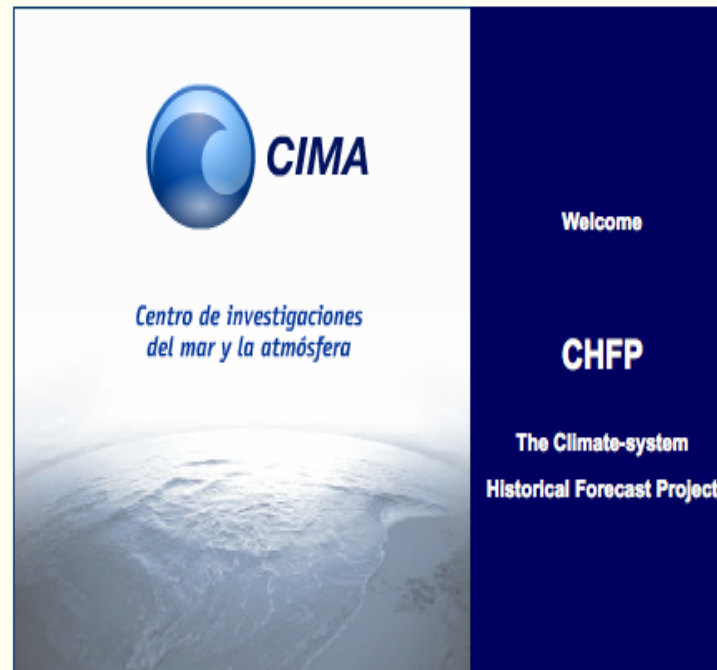# WGSIP
Working Group on Seasonal to Interannual Prediction

- <u>Seasonal</u> activities
  - Climate-system Historical Forecast Project (CHFP)
  - GLACE (Led by R. Koster)
  - Ice-HFP (Led by D. Peterson)
  - Stratospheric HFP (Led by A. Scaife)
- <u>Decadal</u> activities
  - CMIP5 decadal predictions
  - Decadal Forecast Exchange (led by D. Smith)
- Prospects

CHFP
The **C**limate-system **H**istorical **F**orecast **P**roject
Page at
Centro de Investigaciones del Mar y la Atmosfera

C I M A
CONICET
U B A

What is CHFP | How to acces to CHFP data | CHFP dataserver at CIMA | Documents and Guides | Contact

WGSIP

HOME
Data Server LOGIN

- 8 models
- Few users
- *Kirtman et al. (in preparation)*
- Training?
- More hindcasts?

CIMA

Centro de investigaciones del mar y la atmósfera

Welcome

CHFP

The Climate-system
Historical Forecast Project

http://chfps.cima.fcen.uba.ar/

CIMA CHFP Data Server

Global Land Atmosphere Coupling Expt

Randy Koster, S. Seneviratne, B. Van den Hurk, etc…

11 AGCMs + 1 OAGCM

2-month hindcasts initialized on Day 1 & 15 of each month (April to August)
x 10 years (1986-1995)
x 10 members

2 series: realistic (e.g. GSWP-2) vs "random" land surface initialization

Focus on JJA (not boreal spring => look at initialisation of both soil moisture and snow mass?)

"Consensus" skill due to land initialization

Impact on potential predictability (r²ideal)   Impact on skill (r²)
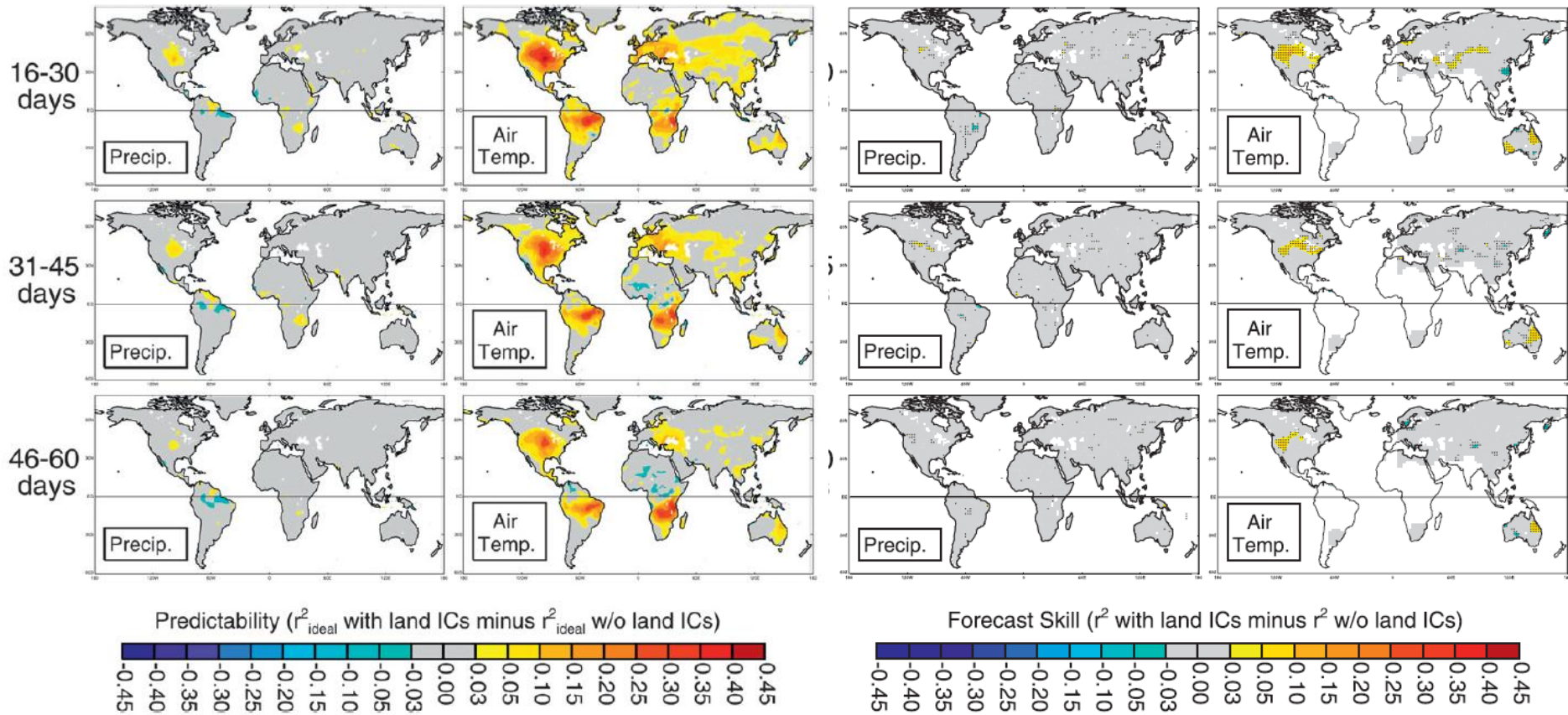
FIG. 3. Multimodel-consensus estimate of (left) precipitation and (right) air temperature predictability associated with soil moisture initialization—in essence a quantification of how one ensemble member in a given forecast reproduces the synthetic truth produced by the remaining ensemble members in that forecast: (top to bottom) all 15-day forecast periods.

