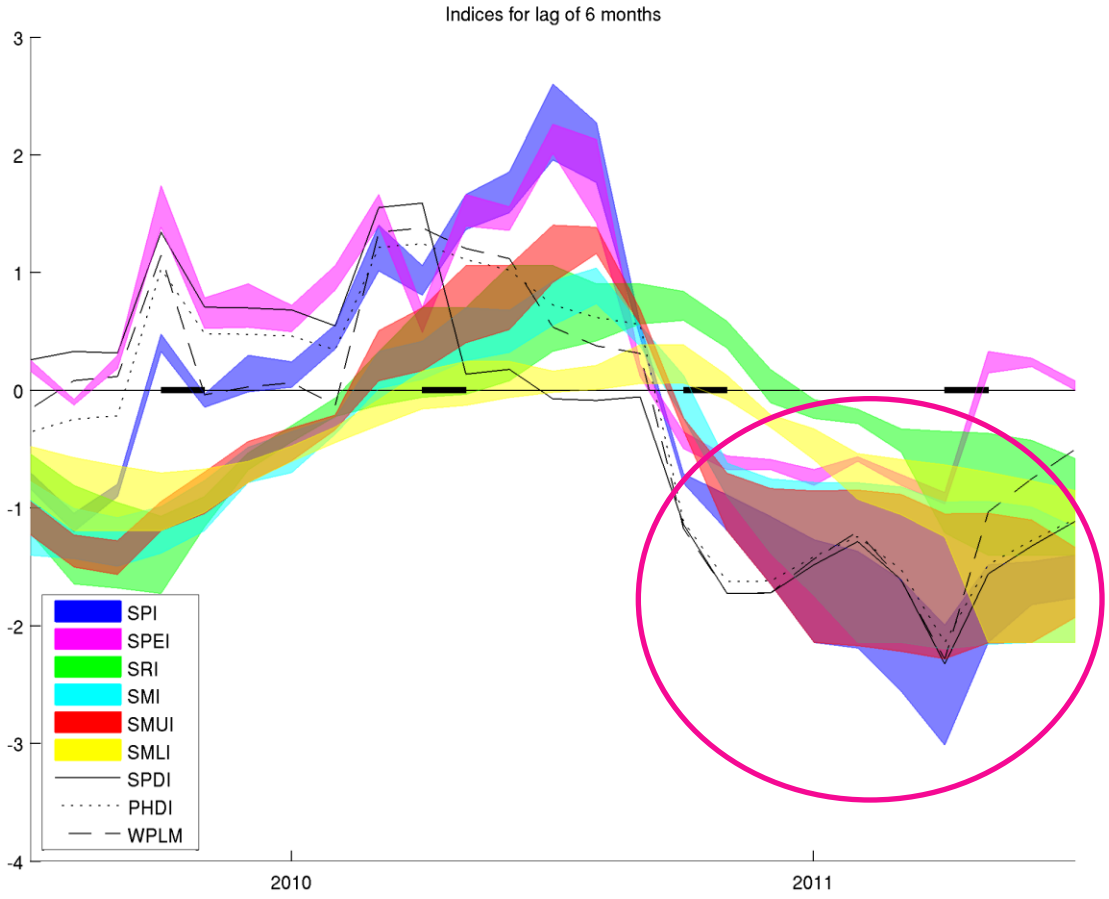


- **Precipitation anomalies are followed by soil moisture**
- **LAI anomalies follow the reduced water availability**
- **Soil moisture and LAI anomalies are consistent with long recover (memory effect)**

Averages over the HoA

ERA-Interim monitoring (drought indices)

