WCRP REPORT
World Climate Research Programme

Project Report

Report of the 13th Session of the CLIVAR Working Group on Seasonal to Interannual Prediction

29th - 31st July 2010 Buenos Aires, Argentina

February 2011

WCRP Informal Report No: 1/2011
ICPO Publication Series no. 151

CLIVAR is a component of the World Climate Research Programme (WCRP). WCRP is sponsored by the World Meteorological Organisation, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO. The scientific planning and development of CLIVAR is under the guidance of the JSC Scientific Steering Group for CLIVAR assisted by the CLIVAR International Project Office. The Joint Scientific Committee (JSC) is the main body of WMO-ICSU-IOC formulating overall WCRP scientific concepts.

Bibliographic Citation

INTERNATIONAL CLIVAR PROJECT OFFICE, 2011: February. Report of the 13th Session of the CLIVAR Working Group on Seasonal to Interannual Prediction. International CLIVAR Project Office, CLIVAR Publication Series No. 1451 (not peer reviewed).

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CHFP

Form group to drive participation in CHFP and help availability of data, including technical details, data format issues (C. Saulo as CIMA contact, A. Pirani, G. Boer and survey responses, B. Kirtman, D. DeWitt and F. Doblas-Reyes).

Invite participation of CHFP and send to all of CLIVAR WGs, panels and GPCs (G. Boer, A. Pirani)

Recommend that data be sent to CIMA via disk

Request documentation on model configuration, version, etc for archived data.

Set timeframe for data delivery – end of August test file, 6 months later for full data set.

Submit CHFP data to CIMA (All)

Explore whether it would be technically possible for locally served data to be included in CIMA retrieval system (C. Saulo, C. Vera)

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Create addition guidance as part of CIMA webpage to share additional documentation, scripts to help archival process (B. Kirtman).

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Explore possibility of linking CHFP data to CPT (D. DeWitt, C. Saulo)

Develop example tools for user analysis of CHFP data including verification (A. Morse)

CliC

Distribute white paper on arctic sea ice (C. Hulbe to WGSIP)

Endorse reanalysis and coordinated effort on sea ice initialization within CliC. Argue strongly that there is a need to develop in the near term pragmatic ways to initialize sea ice particularly thickness (A. Scaife, B. Kirtman).

Adopt CC Bitz suggestion to set up small WGSIP and CliC group willing to look at what have in place in CHFP (A. Kumar, B. Kirtman, CC Bitz, M. Holland)

Propose simple sea-ice experiments with parallel runs with and without initialization, look at case study ensemble for anomaly year(s) – max min, consider which dates would be best (A. Scaife, D.

DeWitt, G. Boer, A. Kumar, T. Ose, M. Balmaseda, M. Deque, contact P. Nobre, F. Doblas-Reyes (to coordinate an email discussion) – then keep CC Bitz, M. Holland still entrained to look at the results).

GEWEX

Circulate Koster GRL article and give feedback that would help JHM review paper he is preparing (B. Kirtman)

TIGGE

Continue discussion with TIGGE on the following topics (B. Kirtman, R. Swinbank)

Investigate how much ocean-atmosphere coupling impact skill (B. Kirtman, A. Kumar, G. Boer, W. Landman)
Role of resolution on skill (S. Behera, D. DeWitt)
Scale interactions (B. Kirtman, A. Scaife to define longer term WGSIP leads)
Ensemble techniques (F. Doblas-Reyes, A. Morse)

WGSIP Participation in WGNE meeting 18-22 October 2010 Japan (D. DeWitt)

Decadal

Increase visibility of decadal activity in modeling working groups so their contribution is clear on decadal cross cut webpage. Decadal webpage should have more visibility within WCRP (A. Pirani – WGSIP/WGCM Decadal Sub-group)

Definition of decadal CMIP5 experiments on PCMDI CMIP5 webpage has to be improved and link back to CLIVAR page (A. Pirani, B. Kirtman, A. Scaife)

WGSIP-WGCM-CMIP overview panel should be solidified and activated. Send email proposing activities, including survey, naming the activity eg CDFP, web visibility, put panel on webpage (A. Pirani, G. Boer – G. Meehl)

WGSIP should propose a set of diagnostics that groups recommend for CMIP5 verification, and in addition what kind of diagnostics, not only against observations, that can be done, for planned Aspen meeting and to feedback to WGCM (A. Scaife, B. Kirtman to email WGSIP).

Propose suggested change chapter title – predictions instead of projections format for Ch.11 and circulate amongst WGSIP, to then take to first lead authors' meeting (G. Boer)

Ocean Observing System

Circulate email to WGSIP asking who is interested in participating in developing a strategy to assess real-time ocean analyses (A. Kumar, O. Alves, S. Behera)

Communicate with H. Hendon re: assessing the impact of the RAMA array (O. Alves)

Standard Hindcast Verification

Strengthen link between ET-ELRF and WGSIP – distribute report from last ET-ELRF meeting to WGSIP (A. Kumar)

Recommend that SVSLRF and WGFVRS webpage linked to from CIMA CHFP webpage to see what state of the art in verification is, see documentation (C. Saulo, F. Doblas-Reyes, A. Pirani)

Applications and Climate Services

To review current Climate Services activities within own National Met Service or other Met Services for which they have information (All)

To review Climate Service activities within wider research community in own country or activities known elsewhere (All)

To decide how these activities interact with wider research/CLIVAR activities. Are best practices of wider research/ development community being involved in NMHS practices? Is there evidence of seamless approaches or are all activities single model stream focused? (All)

The provision of global model (AGCM and CGCM) hindcast and forecast data in CPT format for process studies and operation forecasting and verification (W. Landman)

CHFP - Joint VAMOS-WGSIP

Revisit the wording of the request for information on subproject information when users register to access CHFP dataset (A. Pirani, C. Saulo, G. Boer)

Increase the communication on the data that will be available as part of the CHFP archive (WGSIP)

Survey current contributions to the VAMOS Modeling Plan within the VAMOS community (C. Saulo, C. Ereno)

Develop a VAMOS contribution to CHFP webpage with relevant information on relevant diagnostic subprojects, metrics, references, results (C. Saulo, A. Pirani)

Make use of VAMOS email list to distribute survey asking who will participate in CHFP and CMIP5 decadal runs (G. Boer, C. Ereno)

1. Introduction

The 13th Session of the CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP) was held on 29-31 July 2010, in Buenos Aires, Argentina, hosted by the Comisión Nacional de Actividades Espaciales (CONAE), the Servicio Meteorológico Nacional (SMN), and the Instituto Tecnológico Buenos Aires (ITBA). The meeting took place simultaneously with the 13th Session of the CLIVAR Variability of the American Monsoon System (VAMOS) panel, with the two groups meeting for a joint session with on the final day. The presentations and action items are available here: http://www.clivar.org/organization/wgsip/wgsip13/wgsip13.php

The main topics for discussion were the Climate-system Historical Forecast Project (CHFP) and the coordination of decadal prediction experiments as part of CMIP5, in collaboration with WGCM. The CHFP data set is being hosted by the Centro de Investigaciones del Mar y la Atmósfera (CIMA), Argentina and will be available by early 2011. Links to WWRP TIGGE were discussed in relation to the development of 1-90 day prediction capabilities. The use and need for seasonal to interannual data by seasonal applications, RCOFs and climate services were also discussed. The joint WGSIP-VAMOS meeting focused on the implementation of the VAMOS Modeling Plan and on initiating VAMOS-WGSIP collaboration in the analysis of the CHFP over the Americas.