2. Consensus (left) precipitation and (right) air temperature forecast skill (r^2 against tions for Series 1 minus that for Series 2) as a function of lead, considering (top to) all 15-day forecast periods during JJA. (See text for details.) Dots are shown where the results are statistically different from 0 at the 99% confidence level; white areas lack available validation data.

Koster et al. (2011)

Non-stationarity of the snow-AO relationship

21-yrs sliding correlations
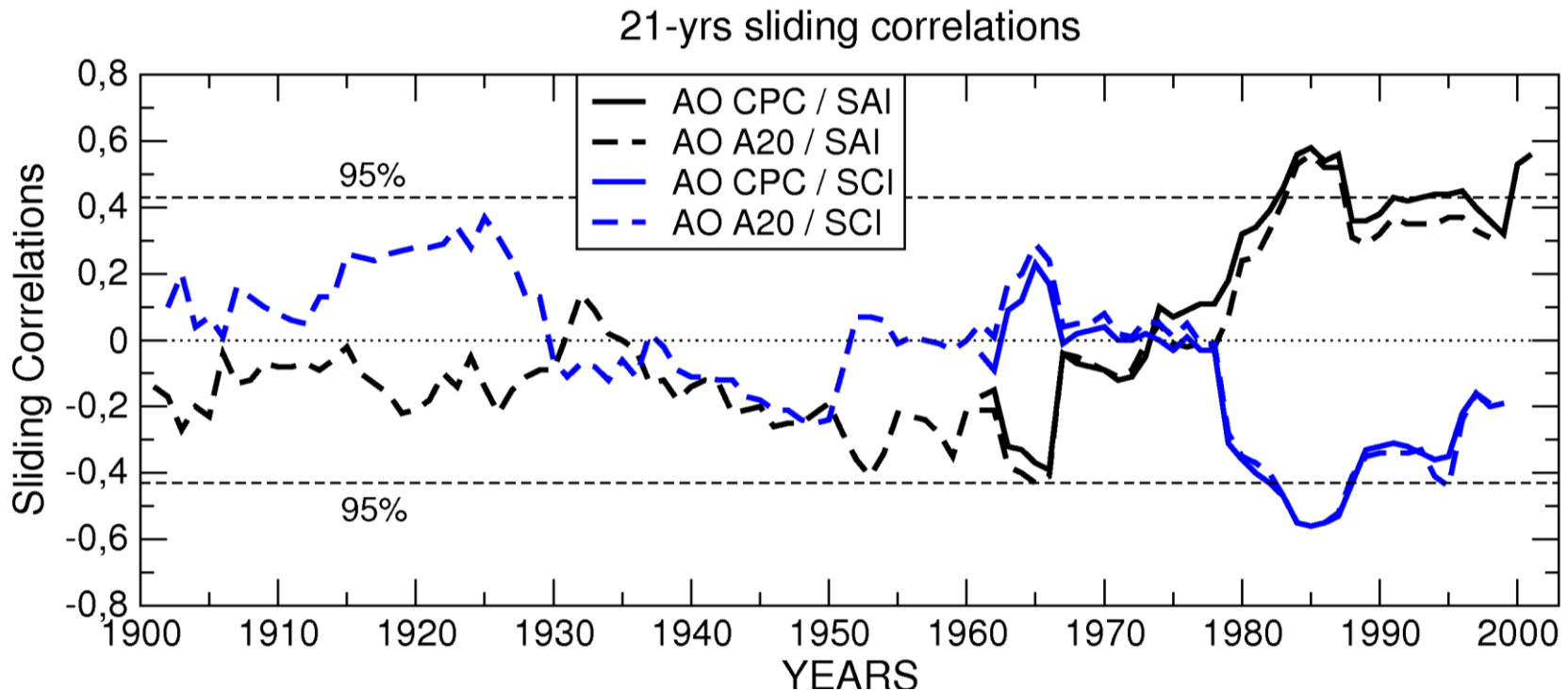
- Stochastic artefact or non-linear interactions with other potential forcings (including QBO)?
- Empirical forecasts must be considered with caution.

