WCRP Working Group on Seasonal to Interannual Prediction

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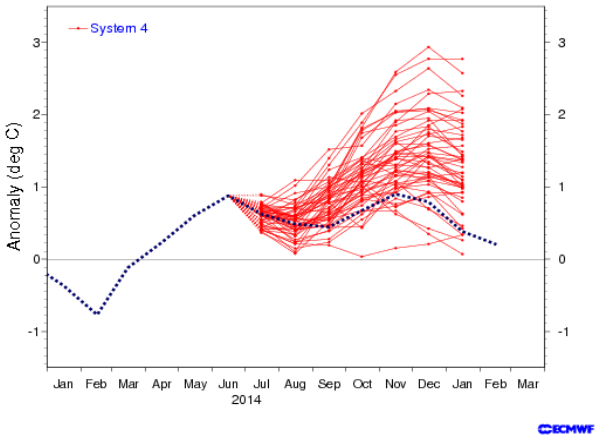
(WGSIP co-chairs)

WMO Global Producing Centres :– seasonal forecasts for the GFCS

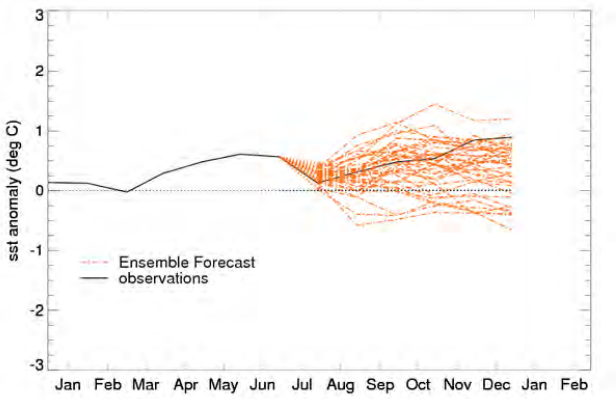
See the WMO Lead Centre for long range forecast multi-model ensembles: www.wmolc.org

