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CLIVAR Working Group on Seasonal to Interannual Prediction
Report of the 8th Session

5-7. November 2003, Honolulu, USA

May 2004

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Action items from WGSIP-8

1. **Standards Project**: A formal reply from the director ICPO to WGSIP request to support the standards project data management has not been received yet (**A. Villwock to ask H. Cattle to send a letter to B. Kirtman; B. Kirtman, M. Harrison and S. Zebiak to seek for alterative resources**).
2. **Review of the CLIVAR programme**: WGSIP was concerned to know the requirements for input for the planned review of CLIVAR. In order to appropriately address this issue in the given timeframe, it would appreciate receiving detailed information as soon as possible (**A. Villwock to H. Cattle and V. Detemmerman**) (done)
3. **Ocean reanalysis workshop**: WGSIP wishes to send a representative to this workshop. (**A. Villwock to further inform WGSIP**).
4. **Interaction of Pacific Panel and WGSIP**: WGSIP is interested in seeing the strawman proposal of the Pacific panel that has been sent to WGOMD (**K. Richards and A. Villwock to communicate to B. Kirtman**)
5. **Interaction of Pacific Panel and WGSIP:** WGSIP with the Pacific Panel to consider the development of a strawman paper on improving our ability to simulate the tropical ocean, e.g. via improved treatment of mixing processes (**T. Stockdale and S. Power, together with Oscar Alves and members of the Pacific Panel**).
6. **Observing System Simulation Experiments (OSSE)**: WGSIP felt that the current model capabilities are not appropriate for a major internationally coordinated OSSE. Further studies are encouraged. (**M. Davey and T. Stockdale write a (short) current assessment to be communicated to the Pacific Panel for consultancy purposes and subsequently to the SSG.)**
7. **WCRP Monsoon Modelling activity**: B. Kirtman (Chairman of TFSP) stated that it is not planned at the current stage that COPE TFSP will take the lead in organising a Pan - WCRP Workshop on Monsoon Modelling. (**A. Villwock to cross-check whether the letter from the AAMP to David Carson with respect to the Monsoon Workshop has been written**).
8. **T-OMIP**: WGSIP recommends that T-OMIP will be folded into coordinated experiment being developed in cooperation with the Pacific panel. (**B. Kirtman to communicate with P. Delecluse**).
9. **TOR of WGSIP and WGSIP role in COPE**: Recognizing that the JSC has recommended that WGSIP lead the COPE Task Force for Seasonal Prediction (TFSP), WGSIP should expand its terms of reference to include sub-seasonal (i.e., weeks) to interannual time scales. WGSIP should also expand its terms of reference to decadal time scales as it impacts prediction and predictability on time scales of weeks to interannual. Decadal prediction is beyond the scope of WGSIP and should most likely be part of the charge of WGCM. Moreover, given WGSIP's leadership of the COPE TFSP as recommended by the JSC, it is suggested that WGSIP report directly to the JSC regarding specific COPE seasonal prediction activities. Regarding all ongoing CLIVAR related projects and new initiatives, WGSIP continues to report to the CLIVAR SSG. (**B. Kirtman and A Villwock to communicate to JSC and CLIVAR SSG; B. Kirtman to draft revised terms of reference and circulate to the panel**).
10. **Dynamical Seasonal Prediction Project (DSP)**: In future, the outcome of this activity will be reported through the SMIP/HFP project. (**A. Villwock to adjust agenda in future**)
11. **WGSIP and GODAE**: WGSIP to contact N. Smith (chair Global Ocean Data Assimilation Experiment for Seasonal Prediction (GODAE)) about clarifying issues of GODAE (**S. Power and B. Kirtman to contact N. Smith**)
12. **El Niño Definition**: WGSIP felt some concern about the information that the Commission on Climatology is seeking to establish a group in order to define an internationally accepted index on El Niño. (**M. Harrison to communicate with V. Detemmerman about the details of this initiative**).
13. **Climate events of the past year**: WGSIP agreed to focus on fewer events but to work towards more comparable and rigorous assessment. At minimum, there should be an

agreement on variables and maps to be presented, if possible with data submitted to one place in order to present multi-model results (**M. Davey and P. Nobre to communicate details by e-mail prior to the next meeting**, **timeline summer 2004**).

14. **SST indices: S. Zebiak, T. Stockdale and S. Power to develop idea for developing and collecting SST indices.**
15. **SMIP-2 / SMIP/HFP**: Details of the data management of this project will to be refined and revisited. It will to be investigated whether the present service through PCMDI can be improved in order to meet the needs of the users. (**B. Kirtman and G. Boer to contact K. Sperber (PCMDI)**)
16. **Workshop on regional modelling**: WGSIP members to provide names for invited speakers to the organizing committee. (**WGSIP members to communicate to B. Kirtman**)
17. **Ensemble Workshop: Members of the panel will communicate the announcement to targeted groups (A. Villwock to communicate the announcement to M. Harrison)**
18. **Next Meeting**: WGSIP-9 to meet at Met. Office in Exeter Oct. 14-16, 2004 (Thu. – Sat.) prior to the Ensemble Workshop and to team up with WGNE for a joint session (**M. Davey to check the availability of the facilities; B. Kirtman to contact K. Puri about the joint session with WGNE; invite Kelvin Richards (chair Pacific Panel) to the next meeting**.
19. **Membership**: WGSIP thanked M. Davey for his long-standing contribution to the panel. B. Kirtman in his function as the chair of the Task Force for Seasonal Prediction (TFSP) of COPE will invite M. Davey to join the TFSP. WGSIP agreed to invite a scientist from South Africa to join the group. (**B. Kirtman to send nominations to the CLIVAR SSG (WGSIP) and to JSC (TFSP), cc to ICPO**)

1. Welcome and opening remarks

The 8th session of the CLIVAR Working Group on Seasonal-to-Interannual Prediction (WGSIP; previously known as CLIVAR NEG-1) was held at, at the East-West Center of the University of Hawaii, 5-7. November 2003. Dr. Kelvin Richards from the University of Hawaii was the local host for the meeting. Dr. Ben Kirtman (co-chairman of WGSIP) opened the session and welcomed the Panel members, invited experts, and local participants. The list of participants is given in appendix (B). Dr. Tim Stockdale (co-chair WGSIP) had sent apologies for being unable to attend the meeting.

The session was held back-to-back with the COPE Workshop on Seasonal Prediction, (see ICPO report No. 79). WGSIP reviewed briefly its research projects, and discussed plans for new initiatives, and other related international research activities.

2. Review of relevant developments and activities

2.1 News from the International CLIVAR Project Office

Dr. Villwock (ICPO) informed the Panel about the relevant developments within CLIVAR that had taken place since the previous WGSIP meeting in Cape Town, South Africa, 15-22?? November 2002 (ICPO Publication Series No. 68).

- **Staff changes in the CLIVAR IPO**
  During the past year there have been no changes in the ICPO staffing but some panel responsibilities have been redistributed. The current staffing encompasses (panel responsibilities in brackets):
  - Dr. Howard Cattle (Director, SSG)
  - Dr. Roberta Boscolo (Atlantic, VACS)
  - Dr Carlos Ereño (VAMOS)
  - Ms Katy Hill (Pacific/Data Management)
  - Dr. Mike Sparrow (Southern Ocean)
  - Dr. Andreas Villwock (WGCM, WGSIP, WGOMD, PAGES/CLIVAR)
  - Dr. Zhongwei Yan (AAMON, ETCCD)

  Because of the cessation of his funding, Dr. Andreas Villwock will leave the CLIVAR office end of the year. Through his new affiliation with the chair of the Joint Scientific Committee, Dr. Peter Lemke, he will continue to spend some time for CLIVAR. The responsibilities for WGCM will be taken over from V. Satyan (JPS), WGOMD (R. Boscolo) and PAGES/CLIVAR (Z. Yan). The responsibilities for WGSIP have to be defined.

- **CLIVAR Website**
  Some services on the CLIVAR website, such as the CLIVAR literature section will not be continued beyond end of the year because of the reduction in staffing.

3. International CLIVAR Conference in 2004

An international open science conference to review the first period of the programme, will be held in Baltimore, USA, 21-25. June 2004. A conference website has been set up under http://www.clivar2004.org/ and the second announcement and call for papers is now available. All contributing papers will be in form of posters. The deadline for submission is Dec. 15, 2003.

4. CLIVAR Exchanges

In 2003 two issues had been published, by the time of the WGSIP meeting, one focusing on the WOCE/CLIVAR transition and the second one on aspects related to CLIVAR VACS. The latter generated such much interest that a double issue was produced. The next issues will focus on Coupled Modelling (December) and the South American Low Level Jet Experiment (March 2004).