Peings et al. (submitted)

Summary

Models vary in their ability to extract forecast skill from land surface initialization (not shown);

In general, low skill for precipitation but moderate skill (in places) for temperature, even out to 2 months;

Land initialization impacts on skill increase dramatically when conditioned on the size of the initial local soil moisture anomaly;

No multi-model study about snow initialization.

Koster et al. (2011) The second phase of GLACE: soil moisture contributions to subseasonal forecast skill. J. Hydromet. 12, 805-822.

Ice Historical Forecast Project

Drew Peterson, D. Notz, S. Tietsche, M. Chevallier, W. Merryfield, A. Scaife

4 OAGCMs:
Max Planck Institute MPI-ESM (Tietsche and Notz)
UKMO GloSea4 (Arribas et al., 2011, 2012)
Météo-France CNRM CM5.1 (Chevallier et al., 2012)
CCCma CanSIPS (Merryfield et al., 2012)

- 9 members for 2007 and 1996
- with and without sea ice initialised with observed extents
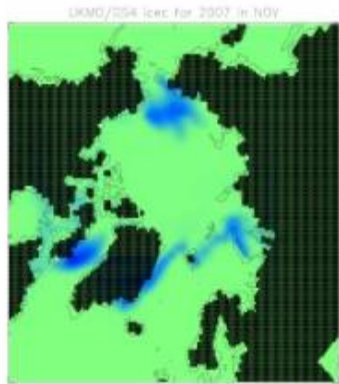- 1 November and 1 August initialisation for Winter and Autumn

Difference in Sea Ice due to Initialisation

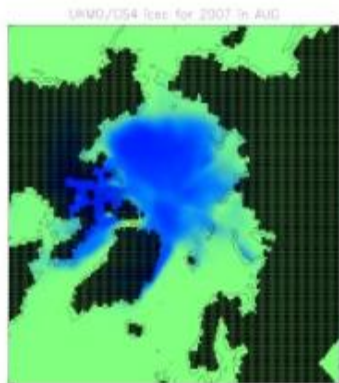**UKMO**   **MPI**   **MeteoFr**   **CCCma**

