Seasonal forecast from System 4

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European Centre for Medium-Range Weather Forecasts

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Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

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Outline

- Overview of System 4
- Some recent research results
- System 4 forecasts for DJF 2014
- FP7 EUPORIAS / SPECS projects & C3S

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System 4 seasonal forecast model

- **IFS (atmosphere)**
  - T_L255L91 Cy36r4, 0.7 deg grid for physics (operational in Dec 2010)
  - Full stratosphere, enhanced stratospheric physics
  - Singular vectors from EPS system to perturb atmosphere initial conditions
  - Ocean currents coupled to atmosphere boundary layer calculations
- **NEMO (ocean)**
  - Global ocean model, 1x1 resolution, 0.3 meridional near equator
  - NEMOVAR (3D-Var) analyses, newly developed.
- **Coupling**
  - Fully coupled, no flux adjustments
  - Sea-ice based on sampling previous five years

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System 4 configuration

- **Real time forecasts:**
  - **51 member ensemble forecast to 7 months**
  - SST and atmos. perturbations added to each member

  - **15 member ensemble forecast to 13 months**
  - Designed to give an ‘outlook’ for ENSO
  - Only once per quarter (Feb, May, Aug and Nov starts)

- **Back integrations from 1981-2010 (30 years)**
  - 15 member ensemble every month
  - 15 members extended to 13 months once per quarter

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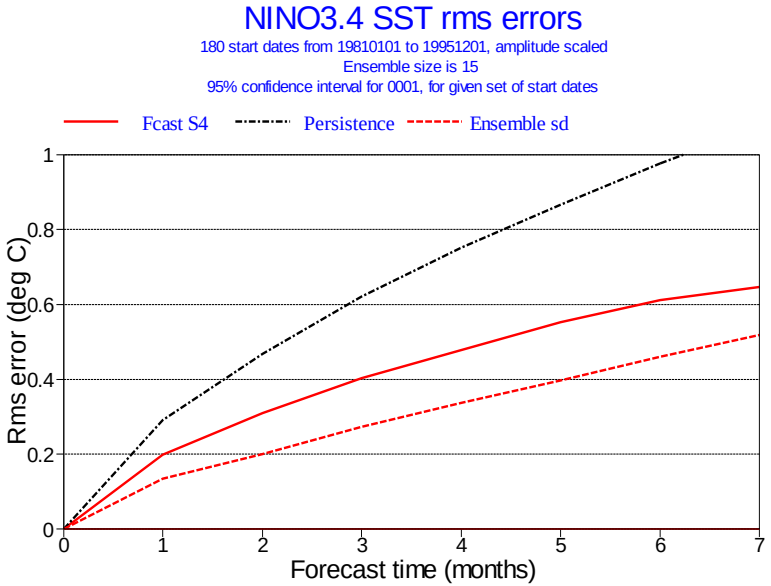
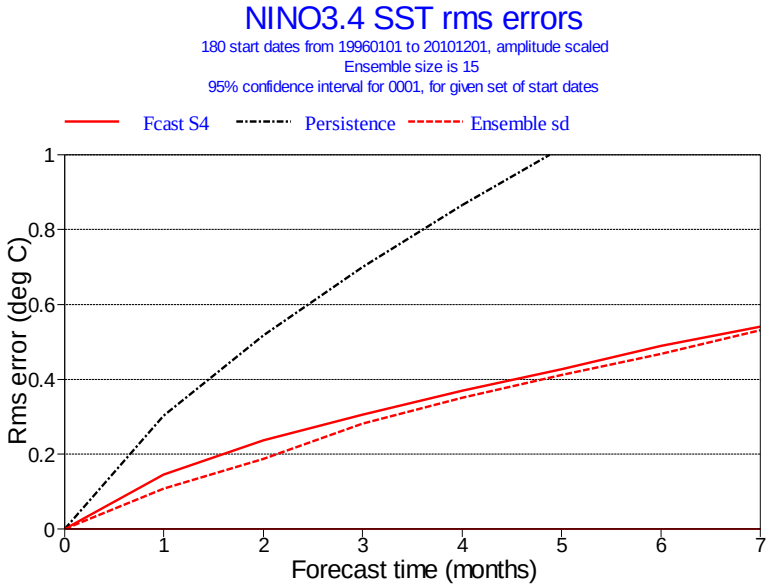
Recent Research

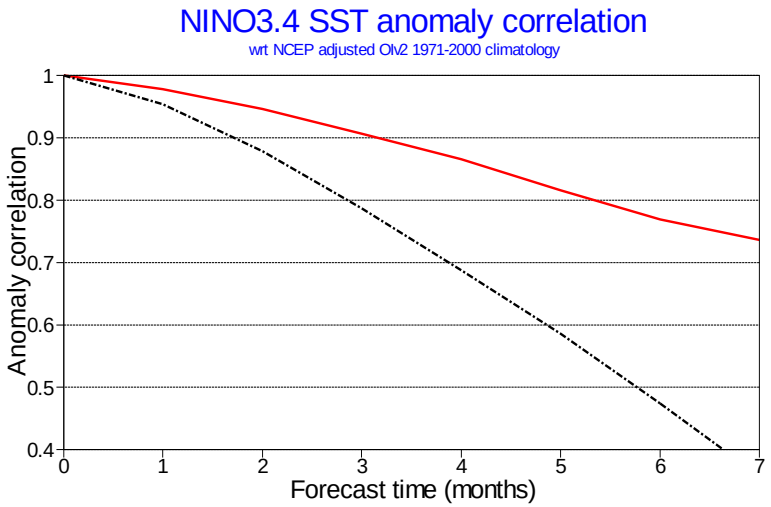
More recent ENSO forecasts are better ....

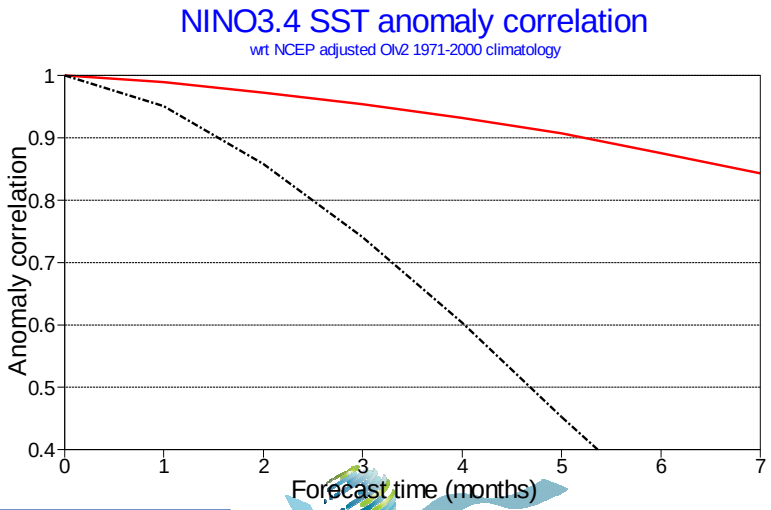




1981-1995

1996-2010





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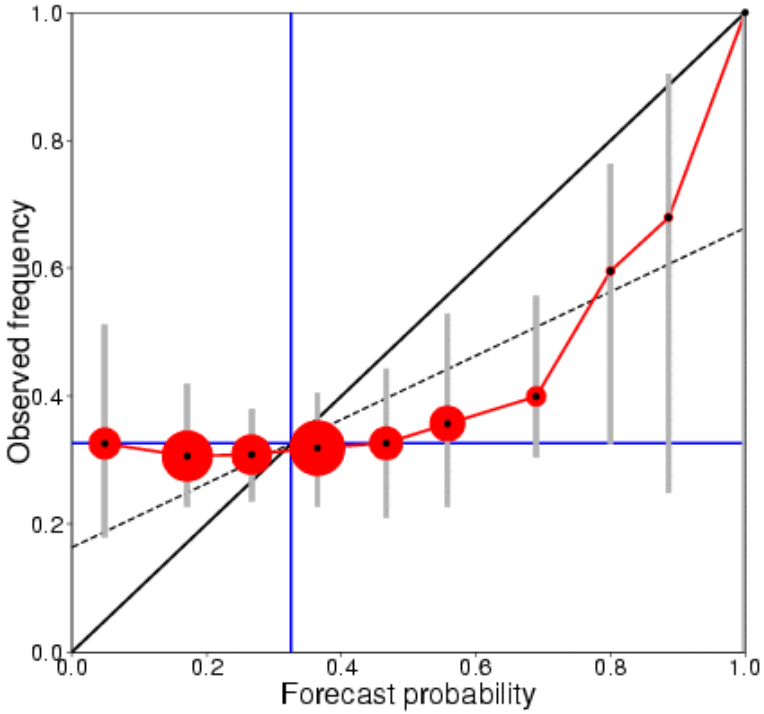
S4 extended hindcast set

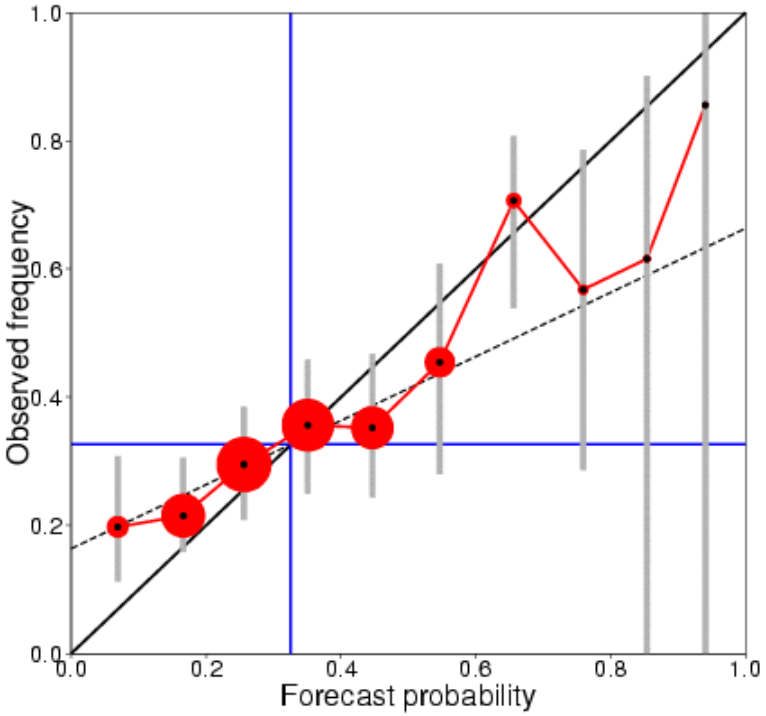
15 members

DJF Europe T2m>upper tercile
Re-forecasts from 1 Nov, 1981-2010
Reliability score: 0.902
ROC skill score: 0.06



51 members

DJF Europe T2m>upper tercile
Re-forecasts from 1 Nov, 1981-2010
Reliability score: 0.981
ROC skill score: 0.22