2.2 CLIVAR Scientific Steering Group 12th session, Victoria, May 2003

The following action items and recommendations of the 12th session of the CLIVAR SSG were brought to the attention of WGSIP:

1. Encourage WGSIP to pursue a workshop with WGNE and WGCM on ensemble methods, building on results from APCN workshop. *This WGSIP/WGNE/WGCM Workshop on Ensemble Methods is now scheduled for October, 18-21, 2004 at the Met Office. Further information is available through* http://www.clivar.org/organization/wgsip/
2. SSG Chairs to write to NOAA expressing support for the WGSIP Niño definition/index and noting that international consensus had been reached on this (Kirtman and Trenberth with SSG Chairs). This items will be discussed in more detail under agenda item 3.1
3. Task the ICPO to ensure that requirement for WGSIP standards project are included in data management strategy (ICPO). A formal reply from the director ICPO to WGSIP request to support the standards project data management has not been received yet (**A. Villwock to ask H. Cattle to send a letter to B. Kirtman; B. Kirtman, M. Harrison and S. Zebiak to seek for alterative resources**).
4. Agree new TOR for WGSIP based on input from Chairs WGSIP and D/WCRP (SSG Chairs with WGSIP and D/WCRP). This will be discussed under agenda item 6.2.
5. Encourage writing team of M. McPhaden, T. Hollingsworth and B. Kirtman to include issue of observing system evaluation for climate prediction (ICPO to draft letter). WGSIP felt that the current model capabilities are not appropriate for a major internationally coordinated OSSE. Further studies are encouraged. (**M. Davey and T. Stockdale write a (short) current assessment to be communicated to the Pacific Panel for consultancy purposes and subsequently to the SSG.)**
6. Encourage WGCM, to plan a workshop on regional modelling, and encourage coordination with WGSIP and WGNE and exploration of possible further collaboration with START and IPCC.
7. COPE - WCRP Banner: Hold a workshop to assess extent to which seasonal prediction is possible and to defining what are the challenges which a major WCRP prediction experiment could/should address. *This workshop was held back-to-back with WGSIP-8, in Honolulu, USA, November. 3-5, 2003.*
8. Organize review/assessment of CLIVAR along lines of PRAs. Select from ex-SSG members reviewers for each subject. Invite reviewers to CLIVAR Conference and ask them to monitor relevant presentations and posters as part of their assessment, to be presented at the SSG meeting immediately following the Conference (SSG Chairs with ICPO). In preparation of the review all CLIVAR Panels will be ask to prepare brief summary of what they have accomplished relative to what they set out to do and what they think they can achieve by a given sunset date of 2013. (Deadline: January 04). WGSIP was concerned to have the requirements for input for the planned review of CLIVAR. In order to appropriately address this issue in the given timeframe, it would appreciate receiving detailed information as soon as possible (**A. Villwock to H. Cattle and V. Detemmerman**).
9. All WCRP projects were asked by the JSC for a sunset date. CLIVAR will formally end 15 years after the commitment conference in 2013.
10. PAGES/CLIVAR Working Group is being reconstituted - new chairs: Andrew Weaver and Eystein Jansen, other members to be invited.
11. A CLIVAR Global Synthesis and Observations Panel (GSOP) is under development. One of their main activities will be on ocean reanalysis. In this context there are plans for an ocean reanalysis workshop. WGSIP wishes to send a representative to this meeting. (**A. Villwock to further inform WGSIP**).
12. Plans for an Indian Ocean Panel has the SSG endorsement. It will be formed in 2004.
13. CLIVAR Conference 2004: Second Circular in press (http://www.clivar2004.org/) See separate paragraph above.
14. Plans for Data Management Workshop are under development
15. Other Workshops planned for 2004:
    - Atlantic Predictability (Reading, 19-23 April 2004). White papers are currently being written, a special issue in Exchanges is planned for fall 2004; a workshop announcement is available under: http://www.met.rdg.ac.uk/clivar/

- Atlantic THC Variability (Kiel, 13-16 September 2004). A workshop announcement is available under: http://www.ifm.uni-kiel.de/allgemein/news/nawshp_04.htm
- WGOMD (Princeton, USA, 16-18 June 2004). A workshop announcement is available under: http://www.gfdl.noaa.gov/~ewm/live/clivar/clivar.html
- VACS (TBD)

2.3 Report from other meetings and groups relevant to WGSIP

CLIVAR Asian-Australian Monsoon Panel

The A-A Monsoon panel met February 2003 in Atlanta, USA. One of the relevant action items with respect to WGSIP and COPE was on the Pan-WCRP monsoon modelling activity. The panel recommended a letter be written to Dr. David Carson (Director JPS) regarding support for a 2-3-day planning workshop with interested groups, in order to develop an overall coordination strategy for the monsoon modelling within WCRP. B. Kirtman (Chairman of TFSP) stated that it is not planned at the current stage that COPE TFSP will take to lead in this activity. (**A. Villwock to cross-check whether the letter from the AAMP to David Carson with respect to the Monsoon Workshop has been written**).

CLIVAR VAMOS

The VAMOS panel is currently discussing the establishment of a subgroup for modelling issues.

CLIVAR Pacific Panel

Dr. Kelvin Richards (chair, Pacific panel) reported from the last session of the CLIVAR Pacific panel which was held in July in Yokohama, Japan.

The research framework of the Pacific panel is provided by the Principal Research Areas G1 (Extending and improving ENSO predictions) and D4 (Pacific and Indian Ocean decadal variability) of the CLIVAR Initial Implementation Plan. In addition, the PBECS initiative (US CLIVAR) provides guidance to the panel.

The basic strategy of PBECS requires broadscale technologies (Argo, WOCE repeat sections, TAO/TRITTON, XBTs, drifters, altimeter, scatterometer winds) to define the interior flow and structure, the forcing fields, and provide the basis for assimilating into OGCMs/climate models

However, some features/processes are poorly resolved or modelled. PBECS is directed to three components of the subtropical cell and connection to the equator:

- Low latitude western boundary currents
- Subtropical subduction
- Equatorial upwelling

Other initiatives the panel is giving attention to are in particular:

PUMP (= Pacific Upwelling and Mixing Physics).

PUMP is a US CLIVAR process study which has the goal to improve model representation of the processes that connect the thermocline and the surface in the east Pacific cold tongue.

- Elements of a program were aired in vigorous discussion at PUMP workshop, but the real shape of the programme has not yet jelled. However.
- It is likely that PUMP will attempt to measure vertical and horizontal mixing in the presence of strong background vertical velocity. The aim is to diagnose the meridional circulation over ± 3° latitude, including upwelling, internal-wave-induced mixing, frontal mixing, TIW mixing.
- PUMP will probably consist of a year-long observational process study, involving both ship-based measurements and enhancements to TAO moorings.

A core group of 8 was appointed by the workshop; this group will draft a document to be circulated to the Pacific Implementation Panel and workshop attendees by August, with the aim of producing a completed scientific plan for presentation to the US CLIVAR SSC in the fall. International collaborators are welcome.

A white paper is available through http://www.pmel.noaa.gov/~kessler/clivar/pump.html

Low-latitude Western Boundary Currents (LLWBC)
The LLWBCs (Mindanao Current, New Guinea Current system) are thought to be a key player in the subtropical overturning circulation of the Pacific, yet they are very poorly known. Models produce quite different representations of their variability, for unknown reasons. We do not have a clear idea even of the annual cycle of the Mindanao Current.

It would be extremely desirable to develop technology to cheaply monitor the transports of the LLWBCs. The broadscale observing system (Argo, altimetry) will adequately resolve the gyre circulation and heat/property transports, but the WBCs that are the crucial link to the tropics will remain poorly sampled without a significant new effort. There are technologies on the near horizon that may make such monitoring reasonably cheap (gliders). Since such sampling must be done within the EEZs of the Philippines, Indonesia and New Guinea, collaboration with scientists from those countries will be necessary. In addition, local knowledge of the currents will be useful, and this could be an opportunity to engage scientists, technicians and institutions in the three countries.

Issues to consider with respect of cooperation with other CLIVAR groups are:

1. Characteristics of the decadal behaviour of the ocean components of coupled models (as a function of model configuration) – a strawman paper has been sent to WGOMD. WGSIP is interested in seeing this proposal (**K. Richards and A. Villwock to communicate to B. Kirtman**)
2. Scale interactions (small scale mixing, TIWs, MJOs, STCs - seasonal, interannual, decadal)
   – e.g. through analysis of existing high resolution GCM runs
3. Biases in coupled models – in the tropics, the venerable too-cold tongue and double ITCZ
4. Other poorly understood processes

Furthermore, Dr. Richards presented some priority areas for the Pacific Panel and WGSIP to consider in the context of improving seasonal forecasts.

Ocean Mixing
From the point of view of predicting and simulating ENSO, mixing processes (both lateral and vertical) in the ocean play a role in determining:

- Location and extension of the cold tongue in the Eastern Pacific, and therefore the location (and possibly the nature) of the interannual variability.
- Vertical thermal structure of the thermocline in the cold tongue area, and therefore the intensity of interannual variability
- The impact of MJO (and Westerly Wind Events generally) on SST gradients, and may determine the degree of interaction between different timescales

WGSIP agreed to consider in cooperation with the Pacific Panel the development of a strawman paper on improving our ability to simulate the tropical oceans, e.g. via improved treatment of mixing processes (**T. Stockdale and S. Power, together with Oscar Alves and members of the Pacific Panel**).

Observing System Simulation Experiments
With respect to Ocean Observing System Experiments (OSSEs) the Pacific Panel suggested aiming for a Pacific Panel/WGSIP position/consensus on OSSEs, with preparation of a draft short statement from WGSIP & Pacific Panel.
– e.g., OSSEs are useful but great care is needed in the interpretation, e.g. due to limitations in understanding & models (good to see research of this kind being conducted but too early for a major international program); OSSEs may be model dependent, some redundancy crucial (data dropouts); systems under rapid development; very expensive; using skill as cost function/metric problematic; "common sense more practical" (Anderson et al. 1999).

WGSIP felt that the current model capabilities are not appropriate for a major internationally coordinated OSSE. It was agreed that further studies be encouraged. (**M. Davey and T. Stockdale**

write a (short) current assessment to be communicated to the Pacific Panel for consultancy and subsequently to the SSG.)

Tropical Ocean Models Intercomparison Experiment
In the context of the Pacific Panel report the status of the Tropical Ocean Models Intercomparison Project (T-OMIP) project was discussed. This project, which was originally initiated by CLIVAR NEG-1 has not made any progress during the past years. In the presence of the more comprehensive OMIP study implemented by the Working Group on Ocean Model Development, the panel recommended that T-OMIP will be folded into coordinated experiment being developed in cooperation with the Pacific panel. (**B. Kirtman to communicate with P. Delecluse**).