See Appendix 1 for the meeting agenda and Appendix 2 for the meeting participants.

2. Climate-system Historical Forecast Project (CHFP)

The CHFP is an international, multi-model hindcast experiment incorporating all physical elements of the climate system designed to test the hypothesis that maximum predictability has not been reached yet by seasonal forecast systems. The objectives of the CHFP are to:

- Provide a baseline assessment of seasonal prediction capabilities using the best available models and data for initialization
- Provide an experimental framework for focused research on how various components of the climate system interact and affect one another
- Provide a test bed for evaluating IPCC class models in seasonal prediction
- Provide a framework for assessing current and planned observing systems
- Integrate process studies/field campaigns into model improvements

CHFP progress currently hinges on making the model data available to the wider community. Most groups that are participating in the CHFP have completed their simulations, however this data is not available yet on the CHFP data server at CIMA. WGSIP has formed a sub-group to drive participating groups to transfer their data to the CIMA server. Groups will initially send a test file by ftp to CIMA to ensure that the data is in the correct format according to the CHFP guidelines, before sending the full data set, preferably by disk.

ACTION: Form group to drive participation in CHFP and help availability of data, including technical details, data format issues (C. Saulo as CIMA contact, A. Pirani, G. Boer and survey responses, B. Kirtman, D. DeWitt and F. Doblas-Reyes).

ACTION: Invite participation of CHFP and send to all of CLIVAR WGs, panels and GPCs (G. Boer, A. Pirani)
Recommend that data be sent to CIMA via disk
Request documentation on model configuration, version, etc for archived data.
Set timeframe for data delivery – end of August test file, 6 months later for full data set.

ACTION: Submit CHFP data to CIMA (All)

2.1 CIMA Server

The Centro de Investigaciones del Mar y la Atmósfera (CIMA), Argentina has agreed to be the main interface between CHFP and its users. The system is ready to receive data and make it available. A website is available (http://chfp.cima.fcen.uba.ar/index.html) and data access has been set up in a similar way that PCMIP provides access for CMIP. Users have to register and create an account, stating that the data will only be used for research. The data can then be selected according to dates, data levels and time frequency, and downloaded by ftp. Users will be invited (this will not be a requirement) to give some information on what diagnostic subprojects they are going to be working on. The sole purpose would be to generate information of the variety of analysis that is being done with CHFP data. This could be listed on the CHFP website so that people can share information on what they are working on and the subsequent publications.

ACTION: Explore whether it would be technically possible for locally served data to be included in CIMA retrieval system (C. Saulo, C. Vera)

ACTION: Complete archival test by RSMAS, and make data available to other groups to see how it appears on the archive (B. Kirtman)
Create additional guidance as part of CIMA webpage to share additional documentation, scripts to help archival process (B. Kirtman).

ACTION: Registration to access data should explicitly say that data will only be used for research – Adam to circulate statement and see ENSEMBLES guidelines (A. Scaife, C. Saulo, A. Pirani)

ACTION: Invite people to submit information on diagnostic subproject during CIMA download process so we can list it on CHFP webpage (A. Pirani, C. Saulo)

2.2 CHFP Data Management

CIMA will be providing a centralized archive for the data, with some data served on local servers. Locally served data will generally be mirrored on the CIMA website, with the exception of ENSEMBLES data that will only be stored at ECMWF. Links will be provided to local servers by the CIMA archive webpage (see: http://chfp.cima.fcen.uba.ar/index.html) so that all data can be accessed by one route. The APEC Climate Center (APCC) will also serve a reduced quantity of fields. WGSIP will explore the possibility of storing CHFP data at the British Atmospheric Data Center (BADC), which is an Earth System Grid Node for the Climate Model Intercomparison Project Phase 5 (CMIP5).

The experimental protocol for the CHFP data encoding was developed from ENSEMBLES experience and is a compromise based on netcdf standards (CF) used for CMIP3 and what is being developed for CMIP5. Since it is a compromise, it has various limitations. There are several data servers, with no unified view. The archive management is based on an informal protocol, some internal standards, and the level of service that the hosts will provide is unclear. There is scarce metadata of each experiment, the list of CF standard_names to describe the physical variables is incomplete, there is suboptimal data transfer and no check-summing, data discovery is inexistent and there are no visualisation tools.

Improvements to the archival and distribution of CHFP data should follow the developments in data distribution and processing resources that are being developed by the Earth System Grid Federation (ESGF) and should include the following:

- Access to distributed data (grid) and processing resources as developed by ESGF.
- Archive management: universal protocols, standards, service, and information sharing, as promoted by the Global Organization for Earth System Science Portals (GO-ESSP).

- Common Information Model (CIM), which the EU-funded Metafor project (http://metaforclimate.eu/) has developed and already considers the requirements to document s2d experiments.
- A full list of standard names (CF, CMOR2).
- Optimized data transfer, check-summing, data discovery as in ESGF.
- Data access: opendap, wget, gridftp.
- Tools for visualisation, better data manipulation and subsetting.

The ESGF is a massive undertaking that provides data access through one portal, regardless of where the data is stored. The ESGF is developing packages that many groups involved in the CHFP will have in-house by the end of 2010 for the CMIP5 experiment and that, at least at those institutes contributing to CMIP5, can be applied to seasonal prediction systems. GO-ESSP is promoting the sharing of archive management information and seasonal prediction needs are already being taken into account, and also included in developments of the Climate Model Output Rewriter (CMOR2).

The current CHFP guidelines will continue to be followed by participating groups. WGSIP will closely follow ESGF developments so as to be in a good position to adopt new procedures in the future that will enable the CHFP to grow.

