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**Report from the 12<sup>th</sup> Session of the Working Group  
on Seasonal to Interannual Prediction (WGSIP)**

**(Submitted by Drs A. Pirani, B. Kirtman and T. Stockdale)**

## Report from the 12<sup>th</sup> Session of the Working Group on Seasonal to Interannual Prediction (WGSIP)

A. Pirani, B. Kirtman and T. Stockdale

The 12<sup>th</sup> Session of WGSIP was held on 12-14 January 2009, hosted by B. Kirtman at the University of Miami Rosenstiel School of Marine and Atmospheric Science (RSMAS), Miami, USA. The meeting report can be downloaded from <http://eprints.soton.ac.uk/65924/>. The presentations given by the meeting participants, together with some additional pre-meeting reports, are available on the meeting webpage (<http://www.clivar.org/organization/wgsip/wgsip12/wgsip12.php>).

The meeting focused on the major projects that are underway for which the panel is responsible, namely the Climate-system Historical Forecast Project (CHFP) and the decadal prediction component of CMIP5. We heard about relevant activities from all the WCRP Projects: J. Christensen - CliC, R. Koster - GEWEX, A. Scaife - SPARC and this provided a fertile discussion on how to integrate the full climate system to seek improved skill at seasonal and longer timescales. C. Vera, representing the WCRP JSC was also in attendance. There was discussion on the impact and requirements of the ocean observing system for seasonal prediction and on standard hindcast verification. Linkages with other projects and components of CLIVAR and WCRP were also explored.

WGSIP welcomed A. Scaife as a new member representing the seasonal to decadal prediction activities of the UK Met Office Hadley Centre, as well as the SPARC and C20C projects. C. Saulo was also welcomed to WGSIP, though she was unable to attend the meeting. C. Saulo represents the seasonal prediction activities of CIMA, Argentina, as well as the VAMOS community.

M. Visbeck, co-chair of CLIVAR was able to attend part of the meeting and discussed the third World Climate Conference (WCC-3), organizational issues within CLIVAR and collaborations with GEWEX. D. Leger participated and reported on the US CLIVAR organizational structure and development of working groups, drought and decadal prediction in particular. A. Kumar represented the US CLIVAR Predictions, Predictability and Applications panel. C. Vera and W.-J. Lee reported on the status of the CHFP distributed servers hosted by CIMA and APCC, respectively. H. Hendon represented the Centre for Australian Weather and Climate Research (CAWCR) group, in O. Alves' absence, as well as the CLIVAR AAMP.

The Climate-system Historical Forecast Project (CHFP) is underway with information on contributing and accessing data and on participating in diagnostic subprojects available on the CHFP website (<http://www.clivar.org/organization/wgsip/chfp/chfp.php>). The CHFP is a multi-model and multi-institutional experimental framework for sub-seasonal to decadal complete physical climate system prediction that was launched at the WCRP Workshop on Seasonal Prediction, Barcelona, Spain, June 2007. By the complete physical climate system, we mean contributions from the atmosphere, oceans, land surface cryosphere and atmospheric composition in producing regional and sub-seasonal to decadal climate anomalies. This experimental framework is based on advances in climate research during the past decade, which have led to the understanding that modeling and predicting a given climate anomaly over any region is incomplete without a proper treatment of the effects of SST, sea ice, snow cover, soil wetness, vegetation, stratospheric processes, and atmospheric composition (carbon dioxide, ozone, etc).

The observed current climate changes are a combination of anthropogenic influences and natural variability. In addition to possible anthropogenic influence on climate due to changing the atmospheric composition, it is quite likely that land use in the tropics will undergo extensive changes, which will lead to significant changes in the biophysical properties of the land surface, which in turn will impact atmospheric variability on sub-seasonal to decadal time scales. It is therefore essential that the past research by two somewhat non-interacting communities (i.e., climate change and seasonal prediction) be merged into a focused effort to understand the predictability of the complete climate system.

The results of these experiments provide a framework for future experiments, specifically these prediction results will provide:

- (i) A baseline assessment of our seasonal prediction capabilities using the best available models of the climate system and data for initialisation.;
- (ii) A framework for assessing of current and planned observing systems, and a test bed for integrating process studies and field campaigns into model improvements;
- (iii) An experimental framework for focused research on how various components of the climate system interact and affect one another□;
- (iv) A test bed for evaluating IPCC class models in seasonal prediction mode.

Over 10 modeling groups are currently participating in the CHFP and there are three distributed data centres that are supporting the experiment: CIMA, APCC and ENSEMBLES. In addition to the distributed data centres, some groups will support their own local servers. Data will be linked from the central CHFP website and data can be downloaded in a common format and grid as it becomes available later this year. The CHFP is designed to be long term with no hard deadlines, particularly as making data available at the distribution centres is still a learning experience. This also means that groups can join the experiment when ready and data from new model versions can be included as they become available.

The CIMA server has data available from its website and by the second half of 2009, it is hoped that the server will have tools available so that some analyses can be performed without having to download the data. APCC is contributing its hindcast data from its multi-model ensemble (MME) and the Climate Information Tool Kit (CLIK) has been developed users to do web-based analysis and downscaling. The addition of externally submitted CFHP data is expected for July-Sept. 2009. The ENSEMBLES Stream 2 matches the CHFP protocol and is publicly available as of March 2009.