Example forecast 1: El Niño

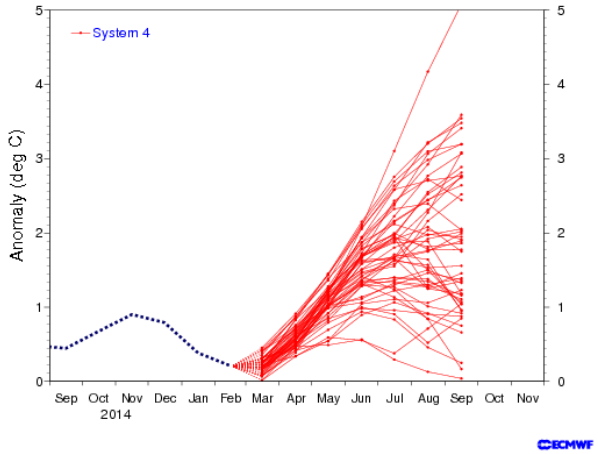
ECMWF 2014



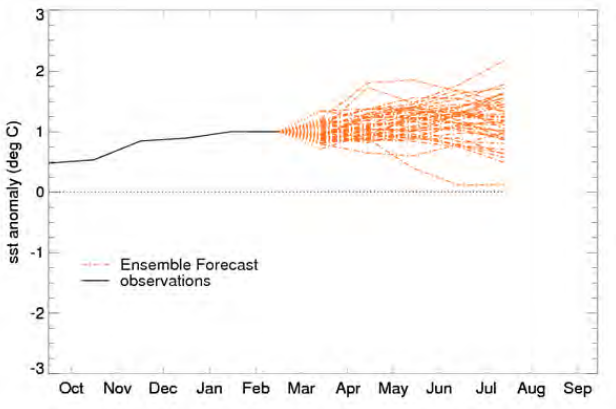
Met Office 2014



ECMWF 2015



Met Office 2015



Forecasts in 2014 were suggesting risk of a very strong El Niño

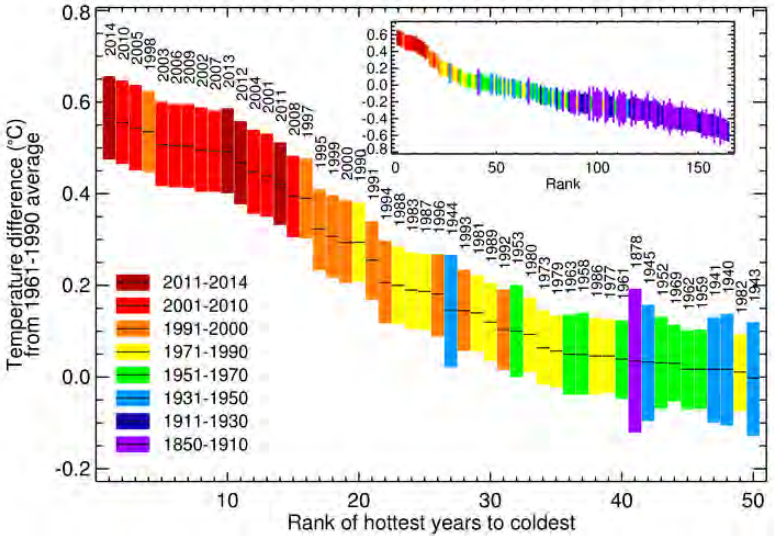
Others suggested a minor event which turned out to be the case (see black line)

We appear to be in a similar situation this year....

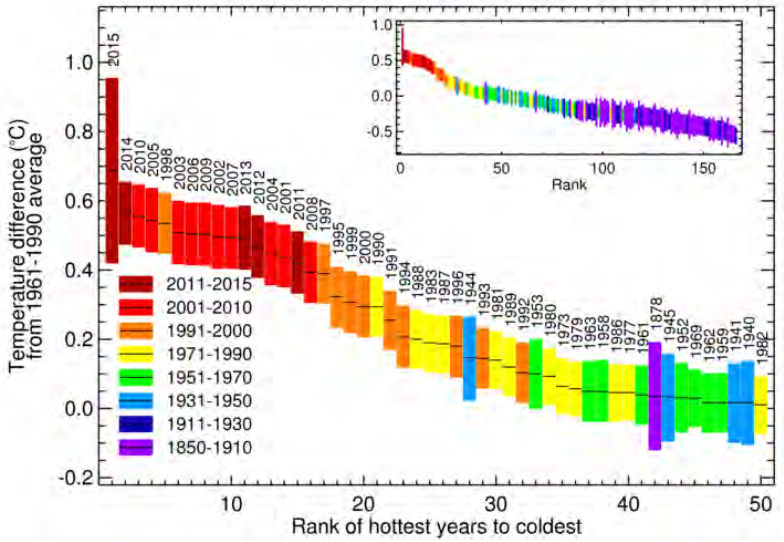
Example forecast 2: Global Temperature

19 December 2013 - The global average temperature in 2014 is expected to be between 0.43 °C and 0.71 °C above the long-term (1961-1990) average of 14.0 °C, with a central estimate of 0.57 °C, according to the Met Office annual global temperature forecast.

Taking into account the range of uncertainty in the forecast, it is likely that 2014 will be one of the warmest ten years in the record which goes back to 1880.



17 December 2014 - The global mean temperature for 2015 is expected to be between 0.52 °C and 0.76 °C* above the long-term (1961-1990) average of 14.0 °C, with a central estimate of 0.64 °C, according to the Met Office annual global temperature forecast.