Nov

Aug
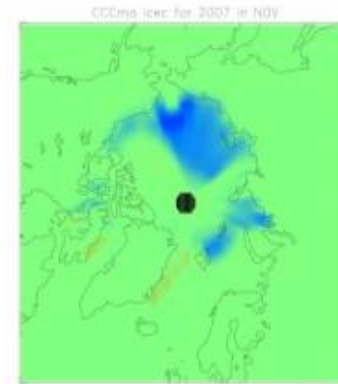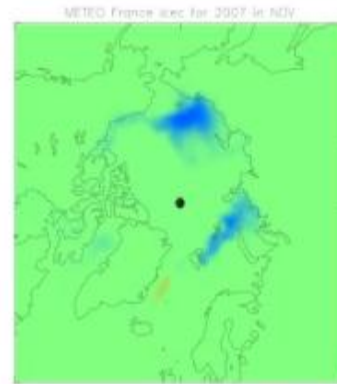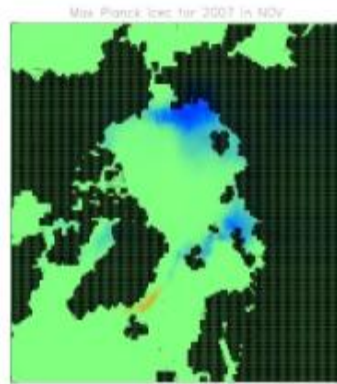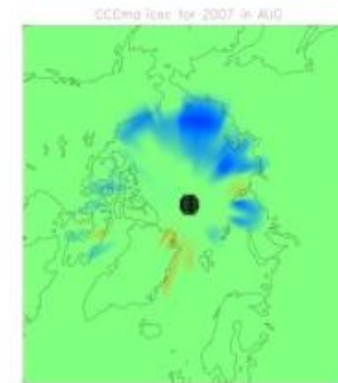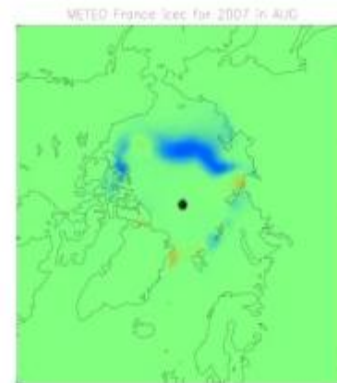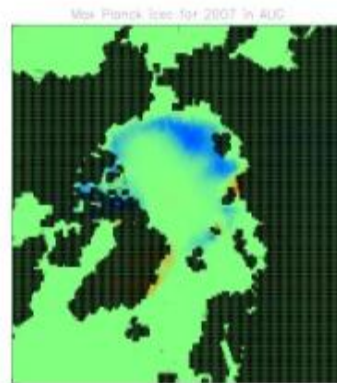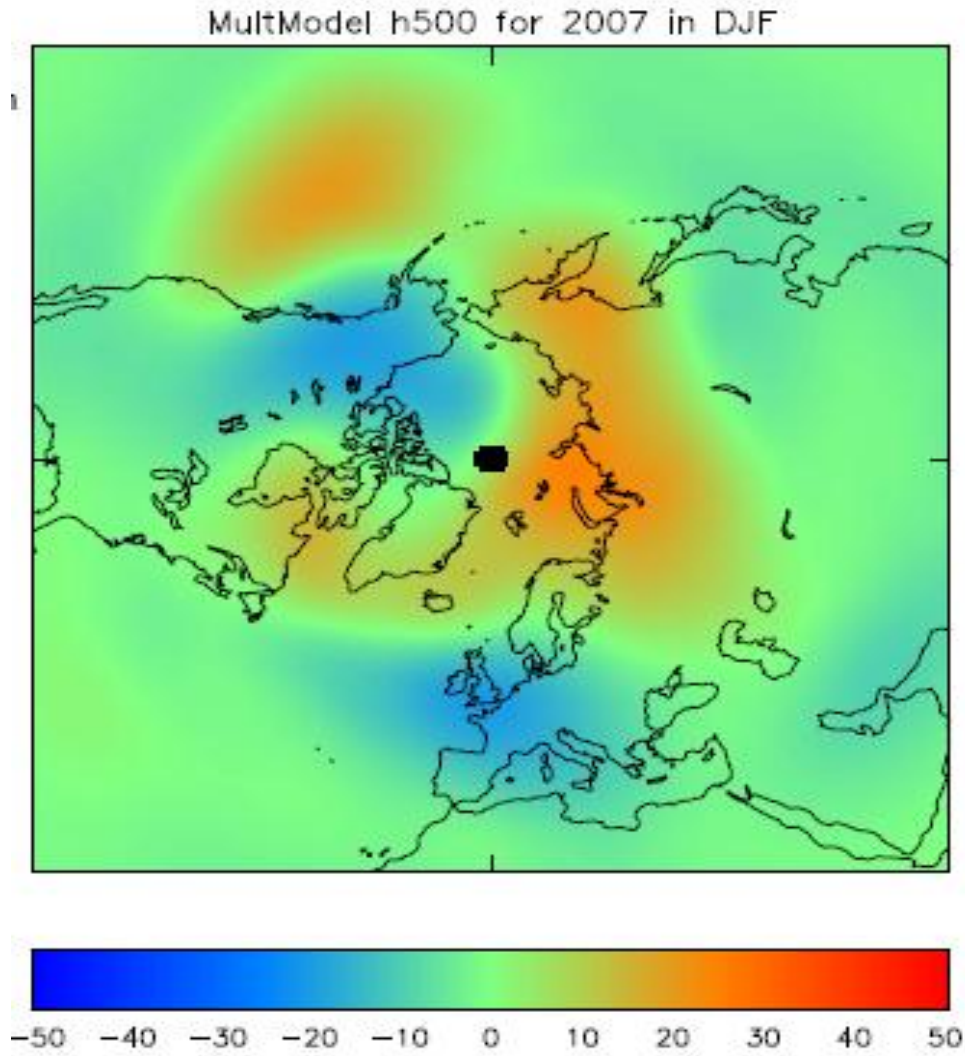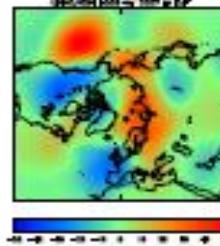
Peterson et al. (2012)

Winter Z500 Response

MultModel h500 for 2007 in DJF
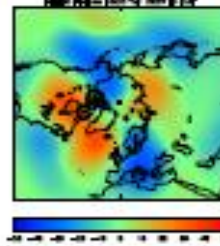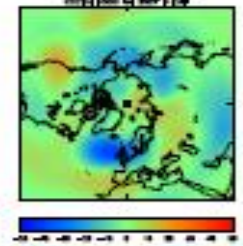
UKMO Max Planck

MétéoFrance CCCma

-50 -40 -30 -20 -10 0 10 20 30 40 50

Peterson et al. (2012)
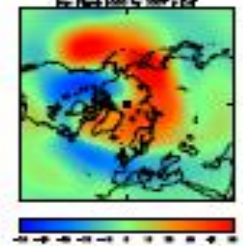
Summary

Multiple Models show similar effects of ice initialization;

Also similar to observed regressions;

Winter circulation has blocking pattern over Scandanavia, reduced European temperatures;

Also blocking pattern over west Pacific and reduced North American temperatures;

Autumn circulation has jet stream returning south over Europe;

Exact location varies with model.

Peterson et al. 2012: The Effects of Sea Ice initialisation on Seasonal Forecasts – the WGSIP IceHFP Project (in preparation)

Stratosphere Historical Forecast Project

## **Amy Butler** + WGSIP members

WGSIP-SPARC initiative

High Top Hindcasts (parallel to CHFP)

4 extended models with a better represented stratosphere (UKMO, Météo-France, CCCMA, NCEP)

- 2 seasons (DJF and JJA)

- 4-month lead time (1st November & 1st May start dates)