2.4 Reports from national or multi-national CLIVAR Committees

US-CLIVAR
Dr. Zebiak reported on the US Climate Process Teams (CPTs). A CPT is a team of observationalists, process modellers, and coupled climate modellers formed around specific issues or key uncertainties that aims to link process-oriented research to modelling for the purpose of addressing key uncertainties in coupled climate models.

The objectives of a CPT:
Speed the improvement of coupled models, data assimilation systems, and model components by:
- Parameterizing the important processes not included explicitly in climate models;
- Transferring theoretical and process-model understanding into improved treatment of processes in climate models;
- Sharpening our understanding of how particular physical processes impact the climate system;
- Identifying sustained observational requirements required by climate models for these parameterizations; and
- Identifying additional process studies necessary to reduce uncertainties associated with important climate model processes/parameterizations.

So far, three CPT's have been established on
- Mixing in overflow regions
- Interaction of Mesoscale Eddies
- Low latitude cloud feedbacks and climate sensitivity

Japan
Dr. Sugi reported about seasonal prediction at JMA and multi-model ensemble forecasts and predictability study.
The seasonal prediction activities at JMA have already a long history, starting with statistical one-month and three-month forecasts in 1942, and statistical warm/cold season forecasts a year later. In 1996 the first dynamical one month forecast was performed followed by a regular El Niño Outlook with a coupled model in 1999. Since 2003 dynamical three month forecasts and dynamical warm/cold season forecasts have been performed.
The operational models for seasonal forecasts are
- One month forecasts: AGCM with fixed SSTA
  T106L40 GSM0103 26 member
- Three month forecasts: AGCM with fixed SSTA
  T63L40 GSM0103 31 member
- Warm/Cold season forecasts: Two tier method
  T63L40 GSM0103 31 member using SSTA from CGCM02

The new ENSO Forecast Model (JMA-CGCM02), in operation since July 2003, consists of an AGCM T42L40 and an OGCM 2-0.5°x 2.5°L20.

In the AGCM a prognostic Arakawa-Schubert convection scheme and prognostic clouds are included. The ocean component has an Ocean Data Assimilation System (ODAS) *using a* 3DVAR method, incremental analysis update by assimilating temperature, salinity and sea surface height.

Results show that the system has an overall skill in seasonal forecasts for seasonal mean temperature over Japan. The percentage of correct three category forecasts is about 40~50%. This value corresponds to the correlation between ensemble mean and observation of 0.23~0.52. Even though the percentage of correct forecasts is 40~50%, the probability forecast is still useful.

Multi-model Ensemble Forecasts and Predictability Studies
Dr. Sugi described the statistical method being used at JMA to conduct multi-model ensemble forecasts. By using multi-model ensemble simulations the model independent signal variance and potential predictability, the signal amplitude and model error variance for each model, and the optimum weight for multi-model ensemble can be estimated.

Canada
Dr. G. Boer reported on some recent developments in Canada. A number of CLIVAR related activities are co-ordinated through the Canadian Climate Variability Research Network.
More information about this activity can be found under: http://www.clivar.ca/network/home.htm

On of the main activities of this network during the past year was the 18th so-called Stansted Seminar which took place 16 - 20 June 2003 at Bishop's University, Lennoxville, Québec under the overarching topic Climate Variability and Predictability from Seasons to Decades.

Australia (S. Power)
The Bureau of Meteorology Research Centre (BMRC) has, in collaboration with the Commonwealth Scientific and Industrial Research Organization (CSIRO) Marine Research, developed a CGCM-based system called the Predictive Ocean Atmosphere Model for Australia (POAMA). The model incorporates the BMRC Atmospheric Model and a global version of the GFDL modular ocean model. One 8-month forecast is produced each day. Further details are at www.bom.gov.au/bmrc/ocean/JAFOOS/POAMA .Contact: O. Alves or G. Wang.

The Queensland Department of Natural Resources and Mines is evaluating a dynamical downscaling approach to seasonal forecasting. The NCEP MRF9 T40 AGCM was forced by observed SST for the period 1965-2002. 6 hourly output was used as lateral conditions for the CSIRO Regional Climate Model (DARLAM) at a horizontal resolution of 75 km over the Australian region and double nested over Queensland at 15 km resolution. 15 member ensembles were constructed. Dynamical downscaling in forecast mode out to 7 months has also been performed since late 1998 using predicted SST from the IRI. Contact: J. Syktus.

2.5 Other WCRP modelling activities

Working Group on Numerical Experimentation (WGNE)
The group was scheduled to meet the week following the WGSIP meeting, in Salvador, Brazil. WGSIP plans to team up with WGNE during next year's session which will be held back to back to the Workshop on Ensemble Methods in Exeter.

JSC/CLIVAR Working Group on Coupled Modelling (WGCM)
The 7th session of the joint JSC/CLIVAR Working Group on Coupled Modelling was held September 24-26, 2003 in Hamburg Germany following the Conference on Earth System Modelling and the 2nd CMIP workshop. The following items of broader relevance were noted.
1. Coupled Model Intercomparison Project (CMIP)
a) Significant accomplishments of CMIP, Oct. 2002 – Sept. 2003
- 20th Century Climate in Coupled Models (20C3M), approved as a CMIP pilot project (Oct. 2002); data collection has begun
- Ocean data from CMIP2+ now available for analysis of subprojects from PCMDI
- Catalogue of MIPs completed with cooperation of WGCM and GAIM, and now on CLIVAR web page with link from CMIP web page
- CMIP and 20C3M summaries published in CLIVAR Exchanges (end of 2002); CMIP Summary published by GAIM (early 2003)

- CMIP subprojects have produced 25 peer-reviewed publications, 6 other publications, 4 PCMDI publications, significant contributions to IPCC TAR; As of September 2003 there are 28 CMIP2+ subprojects currently active, in addition to 10 completed subprojects from CMIP1 and 22 from CMIP2
- Second CMIP Workshop held Sept. 2003

b) CMIP and IPCC

Community runs for IPCC AR4 (approved by TGCIA mid-2003) and revised by WGCM, Sept. 2003 (to be communicated to TGCIA)

1. 20th century simulation to year 2000, then fix all concentrations at year 2000 values and run to 2100 (CO_2 ~ 360ppm)
2. 21st century simulation with SRES A1B to 2100, then fix all concentrations at year 2100 values to 2200 (CO_2 ~ 720ppm)
3. 21st century simulation with SRES B1 to 2100, then fix all concentrations at year 2100 values to 2200 (CO_2 ~ 550ppm)
4. 21st century simulation with SRES A2 to 2100

The groups made a number of comments with respect to the IPCC AR4 process.

c) The next phase of CMIP (CMIP3) will begin in October 2003.

This will include requirements as before for CMIP2, with fields collected as decided for the IPCC and other runs comparable to CMIP2:

1. 1% CO_2 run to year 80 where CO_2 doubles at year 70
2. 100 year (minimum) control run including same time period as in 1 above
3. 2XCO_2 equilibrium with atmosphere-slab ocean
4. 1XCO_2 control with atmosphere-slab ocean

Strongly recommended:

5. 20C3M simulation
6. participate in AMIP, OMIP, and CFMIP

Recommended—idealized stabilization simulations

7. An additional 150 years after CO_2 doubling with CO_2 fixed at 2XCO2
8. 1% CO_2 run to quadrupling with an additional 150 years with CO_2 fixed at 4XCO_2

2. Data Management

The lack of a data portal for model data was highlighted. The value of publishing data should be stressed to strengthen the value of data management efforts. On the national levels funding for DM efforts should be encouraged. In this context the role of WCRP was emphasised. WCRP will set up a DM-council (group). A DM workshop is planned, eventually hosted by PCMDI. It was proposed that PCMDI should be the clearing house / data portal for (coupled) modelling data.

The next meeting of the WGCM is planned for October 2004 in Japan, partly jointly with GAIM.

2.6 National or multi-national projects

Seasonal Diagnostics Consortium

The Seasonal Diagnostics Consortium is an OGP/NOAA sponsored activity to understand seasonal predictability and to seek attribution for the observed seasonal climate anomalies on a near-real time basis. It is well known that observed seasonal climate anomalies are a blend of the atmospheric response to the observed SST forcing, and a variability which is not related to SSTs (the so called atmospheric internal variability). The focus of this consortium is to understand the contribution of these two components to observed seasonal climate anomalies. One way to separate out the influence of SSTs from the atmospheric internal variability is to have an ensemble of AGCM realizations forced with identical SSTs. Ensemble mean atmospheric anomalies then provide information about the SST forced component of the observed seasonal means. However, because of different biases in the AGCMs, attribution of seasonal climate anomalies based on a simulations from a single AGCM alone, can lead to incorrect conclusions. In this consortium activity, this potential problem is partially overcome by bringing together atmospheric simulations from many different models. An agreement

between the atmospheric responses from different AGCMs adds to our confidence in the attribution aspect of the atmospheric climate anomalies.

Participating institutions are: Climate Diagnostics Center (CDC), NASA Seasonal-to-Interannual Prediction Project (NSIPP), International Research Institute for Climate Prediction (IRI), National Centers for Environmental Prediction (NCEP), Center for Ocean-Land-Atmosphere (COLA) Scripps Institute for Oceanography (SIO), and Geophysical Fluid Dynamics Laboratory (GFDL)

The general approach within this project is:

- Make a prediction for SST anomalies - SSTP
- Force an ensemble of AGCM realizations with SSTP
- Construct an ensemble mean response
- A prediction could be the ensemble mean response

Current Status:

Model	**CCM3**	**NCEP**	**NSIPP**	**ECHAM4.5 (From IRI)**	**GFDL**	**COLA**
Type	Spectral	Spectral	Grid	Spectral	Grid	Spectral
Resolution	T40L18	T62L28	2 Deg Lat/Lon	T40L18	N45L18	T63L18
# of Simulations	20	18	9	24	10	10

In total 91 simulation are available at present.