ACTION: Approach BADC to host data and mirror CMIA (A. Scaife, B. Kirtman, F. Doblas-Reyes – to contact B. Lawrence)

ACTION: Stay aware of CMIP distributed archive developments so when time is right to do something WGSIP is well positioned to adopt these (F. Doblas-Reyes)

ACTION: Explore possibility of linking CHFP data to CPT (D. DeWitt, C. Saulo)

ACTION: Develop example tools for user analysis of CHFP data including verification (A. Morse)

3. CliC

The Climate of the Cryosphere (CliC) Project was formed in 2000 to stimulate, coordinate, and support research and to assess and quantify the impacts of climate variability and climate change on components of the cryosphere and the consequences of these impacts for the climate system. Its priorities and objectives have been re-evaluated this year and four initial focus areas for its long term objectives have been defined that will enable (rather than undertake):

- Prediction of the Arctic climate system
- Prediction of the Antarctic climate system
- Prediction of terrestrial cryosphere
- Improved assessments of the past, current and future sea-level variability and change

A white paper on Arctic sea ice has been produced that outlines the outstanding issues:
- Accuracy of sea ice extent products
- Ocean heat: upper layer storage; transport from Atlantic & Pacific
- Feedbacks & small-scale processes
- No systematic data synthesis effort (for Arctic or Antarctic)

And makes the following recommendations:
- Collective, multi-aspect approach for CMIP5 (in contrast to individualist CMIP3)
- Proxy initial conditions using regional models forced by observed (reanalyzed) atmosphere fields; Arctic System Reanalysis (Bromwich et al. *EOS 2010*)

Better sea ice initialization is important and achievable and naturally follows on from the Bromwich reanalysis effort. Papers, including the work by Balmaseda *et al.* (*QJRMS*, DOI: 10.1002/qj.661, 2010)

on the impact of Arctic ice on the atmospheric circulation and its relation with SST forcing, are demonstrating the impact of sea ice on interannual variability at high and mid-latitudes. Studies of more sophisticated initialization are needed with leadership from the CliC community. Many groups have some kind of sea ice model and initialization approach, even if just specifying to climatology. An analysis of what is being done by groups that are participating in CHFP, together with idealized experiments where the initialization is used or switched off of case study years, for example with open or closed Arctic Ocean sea ice conditions, would provide an evaluation of current initialization capabilities.

ACTION: Distribute white paper on Arctic sea ice (C. Hulbe to WGSIP)

ACTION: Endorse reanalysis and coordinated effort on sea ice initialization within CliC. Argue strongly that there is a need to develop in the near term pragmatic ways to initialize sea ice particularly thickness (A. Scaife, B. Kirtman).

ACTION: Adopt CC Bitz suggestion to set up small WGSIP and CliC group willing to look at what have in place in CHFP (A. Kumar, B. Kirtman, CC Bitz, M. Holland)

ACTION: Propose simple sea-ice experiments with parallel runs with and without initialization, look at case study ensemble for anomaly year(s) – max min, consider which dates would be best (A. Scaife, D. DeWitt, G. Boer, A. Kumar, T. Ose, M. Balmaseda, M. Deque, contact P. Nobre, F. Doblas-Reyes (to coordinate an email discussion) – then keep CC Bitz, M. Holland still entrained to look at the results).

4. SPARC and Strat-HFP

The Stratospheric Process and their Role in Climate (SPARC) Project is a core WCRP that aims to "determine the dependence of the mean climate, climate variability, and climate change on stratospheric dynamics as represented in Climate Models", using both CHFP and CMIP5 results.

As outlined in the CHFP objectives (see Section 2), the project aims to provide a test bed for integrating process studies and understanding how various components of the climate system interact and affect one another. These are the motivations for the Stratospheric Extension to the CHFP (Strat-CHFP). There are a wealth of papers and scientific evidence on stratosphere-troposphere interactions. The Strat-HFP will be an assessment of the impact on surface forecast skill of raising the atmospheric model lid for a more accurate representation of the stratosphere and its initialization. These simulations will follow the CHFP protocol and results will be stored in the CIMA CHFP archive. They will also be comparable to CMIP5 simulations that will have both high and low top models.

The following table lists the current participants, with completion of most of the simulations expected by the end of 2010.

Institute	Model	Resolution	Model Top	Reference	Contact
Met Office HC	HadGEM	N96L85 N96L38	85km 40km	Martin et al 2006, J. Clim., 19, 1217-1301	Adam.scaife@metoffice.gov.uk
Meteo France	Arpege 4.4 + OPA	L91 L31	0.01hPa 10hPa	Gueremy et al, 2005, Tellus, 57A, p308-319	Michel.deque@meteo.fr jean.philippe.piedelievre@meteo.fr
ECMWF	IFS	L91 L62	0.01hPa 5hPa		t.stockdale@ecmwf.int

CCCma	CMAM	T63L71 T63L41	~100km ~31km	Scinocca et al 2008, ACP, 8, 7055-7074	John.Scinocca@ac.gc.ca George.Boer@ec.gc.ca
NCEP	CFS v1	L64 ?	?	Saha et al, J.Clim., vol.19, no.15, p3483-3517	Hualu.Pan@noaa.gov Judith.perlwitz@noaa.gov.uk
CPTEC	CPTEC	?	?	?	pnobre@cptec.inpe.br
IFM-GEOMAR	ECHAM5	T63L31 T63L47	10hPa 0.01hPa	Roeckner et al 2003, MPI report No. 349, 127pp Manzini et al 2006, J. Clim., 19, 3863-3881.	nkeenlyside@ifm-geomar.de

The SPARC community is keen to analyze the CHFP and Strat-HFP. The following is a list of possible processed-based diagnostic projects that, based on the literature, may yield interesting results:

- General skill analysis
  - Using standard probabilistic verification measures for different regions - WGSIP
  - Predictions of annular modes?
- Sudden warmings and intraseasonal predictability
  - Particularly in early part of forecasts
- ENSO teleconnections
  - Strong evidence of an effect on Europe, perhaps SH too?
- Interannual predictability from the QBO?
  - Not all models will simulate a QBO but all will initialise it. This will provide information on model weaknesses
- Blocking frequency?
  - Do the high-top models exhibit better blocking stats? Are they linked to SSWs?

The expectation is that improved stratospheric representation will improve the representation of blocking (raising the lid increases blocking frequency) and NAO forecasts, which may lead to improved predictions in the mid-latitudes.

5. GEWEX and GLACE-2

GLACE-2 is an international project aimed at quantifying the soil moisture impacts on prediction skill. The overall goal of GLACE-2 is to determine the degree to which realistic land surface (soil moisture) initialization contributes to forecast skill (rainfall, temperature) at 1-2 month leads, using a wide array of state-of-the-art forecast systems.

Almost all of the expected GLACE-2 submissions are in. The individual models vary in their ability to extract forecast skill from land initialization (not shown). In general, there is low skill for precipitation and moderate skill (in places) for temperature, even out to two months. Land initialization impacts on skill increase dramatically when conditioned on the size of the initial local soil moisture anomaly. If you know the local soil moisture anomaly at time 0 is large, you can expect (in places) that initializing the land correctly will improve your temperature forecast significantly, and your precipitation forecast slightly, even out to 2 months. The results highlight the potential usefulness of improved observational networks for prediction.