(Figures from Susanna Corti)

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ACC=0.61

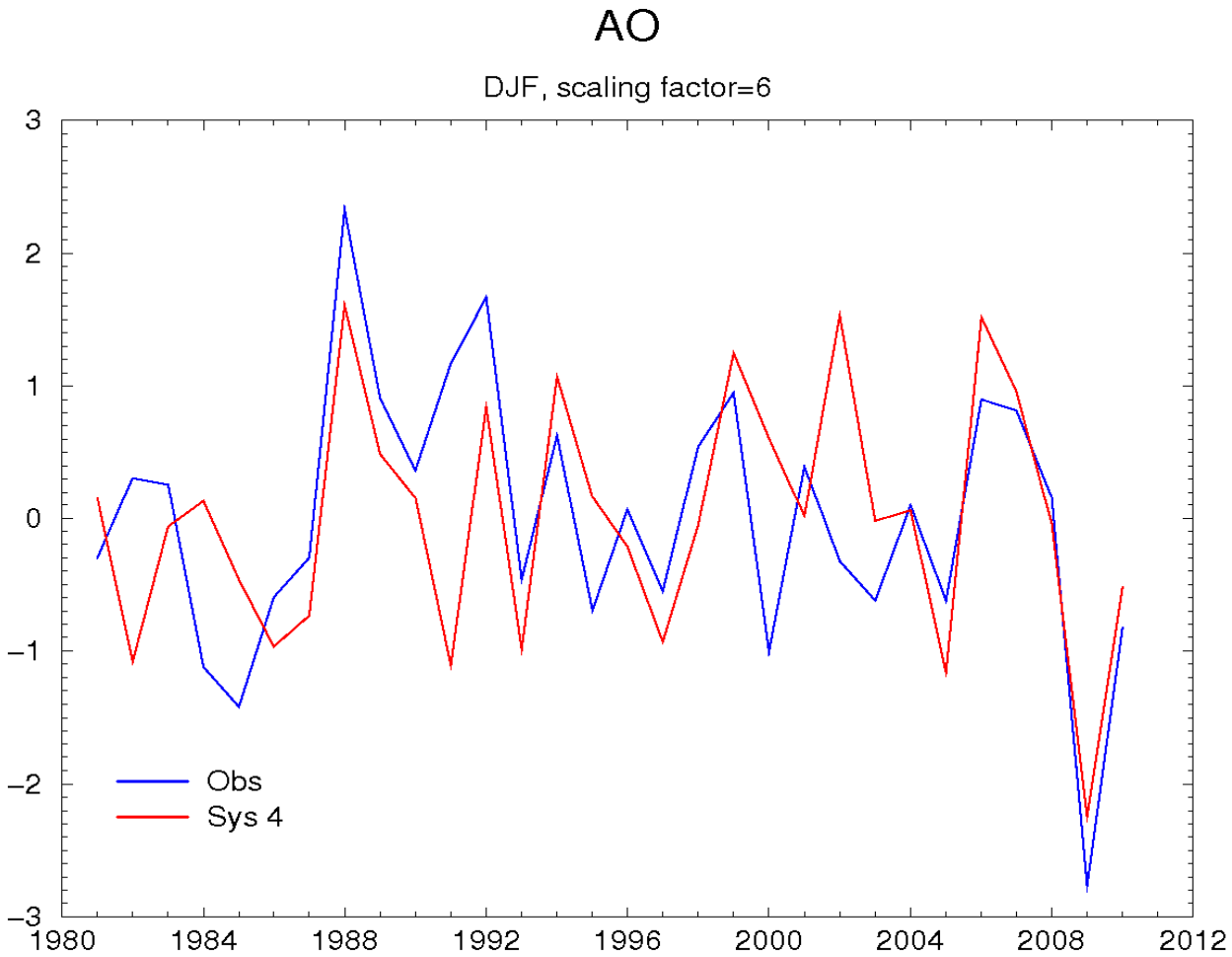

Fig. 1. The Arctic Oscillation Index for DJF, as analysed from ERAI (blue) and as predicted by the S4 ensemble mean from the 1st November (red). The S4 ensemble mean is **scaled by a factor of 6** to be of comparable amplitude to the observed index.

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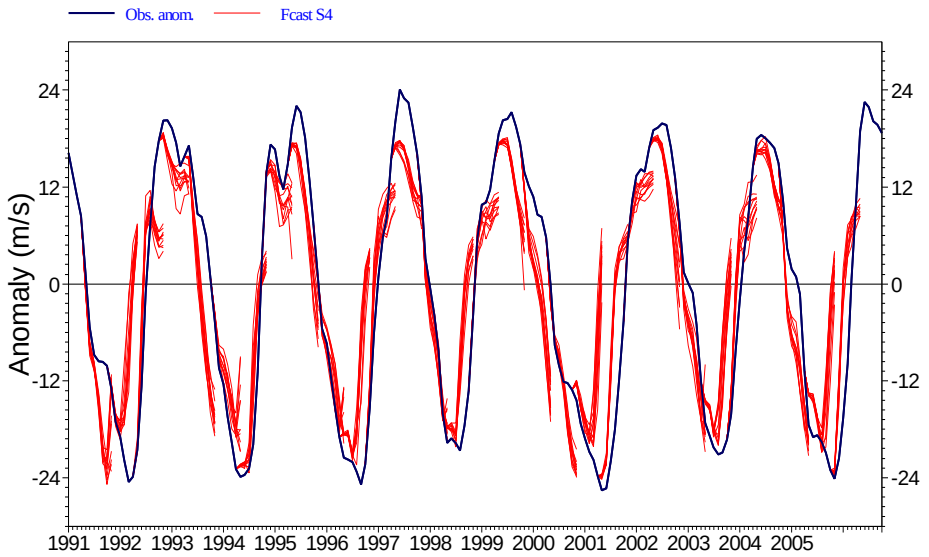
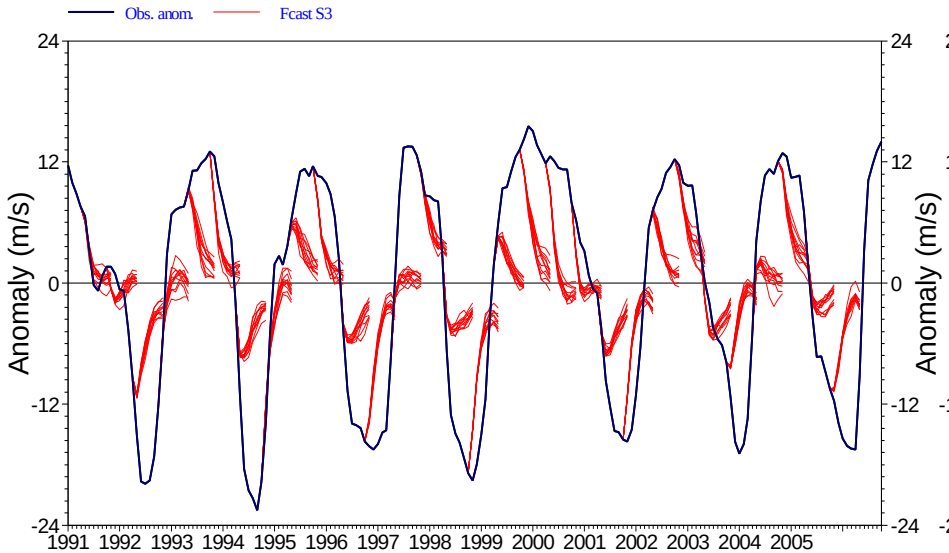
QBO