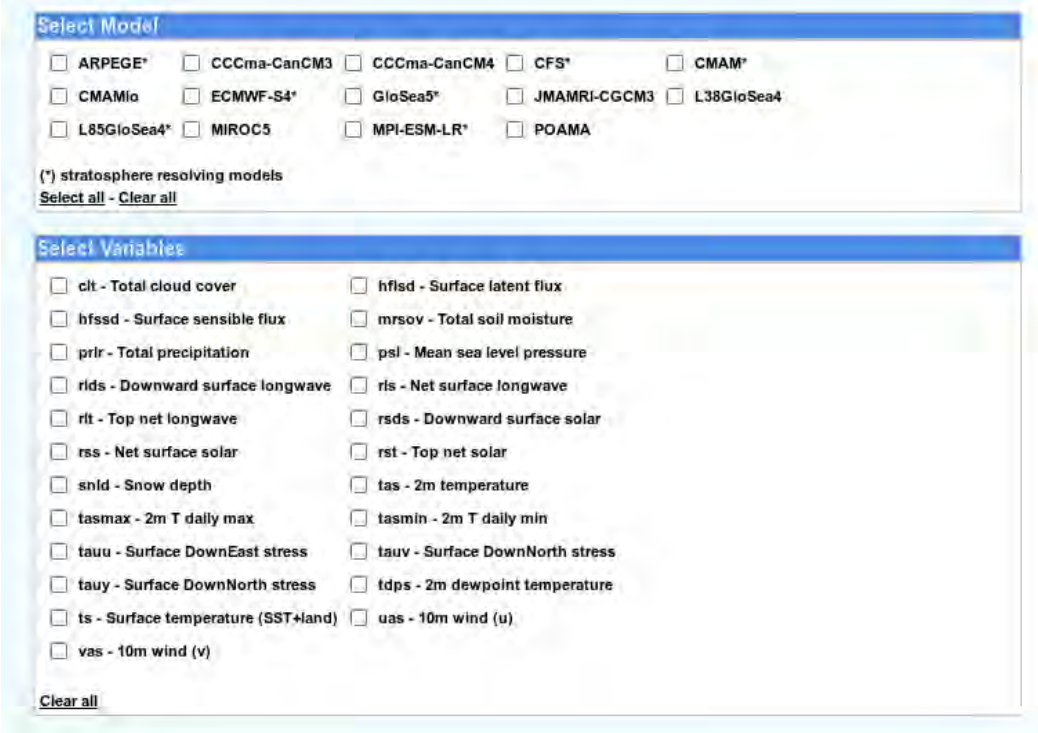
CHFP database

"CMIP for seasonal forecasting"

Idea to create mirror site at BSC this year

Same data in CMIP6 NetCDF4 via ESGF

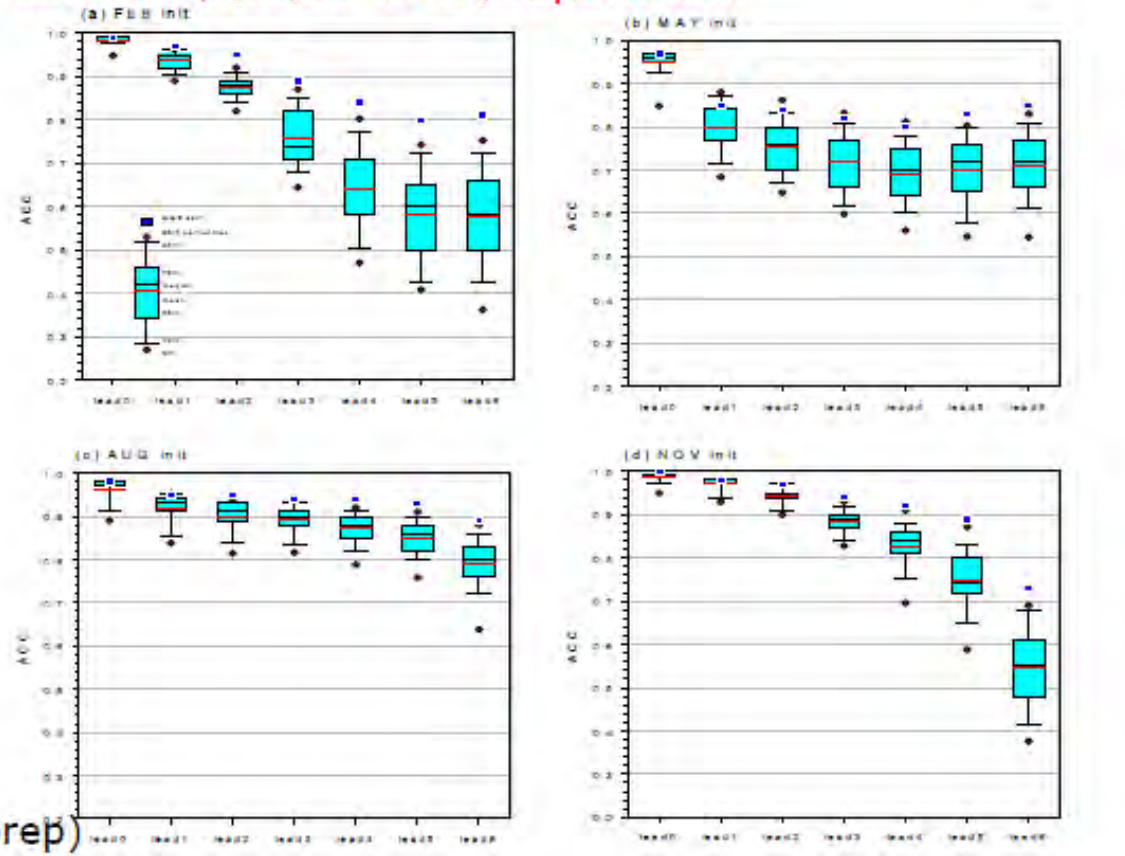
Link to climate4impact and COPERNICUS



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

CHFP multimodel analysis - skill

Niño3.4 correlation for four different start dates as a function of forecast time. The correlation of the multi-model ensemble mean is shown in blue and the distribution of the correlation for each ensemble member with the box-and-whisker plots. A summary paper is in preparation.