A summary article on GLACE-2 has been published (Koster *et al.*, *GRL*, **37**, L02402, doi:10.1029/2009GL041677, 2010) and an overview article is in preparation (Koster *et al.*, *JHM*, 2010). An article on European-focused analysis has been submitted (van den Hurk *et al*., *Clim. Dyn.*, 2010). If there is inherent predictability and an adequate observations network for initialization, then improved skill can be gained from initializing soil moisture.

The follow-up of GLACE-2 is an extension of the simulations from
1986-1995 to 2009, an analysis of predictability of specific extremes (e.g. 2003 heatwave) and 'GLACE-Future' addressing land-atmosphere coupling under changed climatic conditions: whether there are changes in skill performance and the contribution to adaptation to climate change.

ACTION: Circulate Koster GRL article and give feedback that would help JHM review paper he is preparing (B. Kirtman)

6. Links to WWRP TIGGE

The key objectives of the THORPEX Interactive Grand Global Ensemble (TIGGE - http://tigge.ecmwf.int/) are:

- An enhanced collaboration on development of ensemble prediction, internationally and between operational centers and universities,
- New methods of combining ensembles from different sources and of correcting for systematic errors (biases, spread over-/under-estimation),
- A deeper understanding of the contribution of observation, initial and model uncertainties to forecast error,
- A deeper understanding of the feasibility of interactive ensemble system responding dynamically to changing uncertainty (including use for adaptive observing, variable ensemble size, on-demand regional ensembles) and exploiting new technology for grid computing and high-speed data transfer,
- Test concepts of a TIGGE Prediction Centre to produce ensemble-based predictions of high-impact weather, wherever it occurs, on all predictable time ranges,
- The development of a prototype future Global Interactive Forecasting System.

Ten of the leading weather forecast centres in the world regularly contribute ensemble forecasts to the THORPEX Interactive Grand Global Ensemble (TIGGE) project, to support the development of probabilistic forecasting techniques. As well as being part of the THORPEX programme, TIGGE is part of the "Global Earth Observation System of Systems" (GEOSS).

Results indicate that a multi-model ensemble containing nine TIGGE ensembles did not improve on the performance of the best single-model, the ECMWF EPS. However, a reduced multi-model system, consisting of only the four best ensemble system (MSC, NCEP, UKMO and ECMWF), showed an improved performance. However, reforecast-calibrated ECMWF EPS forecasts were of comparable or superior quality to the multi-model predictions, when verified against ERA-interim analysis or against observations (Hagedorn *et al.*, 2010, submitted to *Monthly Weather Review*).

The GIFS TIGGE Working Group meeting in February 2010 has paved the way for discussions on possible collaboration with WGSIP in relation to the CHFP. These will be explored at a workshop on Sub-seasonal to Seasonal Prediction that is being hosted by the UK Met Office in December 2010.

There are various basic mismatches since TIGGE is "real time", has limited data sets and uses a different file format. Some models that are participating in TIGGE have a related coupled version that is used for seasonal forecasts that could be compared.

ACTION: Continue discussion with TIGGE on the following topics (B. Kirtman, R. Swinbank)

ACTION: Investigate how much ocean-atmosphere coupling impact skill (B. Kirtman, A. Kumar, G. Boer, W. Landman)
- Role of resolution on skill (S. Behera, D. DeWitt)
- Scale interactions (B. Kirtman, A. Scaife to define longer term WGSIP leads)
- Ensemble techniques (F. Doblas-Reyes, A. Morse)

ACTION: WGSIP Participation in WGNE meeting 18-22 October 2010 Japan (D. DeWitt)

7. Decadal Prediction

The decadal prediction problem is at the forefront of international scientific interest, as a WCRP cross cutting topics since 2007 and with an active meeting and workshop schedule over the past year or so. The WCRP website hosts the WCRP decadal prediction cross cut website. Links to the cross cut webpage has been added to all the CLIVAR modeling working groups' webpages to increase the visibility of these groups' contributions to the cross cut.

The seasonal to interannual prediction community are natural participants in decadal prediction, with experience and ability in the central aspects of the problem:

- IPCC-class models
- Initialization, ensemble generation
- Retrospective forecast methodology
- Forecast combination, calibration, skill measures …
- (External forcing)

A survey has been distributed to the world modeling centers, CLIVAR and WCRP to gauge participation in the CHFP and the CMIP5 decadal prediction experiments. The wide distribution aims to be inclusive so that groups that have not traditionally contributed to past CMIP experiments and those outside the WGSIP community are surveyed on the CMIP decadal prediction component and CHFP, respectively.

A joint WCGM-WGSIP CMIP5 Decadal Climate Prediction Panel, originally formed at the 12th Session of WGCM in Paris, 2008, is in place to facilitate the response to issues and any coordination as needed. The panel members are G. Boer (Lead), B. Kirtman, G. Meehl, R. Stouffer, K. Taylor, M. Latif, D. Smith and S. Power. More information on its activities will be posted on the WCRP decadal prediction cross cut website. So far, the actions of the Panel have only consisted in some discussion of the treatment of volcano forcing for decadal prediction. Activities will include:

- To circulate an email to members of the community urging participation in CMIP5-decadal experiments;
- To increase the visibility of CMIP5 decadal prediction and the panel on the decadal cross cut website, providing basic information and a link for the PCMDI CMIP5 website;

WGSIP will help lead the evaluation of decadal forecasts building on experience gained in seasonal to interannual prediction. WGSIP will contribute to decadal studies in the areas of predictability, initialization, analysis and verification, with ENSO hindcast activities as a possible template. The contribution from the seasonal to interannual prediction community will be important input for Ch. 11 of the IPCC AR5. An Aspen Global Change Institute Workshop for June 2011 is being organized to finalize a synthesis paper on decadal hindcasts and predictions for assessment by Ch. 11 of the IPCC AR5. WGSIP can recommend diagnostics, including what is being developed as part of the EU projects THOR and COMBINE.

Chapter 11 of the IPCC AR5 is currently titled 'Near-term Climate Change: Projections and Predictability'. WGSIP recommends that the title be changed to 'Near-term Climate Prediction'. The distinction is made between projections and predictions where predictions are initialized simulations. The following are the proposed contents:

- Long timescales in climate system
  Forced and internally generated
- Predictability studies and results
  - Predictability as a feature of the physical system
  - "Skill" as our ability to correctly predict
  - Review of decadal scale predictability studies and implications
- Decadal forecast skill
  - Past studies but especially from CMIP5-decadal (CDFP)
  - Forecast combination, calibration, verification
  - Skill measures (deterministic and probabilistic)
- Predictions 2015-25 (NOT projections)
  - From CMIP5-decadal
  - Deterministic and probabilistic
  - In the context of past skill
  - Naturally includes regions (not a separate topic)
- Summary

The current list of contents for Ch. 11 includes atmospheric composition and air quality, possible effects of geoengineering and the quantification of the range of climate change projections. However, there will be few if any near term “forecasts" or "predictability studies" of atmospheric composition and air quality and the effects of geoengineering. The "quantification" of decadal predictions (NOT long term projections) is already, and properly, part of the "forecast skill" so a separate topic is not needed. It is recommended that the assessment of the spread of long term climate projections is assessed in Chapter 12.