The seasonal prediction problem extends further than the ocean-atmosphere, as primarily addressed by CLIVAR, with potential predictability sources from other components of the physical system. The significant role played by land-atmosphere coupling in seasonal predictability suggests that close ties must exist between WGSIP and the GEWEX community, particularly as regards the CHFP. WGSIP is also in the process of strengthening links with the stratospheric and the cryospheric community. Since the WCRP Task Force of Seasonal Prediction ceased to exist in 2007, WGSIP actively endeavors to maintain close links to the other WCRP projects by inviting representatives to its meetings.

The Global Land/Atmosphere System Study (GLASS) panel within GEWEX looks at modelling the interactions between the land and atmosphere on a global scale, though without focusing specifically on seasonal prediction. Global Land-Atmosphere Coupling Experiment (GLACE) is the main activity on seasonal prediction within GEWEX. GLACE-1 was a successful international modelling project that looked at soil moisture impacts on precipitation. GLACE-2 extends this work to consider the full initialisation forecast problem. GLACE-2 has been endorsed by WGSIP in the WCRP Position Paper on Seasonal Prediction and the project directly complements the CHFP experimental protocol in that no additional future information is included in the runs.

The SPARC area most relevant for WGSIP is stratospheric-tropospheric coupling. SPARC could interact with WGSIP in experiments looking at improved seasonal prediction skill resulting from a resolved stratosphere. Some groups within SPARC are able to run coupled ocean-atmosphere models for a sub-set of CHFP experiments, and some groups within WGSIP are able to extend their atmospheric model to resolve the stratosphere. A joint WGSIP-SPARC CHFP-related activity has been proposed; the Stratosphere-resolving Historical Forecast Project.

Given the different time scales and geographical distribution of cryospheric components in the climate system, perhaps only the accurate knowledge of varying sea-ice and snow properties can provide predictive skill at seasonal time scales. The CHFP recommendations encourage an interactive ice model, while leaving the nature of the model, whether dynamic or thermodynamic,

open. There is an opportunity for running additional CHFP coordinated experiments and diagnostics relevant for the cryosphere.

An area of potential collaboration between WGSIP and CliC would be in sea ice prediction and initialization, where various approaches are currently in use, with no knowledge of how this influences predictability. Another area is spring snow melt into soil moisture and how this influences spring temperature anomalies. This would be relevant to WGSIP, CliC, as well as GEWEX. This has essentially already been done for the warm season in GLACE and similar experiments could be run for the cold season. A proposal is being developed on how to move forward in a CHFP/CliC/GEWEX study of snow cover and soil moisture

The following numerical experiments associated to the CHFP are in progress, planned or under consideration:

- GEWEX: GLACE-2
- SPARC: Seasonal Prediction Skill Assessment: Troposphere-Stratosphere Interactions
- CliC: Sea-ice predictability experiments, and/or impact of snow cover

WGSIP is a co-sponsor of the WCRP CMIP5 near term experimental protocol and a CMIP-WGCM-WGSIP subgroup has been formed to oversee this framework. WGSIP will be active in addressing the science questions that present themselves and the protocol has been designed to extend beyond the requirements for AR5 and to serve the future science development needs in the area. It has also been designed to mesh with decadal predictability studies already underway in Europe.

Initialization is a central theme of decadal prediction and WGSIP will participate actively in the workshop on coupled initialization for decadal experiments that is being led by the Atlantic Implementation Panel to be held in Fall 2009. CLIVAR and WCRP as a whole must redouble efforts to identify and include all sources of potential decadal forecast skill, such as the cryosphere, soil moisture, etc. Connections should be maintained between the CMIP-WGCM-WGSIP group and the emerging US CLIVAR Working Group on decadal variability and prediction, led by A. Kumar.

One of the WGSIP terms of reference specifies its role to advise on the adequacy of the CLIVAR ocean observing system in terms of what are the requirements and impacts of the observing system for seasonal prediction. It is difficult to demonstrate improvements in ENSO prediction that are the direct result of improvements in the observing system because, in general, model error still dominates the absolute error. Although studies of observing system impact are very much encouraged by WGSIP, it is not appropriate at this time to organize any coordinated experimentation on this topic.

While there is skill in forecasting ENSO in the Pacific Ocean, there is little skill in the Indian Ocean. This could be due to model error, a lack of observations compared with the Pacific, a smaller climate signal, or maybe because there is less predictability in this region. The Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) activity is underway to enhance the observing system in the Indian Ocean, the implementation of which is being coordinated by the CLIVAR Indian Ocean Panel. How to demonstrate the benefit of the array for forecasts remains an open question that could be addressed by WGSIP, IOP and AAMP.

The major priorities of WGSIP in the coming year are:

- (i) Ensure that the CHFP experiments are completed and that the data is made available to the research community
  - a. Continue GEWEX GLACE collaboration
  - b. Develop SPARC and CliC seasonal prediction experimental protocols
- (ii) Continue to promote the Decadal Prediction experimental protocol and encourage wide participation

- a. Coordinate with emerging US CLIVAR Working Group for Decadal Prediction and Predictability
- (iii) Participate in the organization of WCC-3 and the development of the white papers on seasonal prediction