Kirtman et al. (in prep)

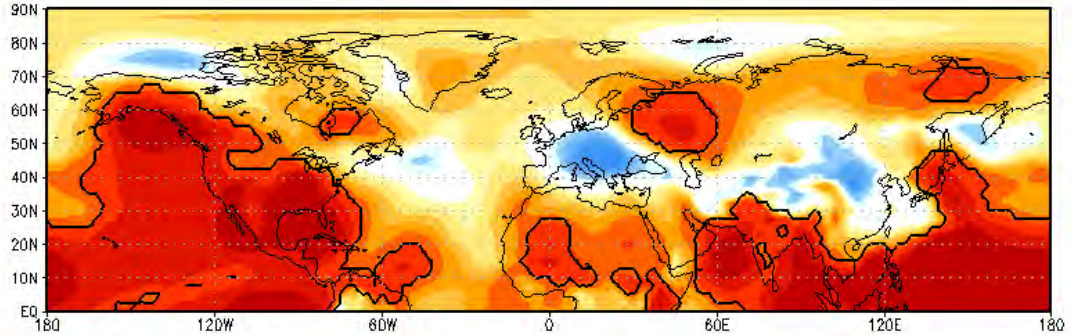
CHFP multimodel analysis - stratosphere

DJF PRMSL- El Niño years (10)

High-top Ensemble

$ACC_{30\text{-}90N}$= 0.47

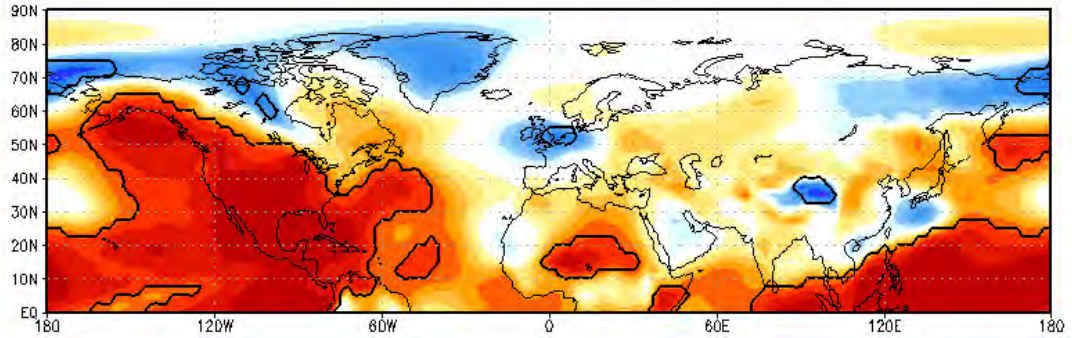
$ACC_{60\text{-}90N}$= 0.36

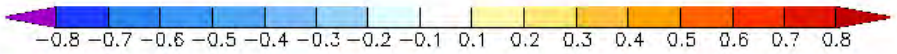


Low-top Ensemble

$ACC_{30\text{-}90N}$= 0.38

$ACC_{60\text{-}90N}$= 0.08





Three new WGSIP projects on seasonal prediction

Teleconnections

lead by Laura Ferranti(ECMWF) and Herve' Douville(CNRM)
Focus on ***tropical rainfall and connections to extratropics***

Drift

lead by Bill Merryfield (EC), Mikhail Tolstykh (RAS)
Focus on ***transient drift after initialisation with observations***

Snowcover

lead by Jee-Hoon Jeong(Ch.Uni.), Yvan Orsolini (NILU)
Focus on ***effects of snow cover initialisation***

Project plans now complete for all three of these

A three component Decadal Climate Prediction Project from WGSIP/WGCM/CLIVAR

(lead by George Boer and Doug Smith)