ACTION: Increase visibility of decadal activity in modeling working groups so their contribution is clear on decadal cross cut webpage. Decadal webpage should have more visibility within WCRP (A. Pirani – WGSIP/WGCM Decadal Sub-group)

ACTION: Definition of decadal CMIP5 experiments on PCMDI CMIP5 webpage has to be improved and link back to CLIVAR page (A. Pirani, B. Kirtman, A. Scaife)

ACTION: WGSIP-WGCM-CMIP overview panel should be solidified and activated. Send email proposing activities, including survey, naming the activity eg CDFP, web visibility, put panel on webpage (A. Pirani, G. Boer – G. Meehl)

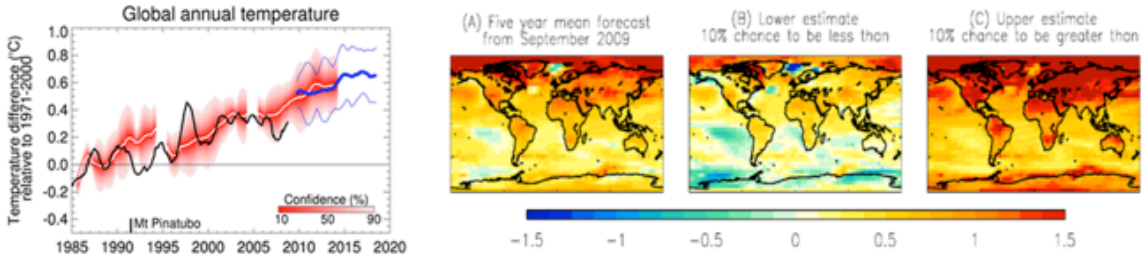
ACTION: WGSIP should propose a set of diagnostics that groups recommend for CMIP5 verification, and in addition what kind of diagnostics, not only against observations, that can be done, for planned Aspen meeting and to feedback to WGCM (A. Scaife, B. Kirtman to email WGSIP).

ACTION: Propose suggested change chapter title – predictions instead of projections format for Ch.11 and circulate amongst WGSIP, to then take to first lead authors’ meeting (G. Boer)

7.1 Exchange of decadal prediction information

The 15th session of the WMO Commission for Climatology recommended action to start the coordination and exchange of decadal predictions. A proposal went out to various groups earlier this year to exchange decadal prediction information. This will be a research exercise to prevent over-confidence from a single model and to give equal access, ownership and recognition to the real time predictions that are available. The initial exchange will simply be for Global Annual Mean Temperature, with one file for each year and each member exchanged once per year around October. See Figure 1 as an example of the prediction intercomparison.

Figure 1: Example diagnostics



The UK Met Office is coordinating this and the following groups are already contributing to this voluntary exercise, with any other groups welcome to join.

Met Office Hadley Centre	- A. Scaife, D. Smith
GFDL	- T. Rosati
RSMAS	- B. Kirtman
University of Tokyo	- M. Kimoto
SMHI	- K. Wyser, C. Jones
CERFACS	- L. Terray
IC3	- F. Doblas-Reyes
MPI	- D. Matei
IFM-GEOMAR	- M. Latif
KNMI	- W. Hazeleger
CCCma-EC	- G. Boer

8. Forecast Verification

8.1 Ocean Observing System

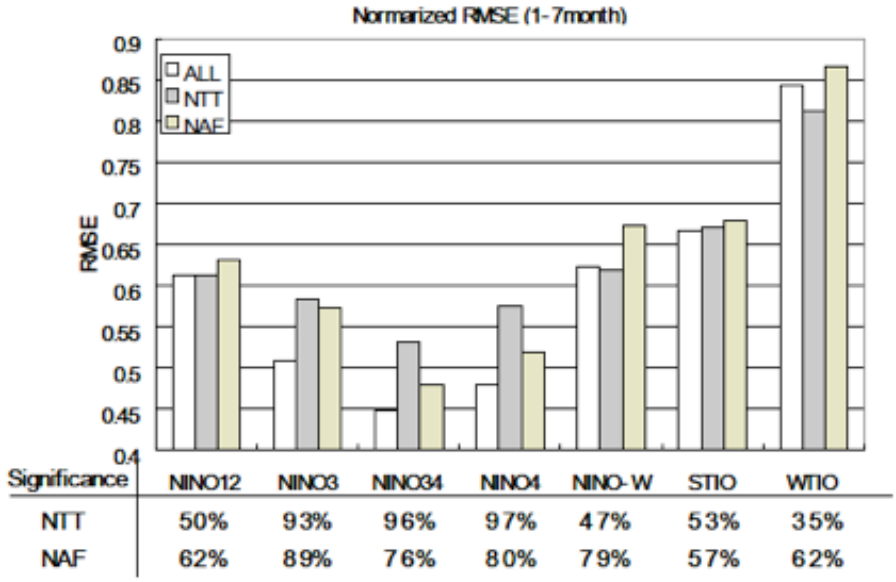
Observations are used for initialization systems of a varying range of sophistication (Univariate, Multivariate, 2D, 3D, 4D, Coupled). Univariate systems were the first generation. The community is now using more complex second generation initialization systems. Current assimilation systems include with bias and shock corrections. Non-stationarity in the observational records continues to be a problem this is only managed satisfactorily by second generation systems.

Table 1: Use of observations in seasonal to interannual prediction systems. Use includes for initialization-assimilation, to force the model, and for bias correction.

Observations	*Use in seasonal to interannual predictions*
XBT	Used
TAO/PIRATA	Used (T used, S and U for validation)
Argo	Used (T, S, some do not use salinity)
Altimeter	Used by some (benefit?, mean sea level)
SST	Usually nudged, should be assimilated
SSS	From satellite, not good enough yet
Drifters	Could be used for validation
Currents	E.g. TAO used for validation

An example of the impact on observations on seasonal forecast skill is given in Figure 2. The TAO array and Argo drifters are complimentary and the RMS error increases when they are both withheld.

Figure 2: Impact of withholding TAO/TRITION (NTT) and Argo (NAF) from the initialization of seasonal forecasts in the skill of JMA forecasting system. The bars show RMS errors of the 1-7 month forecasts of monthly SST anomalies normalized by the RMS errors of persistence forecasts. The significance level of the positive impact is given below the bar graph.