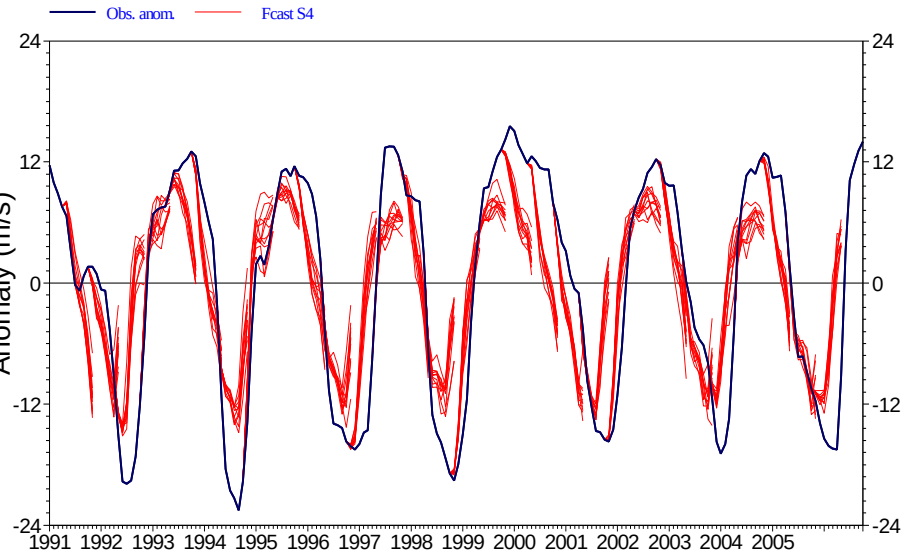
System 4



30hPa

System 3





50hPa

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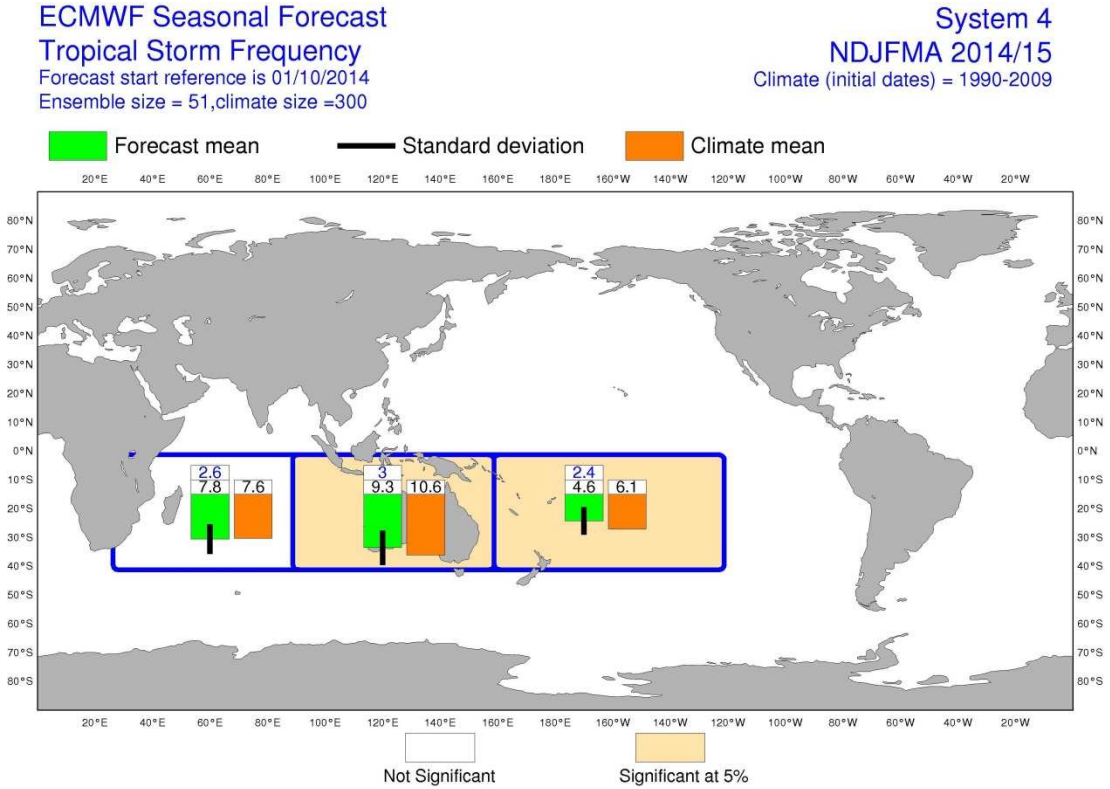
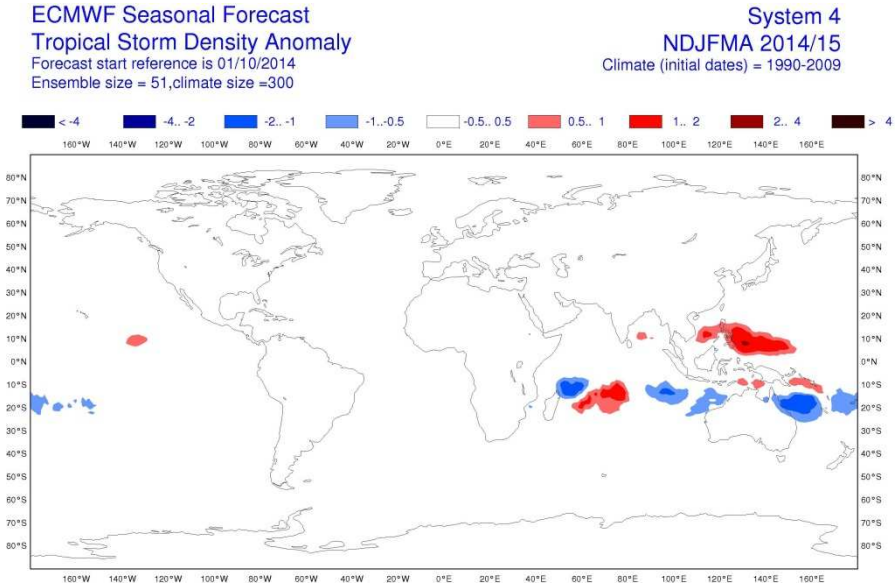
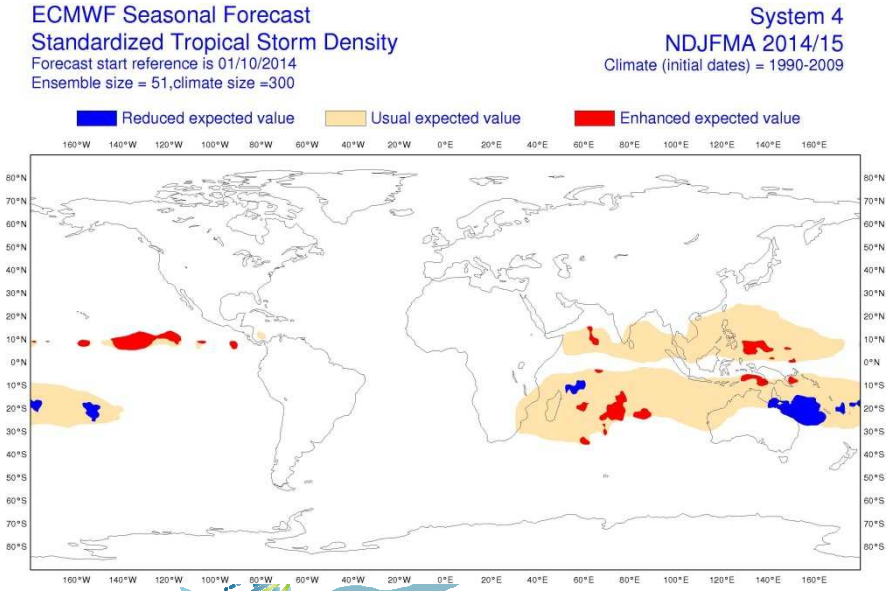
Tropical storm forecasts







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Forecasts for DJF 2014

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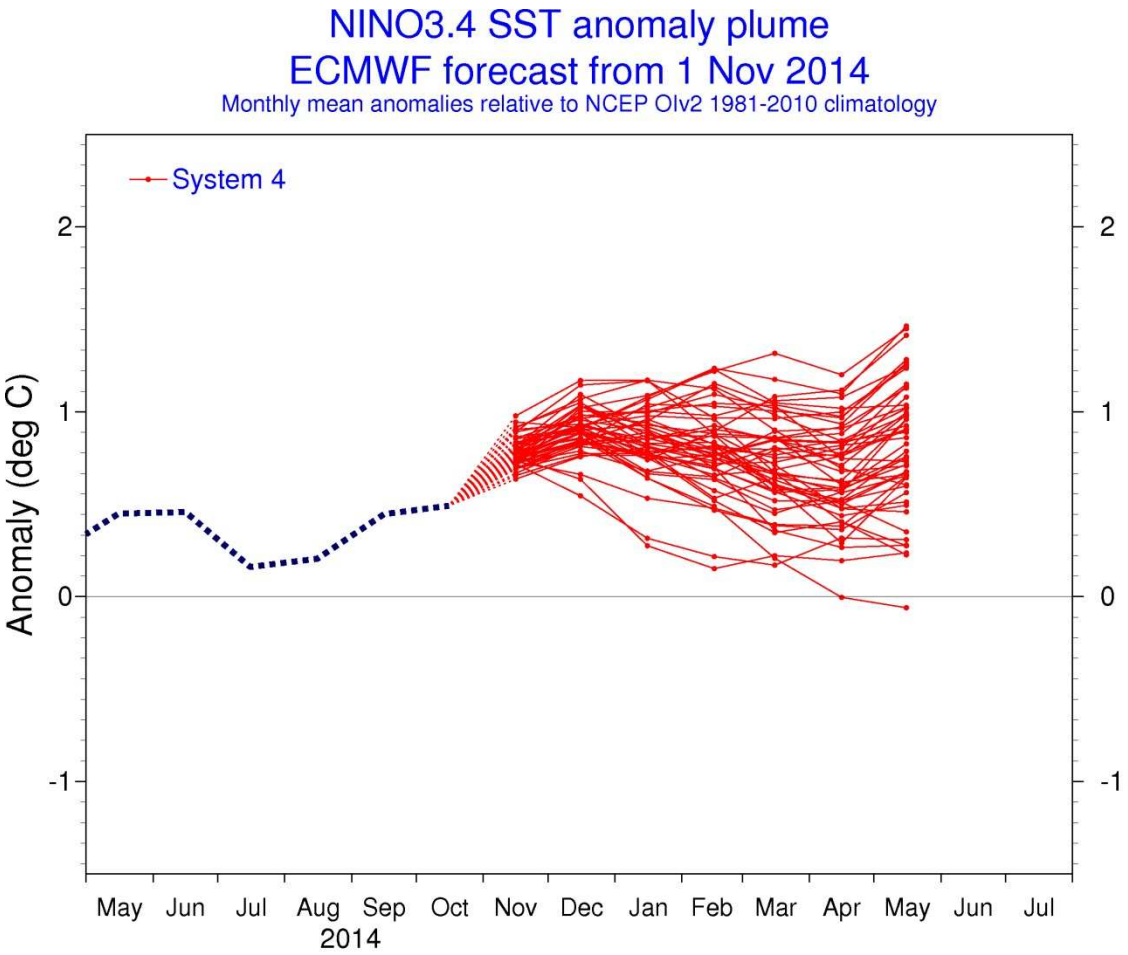
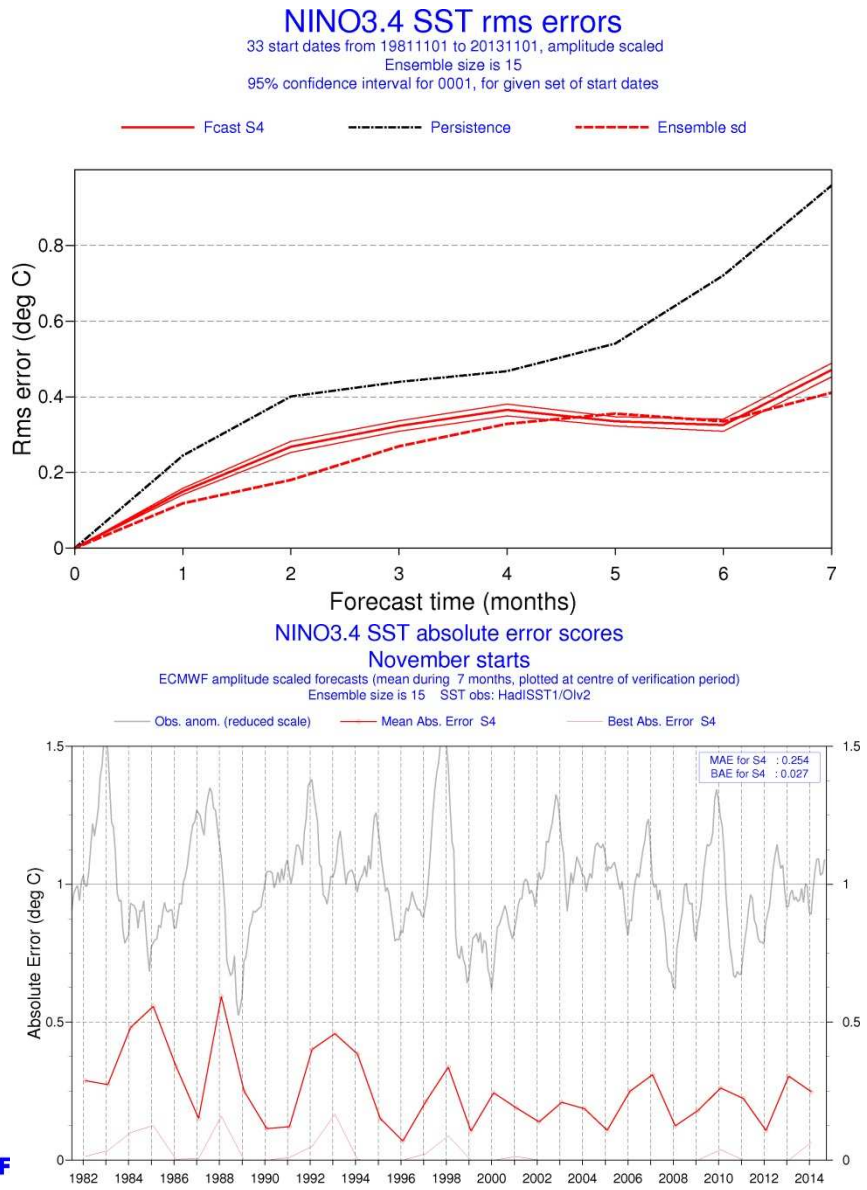
ECMWF forecast: ENSO