- Hindcast period: 1989 onwards

- At least 6 members per year, preferably more

What are we expecting to see?
Analysis of UKMO stratosphere resolving hindcasts:
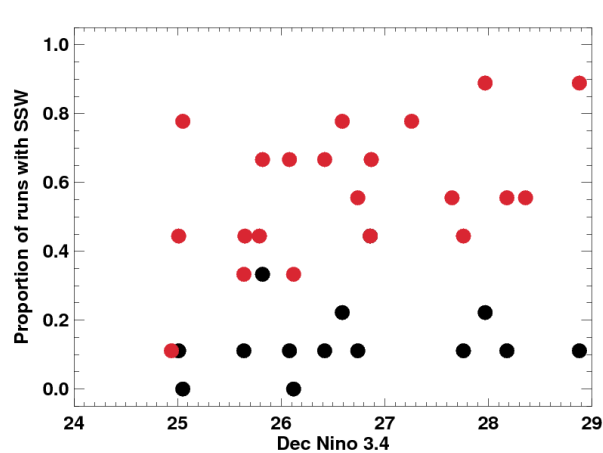
Sudden stratospheric warmings occur with better frequency in high top hindcasts (red)

Increase in frequency with El Nino strength

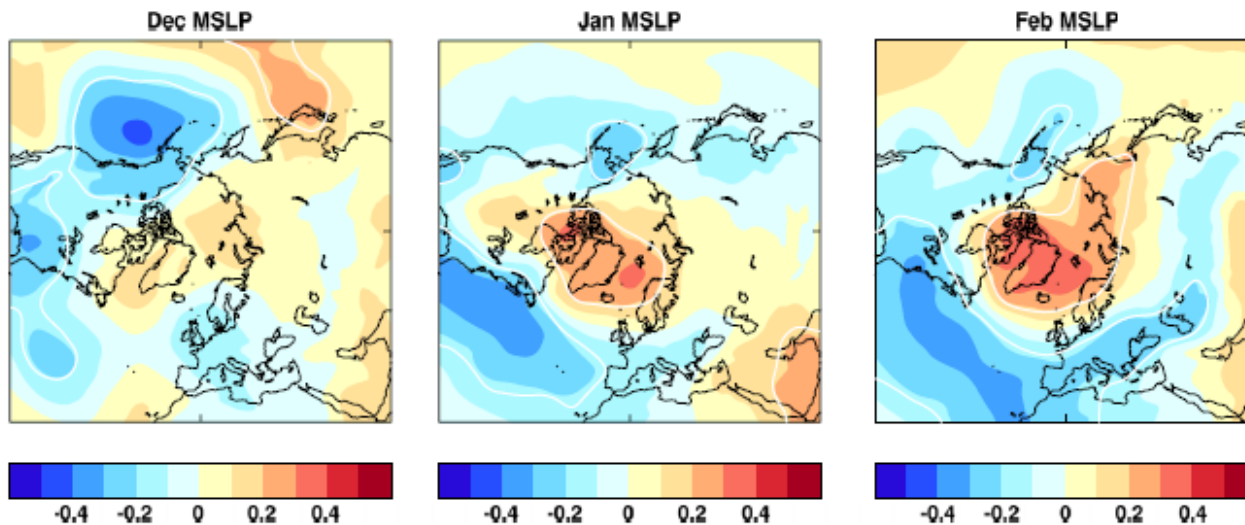Subsequent impact on surface….

Figure 5. Correlation between SSW strength (based on minimum zonal wind at 60N, 10 hPa over the whole winter) and MSLP for L85 hindcasts. White contours show regions where correlation is significant at the 5% level.

Fereday et al. (2012)

Summary

High top and low top hindcasts now in CHFP database;

Multimodel analysis underway;

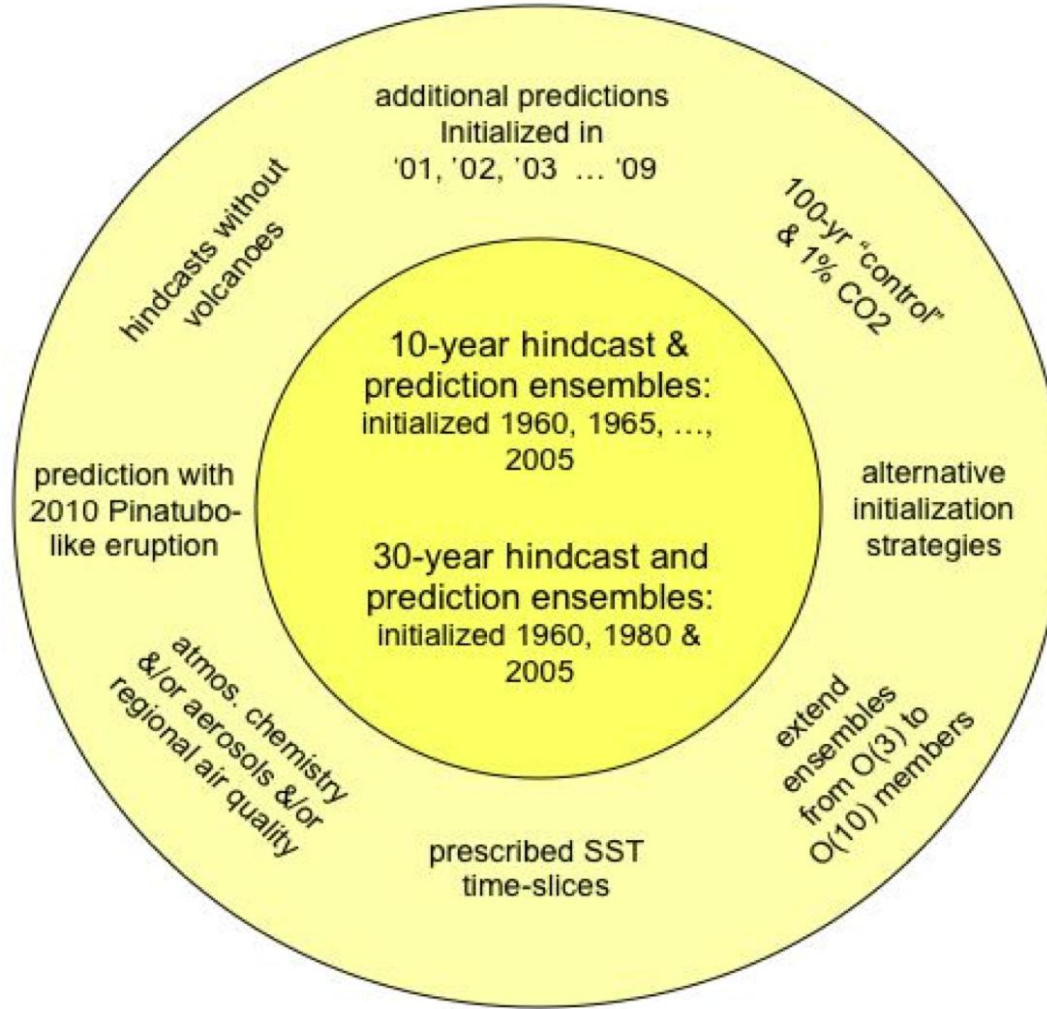Analysis of individual systems implies no big gains in overall skill.