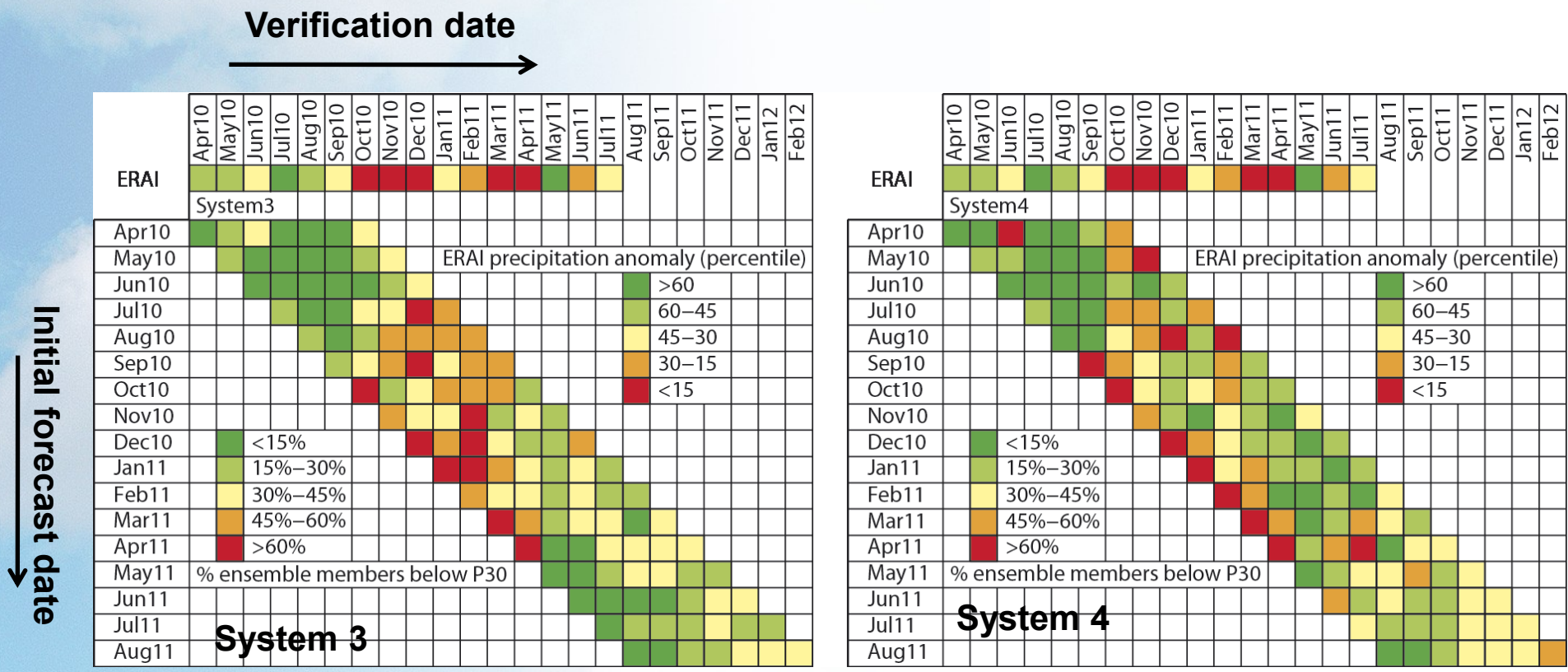
- **Drought indices calculated from ERAI 2010/2011**



- **All indices identify an anomalous situation;**
- **Different onset-intensity;**
- **Large uncertainty;**
- **Would this be helpful for decisions makers ?**

Averages over the HoA

Seasonal forecasts: April 2010 to August 2011

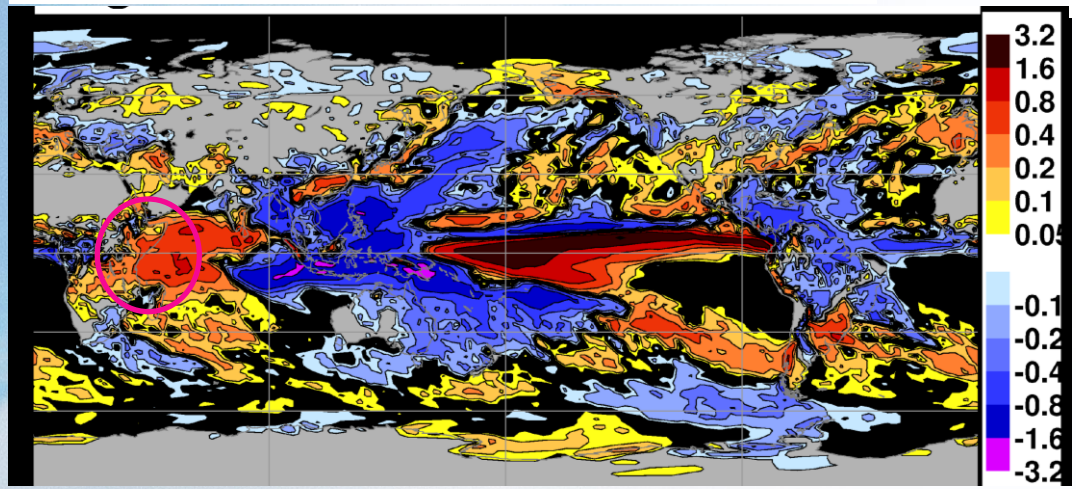


- Good in the first month of forecasts (S4 better)
- Forecasts of dry conditions for Oct-Dec 2010 since July 2010
- Marc-April 2011 very noisy, no consistency in the forecast
- Why the difference in skill between Oct-Dec / March-May (in both systems) ?