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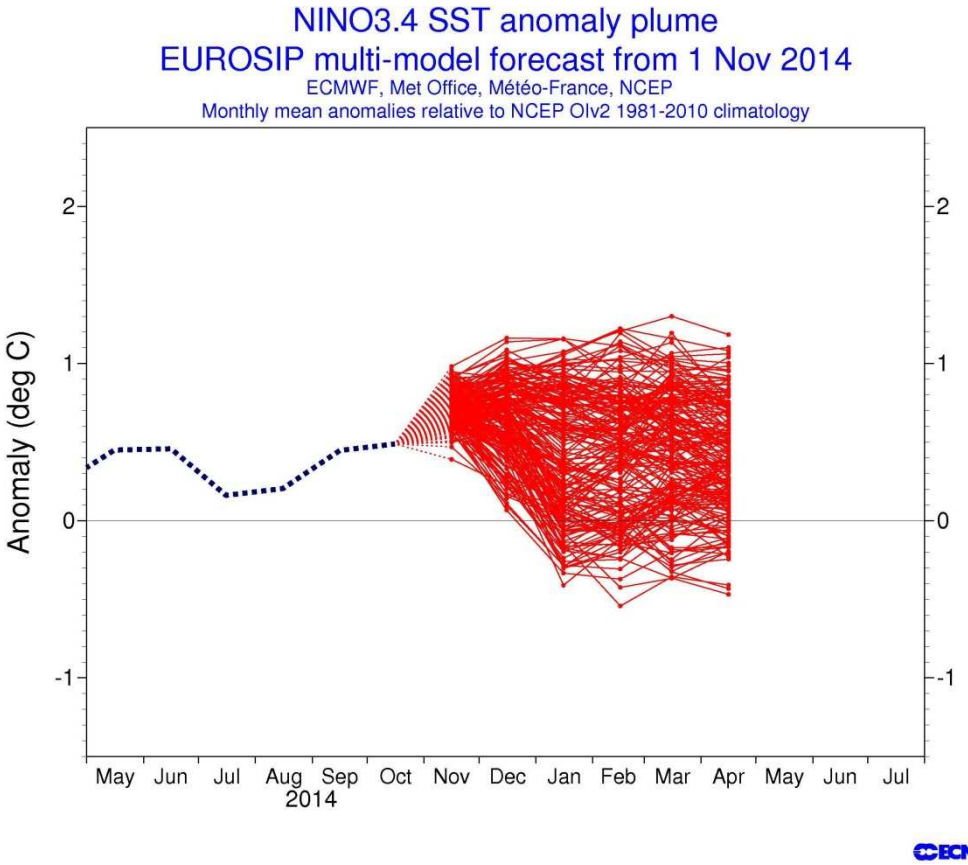
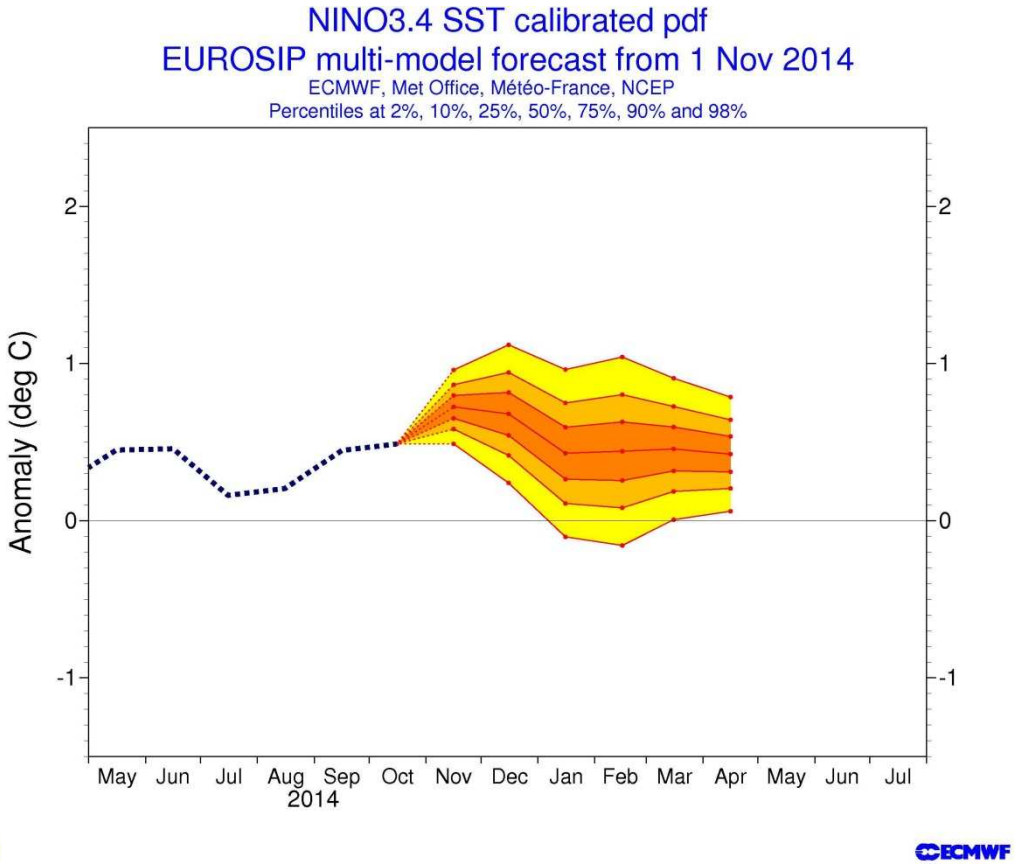
Nino 3.4 plume and p.d.f.





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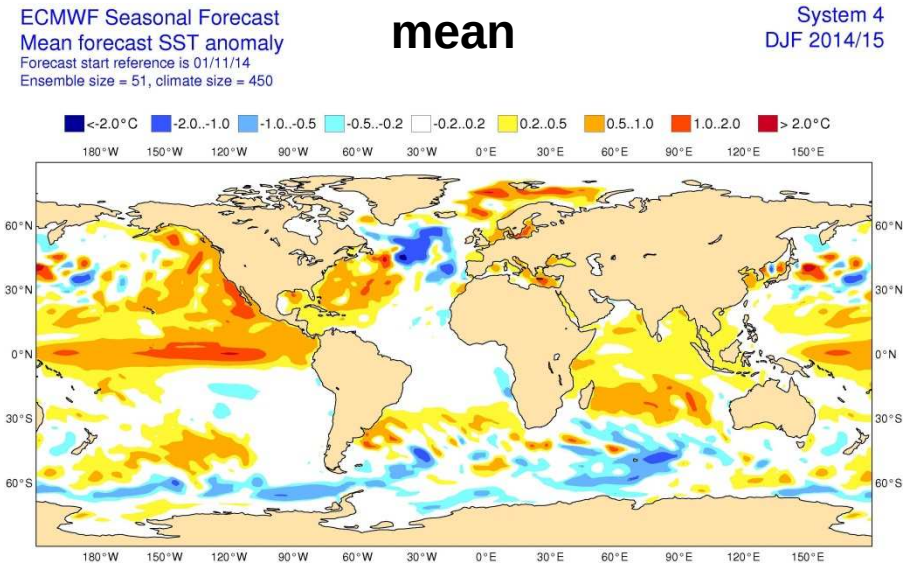
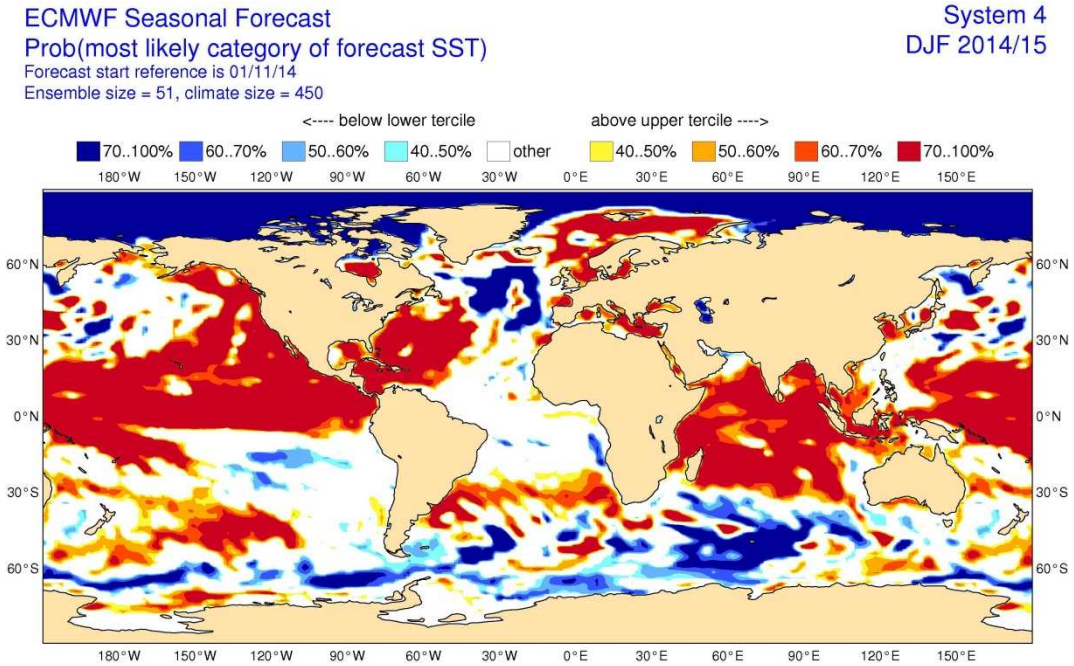
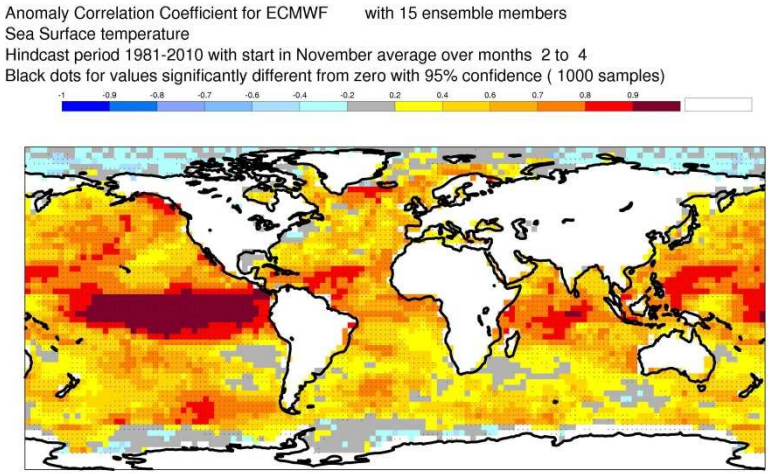
ECMWF forecast: DJF sst