CMIP6 Model Intercomparison Project

Hindcasts

Forecasts

Experiments

Decadal Climate Prediction Project
A - Hindcasts
(WGSIP, WGCM, CLIVAR, lead by George Boer and Doug Smith)

Table 1. Basic Component A: Hindcast/forecast experiments

#	Experiment	Notes	# of years
TIER 1: Hindcast/forecast information			
1.	Ensembles of at least 5-year, but much preferably 10-year, *hindcasts* and *forecasts*	Coupled models with initialization based on observations Start date *every year* from 1960 to the present if at all possible; otherwise every second year at minimum. Start date on or before 31 Dec of the year preceding the forecast period (start dates on or before Nov 15 allow for DJF seasonal forecast results and are recommended) 10 ensemble members (more if possible) Prescribed historical values of atmospheric composition and/or emissions (and other conditions including volcanic aerosols). A suitable "most probable" forcing scenario for future years to be chosen in conjunction with ScenarioMIP.	(30-60)x10x(5-10) = 1500-6000 years of integration
TIER 2: To quantify the effects of initialization			
2.	Ensembles of historical and near-future climate *simulations*	Made with the same model as used for hindcasts 1850 to 2030, preferably with initial conditions from a preindustrial control simulation 10 ensemble members (more if possible) Prescribed historical and future forcing as for the Tier 1 Experiment	170x10=1700 yrs of integration

Table 2. Other hindcast experiments (if resources permit)

#	Experiment	Notes	# of years
TIER 3: Effects of increased ensemble size			
3.	Increase ensemble size for the Tier 1 Experiment	*m* additional ensemble members to improve skill and examine dependence of skill on ensemble size	60x(5-10)x*m*=(300-600)*m* years of integration
TIER 4: Improved estimates of hindcast skill			
4.	Ensembles of at least 5-year, but much preferably 10-year, hindcasts and forecasts	As Experiment 1 but with no information from the future with respect to the forecast Radiative and other forcing information (e.g. greenhouse gas concentrations, aerosols etc.) maintained at initial state value or projected in a simple way. No inclusion of volcano or other short term forcing unless available at initial time.	1500-6000 years of integration
TIER 4: Improved estimates of the effects of initialization			
5	Ensembles of at least 5-year, but much preferably 10-year, hindcasts and forecasts	Historical climate simulations up to the start dates of corresponding forecast with prescribed forcing Simulations continued from forecast start date but with the same forcing as in the Tier 1 Experiment, i.e. with NO information from the future with respect to the start date. These are uninitialized versions of Experiment 4 hindcasts.	1500-6000 yrs of integration

Decadal Climate Prediction Project
B - Forecasts

(WGSIP, WGCM, CLIVAR, lead by George Boer and Doug Smith)

DCPP/WMO/CMIP Real-time decadal forecast protocols

Table 1. Basic Component B: Real-time decadal forecasts

#	Experiment	Notes	# of years
TIER 1: Real-time forecasts			
1.	Ensembles of ongoing real-time 5-year forecasts	Coupled models with initialization based on observations Start date *every year* ongoing Start date on or before 31 Dec (start dates on or before Nov 15 allow for DJF seasonal forecast results and are recommended) 10 ensemble members (more if possible) Atmospheric composition and/or emissions (and other conditions including volcanic aerosols) to follow a prescribed forcing scenario chosen in conjunction with ScenarioMIP.	10x5=50 years of integration for 5-year forecasts
TIER 2: Increased ensemble size and duration			
2a	Increase ensemble size	*m* additional ensemble members to reduce noise and improve skill	5*m* yrs of integration
2b	Extend forecast duration to 10 years	To provide forecast information for the period 5 to10 years ahead	10x5=50 yrs of integration

Table 2. Component B Data

Because of its "quasi-real time" aspect, the data aspects of Component B differ somewhat from those of Components A and C.

Data to be served via WMO Lead Centres and mirrored on the Earth System Grid (ESG) with protocols paralleling CMIP5 although with modifications as specified by the WGCM Infrastructure Panel (WIP). Data to be archived by March 31st each year.

Priority	Description	Notes
Priority 1 - monthly means - basic variables - single level files	- surface air temperature, precipitation, mean sea level pressure, sea-ice, snow, 500hPa geopotential height, 850hPa temperature - vertically integrated amounts of energy, salt in the ocean - Atlantic MOC - fluxes of energy and moisture at the TOA and surface	Basic data sets for many investigations. Applies to quasi-real time decadal predictions currently being made.
Priority 2 - hindcast data for skill assessment and forecast calibration	- Same variables as for Priority 1	Hindcast data for models which have contributed to the multi-model prediction exercise since CMIP5
Priority as in the DCPP Data Retention Table	- Variables as in the DCPP Data Retention Table	More extensive data for forecast production, research and applications. Ongoing upon the completion of Component A hindcasts.