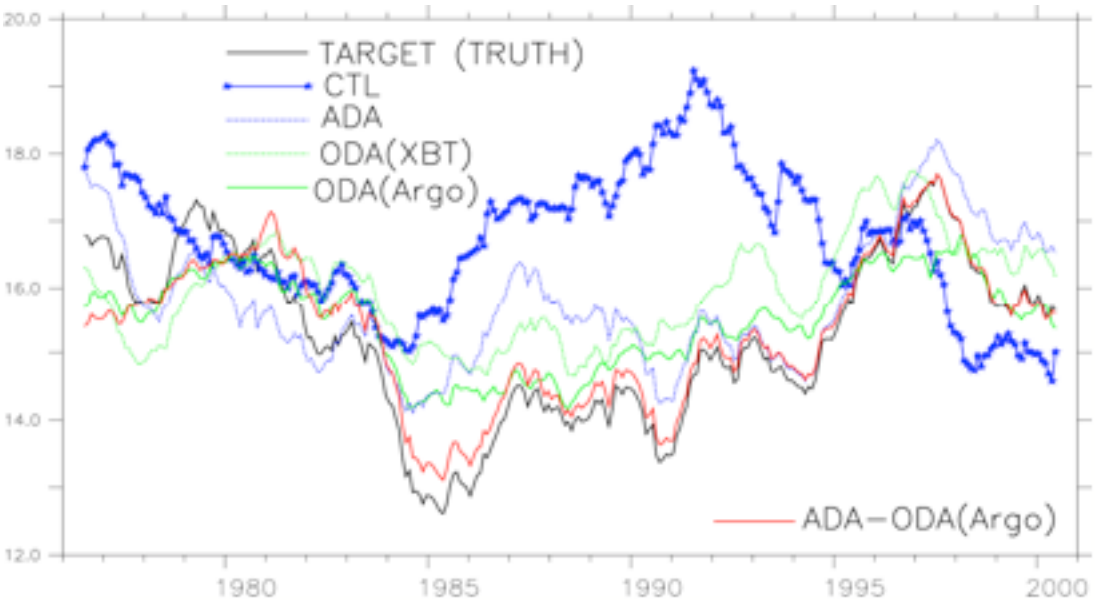
Significance	NINO12	NINO3	NINO34	NINO4	NINO-W	STIO	WTIO
NTT	50%	93%	96%	97%	47%	53%	35%
NAF	62%	89%	76%	80%	79%	57%	62%

Different assimilation systems ECMWF, PEODAS, GODAS, ENACT) are also being compared according to the simulation of specific physical modes such as ENSO, though determining which system is closest to reality is problematic since they are all using observations in different ways.

Observations before this decade were scarce in the Indian Ocean. This has changed since then with the onset of Argo. Demonstrating the impact on skill should include the period 1981 to 2010.

Decadal predictions have the same initialization requirements as seasonal predictions, but they additionally need the initialization of the deep ocean, see Figure 3 that shows the need for Argo to constrain the deep thermohaline circulation and for coupled ocean-atmosphere data assimilation. Atmosphere initialization has also been found to be important for seasonal and ENSO forecasts. The problem with anomaly initialization for ENSO is that it adds skill to the first few months, after which the model drifts.

Figure 3: The Atlantic Meridional overturning circulation in twin experiments with the GFDL model with different assimilation systems (from Zhang et al., 2007)



ACTION: Circulate email to WGSIP asking who is interested in participating in developing a strategy to assess real-time ocean analyses (A. Kumar, O. Alves, S. Behera)

ACTION: Communicate with H. Hendon re: assessing the impact of the RAMA array (O. Alves)

8.2 Standard Hindcast Verification

There are several groups within WMO that provide guidance on long range forecast verification with which WGSIP can interact to develop recommendations for forecast verification. This will be useful for groups regularly performing seasonal forecasts, as well as for users wishing to evaluate the CHFP dataset and CMIP5 decadal forecasts. Global Producing Centers are part of the Expert Group on Extended and Long-Range Forecasts (ET-ELRF) that provides this guidance. There is also a US CLIVAR Decadal Prediction Working Group (DPWG) that has the goal for providing some best practices for evaluating decadal predictions.

WWRP/WGNE Joint Working Group on Forecast Verification Research (JWGFVR) maintains a comprehensive website through CAWCR for education and outreach, including web tools and tutorials on verification methods: http://www.cawcr.gov.au/projects/verification/. This is for verification in general, not just on seasonal to interannual scales, which opens the door to close collaboration with the fast developments taking place in medium-range forecast verification. The website includes an extensive bibliography and the JWGFVR has coordinated a special issue of Meteorological Applications as a follow up to the Third International Verification Workshop, held in 2007 in Reading, UK. The aim of this was to bring verification methodologies and their applications, both in research and operational activities, to the attention of a wider community, and provide the reader with background information on the state of the art in verification methods, newly developed techniques and current challenges, such as accounting for insufficient observations, appropriateness of scores and confidence estimation.

WGSIP can interact with the WMO Expert Team on Extended and Long-range Forecasting (ET-ELRF) to propose recommendations for improvements of the Standardized Verification System for Long range Forecasts (SVSLRF), including for developing areas such as multi-model ensemble verification.

The WMO Standardized Verification System (SVS) for Long Range Forecasts (LRF) facilitates the exchange, archival, and intercomparison of seasonal to interannual forecasts produced by the Global Producing Centers (GPCs). The Australian Bureau of Meteorology and the Meteorological Service of Canada jointly manage the WMO Lead Centre for the SVSLRF. The Lead Centre provides access to recommended verification datasets, verifying software, documentation of the verification system, broad technical support, access to the final verification data as well as graphing and display of results: http://www.bom.gov.au/wmo/lrfvs/index.html.

Other forecast verification utilities developed at NCAR using the R coding language are available here: http://cran.r-project.org/web/packages/verification/index.html. It contains functions to obtain estimates of most popular deterministic and probabilistic scores.

There are some plans to extend the SVFLRF to the sub-seasonal. As an example, NCEP does some verification verification of monthly forecasts for teleconnections indices including the AMO, PDO http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml, as well as implementing the MJO verification diagnostics developed by the US CLIVAR Working Group on the MJO: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml.

WGNE will be discussing at its next meeting in October 2010 a coordinated effort to verify at sub-seasonal forecasts with standard metrics.