However

Improved representation of stratospheric processes;

Improved signatures of stratosphere-troposphere coupling in surface climate.

Fereday et al. 2012: Seasonal forecasts of northern hemisphere winter 2009/10. Environ. Res. Lett., 7, 034031
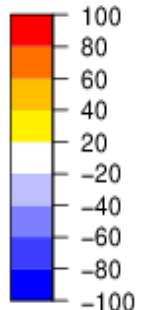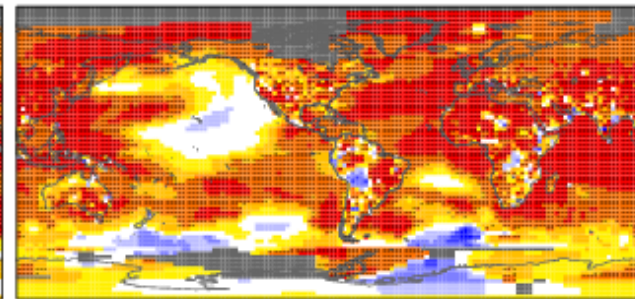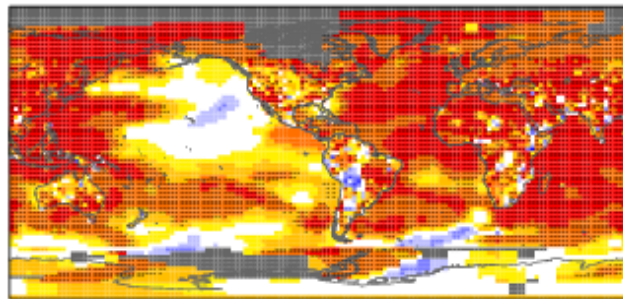
CMIP5 Decadal Predictions

Taylor et al. (2008)

Multi-model ensemble-mean correlation from CMIP5 decadal predictions vs ERSST-GHCN temperature over 1960-2005 (5-yr start date frequency)

Doblas-Reyes et al. (2012)

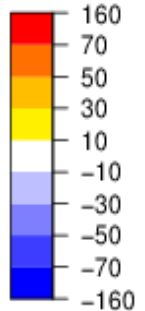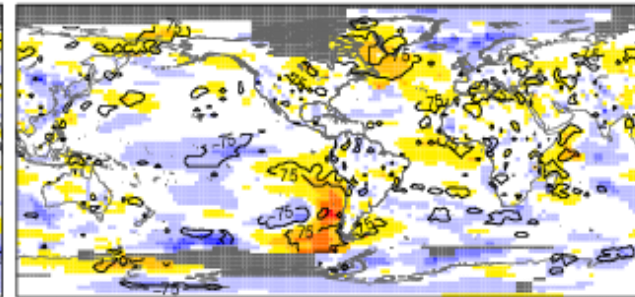Multi-model ensemble-mean correlation from CMIP5 decadal predictions vs GPCP for precipitation over 1960-2005 (5-yr start date frequency)
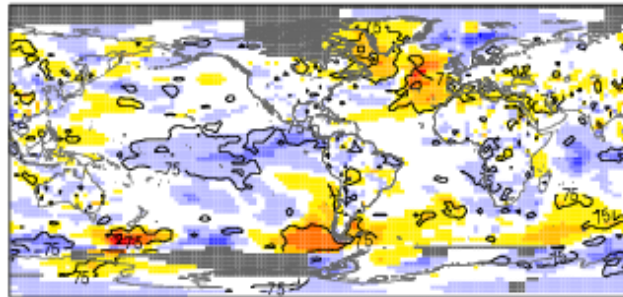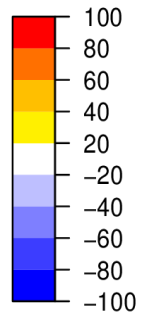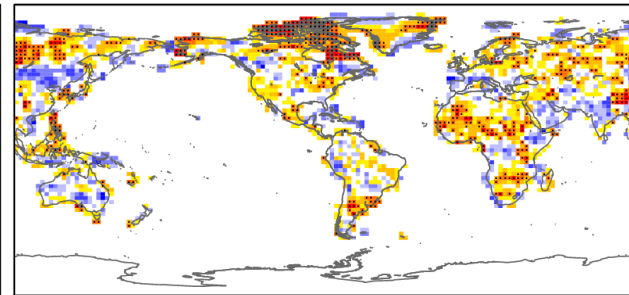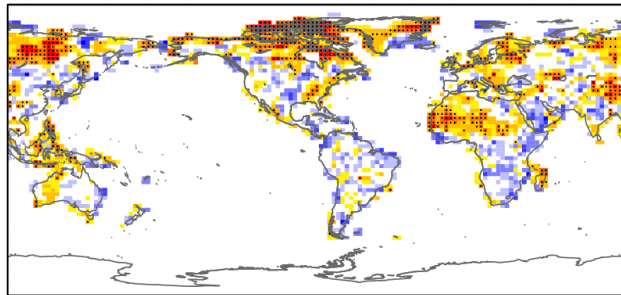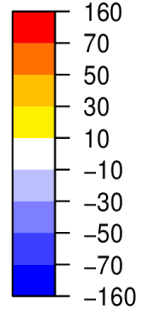
Years 2-5