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Decadal Forecast Exchange

The Met Office coordinates an informal exchange of near-real time decadal predictions. Many institutions around the world are developing decadal prediction capability and this informal exchange is intended to facilitate research and collaboration on the topic. There are a mixture of dynamical and statistical models and currently three variables are included: Surface air temperature, sea-level pressure and precipitation. More variables, including ocean variables are planned for the future. Please use the drop-down menus below to explore the data collected to date.

This work is supported by the European Commission SPECS project.

SPECS

Important details

For more details on interpretation, see How to use our long-range predictions.

Images last updated 2014-02-20

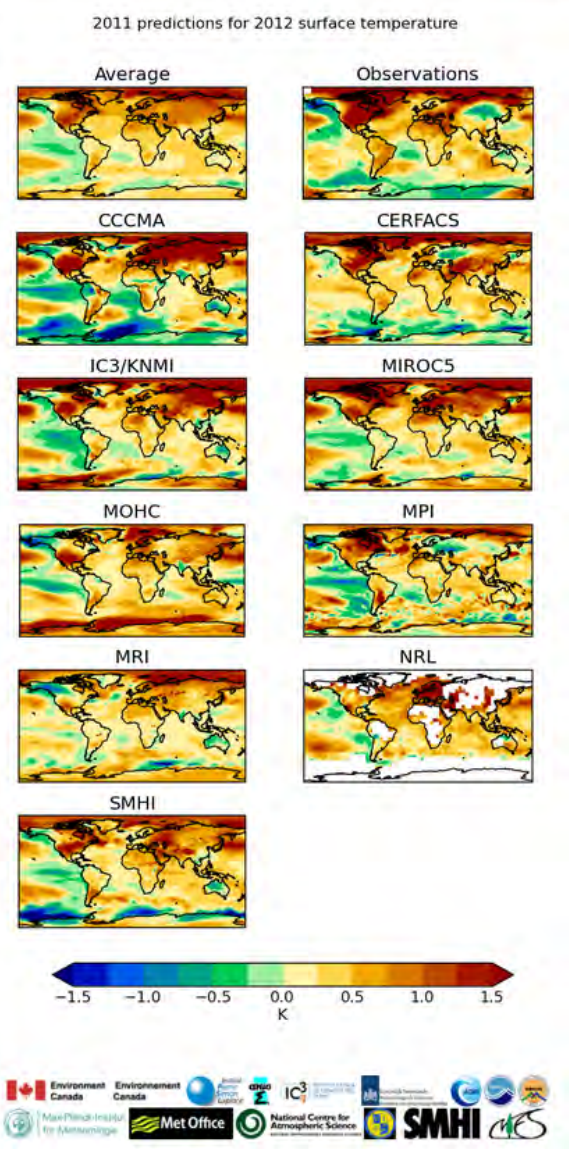
Issued	Period	Element
2011	year 1	surface air temperature

Images last updated 2014-02-20

Issued	Period	Element
2011	year 1	surface air temperati

Decadal forecast exchange 2011 predictions for year 1 surface air temperature

Decadal prediction is still experimental and the forecasts should not be relied on for making decisions, particularly on regional scales.



http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/long-range/decadal-multimodel

Decadal Climate Prediction Project C - Experiments

(WGSIP, WGCM, CLIVAR, lead by George Boer and Doug Smith)

Table 1.

Component C1: Haitus+: Accelerated and retarded rates of global temperature change

Objectives: To investigate the role of eastern Pacific and North Atlantic sea surface temperatures in the modulation of global surface temperature trends and in driving regional climate variations.

#	TIER	Experiment	Notes	# of years
Pacemaker experiments				
C1.1	1	Coupled model forced with observed anomalies of sea surface temperature in the tropical Pacific	Follow the experimental design of Kosaka and Xie (2013). Time period: 1950 to 2015 Ensemble size: 10 members Restoring timescales: 10 days for 50m deep mixed layer	66x10=660 years
C1.2	1	As above but for the North Atlantic	As C1.1 but forced by observed sea surface temperature anomalies in the North Atlantic, 20°N to 60°N Time period: 1950 to 2015 Ensemble size: 10 members Restoring timescales: 10 days for 50m deep mixed layer	66x10=660 years
C1.3	2	As C1.1	As C1.1 but for the period from 1920 making the full period of the experiment 1920-2015	30x10=300 years
C1.4	2	As C1.2	As C1.2 but for the period from 1920 making the full period of the experiment 1920-2015	30x10=300 years

Table 2.