ACTION: Strengthen link between ET-ELRF and WGSIP – distribute report from last ET-ELRF meeting to WGSIP (A. Kumar)

ACTION: Recommend that SVSLRF and WGFVRS webpage linked to from CIMA CHFP webpage to see what state of the art in verification is, see documentation (C. Saulo, F. Doblas-Reyes, A. Pirani)

9. Applications and Climate Services

The integration of dynamic disease models with seasonal lead time ensemble prediction systems has been developed over the last 10 years especially through the EC funded FP5 DEMETER and FP6 ENSEMBLES projects, particularly for malaria. In ENSEMBLES, the Liverpool Malaria Model (LMM) was extended to run over multi-decadal scales driven by Regional Climate Models (RCM) outputs produced for FP6 AMMA project. At seasonal scales the LMM shows skill for some regions, in Africa, with a lead-time of 4 to 6 months, including areas with epidemic malaria transmission. The knowledge of integrating disease and climate models has been transferred to projections of disease for Europe. In the ERA-NET ENHanCE project an RCM driven blue tongue model has been developed for what is an economically important disease for ruminants especially sheep. Forthcoming work in FP7 QWeCI will develop a seamless ensemble prediction system ranging across days to decades to use with disease models for Africa.

As a result of these and other ongoing projects, there is more interaction with users than in the past. However more is needed to widen participation through the use of state of the art climate datasets. Many users continue to use older datasets, often supplied through an intermediary. In addition to the challenge of facilitating access to climate data, emphasis should be placed the recommendation that applications models should use multi-model ensembles where possible. These issues are inextricably linked to the development of Climate Services at a national and international level. WGSIP can contribute, sharing good practice recommendations, climate datasets and helping to connect the Climate Services agenda with the impacts community building on experiences learned from operational seasonal prediction services.

ACTION: To review current Climate Services activities within own National Met Service or other Met Services for which they have information (All)

ACTION: To review Climate Service activities within wider research community in own country or activities known elsewhere (All)

ACTION: To decide how these activities interact with wider research/CLIVAR activities. Are best practices of wider research/ development community being involved in NMHS practices? Is there evidence of seamless approaches or are all activities single model stream focused? (All)

9.1. Interactions with WMO Regional Climate Outlook Fora (RCOFs)

The first series of WMO RCOF were held in Southern Africa and were followed by other RCPFs around the world to provide guidance during the 1997-98 El Nino event. The Forum process has promoted the recognition in many parts of the world that short-range climate predictions could be of substantial benefit in adapting to and mitigating climate variations. An important aspect of the Fora is the facility to bring together experts in various fields, local meteorologists and end-users of forecasts in an environment that encourages interaction and learning, so capacity building is a key task.

Current WMO RCOFs:

- Southern African Regional Climate Outlook Forum (SARCOF)
- Greater Horn of Africa Climate Outlook Forum (GHACOF)
- Climate Outlook Forum for West Africa (PRESAO : PRÉvisions Saisonnières en Afrique de l'Ouest)
- FOCRAII : Forum on Regional Climate Monitoring, Assessment and Prediction for Regional Association II (Asia)
- Western Coast of South America Climate Outlook Forum (WCSACOF)
- Southeast of South America Climate Outlook Forum (SSACOF)
- The Pacific Islands: The Island Climate Update
- Pacific Islands online Climate Outlook Forum (PICOF)
- Climate Outlook Forum for Central America
- Southeastern Europe Climate Outlook Forum (SEECOF)
- South Asian Climate Outlook Forum (SASCOF)
- Climate Outlook for Cricket in the Caribbean: The Outfield

WGSIP can contribute to the RCOF process by making CHFP data available through the IRI data library, formatted for use with the IRI Climate Predictability Tool (CPT) for process studies and for operational forecasting.

ACTION: The provision of global model (AGCM and CGCM) hindcast and forecast data in CPT format for process studies and operation forecasting and verification (W. Landman)

10. Joint VAMOS-WGSIP Session

WGSIP and VAMOS met for a joint session to exchange updates on the CHFP, the La Plata Basin (LPB) project, the CLARIS-LPB contribution for CORDEX, and progress in sub-seasonal and seasonal prediction, model biases and developing forecast metrics for VAMOS applications. With regards to metrics for VAMOS, there is a diversity of interest, focus and metrics within the VAMOS community. IASCLiP and NAME put a strong emphasis on seasonal and sub-seasonal forecasts and have stronger links to 'applications' than MESA and VOCALS. VOCALS is more concentrated overall on coupled model performance and MESA papers have reported on model deficiencies in representing key features of the South American Monsoon System (SAMS).

The VAMOS Modeling Plan (http://www.clivar.org/organization/vamos/Publications/Vamos_Modeling_Plan_Jun08.pdf) promotes a multi-scale modeling approach for:

- Simulating, understanding and predicting the diurnal cycle

- Predicting the Pan-American Monsoon, onset, mature and demise stages
- Modeling and predicting SST variability in the Pan-American Seas
- Improving the prediction of droughts and floods

The modeling plan has been approved and its implementation will depend on leveraging and coordinating ongoing activities within WGSIP and VAMOS and facilitating collaborative science.

In view of the success and wide interest that the VAMOS Modeling Plan, WGSIP and VAMOS will carry out the implementation of the Plan's activities jointly.

VAMOS will take advantage of the CHFP archive to perform diagnostic studies in support of its science components.

VAMOS and WGSIP will work on identifying metrics derived from seasonal hindcasts to evaluate predictive skill of the American monsoons onset and regional temperature and rainfall anomalies.
The science and research activities that are being carried out within the VAMOS community will be identified according to the modeling plan. This information will be used to update the modeling plan if needed.

ACTION: Revisit the wording of the request for information on subproject information when users register to access CHFP dataset (A. Pirani, C. Saulo, G. Boer)

ACTION: Increase the communication on the data that will be available as part of the CHFP archive (WGSIP)

ACTION: Survey current contributions to the VAMOS Modeling Plan within the VAMOS community (C. Saulo, C. Ereno)

ACTION: Develop a VAMOS contribution to CHFP webpage with relevant information on relevant diagnostic subprojects, metrics, references (C. Saulo, A. Pirani)

ACTION: Make use of VAMOS email list to distribute survey asking who will participate in CHFP and CMIP5 decadal runs (G. Boer, C. Ereno)

Appendix 1

List of Participants (WGSIP meeting only)

B. Kirtman	(co-chair) Rosenstiel School of Marine and Atmos. Sciences, Uni. of Miami and COLA, USA
A. Scaife	(co-chair) Hadley Centre, UK Met Office, UK
O. Alves	BMRC, Australia
S. Behera	Research Institute for Global Change/JAMSTEC, Japan
G.J. Boer	Canadian Centre for Climate Modelling & Analysis, Canada
D. DeWitt	IRI, USA
F. Doblas Reyes	Catalan Institute of Climate Sciences, Spain
A. Kumar	NOAA Climate Prediction Center, USA
W. Landman	Council for Scientific and Industrial Research Natural Resources and the Environment, South Africa
A. Morse	University of Liverpool, UK
C. Saulo	CIMA, Universidad de Buenos Aires, Argentina
M. Deque	CNRM Meteo France, France
P. Silva Dias	THORPEX National Laboratory for Scientific Computation, Brazil
C. Hulbe	(CliC) Portland State University, USA
T. Ose	JMA, Japan
A. Pirani	(CLIVAR), ICTP, Italy