Years 6-9

Init

Init-Noinit
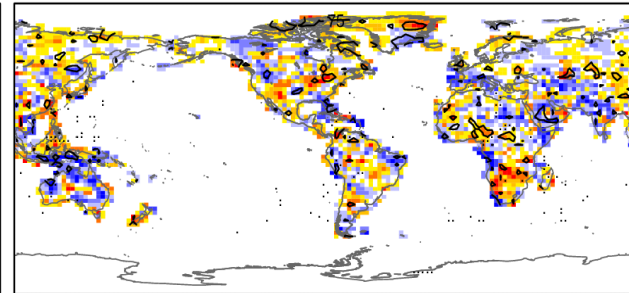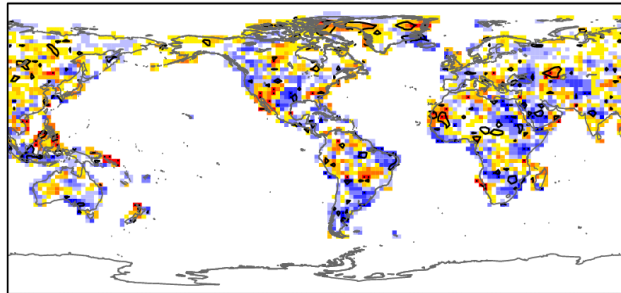
Doblas-Reyes et al. (2012)

Decadal Forecast Exchange

Doug Smith, Adam Scaife and the decadal prediction community….

15th session of the WMO Commission for Climatology recommended action to start the coordination and exchange of decadal predictions

10 OAGCMs (+ 2 statistical models)

Very basic outputs: Global annual mean temperature, one file for each year & each member, exchanged once per year around November (equal ownership)

Surface temperature: 2012-2016 relative to 1971-2000

(d) CCCMA (e) GFDL (f) IC3/KNMI
(g) MIROC5 (h) MOHC (i) MPI
(j) MRI (k) RSMAS (l) SMHI
(m) NRL (n) Reading (AR1) (o) Reading (CA)

−1.5   −1   −0.5   0   0.5   1   1.5
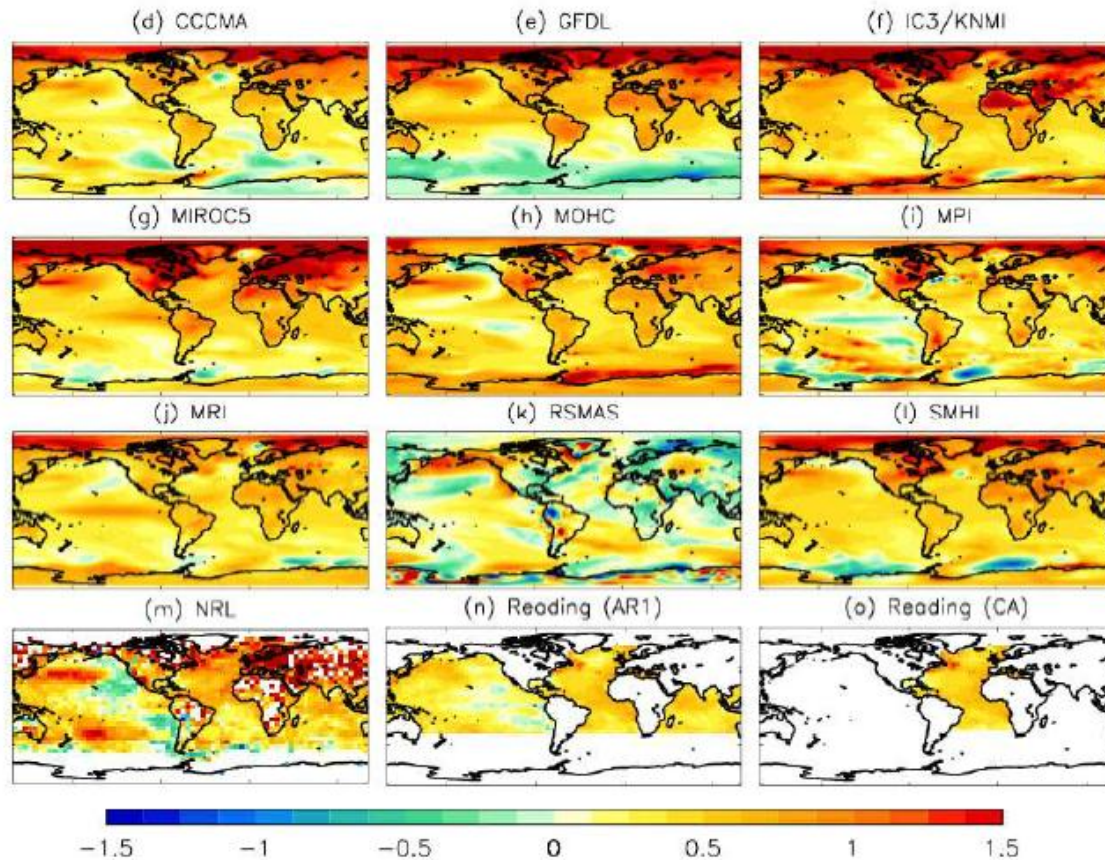
Figure 3: Forecast temperature anomalies (as Fig. 2) for the 5-year period 2012 to 2016.