Ensemble mean





Tercile probabilities



ACC skill (1981-2010)

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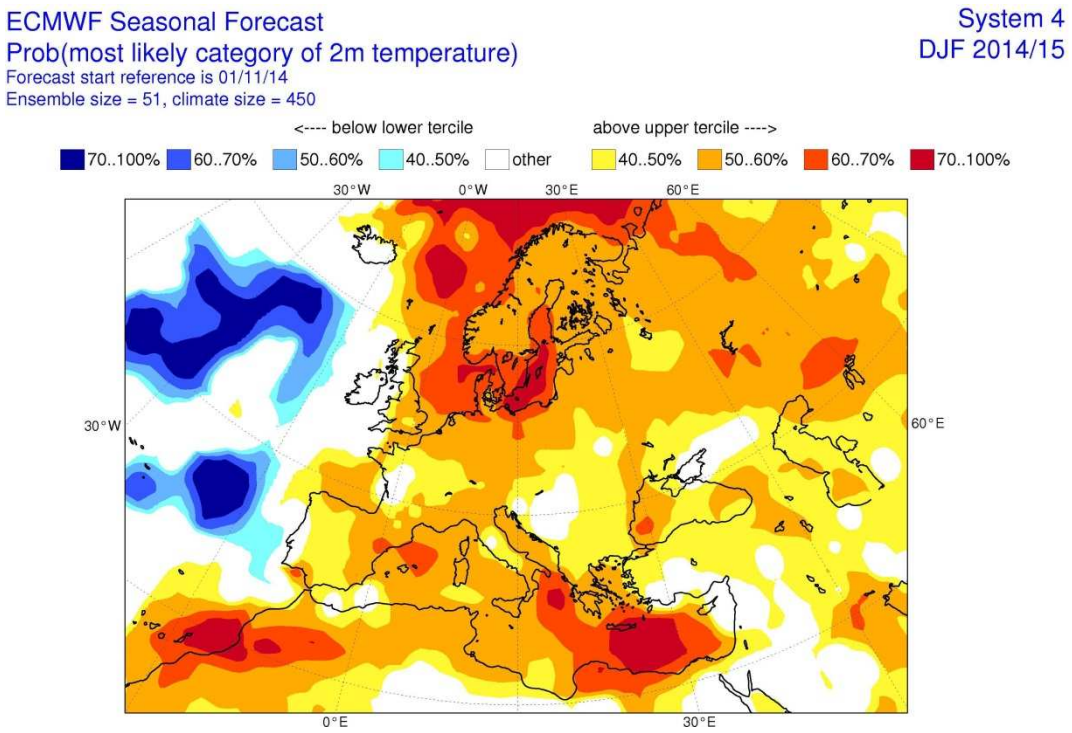
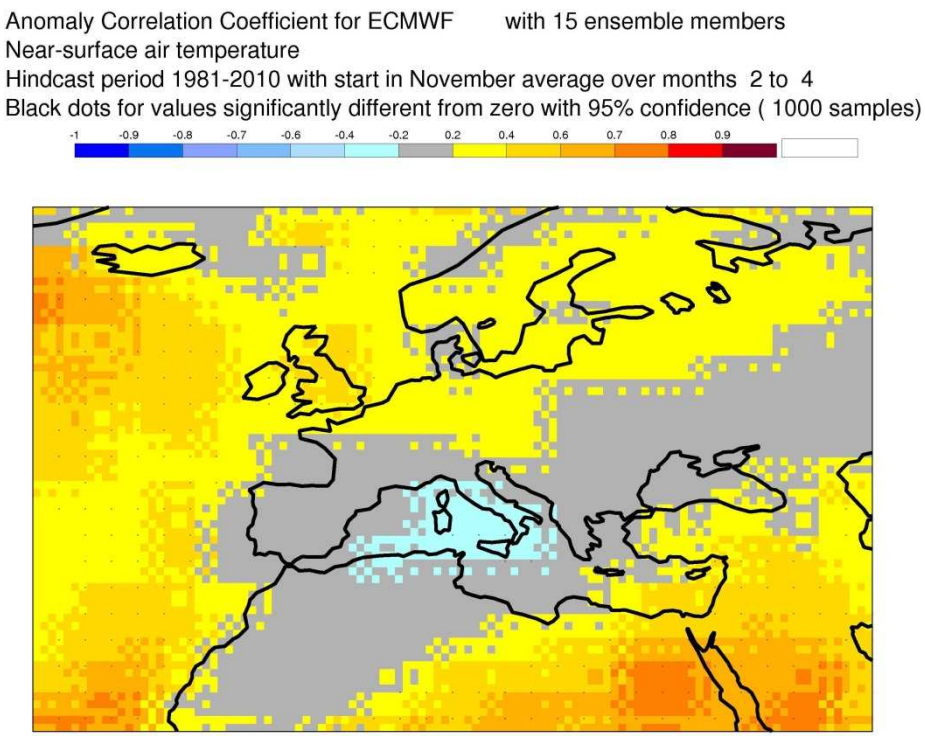
ECMWF forecast: DJF 2mT



Tercile probabilities



ACC skill (1981-2010)

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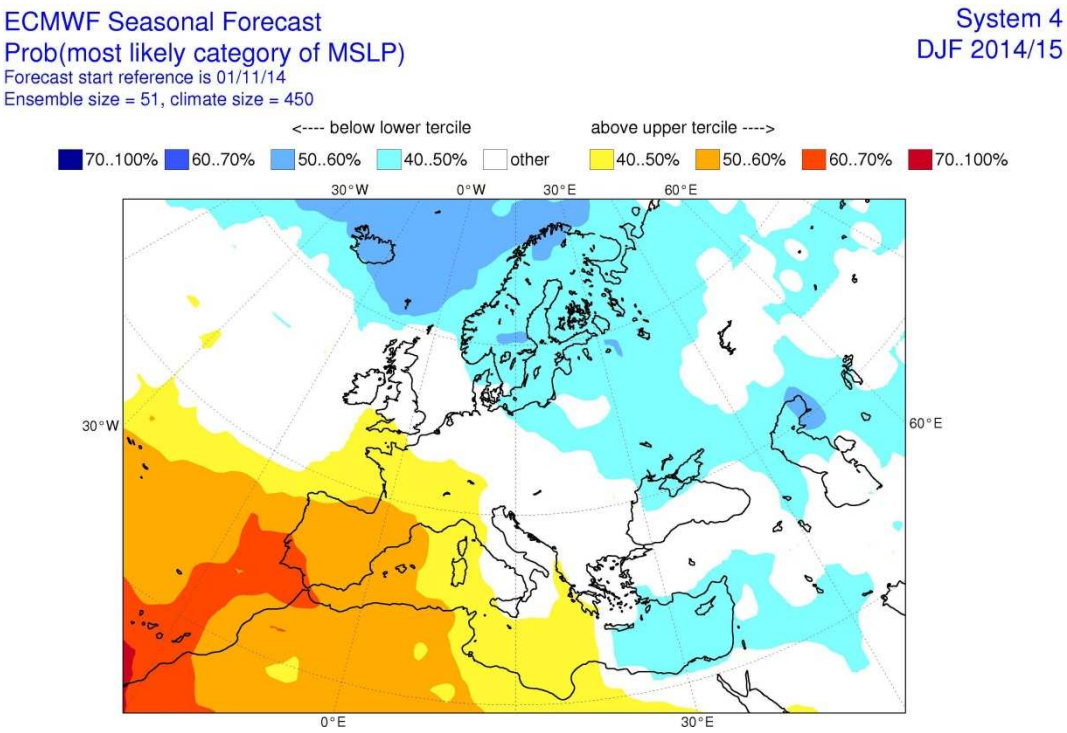
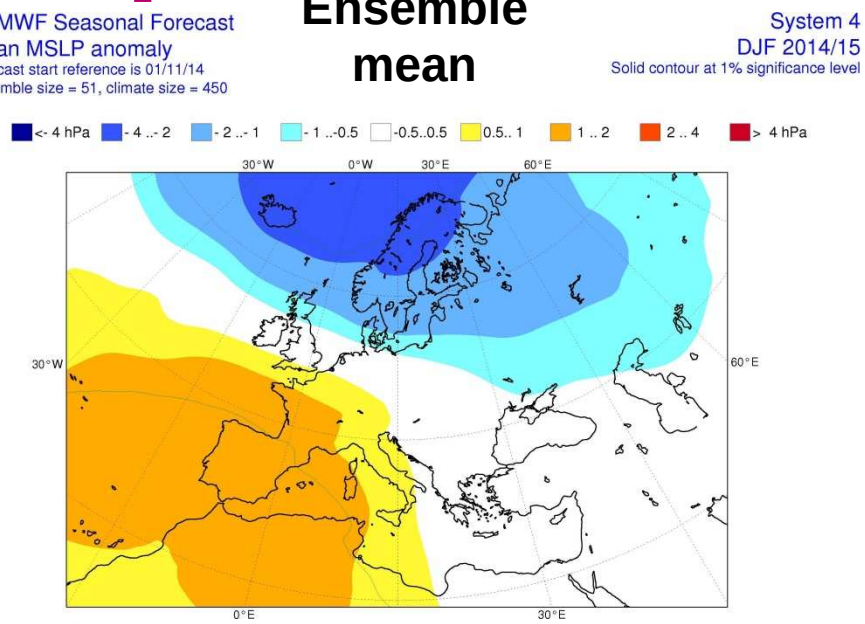
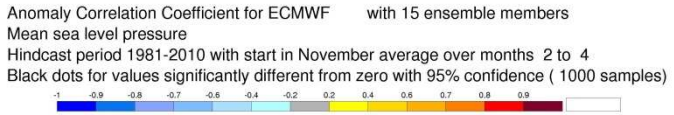
ECMWF forecast: DJF mslp