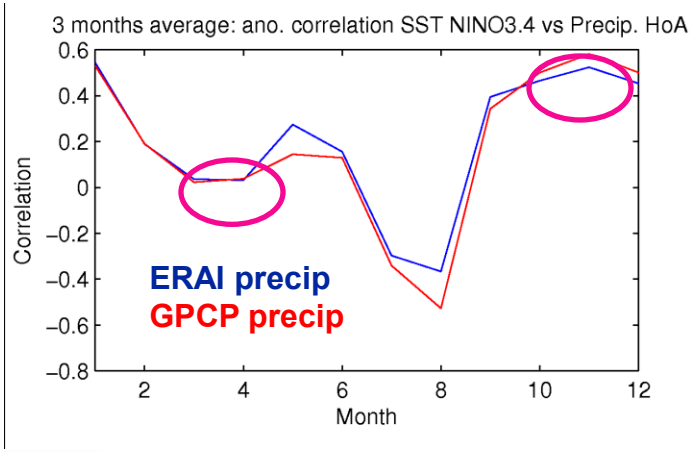
Averages over the HoA

Precipitation anomalies and link with ENSO

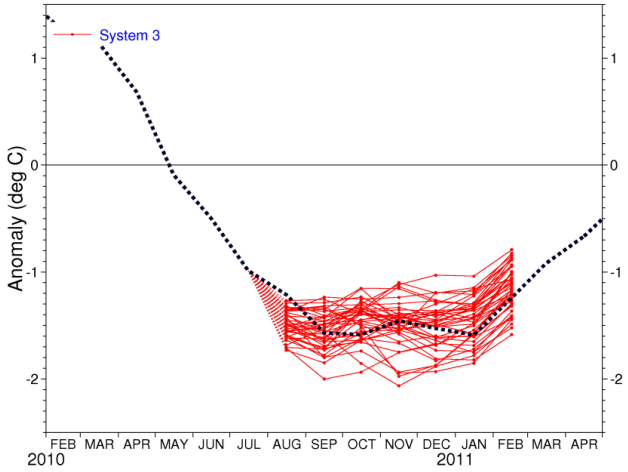
Regression ERAI Nino3.4 SST Sep-Nov. precip