Other applications are

- Climate Attribution
- Postmortem of Operational Climate Predictions
- Improving Climate Predictions
- Nowcasting Climate
- Assessment of Models for Seasonal Climate Predictions

More information can be found under
http://www.emc.ncep.noaa.gov/cmb/atm_forecast/consortium
Contact is Arun Kumar (arun.kumar@noaa.gov).

ODASI (Ocean Data Assimilation Consortium for Seasonal-to-Interannual Prediction)
Consortium for NOAA/OGP/CDEP with participation from COLA, IRI, LDEO, NCEP and NSIPP. This plans to provide:

- *in situ* data stream QC's for S-I applications (contribution to GODAE)
- a suite of retrospective and real-time products (GODAE, CLIVAR)
- a suite of initial conditions that can be used for multi-model ensemble forecasts
- an ensemble of forecasts, 1980 - present: useful for Tier2 ensembles
- metrics designed to discriminate between products
- an evaluation of the products

ODASI Themes encompass:

1. ODA product intercomparisons (models, assimilation methodologies, assimilation parameters) using a common forcing data set and common QC'd *in situ* data streams

   Models: MOM4, MOM3, Poseidon, Cane-Patton, LDEO4
   Methodologies: 3DVAR, OI, EnKF, Reduced state KF and optimal smoother, bias correction strategies
   Coupled Forecast Systems: CGCMs, Hybrid models, Intermediate models

2. Development of observational data streams

3. Validation of assimilation products in forecast experiments
4. Observing system impacts - focused on TAO:
   TAO array was established for S-I forecasting.
   - Is it effective in its present configuration?
   - Could it be modified to provide better support for S-I forecasts?
   - What is its role c.f. other elements of the ocean observing system?

The experimental design of the ODASI experiment is as follows:

- initial conditions for 1 January and 1 July, 1993 to 2002
- Forecast duration: 12 months
- 6-member ensembles for each system
- The observations: (assembled and QC'd by Dave Behringer at NCEP)
  - historical XBTs from NODC, MEDS
  - TAO from PMEL
  - Argo profiles from GODAE

- Surface forcing: (assembled by GFDL)
  - NCEP GDAS daily forcing: momentum, heat, freshwater
  - surface wind climatology replaced by Atlas's SSMI surface wind analysis
  - include a restoration to observed SST and SSS

Initial conditions for forecast experiments prepared using

1. All *in situ* temperature profiles, including the full TAO array
2. Western Pacific (west of 170°W) TAO moorings
3. Eastern Pacific TAO moorings

Hypothesis: The eastern Pacific data important for shorter lead forecasts and the western Pacific data are important for longer lead forecasts.

Address uncertainty in the results by use of

- ensembles
- different assimilation systems
- different CGCMs
- different classes of models (CGCMs, hybrid, intermediate)

Conclusions:
The analysis is in the early stages, more detailed studies are required.
More ensemble members and more cases of both warm and cold events are needed for robust conclusions with statistical significance. So far the results indicate:

- Eastern array definitely improves forecast skill
- Western array improves skill in central Pacific
- Entire array
  - best results
  - probably associated with atmospheric response across the entire Pacific
  - some indication that get a tighter spread
- results are subtle - complicated by coupled model shocks and drifts

A Coupled Data Assimilation Workshop was held in Portland, April 2003 to address issues like methods for forecast initialization, assimilation of subsurface information and impact on skill, and forecast errors due to coupled model shocks and drifts.

More information is under http://nsipp.gsfc.nasa.gov/ODASI

Global Ocean Data Assimilation Experiment (GODAE)
There was no report on progress within this project and WGSIP felt the need to clarify some issues of the Global Ocean Data Assimilation Experiment for seasonal prediction (**S. Power and B. Kirtman to contact N. Smith**),

IRI/ARCS Regional Applications Project
Background:
This consortium is a cooperation of ECPC, UW, NCEP, FSU and IRI. During its first phase (1999-2002) the consortium developed a regional model intercomparison project for S. America, centred on Brazil. The purpose of this project was to evaluate the various regional models that had been developed and were being analysed by IRI. NCEP, and various ARCs. Brazil was chosen for the first intercomparison, in part because global models had previously shown great skill in describing ENSO and other seasonal anomalies there and we wanted to determine the additional skill that might be provided by regional models. The initial goal was to drive these regional models by the global analysis and then in the second phase to drive the regional models by global forecasts. The first phase has now been finished and results are being prepared for publication.
Current status:
The IRI/ARCS regional model consortium has now moved beyond simply comparing regional simulations (and forecasts) to connecting these regional models to the application community such as: Firedanger, Crops, Hydrology, Ecology.
In fact, the application community has already connected directly to the global modeling community, in part because this community has larger forecast ensembles available. For example, the IRI is currently attempting to statistically downscale from its current multi-model global model ensemble rather than develop corresponding multi-model regional model ensembles.
To provide additional regional model ensembles, NCEP has begun to develop ensembles of regional model forecasts for the US, which are freely available to interested researchers
The regional consortium is also still attempting to improve and further develop regional models

- ECPC RSM CVS with pressure diffusion will soon replace current RSM96/97 versions and thus be more compatible with the ECPC SFM
- NCEP is replacing RSM97 physics with new GFS physics
- Variable resolution global models are being investigated by the IRI

Development of a European Multimodel Ensemble system for seasonal to inTER annual prediction (DEMETER)
The objective of the project is to develop a well-validated European coupled multi-model ensemble forecast system for reliable seasonal to interannual prediction. A fundamental aspect is to establish the practical utility of such a system, particularly to the agriculture and health sectors. DEMETER has 12 partners and has been funded by the European Union for the period April 2000-September 2003. Dr. Hagedorn reported that this project has produced a unique dataset for assessment of predictability on seasonal timescale and proven the superiority of multi-model concept. It has also demonstrated a potential economic value through end-user applications. In some sense ENSEMBLES will be the successor of DEMETER.
More information is available under http://www.ecmwf.int/research/demeter/

Dynamical Seasonal Prediction (DSP)
Dr. B. Kirtman reported briefly on this project. It has been extended to autumn and spring seasons which will be reported in a paper "Predictability of the Seasonal Mean Atmospheric Circulation During Autumn, Winter and Spring" by Straus, Paolino, Shukla, Schubert, Suarez, Kumar and Pegion – J. Climate, (2003/04).
There are plans to extend the project to the prediction of extreme droughts and heat waves over U.S. and to develop a plan to explore the impact of uncertainty in SSTA. Since the project fits very well under the scope of SMIP/HFPs developments of DSP activities will be incorporated in the SMIP report. (**A. Villwock to remove this item from the agenda for future meetings**).

Enhanced Ocean Data Assimilation and Climate Prediction (ENACT)
ENACT is a project within the Vth European Framework Programme running from 2002-2004. The

project has 10 partners (Met Office., U. Reading, Collecte Localisation Satellites (CLS). European Centre for Research and Advanced Training in Scientific Computation (CERFACS), Laboratoire d'Océanographie Dynamique et de Climatologie (LODYC), European Centre for Medium-Range Weather Forecasts (ECMWF), Max Planck Institute for Meteorology, The Royal Netherlands Meteorological Institute (KNMI), Nansen Environmental and Remote Sensing Center (NERSC), and Istituto Nazionale di Geofisica e Vulcanologia (INGV).

ENACT aims:
(A) to enhance ocean data assimilation systems and produce improved practical global ocean analyses,

- assemble high-quality *in situ* and satellite-derived ocean observational datasets
- develop and implement state-of-the-art data assimilation systems.
- produce ocean analyses extending over a 40 year period
- assessment

(B) to use the analyses to improve seasonal climate prediction and investigate ocean climate.

- quantify seasonal to multi-annual climate prediction impact
- sets of retrospective forecasts using coupled ocean-atmosphere GCMs
- assess ocean analyses jointly to quantify uncertainties
- investigate the mean state and variability of ocean circulation on seasonal to multi-decadal timescales.

It is primarily an EU project to inter-compare ocean analysis systems:

- 'OI', 3D-var, 4D-var, EnKF
- HOPE-E, HOPE-C, UM, OPA
- Analyses produced for ERA40 period using a common set of observations 1957-2004

CGCM forecasts will be made to assess analyses, some out to 5 years. The project manager is Mike Davey (Met Office)

The current project status (Oct. 2003) is:

- forcing fields are ready
- *in situ*, altimeter, obs. datasets are ready
- some ocean analysis systems are ready, others still under development
- DODS server in place, client testing underway
- CGCMs are ready. First experiments will be hindcasts from control (no assimilation) ocean runs

More information is under: http://www.lodyc.jussieu.fr/ENACT/

Asian-Pacific Climate Network (APCN)
Dr. I.-S. Kang reported on the multi-model ensemble modelling approach of the APCN.
APCN history:

- Proposed at the 3rd APEC Ministers Conference on Regional Science and Technology Cooperation (October 1998, Mexico City)
- Approved at the 17th APEC ISTWG Meeting (August 1999, Seattle)
- The first APCN Working Group Meeting (May 2001, Seoul)
- The second APCN Working Group & first Steering Committee Meeting (June 2002, Seoul)
- Approved the APEC Central Fund to support an international symposium on the APCN project at the APEC ministerial meeting (October 2002, Singapore)
- APCN Symposium on the MME for Climate Prediction/Second Steering Committee Meeting and Third Working Group Meeting (Oct 2003, Jeju Korea)

The goals of APCN are:
APCN is aimed at realizing the APEC vision of regional prosperity by

- Producing real-time operational seasonal forecast information based on a well-validated multi-model ensemble systems
- Sharing high-cost climate data and information

- Enhancing capacity-building in the monitoring and prediction of unusual weather and climate in the Asia-Pacific region
- Assisting the management of climate risks in the Asia-Pacific region

APCN has a two phased approach:

Experimental phase
- Establishing the scientific bases for multi-model ensemble forecasts
- Enhancement of the infrastructure and systems for the climate information exchange

Implementation phase
- Generation of real-time multi-model ensemble forecasts
- Dissemination of climate monitoring and forecast information

At present 10 models from 9 organizations and 7 countries are participating.