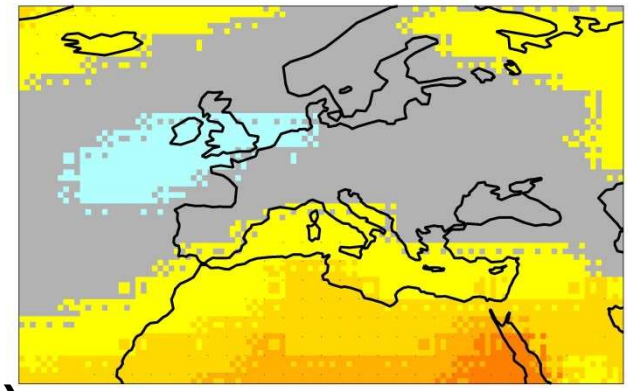


Tercile probabilities

Ensemble mean







ACC skill (1981-2010)

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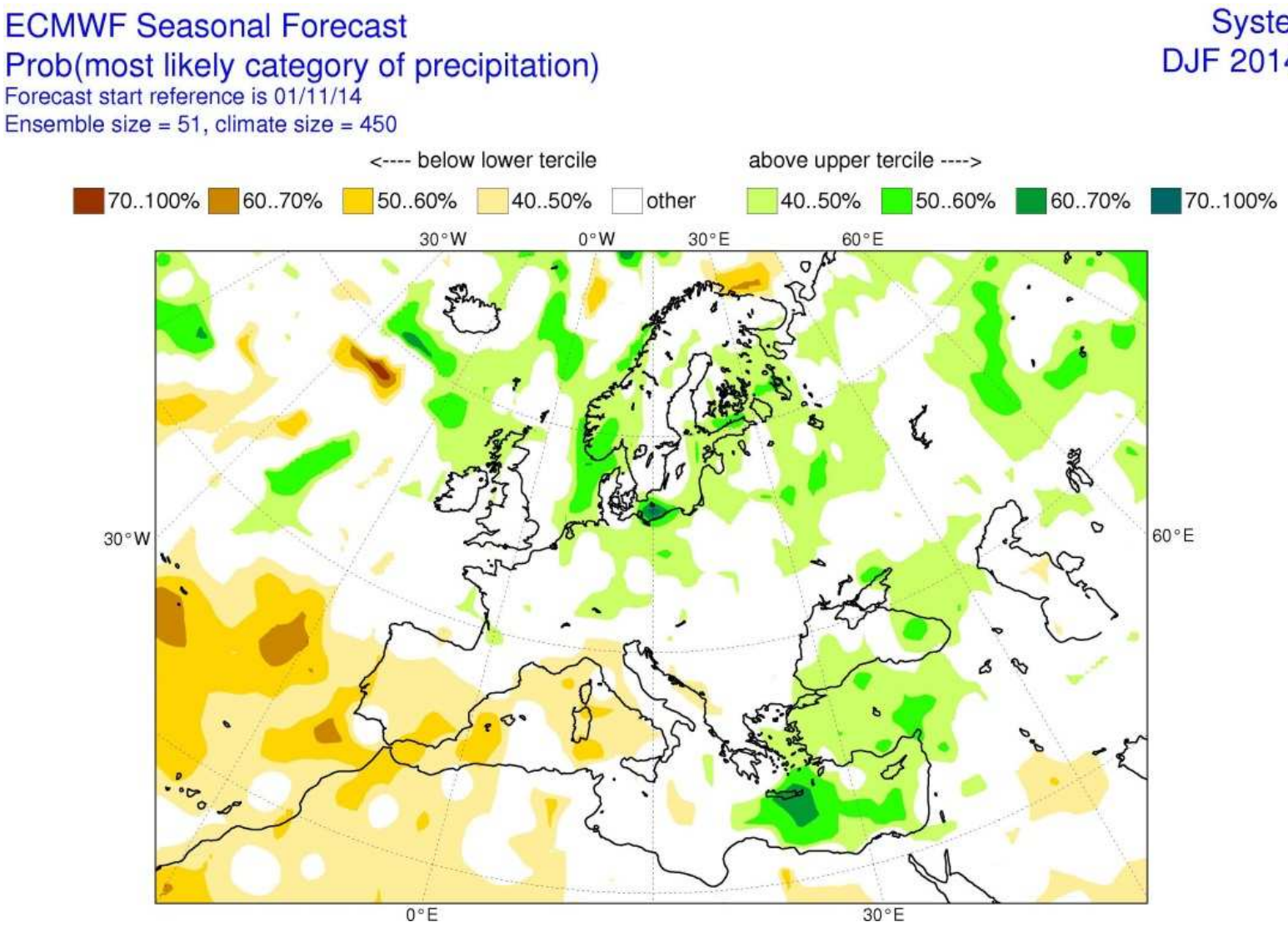
ECMWF forecast: DJF precip



Tercile probabilities

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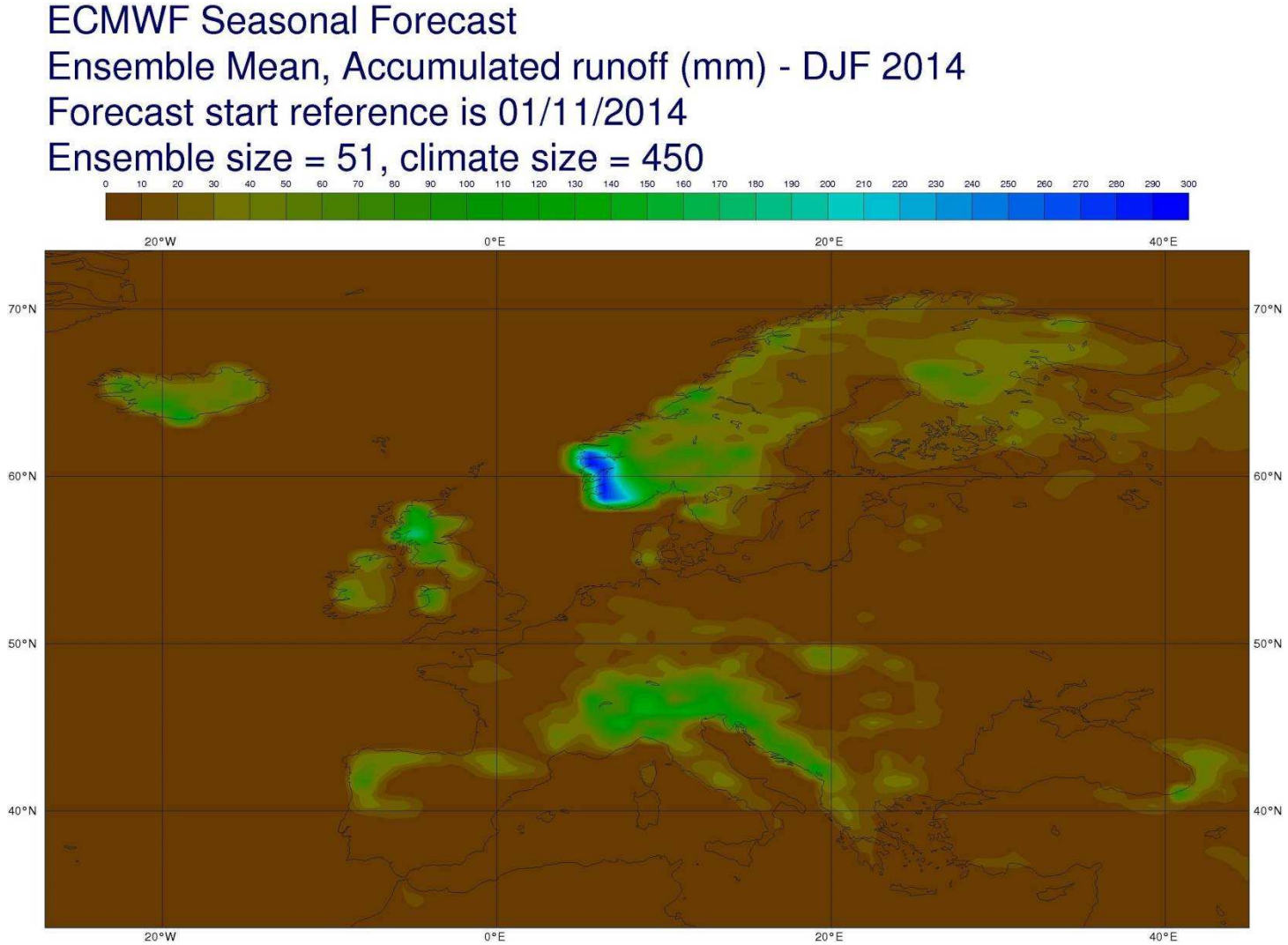
ECMWF forecast: DJF runoff



Ensemble mean

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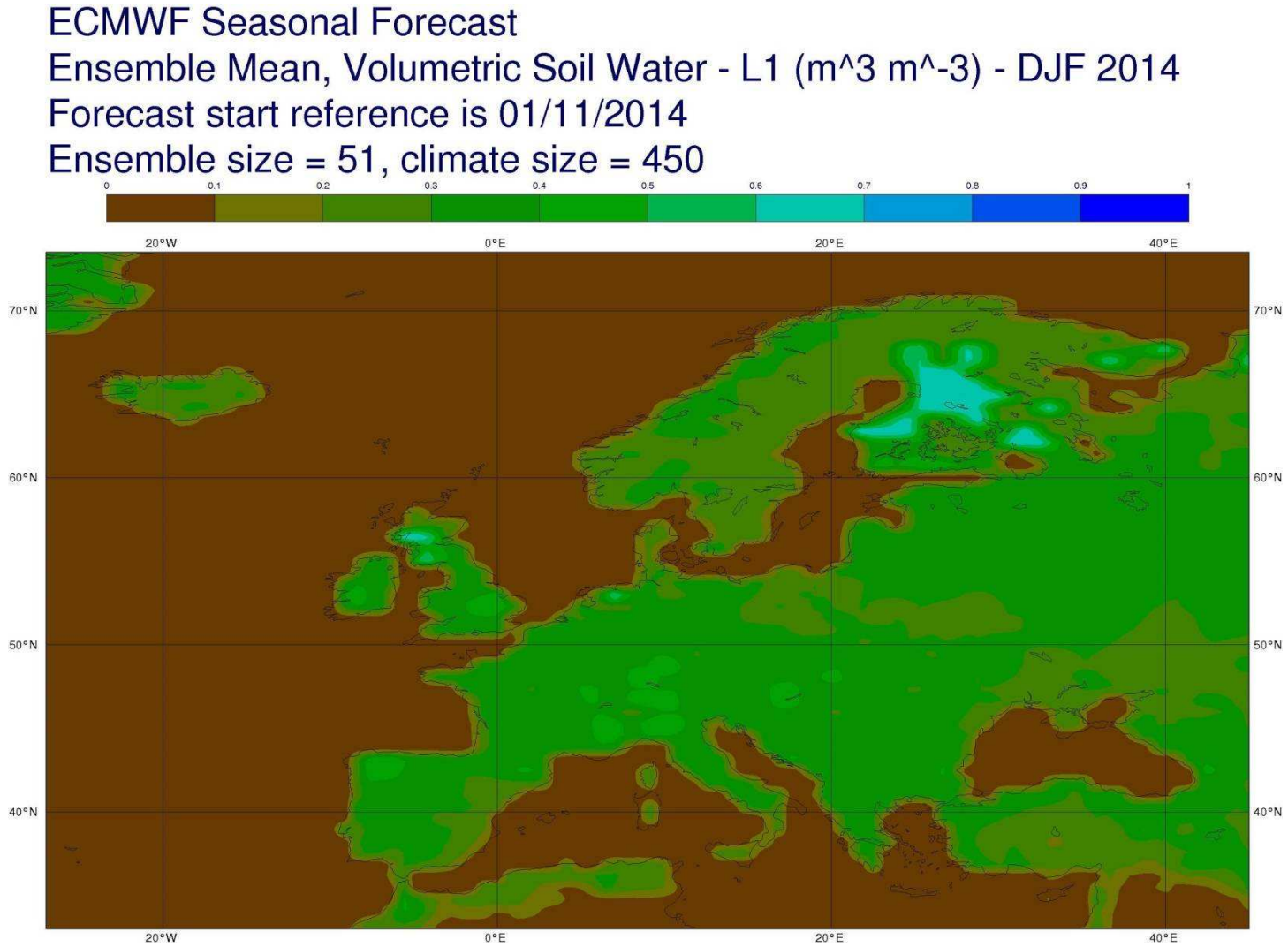
ECMWF forecast: DJF soil moisture



