WGSIP: Working Group on Seasonal to Interannual Prediction

Adam Scaife, Ben Kirtman and Francisco Doblas-Reyes (co-chairs)
George Boer, Arun Kumar, Andy Morse, Celeste Saulo, Swadhin Behera, Andy Robertson, Oscar Alves, Herve Douville, Sonia Seneviratne, William Merryfield and Toshio Yasuda.
Three WCRP modelling groups:

Working Group on Coupled Modelling (WGCM)

Working Group on Seasonal to interannual Prediction (WGSIP)

Working Group on Numerical Experimentation (WGNE)
The Climate-system Historical Forecast Project Page at Centro de Investigaciones del Mar y la Atmosfera

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

CIMA CHFP Data Server
Current status
## Sub-projects: three experiments

<table>
<thead>
<tr>
<th>Land Surface: the GLACE experiment:</th>
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<tbody>
<tr>
<td>Soil moisture experiments in seasonal mode</td>
</tr>
<tr>
<td>Led by R Koster</td>
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</table>

<table>
<thead>
<tr>
<th>Stratosphere: Stratospheric Historical Forecast Project</th>
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<tbody>
<tr>
<td>High Top – Low Top hindcasts</td>
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<td>Led by A Butler</td>
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</table>

<table>
<thead>
<tr>
<th>Sea Ice: Ice Historical Forecast Project</th>
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</thead>
<tbody>
<tr>
<td>Case studies with/without initial sea-ice data (2007/1996)</td>
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<tr>
<td>Led by D Peterson</td>
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</tbody>
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Ice Historical Forecast Project

Drew Peterson, Dirk Notz, Steffen Tietsche, Matthieu Chevallier, William Merryfield, Adam Scaife

Max Planck Institute MPI-ESM (Steffen Tietsche and Dirk Notz)

UKMO GloSea4 (Arribas et al., 2011, 2012)

Meteo-France CNRM CM5.1 (Voldoire et al., 2012, Chevallier et al., 2012)

CCCma CanSIPS (Merryfield et al., 2012)

- 9 members for 2007 and 1996
- with and without sea ice initialised according to observed extents
- 1 November and 1 August initialisation for Winter and Autumn
Difference in Sea Ice due to Initialisation

UKMO   MPI    MeteoFr    CCCma

Nov
b) c) d)  

Aug
f) g) h)
Winter Near Surface Temperature Response
Winter Geopotential Height Response (@ 500hPa)
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

Paper in preparation:

Peterson et al 2012: The Effects of Sea Ice initialisation on Seasonal Forecasts – the WGSIP IceHFP Project
Stratosphere Historical Forecast Project
a WGSIP-SPARC project

Amy Butler, Adam Scaife, Alexander Lawes, Natalia Calvo, Andrew Charlton-Perez + WGSIP members

High Top Hindcasts
Parallel to WGSIP-CHFP
Extended models
Initialising extra atmosphere, better represented stratosphere

Integrations

• 4 month lead times (1st November and 1st May start dates)
• 2 seasons (DJF and JJA)
• Case study years: 1989 onwards
• At least 6 members per year, preferably more
## Participants and Status

<table>
<thead>
<tr>
<th>Institute</th>
<th>Model</th>
<th>Resolution</th>
<th>Reference</th>
<th>Status</th>
<th>Contact</th>
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<tbody>
<tr>
<td>UKMO</td>
<td>HadGEM</td>
<td>N96L85, 85km</td>
<td>Martin et al 2006, J. Clim., 19, 1217-1301</td>
<td>DONE IN SERVER</td>
<td><a href="mailto:Adam.scaife@metoffice.gov.uk">Adam.scaife@metoffice.gov.uk</a></td>
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<tr>
<td></td>
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<td>N96L38, 40km</td>
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<td>Meteo France</td>
<td>Arpege 4.4 + OPA</td>
<td>L91, 0.01hPa, L31, 10hPa</td>
<td>Gueremy et al, 2005, Tellus, 57A, p308-319</td>
<td>DONE IN SERVER</td>
<td><a href="mailto:Michel.deque@meteo.fr">Michel.deque@meteo.fr</a>, <a href="mailto:jean.philippe.piedelievre@meteo.fr">jean.philippe.piedelievre@meteo.fr</a></td>
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<tr>
<td>CCCMA</td>
<td>CMAM</td>
<td>T63L71, ~100km</td>
<td>Scinocca et al 2008, ACP, 8, 7055-7074</td>
<td>DONE IN SERVER</td>
<td><a href="mailto:John.Scinocca@ac.gc.ca">John.Scinocca@ac.gc.ca</a>, <a href="mailto:George.Boer@ec.gc.ca">George.Boer@ec.gc.ca</a></td>
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<td>T63L41, ~31km</td>
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<tr>
<td>NCEP</td>
<td>CFS v1</td>
<td>L64, 0.2hPa</td>
<td>Saha et al, J.Clim., vol.19, no.15, p3483-3517</td>
<td>DONE IN SERVER</td>
<td><a href="mailto:Amy.Butler@noaa.gov">Amy.Butler@noaa.gov</a>, <a href="mailto:Arun.Kumar@noaa.gov">Arun.Kumar@noaa.gov</a></td>
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What are we expecting to see?
Analysis of UKMO stratosphere resolving hindcasts:

Low top and high top models

Possible improvement in ROC scores in winter but not significant

Arribas et al, in preparation
What are we expecting to see?

Analysis of UKMO stratosphere resolving hindcasts:

Winter 2009/10: stronger Arctic pressure signal

Significant

High top spans observations but low top doesn’t

Conditional predictability for AO given active stratosphere....
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

Clear signatures of stratosphere-troposphere coupling in surface climate

Improved conditional predictability for key events like the record low AO in winter 2009/10
Where does Decadal Prediction fit?

Weather

Climate

Seasonal-Interannual

- initial condition problem
- forced boundary value problem
- decadal prediction
- initial condition + boundary forcing
Decadal Predictions

CMIP5 Protocol

additional predictions
Initialized in
'01, '02, '03 ... '09

10-year hindcast &
prediction ensembles:
initialized 1960, 1965, ..., 2005

30-year hindcast and
prediction ensembles:
initialized 1960, 1980 & 2005

CMIP-WGCM-WGSLP oversee this framework
Part of our discussion this morning is to think about ‘What next?’
Decadal Forecast Exchange

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

• Many groups are now developing decadal predictions

• Key experiments done and analysed for CMIP5

• What about real time predictions?

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

  Proposal went out to various groups to exchange decadal prediction information

  research exercise – we can learn a lot from this
  prevent over-confidence from a single model
  equal access, ownership and recognition
We had an overwhelmingly positive response:

Uni. Tokyo – Kimoto Masahide
SMHI – Klaus Wyser, Colin Jones
IC3 – Francisco Doblas-Reyes, Virginie Guemas
MPI – Daniela Matei, Wolfgang Muller, Holger Pohlman
CCCMA – George Boer, Bill Merryfield
NRL – Judith Lean, David Rind
MRI – Masayoshi Ishii
KNMI – Wilco Hazeleger, Bert Wouters
GFDL – Tony Rosatti
RSMAS – Ben Kirtman
UKMO-Hadley – Doug Smith, Adam Scaife
NOAA – Arun Kumar

Are others planning to make regular decadal predictions? If so, would you like to take part?
We are exchanging very basic quantities:

Global Annual Mean Temperature
One file for each year, each member
Exchanged once per year around November
Equal ownership

Example diagnostics:
Surface temperature: 2012-2016 relative to 1971-2000

Figure 3: Forecast temperature anomalies (as Fig. 2) for the 5-year period 2012 to 2016.
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).
SUMMARY

Real-time multi-model decadal climate predictions

Climate Dynamics, submitted 2012. Also IPCC AR5…

Please contact Doug Smith or Adam Scaife to contribute your forecasts to the exchange for 2013…
# WMO Global Producing Centres

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<thead>
<tr>
<th>Canada</th>
<th>Montreal</th>
<th>BCC</th>
<th>Beijing</th>
<th>ECMWF</th>
<th>Moscow</th>
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<tbody>
<tr>
<td>Seoul</td>
<td>Tokyo</td>
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<td>Pretoria</td>
<td>CPTEC</td>
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WCRP Regional Climate Outlook Forums worldwide
WGSIP/WGCM discussion points

Decadal prediction protocol for CMIP6
- Address bias adjustment issues
- Number of start dates – every year? Case studies?
- No need for sub-daily output?
- Length 5, 10, 30 years?
- Coordinated assessment to accelerate development? Test for overconfidence?
- “No Assimilation” runs in parallel
- Ensemble size, is 3 too small?
- Include ESMs?

Decadal prediction: a sensitive test of climate sensitivity?

CORDEX downscaling of decadal predictions – try stats?

Scenarios: aerosols and solar important for decadal predictions but initialisation and future behaviour not properly catered for

Decadal prediction exchange: future? Near real-time?

AMIP: larger ensemble size to compare with hindcasts?

Relative Benefit? Decadal, Seasonal, Projections (2500, 1800, 2000)