Multi-Model Ensemble Technique

MME I	Simple composite
MME II	Super-ensemble based on Singular Value Decomposition
MME III	Composite after statistical downscaling bias correction (Coupled Pattern Projection Method).

Used Model	CWB, NSIPP GCPS, NCEP, JMA, GDAPS
Periods	• 21-year hindcasts from 1979 to 1999 • 2001/2002/2003 summer forecasts
Variables	• Precipitation, 850hPa Temperature

Summary of the experiments:
- The APCN participating models reproduce the major features of the observations, but there is a considerable diversity among model results.
- APCN MME System provides superior performance to any single model prediction in term of climatology, variability and predictability.
- Statistical bias correction of individual models prior to multi-model ensemble (MME3) enhances predictability compared to simple model composite (MME1) or SVD superensemble (MME2)
- Differences between the MME performance in the cross-validation during the hindcast period and in the independent predictions appear to arise from the uncertainty of boundary forcing, currently specified by persistent conditions from the operational forecast.

The First APCN International Symposium on MME for Climate Prediction was held 14-17 October, 2003, in Jeju, Korea. The main recommendations of the meeting were:
- seek tier-1 forecasts from APCN members in addition to tier-2 forecasts and produce MME using both systems;
- develop MME for SST and arrange for a few atmospheric models to use the MME SST product to produce seasonal forecasts;
- encourage members to provide historical forecasts that do not involve the use of information that would not have been available at the time of the forecast (e.g. not forecasts using observed SSTs);
- verification of MME forecasts is essential for APCN and should follow the WMO CBS recommendations; and
- strategic approaches to developing forecast applications and downscaling should be defined and discussion papers drawn up.

More information is available under http://www.apcn21.net

2.7 Application programmes

Dr. M. Harrison reported on developments within the World Climate Applications and Climate Information and Prediction Services (CLIPS) programme.
CLIPS has four main objectives:

- To develop the infrastructure for Seasonal to Interannual Prediction (SIP)
- To develop the concept of Regional Climate Centres
- To promote the science and the application of SIP products
- To promote capacity building of producers and users of SIP

He highlighted the role of the regional climate outlook fora in Africa and the CLIPS focal points (mainly the national representatives of the Met. Services) which provide an interface between predictions and applications. Many countries have already defined focal points.
The development of the concept for Regional Climate Centres (RCCs) is under way but no RCC has been defined as yet.

More information is under http://www.wmo.ch/web/wcp/clips2001/html/index.html

IRI (S. Zebiak)
Amongst the key activities of the International Research Institute for Climate Prediction (IRI) are:

- climate prediction
- climate and environmental monitoring
- impacts
- decision support/tools
- institutions/policy
- capacity building/outreach/education

Dr. Zebiak gave some examples for application projects coordinated through the IRI:
1. Greater Horn of Africa Project
Objectives

1. Improvement of regional climate models and products
2. Increased availability and application of tailored products for reducing vulnerability to climate extremes and adapting to climate change.
3. More effective applications of climate products and services to reduce disaster losses and promote sustainable development.

2. Diseases in West Africa:
Through seasonal predictions of rainfall an early warning can be made for changes in the incidence of the meningococcal meningitis disease in the West African Sahel region.

3. An integrated approach for managing the impacts of climate variability in Ceará, (NE) Brazil
This project with a number of partners in the US and South America has the objective to support the continued development of Ceará's society and economy by reducing its vulnerability to recurrent droughts. The end-to-end system works in the following way:

1. Results of an ensemble forecast are communicated to the major water users, the water committee and the water agency.
2. Based on guidance from the forecast and water agencies and the water committee, the users propose the contracts they would like to have (total amount of water desired, its monthly breakdown, the desired reliability and the desired maximum failure in the event things fail).
3. Priorities for different users and values assigned to each use (e.g., have to meet human consumption needs first) are then determined through a negotiation in the committee.
4. The priorities and the desired demands are then presented to the water agency, which runs reservoir operation scenarios and determines the maximum water that can be allocated to each user given the monthly demand pattern, desired reliability and priority. This is done using a system optimization model that can run relatively fast.
5. This is communicated back to the water committee and to the users.
6. The users now revise their offers (in a meeting or electronically) including opting for multiple

contracts at different reliabilities

7. The process repeats until the committee declares an allocation and priority schedule for failure in terms of contracts for each major user.

3. WGSIP activities

3.1 El Niño definition

Following the recommendations of the CLIVAR WGSIP, it was suggested that NOAA adopt three-month running mean averages of the Niño 3.4 index as the best oceanic scale for assessing the state of the ENSO cycle. Advantages of using this scale include:

- It is readily available in near real time and based on an internationally-accepted measure of the state of the tropical Pacific Ocean (the Niño 3.4 index);
- It is linked to global-scale temperature and rainfall patterns; and
- It permits ready comparison with past events, both warm and cold, without being prescriptive concerning impacts.

The NOAA Climate Prediction Center (CPC) will use this scale, together with other existing oceanic and atmospheric indices, to assess the state of the ENSO cycle, and the existence of El Niño and La Niña conditions. The CPC assessments will be disseminated to users via the Monthly Climate Diagnostics Bulletin and the monthly ENSO Diagnostic Discussion, available on the CPC website http://www.cpc.ncep.noaa.gov.

NOAA will use a the following method in order to define events:

- El Niño: A phenomenon in the equatorial Pacific Ocean characterized by a ***positive*** sea surface temperature departure from normal (for the 1971-2000 base period) in the Niño 3.4 region greater than or equal in magnitude to 0.5C, averaged over three consecutive months.
- La Niña: A phenomenon in the equatorial Pacific Ocean characterized by a ***negative*** sea surface temperature departure from normal (for the 1971-2000 base period) in the Niño 3.4 region greater than or equal in magnitude to 0.5C, averaged over three consecutive months.

WGSIP tried to avoid in their original definition any form of threshold. The Commission on Climatology (CCl) did not accept the setting of such a boundary to classify ENSO events. Most recently the President of the CCl Dr. Boodhoo sent a request to the JSC chair, P. Lemke, asking JSC to nominate someone to join a team/workshop to "investigate an ENSO index that could be globally acceptable". Furthermore, he stated that "This may culminate in an international standard for describing the state of ENSO. In turn, this definition may enable Members (of WMO) to better appreciate its impacts of regional and local climate." This issue was brought to the attention of WGSIP at the meeting. WGSIP felt some concern about the information that the Commission on Climatology is seeking to establish a group in order to define an internationally accepted index on El Niño, since this had been done by WGSIP about a year ago. **M. Harrison was asked to communicate with V Detemmerman (JPS for WCRP) about the details of this initiative (action item)**.

3.2 SMIP2

Dr. G. Boer gave a progress report on the SMIP-2 Project which was initiated by WGSIP about three years ago. Coordinators are G. Boer (CCCma), M. Davey (UKMO), I.-S. Kang (SNU), and K. R. Sperber (PCMDI). The purpose of the study is to investigate 1 or 2 season potential predictability based on the initial condition and observed boundary conditions.

The experimental set-up of SMIP involves: 7 month x 4 season x 22 year (1979-2000) model integration with 6 or more ensembles. Four institutes (NCEP (USA), CCCma (Canada), SNU/KMA (Korea), MRI/JMA (Japan)) have participated with 5 models.
Follow-on studies are the SMIP-2 and SMIP/HFP (Historical Forecast Project) experiments.

- SMIP2 aims to assess the potential predictability 12 seasons in advance by carrying out 7-month ensemble integrations of atmospheric GCMs with observed initial conditions and observed (prescribed) boundary conditions.

- SMIP2/HFP will investigate the actual predictability for one season in advance by carrying out 4-month ensemble integrations of atmospheric GCMs with observed initial conditions and predicted boundary conditions or coupled GCMs.

Why SMIP2?

- new knowledge on Seasonal-to-Interannual Prediction (SIP)
- intercomparison of models in the SIP context
- measures of potential and/or actual predictability in current models
- diagnostic subprojects entrain "outside expertise" to analyse results
- provides the collection of results for research into multi-model ensemble approaches to SIP

Application

- objective approach
- ensembles of forecasts and models
- reforecast project with stable system
- basis for
  - bias correction
  - "combination" of forecasts (MME approaches)
  - skill measures
  - probability forecasts
  - risk assessment

Data status

Data have been submitted by KMA and MRI. COLA and DEMETER provide the data through their own server. Data will become available soon from CCC/CCCma/RPN.
The role of PCMDI in SMIP has to be clarified. Issues are:

- active data collection
- initial analysis
- the level of support from PCMDI

Future issues are: initial analysis, diagnostic subprojects (after data collection) and potentially a workshop.
Further information about these studies can be found under: http://www-pcmdi.llnl.gov/smip/

WGSIP agreed that details of the data management of this project will to be refined and revisited. It will to be investigated as to whether the present service through PCMDI can be improved in order to meet the needs of the users. (**B. Kirtman and G. Boer to contact K. Sperber (PCMDI)**)

3.3 Model experimentation and output standards experiment

This new activity had been initiated by WGSIP three years ago. On the last meeting it was agreed to seek for resources to implement this project. Dr. Zebiak wrote a letter to the director ICPO, Dr. Cattle, but no formal reply has been received to date. Thus, WGSIP asked the representative of the ICPO, Dr. Villwock, to follow-up on this issue in order to get a formal reply (action item).