Ensemble mean

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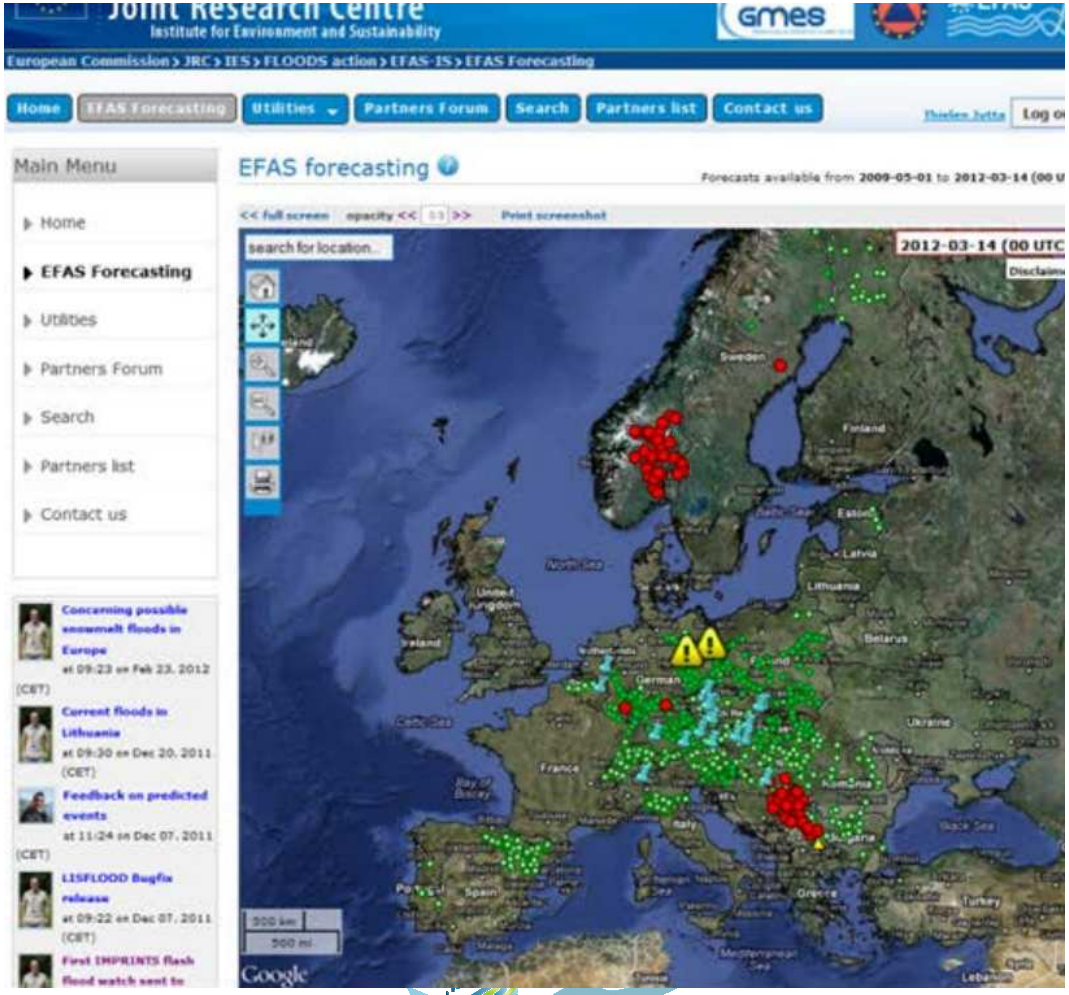
European Flood Awareness System (EFAS)

- http://www.ecmwf.int/en/research/projects/efas
- **https://www.efas.eu/**



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EUPORIAS

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Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

Project runs from Nov 2012 until Jan 2017

CERFACS

Met Office

Norwegian Meteorological Institute met.no

cnrs

VORTEX

UNIVERSITY OF OXFORD

ECMWF

INPE

Universität Hamburg

ENEA

Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

SMHI

CSIC

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

METEO FRANCE

Toujours un temps d'avance

MAX-PLANCK-GESELLSCHAFT

UNIVERSITY OF LEEDS

NILU

IC3

University of Reading

Royal Netherlands Meteorological Institute

Ministry of Infrastructure and the Environment

UNIVERSITY OF EXETER

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Euporias

- **What: “Prototypes” of stakeholder projects representing possible uses of seasonal forecasts (SFs)**
- **Why: To understand appreciation and use of SFs across Europe**
- **How: Extensive user survey (face-to-face interviews, web, etc.):**
  - Relatively few people/companies use SFs
    exceptions: energy, water, transport and health, larger companies
  - SFs mostly used as qualitative information/ background
  - Main problems: Low skill, low resolution, lack of accessibility
  - Wanted are T, precip, wind, solar radiation, humidity

→ See EUPORIAS report soon to come

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Goal is to improve on seasonal forecasting by looking at

Horizontal resolution

Stochastic representations

Empirical predictions

Forecast quality

Forecast visualisation & Outreach

Climate-vegetation representation

Ensemble generation

Calibration & combination

Stratosphere & radiative forcing

Land-surface initialisations

Pilot applications (cf. Euporias)

Local predictions (statistical & dynamical downscaling)

Sources of skill

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Copernicus Climate Change Service (C3S)

Goals:

•informing policy development to protect citizens from climate-related hazards such as high-impact weather events;

•improving planning of mitigation and adaptation practices for key human and societal activities;

•promoting the development of new services for the benefit of society.

•**More info:**

http://www.ecmwf.int/en/about/what-we-do/copernicus/copernicus-climate-change-service