Appendix 2

13th Session of WGSIP
29-31 July 2010 - Buenos Aires, Argentina

DAY 1 - Thursday 29 July 9:00-17:30

1. Welcome and review of Agenda (B. Kirtman and A. Scaife (co-chairs, WGSIP))

1.1. Opening comments from C. Saulo
1.2. Introduction of new members
1.3. Structure and main aims of meeting
1.4. Review of action items from last meeting

2. Reports on CLIVAR and WCRP activities

2.1. Summary report on overall CLIVAR / WCRP issues (B. Kirtman, A. Scaife, A. Pirani)
2.1.1. WCRP modeling (WGCM, WGNE)
2.1.2. WCC-3 and Climate Services

3. Climate-system Historical Forecast Project (CHFP) (B. Kirtman)

3.1. List of models and status of data (all)
3.2. Data management
3.2.1. Server at CIMA, capacity building, CIMA workshop (C. Vera)
3.2.2. Datasets to be served locally
3.2.3. Discussion of the CHFP data servers, together with real-time distribution systems
3.2.4. Discussion on how to coordinate the seasonal forecast data servers, which are based on the ENSEMBLES server, and those that are being developed for CMIP5 (ESGF) (F. Doblas-Reyes)
3.3. CHFP analysis
3.3.1. Entrainment of wider community
3.3.2. Diagnostic sub-projects
3.3.3. Future developments - Evolution of the data system - Additional experimentation
3.4. Contribution to wider modeling activities (CMIP5, decadal hindcasts, COMBINE, etc)

12:30 - 13:30 LUNCH TIME

4. GEWEX and land surface issues (S. Seneviratne by phone, coordinating with H. Douville)

4.1. GLACE-II reports
4.2. Possible focus on land surface for a future meeting: analysis of CHFP, GLACE-II, operational systems and any other work.
4.3. Other comments on GEWEX links regarding CHFP? (All)

5. SPARC and Stratospheric impacts (A. Scaife)

5.1. How to proceed with S-CHFP
5.2. SPACR-DynVar workshop

6. Cryosphere issues (C. Hulbe)

6.1. How will CHFP by analysed regarding the cryosphere
6.2. Modelling and initialising sea-ice
6.3. Linkages with CliC

7. WGSIP-CHFP-WWRP-TIGGE Collaboration (B. Kirtman, P. Silva Dias)

7.1. Discussion of WWRP development of operational 1-90 prediction capability (P. Silva Dias)
7.2. Subseasonal Prediction (A. Kumar)

8. Applications (A. Morse)

8.1. Status report on use of and need for research data in seasonal applications
8.1.1. Experience and progress from recent and ongoing projects (ENSEMBLES, Uni, Cantabira Downscaling Portal, AMMA, QWECI)
8.1.2. Summary of European-funded projects on climate services with a seasonal and interannual prediction component: CLIM-RUN and ECLISE (F. Doblas-Reyes)
8.2. WGSIP interaction with the WMO RCOFs - A Southern African perspective (W. Landman)
8.3. Regional climate downscaling, CORDEX (M. Deque)

DAY 2 - Friday 30 July 9:00-17:30

9. Decadal prediction (G. Boer)

9.1. Decadal Prediction: WCRP cross cutting topic overview and Workshop Reports (B. Kirtman)
9.1.1. RSMAS Meeting on Prediction Capabilities and Use
9.1.2. Utrecht Meeting on Initialization
9.2. Overview and status of CMIP5 near-term experiments (G. Boer)
9.2.1. Status of CMIP-WGCM-WGSIP coordinating group (G. Boer)
9.3. Consolidating WGSIP's contribution to decadal problem - predictability studies, intialization and verification (G. Boer)
9.4. Assessment of seasonal prediction performance (eg in CHFP) for climate models and IPCC AR5
9.5. Data handling plans
9.6. Exchange of experimental decadal prediction information (A. Scaife)

12:30 - 13:30 LUNCH

10. Ocean observing system (O. Alves)

10.1. How adequate is the present system for ENSO, and for SIP more generally?
10.2. How adequate for decadal prediction?
10.3. What is the evidence base for our assessment? Should we organize coordinated observing system experiments in the near future, later, or perhaps not at all?

11. Standard hindcast verification

11.1. Sub-seasonal standards (A. Kumar)
11.2. Links to WMO Expert Teams on Long and Short Range Standard Verification Systems (F. Doblas Reyes)

12. WGSIP Linkages

12.1. Focus on Indian Ocean variability (S. Behera)
12.2. Updates on Indiam Monsoon, AAMP activities, and new South Asia RCOF
12.3. ENSO prediction limits: some models now doing well at 12 month range, should we explore these longer ranges (e.g. up to 2 years??)
12.4. US Clivar Decadal Predictability Working Group (A. Kumar)
12.5. WCRP/CLIVAR - WWRP THORPEX YOTC Group
12.6. WCRP Drought Interest Group (A. Pirani)

13. Review of activities around the world

13.1. Opportunity for all to present. Request is for 5-10 mins only, highlighting both strategic developments (in terms of science, not organizational issues) and any notable scientific highlights. Can include developments at institutes other than those represented at WGSIP (eg notable national or regional activities). Pre-circulation (or at least, availability at the time of the meeting) of a summary would be helpful.

14. Action items and organization of future activities (A. Scaife and B. Kirtman)

14.1. Agreement on overall work plan and priorities
14.2. Action items for the coming year
14.3. Membership and distribution of responsibilities
14.4. Timing and possible locations for next WGSIP session.
14.5. Close of WGSIP session.

DAY 3 - Saturday 31 July 9:00-17:30 - Joint WGSIP-VAMOS Session-

15. Overview of S. American Activities (VOCALS, LPB, CLARIS, CORDEX) (H. Berbery)

15.1. Model biases and model developent activities in S. America (R. Mechoso)
15.2. Overview of SIP in S. America (P. Silva Dias)
15.3. CORDEX plans for S. America (S. Solman)

16. VAMOS-WGSIP Modeling Collaboration

16.1. Update of CHFP (B.Kirtman)
16.2. Status on implementation of the VAMOS Modeling Plan
16.3. Forecast metrics for VAMOS applications (C. Saulo)
16.4. Develop Plans for Implementation and Future Experiments
16.5. Focus on tropical Atlantic variability, in context of ARGO data

12.30 -13:30 LUNCH

17. Subseasonal Prediction (A. Kumar)

18. Invited talks on S. American research

18.1. Land-atmosphere coupling (A. Sorensson)
18.2. Climate variability and extremes (F. Robledo)
18.3. Downscaling applications to hydrological models (R. Saurral)

5:30 Close of WGSIP and VAMOS Joint Session

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