Anom. correlation SST Nino3.4 precip HoA



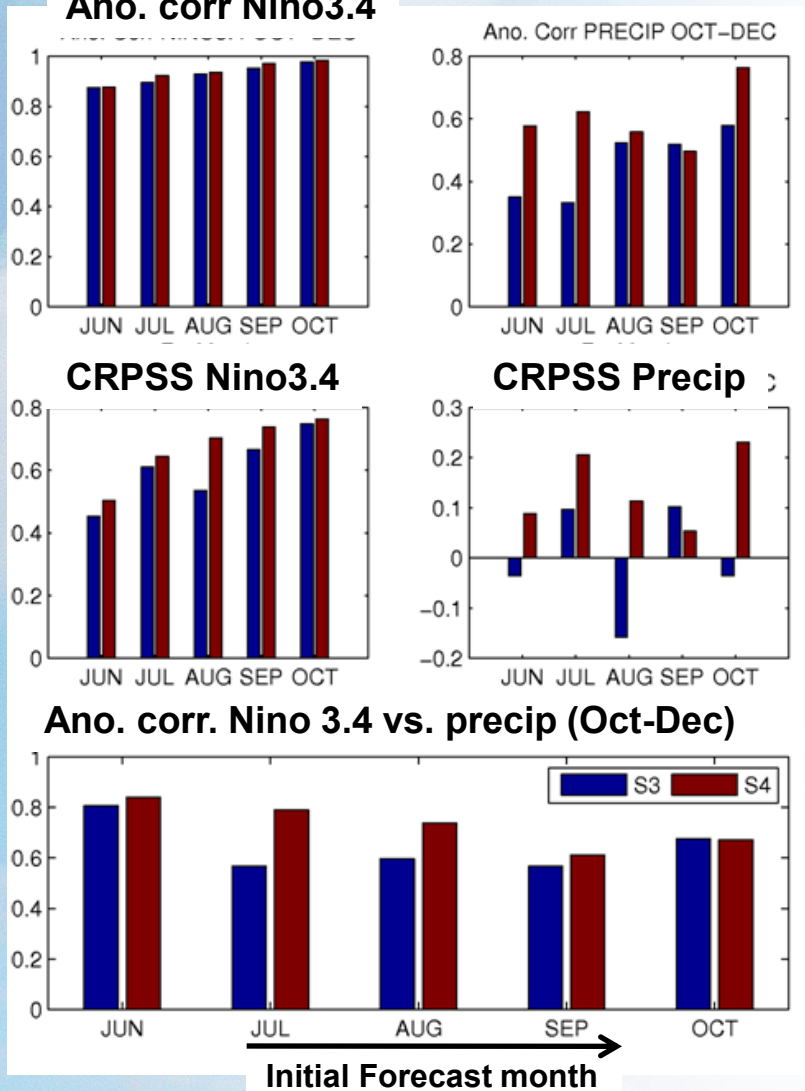
S3 Nino3.4 forecast Aug 2010



- **Oct-Dec precipitation anomalies (both ERAI and GPCP) connected with Nino3.4 : Some predictability in S3/S4 ? Associated with the Indian Ocean dipole**
- **Main rainy season March-June no relation with Nino3.4 (difficult for S3/S4 ?), mainly driven by ITCZ**
- **2010 strong La Niña (2th strongest since 1979)**