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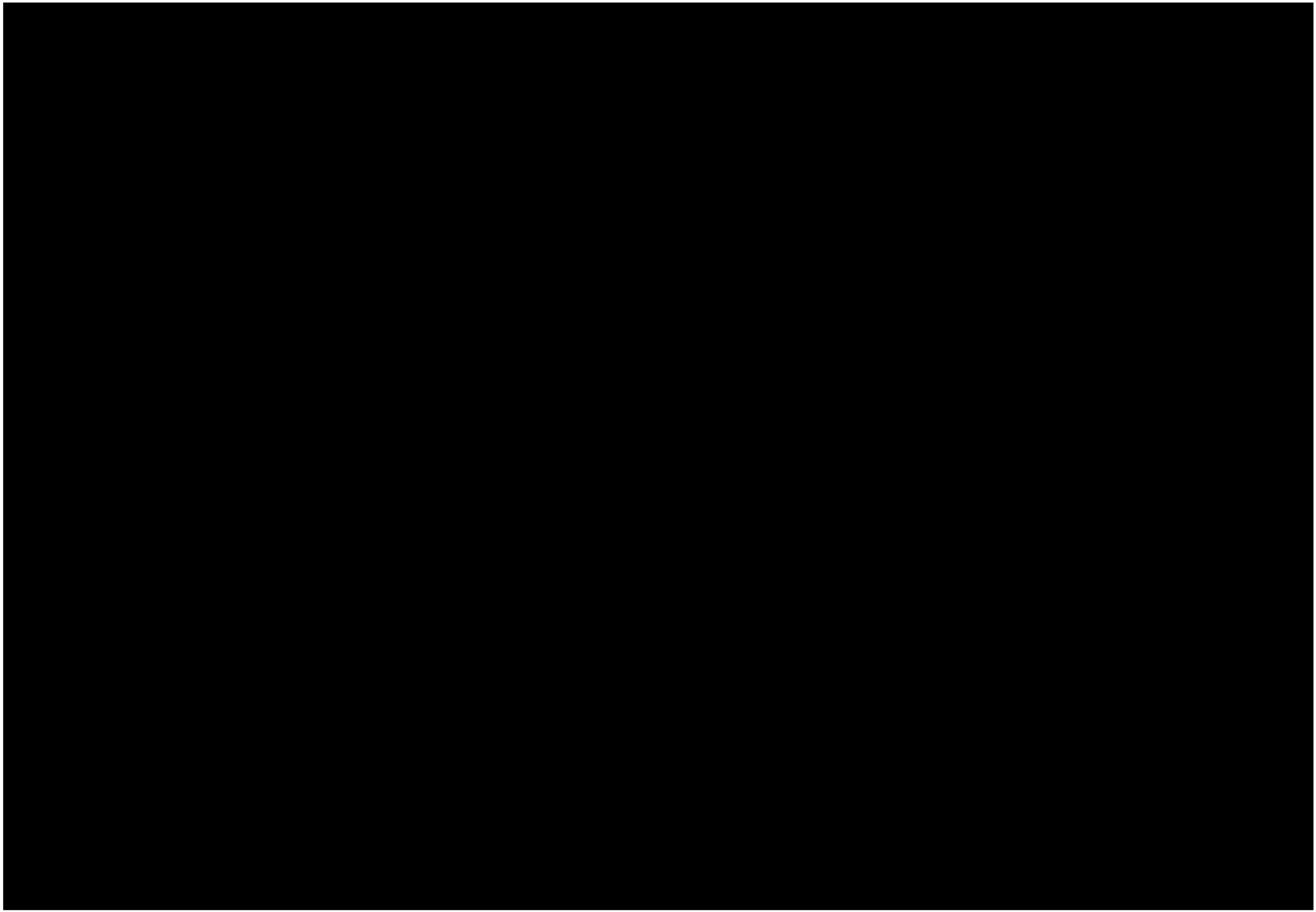
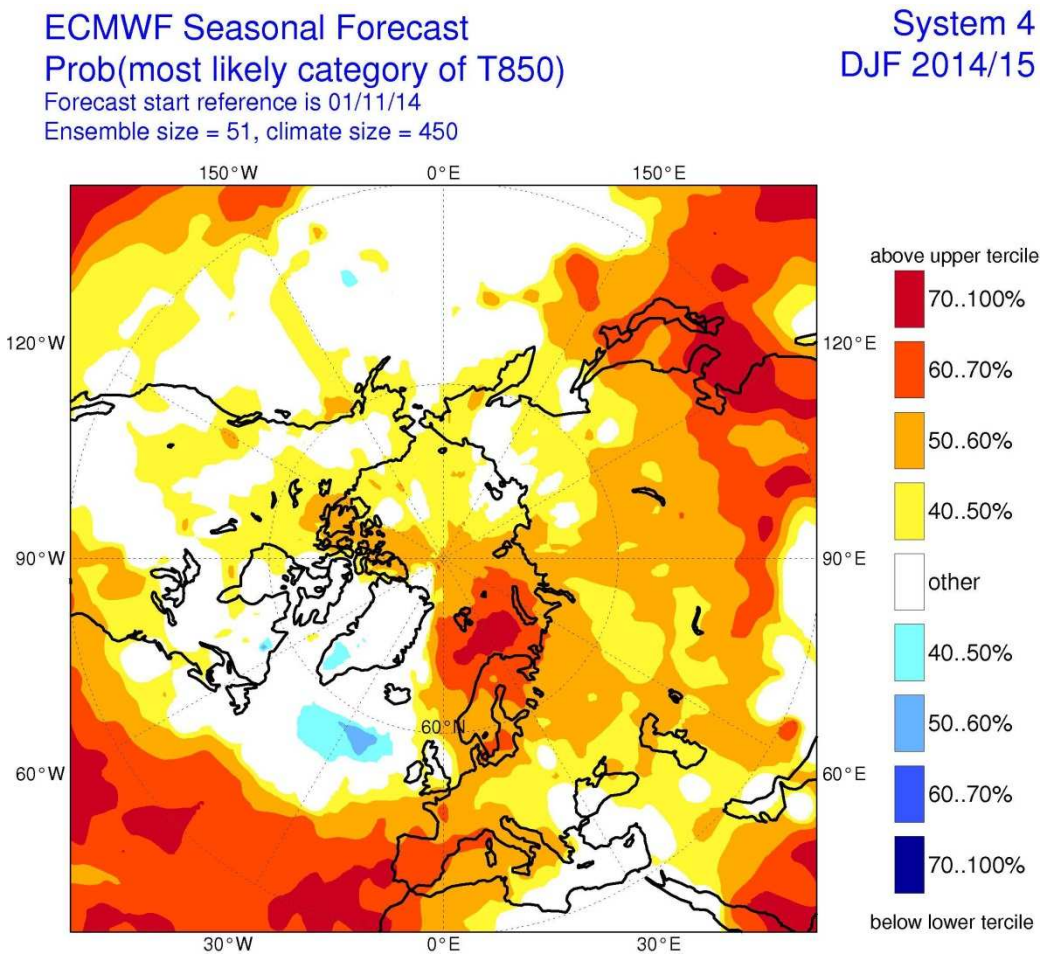
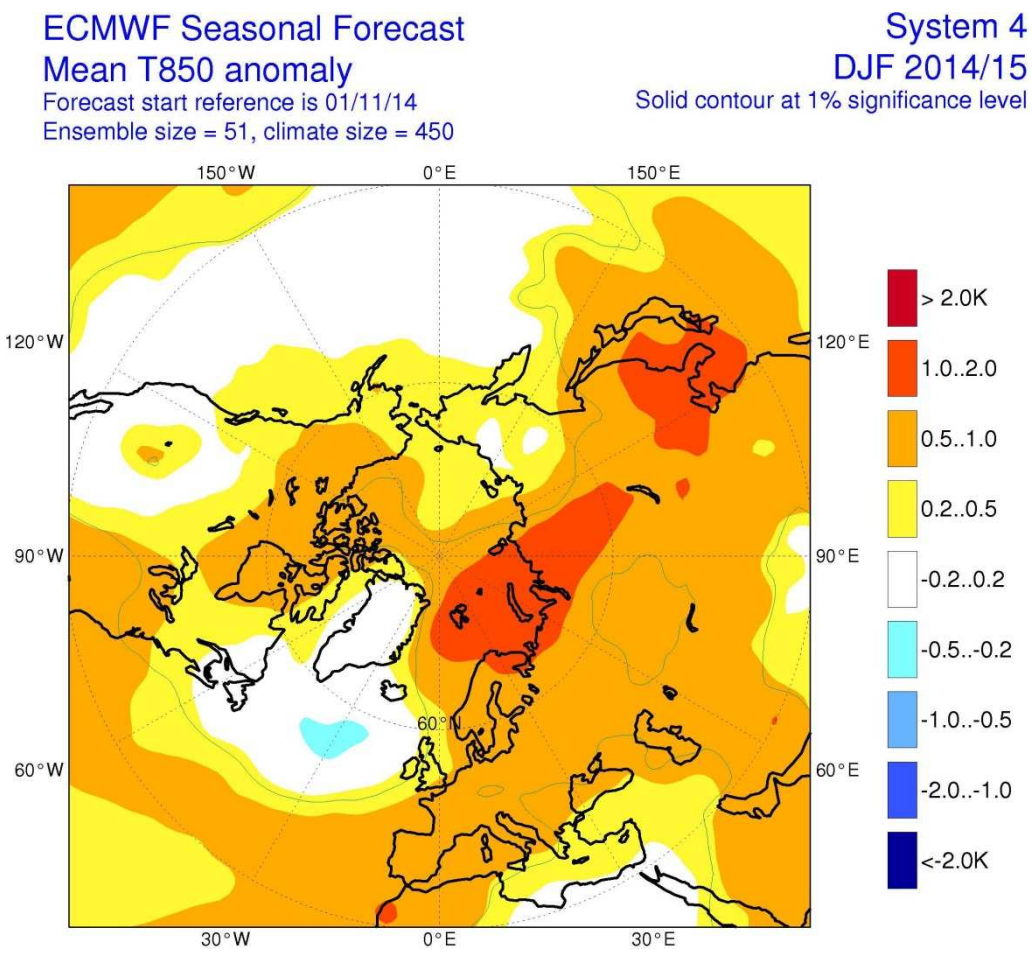


ECMWF forecast: DJF T850hPa



Tercile probabilities



Ensemble mean anomaly

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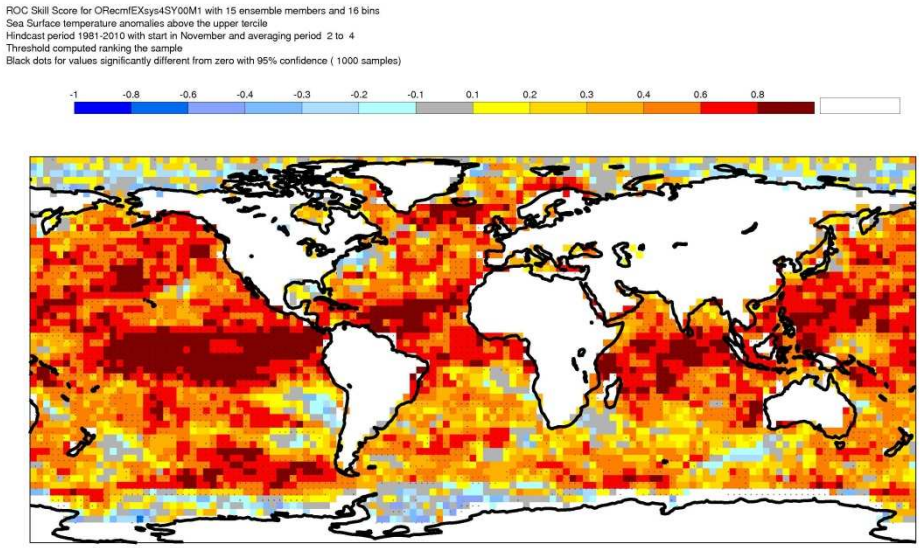
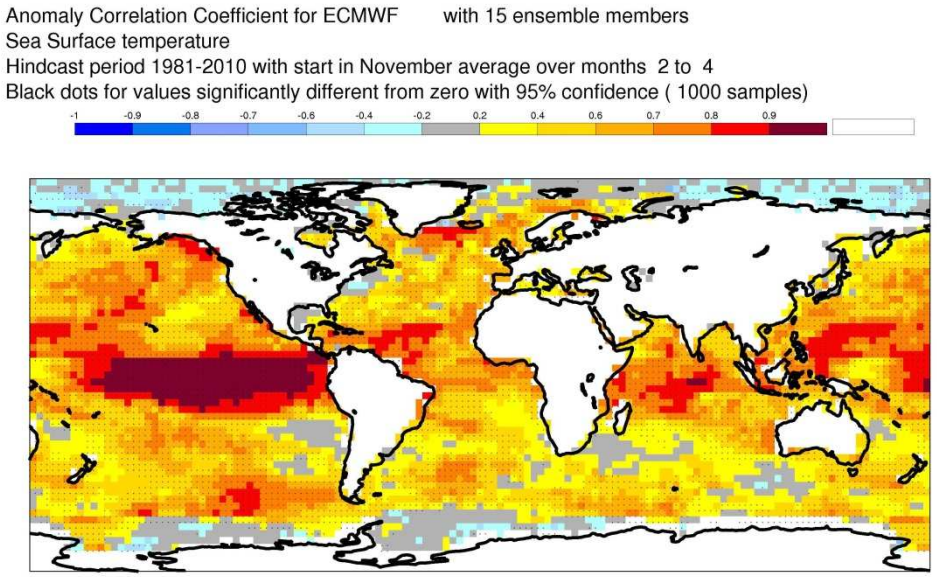
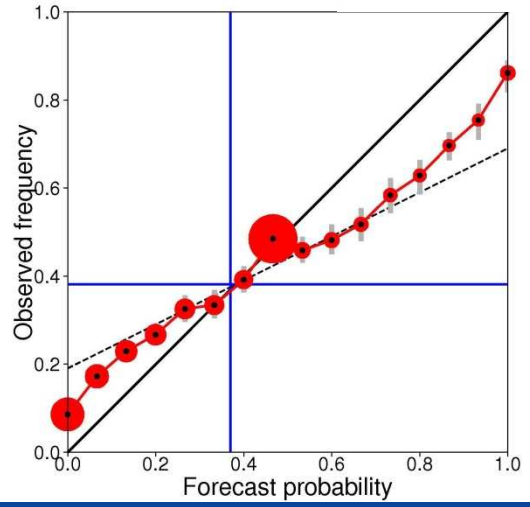
ECMWF forecast: DJF sst





ROC skill scores

ACC skill (1981-2010)



reliability

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