Dr. M. Davey summarised the activities of the two subgroups of the WMO Commission for Basic Systems, the Global Producers of Long Range Forecasts (GPLRF) and the Expert Team on Infrastructure for Long-range Forecasting (ETLRF). Their activities are in particular relevant to WGSIP's "Model experimentation and output standards project". Reports of their recent meetings are available under http://www.wmo.ch/web/www/reports.html#GDPS

The ETLRF noted that there is a bewildering range of non-standard seasonal-interannual (SI) forecasts available from diverse sources, which are difficult to use/combine/compare/understand. WMO is facilitating an LRF infrastructure, principally for National Met. Services (NMSs) and forecast producers to inform NMSs and to facilitate: products for end-user application and product comparisons and combinations.

Provision of operational Long Range Forecasts (LRF; 30 days to 2 years):
The initial emphasis is mainly on global-scale dynamical-ensemble products from a limited set of providers (e.g. APCN, BoM, CPTEC, CMS, ECMWF, IRI, JMA, Met Office, NCEP, SAWS, etc.). The envisaged structure is intended to be flexible and expandable. A distribution mechanism based on a web-based system accessible by NMSs and similar organisations to agreed products (rather than active distribution) is a possibility. A mix of public and restricted products (Resolution 40) is also possible.
The ET ILRF Report provides a list of recommended LRF products (Annex to paragraph 3.4.1) to be made available by global scale forecasting centres, subsequently approved by WMO Inter-Commission Task Team on Regional Climate Centres (ICTT_RCC), and WMO CBS Congress (i.e. by WMO members). Basic standards encompass:

- Temporal resolution — Monthly and seasonal (3-month) averages/accumulations/incidences
- Spatial resolution — 2.5° x 2.5° (note: selected to match resolution of current verification data)
- Spatial coverage — Global + sub-regions
- Lead time — 0 – 6 months for monthly forecasts and 0 - 4 months for seasonal forecasts.(i.e. 6-month range)
- Issue frequency — Monthly
- Output types. — Gridded numerical values, area-averaged values and indices, and/or images.
- Indications of skill — must be provided (c.f. recommendations from WMO ET on the Standardised Verification System)

A. Calibrated outputs from ensemble prediction system showing the mean and spread of the distribution for:
- 2m temperature over land; sea surface temperature; precipitation; Z500; MSLP; T850
- SST area averages e.g. Nino3, Nino3.4, Nino4, including ensemble plumes of monthly values.
- Surface pressure field indices e.g. SOI, NAO including ensemble plumes of monthly values.

B. Calibrated probability information for forecast categories
- Tercile categories (consistent with present capabilities), with larger numbers of categories (e.g. deciles) foreseen.
    - 2m temperature over land; SST, precipitation, Z500, MSLP, T850
- information on category boundaries to be included.

Uniformity of products:
- use of a common grid
- reference climatology
- resolution of the probability distribution
- definition of period for terciles
- category boundaries for terciles
- indication of uncertainty
- timing of issue

Other requirements: (as feasible)
- as in A and B for 850hPa wind, Z200, sunshine, solar radiation
- other SST area averages
- tropical cyclone activity
- monsoon onset/duration
- within-season activity, etc.

Additional information:
- skill information must accompany each product, with corresponding spatial and temporal detail based on at least 15 years of retrospective forecasts, should also include a widely-understandable form
- an alert of significant changes in models or practices used to generate the forecasts
- verification
- documentation

On the meeting of participating forecast centres in Feb 2003, many centres indicated that they are keen to participate. A gradual convergence to uniform standards/formats is expected. The report includes a 5-year 'vision' for this project.

Terms and conditions of provision:
Centres can set their own terms (c.f. Met Office and ECMWF examples) but should promote provision to NMSs, RCCs and the research community as openly as possible. Furthermore, the importance of feedback from forecast receivers was amplified.

Verification:
WMO GDPS Manual 11.8, 11.9 (scores, descriptions), an example is available at http://www.bom.gov.au/silo/products/verif/. The Standards Project as defined by WGSIP could make valuable contributions.

Data Management:
It was recommended that data be provided in raw and calibrated, actual and anomaly form.
GRIB, GRIB2 data formats. A possible data hierarchy could be:

- raw data;
- calibrated data
- complete products

LRF centres can provide data at one or more levels.

Suggested additions to the ET_ILRF list:

- 200hPa velocity potential and streamfunction,
- 850hPa u.v.
- SST in Nino1+2 region

Dr. S. Power mentioned that the CBS Long Range Forecasting system is in the process of establishing a web portal under the leadership of BMRC and Canada. A meeting will be held in Montreal, early December. This activity could have some benefit for WGSIP standards project.

3.4 Climate events of the past year

Prior to the meeting a number of climate events of the past year were selected and the working group members were asked to assess whether their seasonal prediction models were able to predict these events or not.

Observed conditions:
1. ENSO phase
The ENSO index dropped rapidly from slightly warm conditions to a stable neutral phase by mid of this year.

2. European heat wave and spring/summer drought
In central Europe, the past summer was characterized by extreme high temperatures and drought conditions which already persisted from winter / spring. Impacts of these conditions were for instance:

- 35,000 deaths caused due to the heat wave (about 15,000 in France)
- Agriculture: Harvest reduced up to 40% (crop, eastern Germany)
- Impacts of power production (hydropower plants (water shortage) and nuclear power plants (cooling problems)
- Transportation: on rivers (Elbe, Rhine, Danube) reduced or stopped because of low water levels

3. Indian Monsoon 2003
The 2003 summer monsoon over India produced above average rainfall, in particular in the northern part of the subcontinent. Prior to the monsoon, a heat wave with extremely high temperatures (>50ºC) was observed.

4. Wet summer conditions at the US east coast
Wet conditions were observed along the US east coast throughout the summer. It was speculated that the conditions over Europe and the US east coast are related through a persistent atmospheric wave pattern.

5. Sahel summer rainfall
The observed summer rainfall in the Sahel region was above normal.

6. Cold temperatures in Japan
Anomalous cold conditions were notified during summer.

The model capabilities in predicting these events (from various starting dates and initial conditions) are qualitatively summarized in Table 1.

WGSIP regarded this annual assessment of specific climate events as a useful exercise. WGSIP agreed to focus on fewer events but to work towards a more comparable and rigorous assessment. At minimum, there should be an agreement on variables and maps to be presented, if possible with data submitted to one place in order to present multi-model results (**M. Davey and P. Nobre to communicate details by e-mail prior to the next meeting**, **timeline summer 2004**). Dr. T. Stockdale volunteered to start with Niño3.4 SST forecasts to be put up on a public ftp site.

	ENSO	Europe	Indian Monsoon	US east coast	Sahel	Japan
ECMWF	Decline ok, tendency towards cooler conditions	Partly in early summer, drought not predicted	Heat wave: to some extent; marginally wet	to some extend but too weak and more over the ocean	Initially no signal, later slightly dry!	hint in the early forecasts (May), but not confirmed later on.
COLA	Pretty well	drought: no, heat wave: no	heat wave: no; monsoon rain: slightly above normal	no	no, slightly dry	no
NSIPP		drought: no, heat wave to some extend but too weak	Heat wave: to some extent; Not very well	no		
Met Office	Decline ok, but La Niña in 2003	MJJ and JJA clearly favoured upper tercile	Forecast wet in north and normal/wet south	no below normal' precip. favoured	JJA forecast dry coast, wet Sahel	
JMA	Reasonable	yes (hot and dry)	normal monsoon		indication for above normal	no
CCCma	-	a hint of warmer than average conditions	Heatwave partly		yes, to some extent	
IRI	-	to some extent	reasonably well	weak signal		no
CPTEC						

3.5 Monsoon predictability

Dr. Kang showed some results from the AAMP AGCM Intercomparison, which has formally ended. 12 institutions participated in the intercomparison study, which primarily focused on the difference in the 1997-98 Indian monsoon. The results are published in Wang et al. 2003: J. Climate. (to be confirmed)

3.6 GEWEX – GLACE

Dr. Koster focused in his presentation on the "GLACE" (Global Land-Atmosphere Coupling Experiment). GLACE is a broad follow-on to the four-model intercomparison study described by Koster et al. (*J. Hydrometeorology*, **3**, 363-375, 2002), hereafter referred to as K02. The strategy of the original experiment was:

- Establish a time series of surface conditions.
- Run a 16-member ensemble, with each member forced to maintain the same time series of surface prognostic variables.

GLACE will build on previous study through:

- *Participation from a wider range of models*. The idea is to generate a comprehensive "table" of coupling strengths, a table that can help in the interpretation of the published results of a wide variety of models.
- *Separation of the effects of "fast" and "slow" reservoirs*. The K02 results largely reflect the

specification of the "fast" reservoirs (e.g., surface temperature). They thus may have little relevance to issues of seasonal prediction.

- *Effect on air temperature*. Ignored in the K02 study is the effect of the specification of surface variables on the evolution of air temperature. (This is a particularly interesting issue when only the "slow" soil moisture reservoirs are specified.)
- *Correction of miscellaneous technical issues*. Lessons learned from the K02 study can be applied immediately to GLACE.

Proposed plan for GLACE

- Step 1: 16-member ensemble, with prognostic states written out at each time step by one of the members.
- Step 2: 16-member ensemble, with all members forced to use the same time series of surface prognostic states.
- Step 3: 16-member ensemble, with all members forced to use the same time series of deeper (root zone and below) soil moisture states.