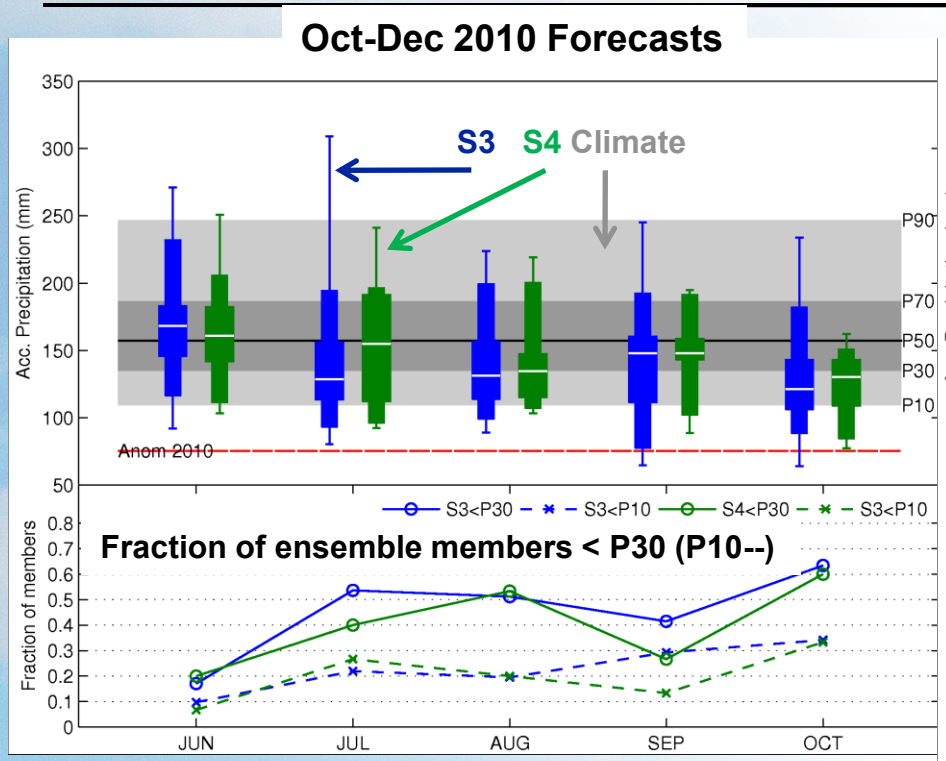
Seasonal forecasts S3/S4 skill

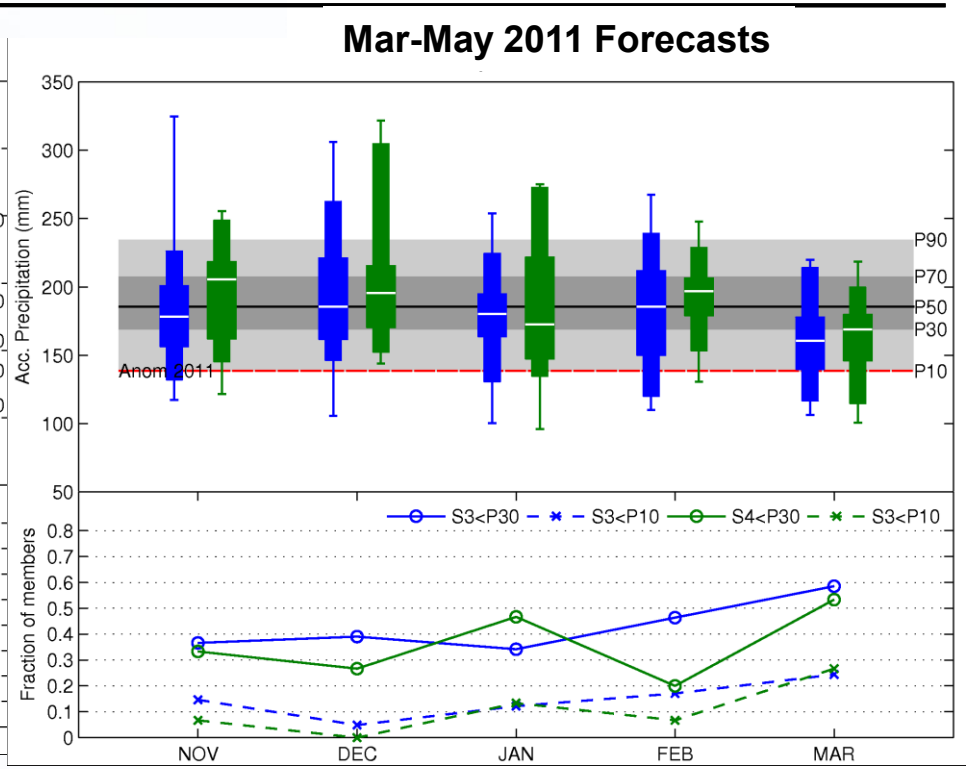
Skill of S3/S4 SSTs, precip for Oct-Dec



- Both S3/S4 show a good skill for Nino3.4 (Oct-Dec) 4 months in advance.;
- S3 skill for precipitation is very low (CRPSS<0 Jun, Aug, Oct).;
- S4 shows some skill in predicting precipitation in the HoA region;
- The teleconnection between Nino3.4 and precip is present in both S3 and S4 up to 4 months in advance.
- Precip scores for Mar-May are very low in both S3/S4 (especially for Apr)

Seasonal forecasts 2010/11





- **From July 2010 onwards S3 > 50% (below percentile 30) and >20% (below percentile 10), persistent;**
- **S4 similar S3 but predicting normal situation in September (only 15 ensemble members, S3 has 41);**
- **Mar-May 2011 forecasts from Nov to Feb indicated normal conditions, only the March forecasts pointed to a dry situation;**
- **Would this information be useful to the population ? Decision makers ?**
- **How to process / deliver these forecasts to users ?**

Overview

- **ERA-Interim monitoring**
  - ERAI precipitation comparable with other global datasets (large uncertainty)
  - 2010/11 anomaly of precipitation well captured by ERAI, with a consistent signal in soil moisture and LAI anomalies
  - Ongoing analysis with more drought indexes. The results point to the feasibility of using ERA-Interim as a monitoring tool for drought conditions (near-real time update very important)
- **Seasonal Forecasts**
  - October to December precipitation anomalies in 2010 were predicted from July onwards, due to the strong La Niña situation;
  - S4 outperforms S3 in the prediction of precipitation and nino3.4 (S4 is penalized in the 2010/11 case study – hindcast period: 15 ensemble members);
  - October-December 2011 forecasts point to normal situation;
- **Ongoing:**
  - Further analysis of the ENSO-Indian Ocean-Precipitation (HoA);
  - Drought indices based on ERAI, more case studies (Russia 2010), extend drought indices from monitoring to seasonal forecasts.
  - Disseminate these results as possible applications of ERAI and seasonal forecasts to end users.