Smith et al. (2012)

Surface temperature: 2012-2016
effect of initialisation
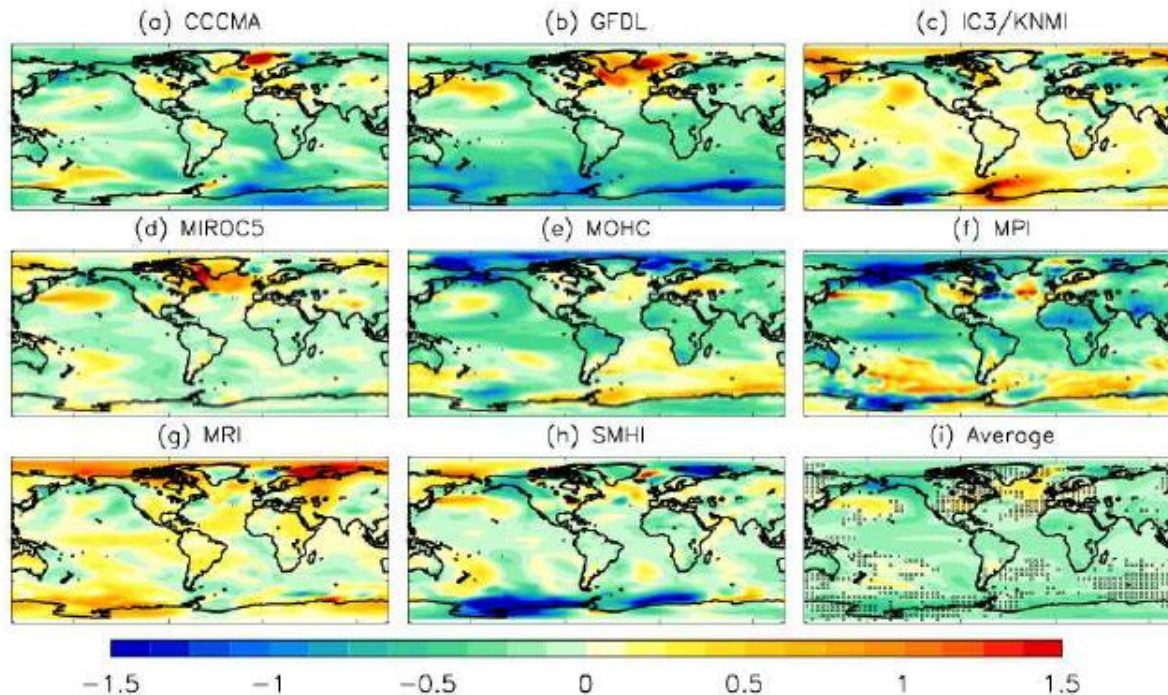
Figure 6: Impact of initialization (initialized minus uninitialized ensemble means) on forecasts of the period 2012 to 2016. Unstippled regions in (i) indicate a 90% or higher probability that differences between the initialized and uninitialized ensemble means did not occur by chance (based on a 2 tailed t-test of differences between the two ensemble means assuming the ensembles are normally distributed).

Smith et al. (2012)

Summary

The hindcast skill (1960-2005) is mainly due to radiative forcings (including volcanic aerosols in CMIP5);

Initialization improves the temperature correlation over the North Atlantic, regions of the South Pacific and small continental areas of the Northern Hemisphere;

Initialization can degrade skill in other areas and has very limited positive impacts on precipitation;

2012-2016 could be globally cooler than "expected" (underestimated aerosol loadings in RCP scenarios?)

Doblas-Reyes, F. J., et al., 2012: Initialized near-term regional climate change prediction. Nature, submitted

Smith, D. M., et al., 2012: Real-time multi-model decadal climate predictions. Clim. Dyn., submitted

Prospects

Joint WWRP-WCRP subseasonal to seasonal (S2S) prediction project: synergy with CHFP ?

CHFP as a repository of seasonal hindcasts ?

FP7 SPECS as the next European contribution to HFP ?

CMIP6 experiment design for decadal predictions: more comprehensive hindcasts versus more process-oriented predictability and/or case studies ?