All simulations are run from June through August

Timetable for GLACE

January, 2003: Experiment plan distributed
February, 2003: Feedback from modeling groups.
August, 2003: Deadline for finishing simulations
September, 2003 – February, 2004: Process/document results
-- Gather late submissions (Sept. – Feb.)
-- Process data (Sept. – Nov.)
-- Distribute preliminary results (Sept.)
-- GEWEX News article (submitted Sept.)
-- CLIVAR Exchanges article (submitted Oct.)
-- Prepare journal articles, iterate with participants (Nov. – Feb.)
-- Submit journal articles (February, April)

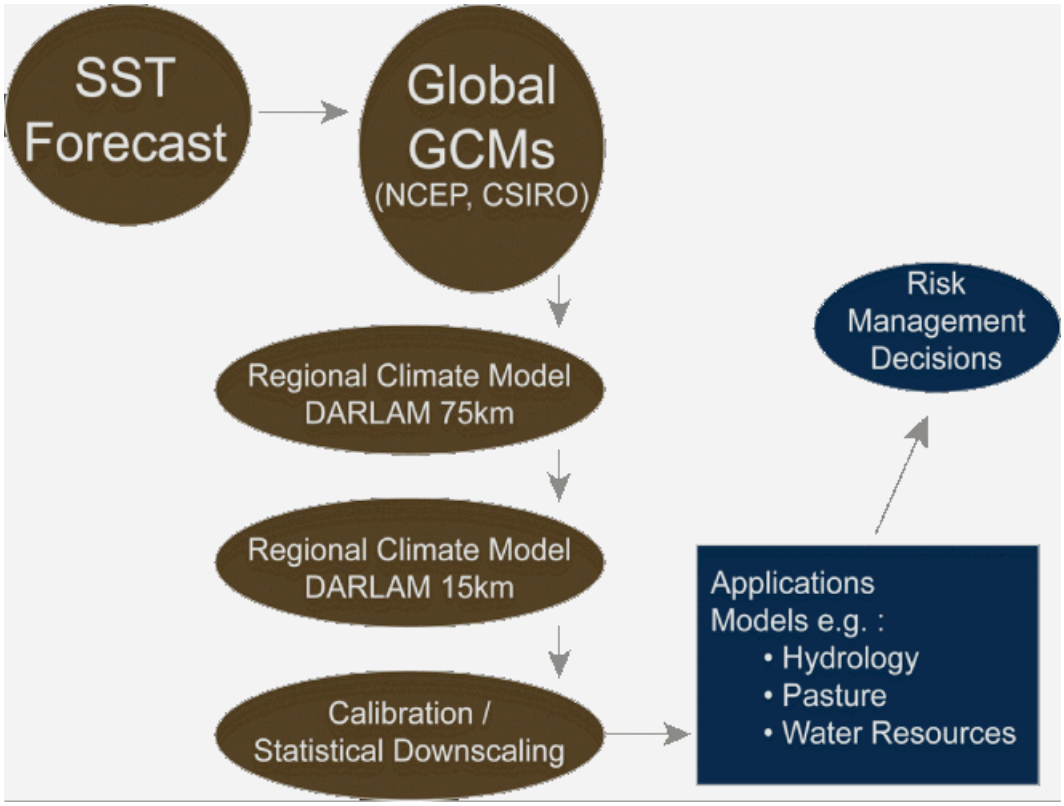
No physical workshop is planned. Preliminary findings will be continually communicated with participants, who will be encouraged to participate in the interpretation of the results.
The experimental website of the experiment is http://glace.gsfc.nasa.gov

3.7 Regional modelling

Dr. Jozef Syktus presented an invited paper on regional modelling entitled: Dynamical Downscaling of Seasonal Climate Information: Linkage with Grazing Simulation System.
Experimental details are:

- Complex hindcast experiments using observed historical SST
- NCEP MRF9 T40/18 – 10 runs: 1965 – 2003 *NCEP AGCM 6hrs data used to double nest DARLAM*
- CSIRO RCM 75km/L18 – 15 runs: 1965 - 2003
- CSIRO RCM 15km/L18 – 15 runs: 1965 - 2003
- CSIRO T63/L18 AGCM – 12 runs: 1871 & 1949 - 2003

A schematic of the method used is shown the in schematic diagram below.



Conclusions

- Generated a large ensemble of dynamically downscaled hindcasts (1965-2003) and forecasts (1999-2003). More work to fully evaluate the results is required.
- Rainfall hindcast with GCM forced by observed SST and double nested with RCM 75km and 15km has been evaluated.
- RCM nesting improved rainfall correlation temporally and spatially.
- National Resources & Mines is the only site in Australia to produce monthly seasonal rainfall forecasts using global and regional climate models (since late 1998).
- RCM hindcasts linked to decision on livestock stocking rate in grazing system model Aussie GRASS.
- RCM hindcasts expressed as quintiles to allow comparison with other forecast systems. Evaluation in terms of animal production (beef) and risk of resource degradation.
- RCM as good as operational forecast system based on SOI phase in terms of area of increased production and decreased risk of resource degradation.

Dr. S. Zebiak presented some different studies preformed at IRI. The first study on regional climate downscaling uses a stretched-grid technique to focus on a small area with high resolution in order to facilitate climate applications. The large model domain gives the regional model more freedom to develop regional features. The smoothly stretching grid avoids the abrupt change of resolution in the nesting method and provides significant saving of computational costs. The results show that the stretched-grid regional climate model (RegCM2) with full physics produced accurate high-resolution downscaling results over a small area of interest.
Reference: Qian, J.-H., F. Giorgi, and M.S. Fox-Rabinovitz, 1999: Regional stretched grid generation and its application to the NCAR RegCM. *J. Geophys. Res.*, **104**, 6501-6513.

The second study Dr. Zebiak presented focused on 'Statistical downscaling of daily rainfall occurrence over Ceará (NE-Brazil)'. The approach was as follows:

- Construct a statistical transformation of atmospheric GCM predictions from the IRI two-tier system
- Predict local daily rainfall characteristics (e.g., occurrence frequency, dry-spell frequency) over Ceará up to several seasons in advance

- Train on observed station data

Two types of transformations were considered:

1. A (linear) empirical relationship between the GCM's seasonal-mean rainfall predictions, and the observed station-scale rainfall statistic of interest
   - e.g., rainfall occurrence frequency or dry spell frequency
   - "MOS" transformation
2. A stochastic model of observed daily rainfall on a spatial network of stations, with large-scale seasonal mean rainfall from the GCM as a predictor
   - use a non-homogeneous hidden Markov model (NHMM)
   - local daily rainfall is conditioned upon a small set of discrete "hidden" weather states
   - state-transitions follow a Markov chain
   - GCM's large-scale seasonal climate prediction introduced to skew the state transitions

Experimental set-up:

- Network of 10 daily-rainfall stations for the February–April season (1975–2002)
- ECHAM4.5 GCM seasonal-mean rainfall predictions from simulations with prescribed historical SST distribution
  - "potential predictability" given near-perfect SST predictions
- Model skill is assessed using leave-one-year-out cross validation

Conclusions:

- Inexpensive "base-line" downscaling methods
- In terms of seasonal-mean statistics (rainfall occurrence frequency, dry-spell frequency), both the MOS and NHMM yield similar explained interannual variances of up to 50-60% at some stations
- The NHMM yields considerably more statistical and physical information than the MOS
  - simulates an ensemble of sequences of daily rainfall occurrence at each station, which may be used as input to a crop model etc., if such applications can be developed
  - hidden weather states enable a physical interpretation of the results

Work in progress at IRI:

- Comparison with dynamical downscaling
- Application to IRI seasonal forecasts
- Further develop NHMM in collaboration with computer scientists at UCI
  - flexible downscaling and analysis tool
  - issue of predictor selection

Dr. B. Kirtman reported that a WGNE-WGCM/IPCC/PRUDENCE Workshop entitled: 'The added-value of regional climate models' is planned for April 2004 in Lund, Sweden. The organizing committee consists of W. Wergen (WGNE), R. Jones and H. Van Storch, F. Giorgi (IPCC), J. Christensen (PRUDENCE), and B. Kirtman (WGSIP)

The main focus is on climate, but 1-2 talks will be on seasonal to interannual prediction. WGSIP members were requested to provide names for invited speakers to the organizing committee. (**WGSIP members to communicate to B. Kirtman**)

3.8 Workshop on ensemble methods in weather and climate

Dr. G. Boer presented the first announcement for the Workshop on Ensemble Methods, which will be held at the Met Office, Exeter, UK, Oct. 18-21, 2004. The meeting will jointly be organized by WGSIP, WGNE and WGCM. The members of scientific organizing committee are:

G. Boer, B. Kirtman, T. Stockdale (WGSIP)
K. Puri, M. Miller, A. Lorenc (WGNE)
T. Delworth (WGCM)
A Villwock (ICPO)

The intent of the Workshop is to review the theory, current application, and future directions of ensemble methods, including multi-model ensemble methods, across timescales from weather

forecasting to climate change. To this end, we plan two presentations by invited speakers on each of the four days of the Workshop. A Workshop Report will be produced which will attempt to summarize the presentations and discussions and, in so far as possible, give a broad statement of the present state and potential future of ensemble methods.
The Workshop is open and about 50-100 participants are expected.

More information will become available under:
http://www.clivar.org/organization/wgsip/ens_wshp/

4. Local presentations

Pre-monsoon heat waves over India (*H. Annamalai*)
Summary:
Heat waves prior to the Indian summer monsoon are observed frequently. From 1978-2003 8 severe heat waves have been observed, the last 3 in 1998, 2002, and 2003. Temperature maxima typically exceed 50 C and 1000-1500 deaths are caused by these events.
Remote Rossby waves from the western Pacific Ocean have been identified as a potential mechanism.

Dynamics of synoptic eddy and low frequency flow (self) feedback (*Fei-Fei Jin*)
Summary:

1. A new approach is proposed to delineate the synoptic eddy and low-frequency flow (SELF) feedback.
2. A linear dynamic operator for SELF feedback is derived and validated.
3. AAO, AO can be understood as the least damped internal modes of linear dynamic system with SELF feedback.
4. The new framework may be lead to a new approach for seasonal prediction.