Component C2: Case study of mid-1990s Atlantic subpolar gyre warming

Objectives: To investigate the predictability of the mid-1990s warming of the subpolar gyre, and its impact on climate variability.

#	TIER	Experiment	Notes	# of years
Prediction experiments				
C2.1	3	Repeat hindcasts with altered initial conditions	Initialize with climatology (the average over 1960 to 2009) in N Atlantic "sub-polar ocean"[95° W to 30° E, 45° N-90° N with a linear transition between climatology and actual observations over the 10° buffer zone 35° N-45° N] - 10 member ensembles - 5, preferably 10 years - start dates end of 1993, 1994, 1995, 1996	4x(5,10)x10=200-400 years
C2.2	3	ditto	as above with start dates 1992, 1997, 1998, 1999	200-400 years

Table 3.

Component C3: Volcano effects on decadal prediction

Objectives:

- Assess the impact of volcanoes on decadal prediction skill
- Investigate the potential effects of a volcanic eruption on forecasts of the coming decade
- Investigate the sensitivity of volcanic response to the state of the climate system

#	TIER	Experiment	Notes	# of years
Prediction experiments with and without volcano forcing				
C3.1	1	Pinatubo	Repeat 1991 forecasts without Pinatubo forcing - 5, preferably 10 years - 10 ensemble members - specify the "background" volcanic aerosol to be the same as that used in the 2015 forecast	(5,10)x10=50-100 years
C3.2	2	El Chichon	1982 hindcasts as above but without El Chichon forcing	50-100 years
C3.3	2	Agung	1963 hindcasts as above but without Agung forcing	50-100 years

#	TIER	Experiment	Notes	# of years
Prediction experiments for 2015 with added forcing				
C3.4	1	Added forcing	Repeat 2015-2019/24 forecast with Pinatubo forcing	50-100 years
C3.5	3	Added forcing	Repeat 2015-2019/24 forecast with El Chichon forcing	50-100 years
C3.6	3	Added forcing	Repeat 2015-2019/24 forecast with Agung forcing	50-100 years

JSC35 Actions

20. Action: Synthesis paper on modeling of the regional climate
Develop a synthesis paper on the status of model-based climate information on regional scales. As part of this activity consider organizing a science workshop with CORDEX, WGNE, WGCM, WGSIP and core projects.
Responsible: WGRC Co-Chairs with leads of all spell out
Deadline: Dec 2014 – Doblas-Reyes input to new white paper for WGSIP, also inputting the interests of the climate prediction sector to this grand challenge e.g. Paris meeting last month

22. Action: Reporting on model development
Model development and identified impediments to or requirements for model improvement to be identified and mentioned explicitly in Project and GC reports to JSC (at least one slide for the developments and impediments).
Responsible: all Projects, WGs and GCs
Deadline: starting at JSC-36 – this presentation, new WGSIP projects on drift & teleconnections

10. Action: Atmospheric dynamics
SPARC to collect and provide an inventory of relevant atmospheric dynamics across WCRP, host on SPARC website, and serve as point of contact in this regard.
Responsible: SPARC Co-chairs
Deadline: analyze progress at SPARC SSG in January 2015. – SPARC plan on Clim. Dynamics

Also new membership: 2 members standing down, 1 new member proposed (Pierre Gentine)

WGSIP summary

Strong links to operational climate predictions and GFCS

Exciting results on winter predictability and a clear role for the stratosphere

Three new science projects:
- **tropical/extratropical interactions**
- **drift/shocks**
- **snow cover**

Decadal prediction for CMIP6 jointly with WGCM and CLIVAR
- **there is an outstanding issue on CMIP DECK contributions...**

Decadal forecasts being exchanged – Commission for Climatology
- **we would like support from WCRP JSC to CBS to push this along – a letter?**

Strong links to Grand Challenges and Sub-Seasonal to Seasonal Prediction
- **we would like to encourage regional climate modellers to consider *predictability***

WGSIP17 at SMHI in September