Tropical Asia-Pacific climate simulated in the IPRC hybrid CGCM (*Xiouhua Fu, Bin Wang, Julian P. McCreary, Tim Li, and Fei-fei Jin*)
Summary:
1. A hybrid coupled GCM (ECHAM4 T30L19 AGCM (Roeckner et al. 1996) and 2-1/2-layer upper ocean model (0.5ºx0.5º) (Fu and Wang 2001)) has been developed at IPRC. This model reasonably simulates some climate variability in the tropical Asia-Pacific sector with time scales from weeks to years (not seamless!). It also suffers some biases (e.g. too warm in the southeast Pacific) commonly existing in the current CGCMs.

2. With this model, it is shown that two different ISO solutions exist in the coupled system and the atmosphere-only system. The simulation of the coupled model is closer to the observations.

- Fully coupling without heat flux correction
- Coupling region: Tropical Indian and Pacific Oceans
- Coupling interval: once per day

5. Presentations by WGSIP members

CMC/CCCma/RPN/McGill (G. Boer)
Upgrades of the computational and modelling systems are currently under way.

NSIPP (R. Koster)
A major reorganization within NASA is under way. NSIPP and the DAO (Data Assimilation Office) have merged to GMAO (Global Modelling and Assimilation Office). The modelling system remained the same.

COLA (B. Kirtman)
Dr. Kirtman presented results from a study where the COLA AGCM, the CAM model and a MOM ocean model were coupled in different configurations to assess the model depended and independent errors, respectively. The following configurations were used:

1. CAM coupled to MOM3
2. COLA coupled to MOM3
3. CAM and COLA coupled to MOM3, MOM3 gets the heatflux from CAM and the momentum flux from COLA and returns the SST to both models
4. as 3 but MOM3 gets the heatflux from COLA and the momentum flux from CAM

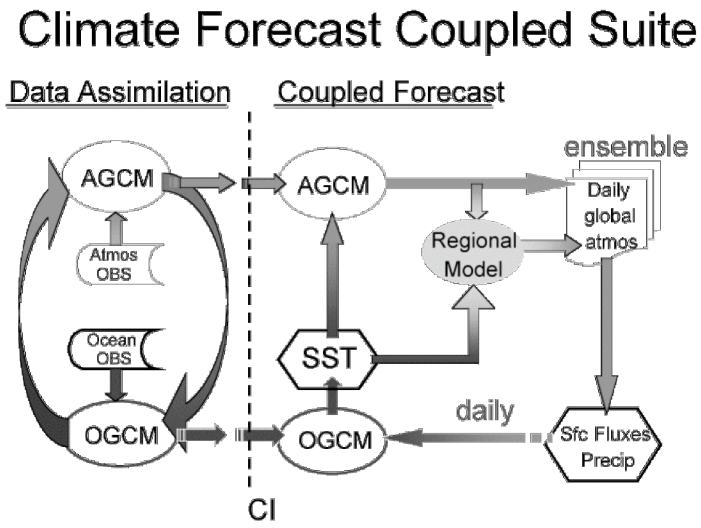
The results can be summarized as follows:

- Errors independent of AGCM
  - warm bias along eastern boundaries
  - underestimate of slope of thermocline
    - westerly zonal wind stress bias
    - even when there is a strong SST cold bias
  - double ITZC problem
    - thermocline ventilation/subduction (wind stress curl) problem
- Dependant errors
  - COLA heat flux largely responsible for warm bias
    - radiative-convective equilibrium temperature too warm
  - CAM winds too easterly in western Pacific

CPTEC - Brazil (P. Nobre)

The CPTEC Coupled Ocean-Atmosphere Model

- CPTEC F90 AGCM – MOM_3
- Sensibility tests to choose AGCM spectral resolution and cumulus parameterization.
- MOM_3 compilation and tuning for hires global tropics grid.
- Anomaly coupling strategy from COLA.



6. Other business

6.1 Membership

WGSIP thanked M. Davey for his long-standing contribution to the panel. B. Kirtman in his function as the chair of the Task Force for Seasonal Prediction (TFSP) of COPE will invite M. Davey to join the TFSP. WGSIP agreed to invite a scientist from South Africa to join the group. (**B. Kirtman to send nominations to the CLIVAR SSG (WGSIP) and to JSC (TFSP), cc to ICPO**)

6.2 Terms of Reference (TOR)

TOR of WGSIP and WGSIP role in COPE: Recognizing that the JSC has recommended that WGSIP lead the COPE Task Force for Seasonal Prediction (TFSP), WGSIP should expand its present terms of reference (see Appendix 1) to include sub-seasonal (i.e., weeks) to interannual time scales. WGSIP

should also expand its terms of reference to decadal time scales as it impacts prediction and predictability on time scales of weeks to interannual. Decadal prediction is presently beyond the scope of WGSIP and should most likely be part of the charge of WGCM. Moreover, given WGSIP's leadership of the COPE TFSP as recommended by the JSC, it is suggested that WGSIP report directly to the JSC regarding specific COPE seasonal prediction activities. Regarding all ongoing CLIVAR related projects and new initiatives, WGSIP continues to report to the CLIVAR SSG. (**B. Kirtman and A Villwock to communicate to JSC and CLIVAR SSG; B. Kirtman to draft revised terms of reference and circulate to the panel**).

6.3 Next meeting

WGSIP-9 to meet at Met. Office in Exeter Oct. 14-16, 2004 (Thu. – Sat.) prior to the Ensemble Workshop and to team up with WGNE for a joint session (**M. Davey to check the availability of the facilities; B. Kirtman to contact K. Puri about the joint session with WGNE; invite Kelvin Richards (chair Pacific Panel) to the next meeting**).

Appendices

Appendix A: WGSIP Terms of Reference and Membership

The CLIVAR Working Group on Seasonal-to-Interannual Prediction (WGSIP; previously known as CLIVAR NEG-1) is a part of the CLIVAR organization. The overall responsibility of the panel is seasonal-to-interannual prediction. More specifically its terms of references are:

1. Develop a programme of numerical experimentation for seasonal-to-interannual variability and predictability, paying special attention to assessing and improving predictions.

2. Develop appropriate data assimilation, model initialization and forecasting procedures for seasonal-to-interannual predictions, considering such factors as observing system evaluation, use of ensemble and probabilistic methods and statistical and empirical enhancements, and measures of forecast skill.

3. Advise the CLIVAR SSG on the status of seasonal to interannual forecasting and on the adequacy of the CLIVAR observing system, and to liaise with JSC/CLIVAR Working Group on Coupled Modelling and the JSC/CAS Working Group on Numerical Experimentation.

Members (2003):

B. Kirtman (co-chair)	COLA, George Mason University, Calverton, USA
T. Stockdale (co-chair)	ECMWF, Reading, UK
G. J. Boer	CCCma, Meteorological Service of Canada, University of Victoria, Victoria, Canada
M.K. Davey	University College, London, UK
M. Harrison	Met. Office, Exeter, UK
I.S. Kang	Seoul National University, Seoul, Korea
R. Koster	NASA/GSFC, Greenbelt, USA
P. Nobre	INPE/CPTEC, St Jose dos Campos, Brazil
S. Power	BMRC, Melbourne, Australia
M. Sugi	JMA, Tokyo, Japan
S. Zebiak	Lamont-Doherty Earth Observatory, Palisades, USA

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Appendix C: Agenda

1. Welcome and opening remarks (B. Kirtman (chair, WGSIP), K. Richards (local host), A. Villwock (ICPO)

2. Review of relevant developments and activities

2.1 Report from the CLIVAR IPO (A. Villwock)
2.2 Report from the 12th session of the CLIVAR SSG (B. Kirtman, A. Villwock)
2.3 Report from other meetings and groups relevant to WGSIP (AAMON (Global Monsoon Modelling Initiative), Pacific, etc.) (all, lead: B. Kirtman, A. Villwock)
2.4 Reports from regional or national CLIVAR Committees (e.g., US CLIVAR). (all, lead B. Kirtman, T. Stockdale)
2.5 Other WCRP modelling activities; JSC/CLIVAR Working Group on Coupled Modelling (WGCM); the JSC/CAS Working Group on Numerical Experimentation (WGNE) (to be advised, lead B. Kirtman, A. Villwock)
2.6 Update on related studies such as the IRI/ARCs project (S. Zebiak) and the European DEMETER project (R. Hagedorn), multi-model ensemble prediction project intercomparison projects; COLA/GFDL/GSFC/NCAR/NCEP study on DSP (B. Kirtman); Relationship between WGSIP and GODAE (N.N), Asia-Pacific Economic Cooperation (APEC) Climate Network (I. Kang), European ENACT project on ocean data assimilation for seasonal prediction (M. Davey).
2.7 Application programmes (Clips, START, etc.) (M. Harrison, S. Zebiak)

3. WGSIP activities (brief updates)

3.1 WGSIP activities on El Niño Definition – Feedback from SSG and JSC (B. Kirtman, T. Stockdale)
3.2 Climate "events" and forecasts of the preceding year: (T. Stockdale, and all)

1. ENSO SST variability	(a) the rapid decline of the 2002 event (b) the non-occurence of La Nina in 2003 (c) SST variability in other tropical ocean in addition to the ENSO region, and related convective activity in the tropics
2. European heatwave	(a) The dry conditions from Feb onwards (b) The very high JJA and August temperatures
3. US East Coast	persistent wet conditions for much of 2003
4. Indian monsoon	(a) heat wave prior to onset (b) normal monsoon rainfall
5. Sahel summer rainfall	the Niger river reported at its highest level since 1928.
6. Cool summer over Japan	(except south western part) during 2003 July and August.

3.3 Model experimentation and outputs standards project (S. Zebiak) and Expert Team for Long Range Forecast Verification & Proposed WMO CBS infrastructure for long-range forecasting products (B. Kirtman, S. Power, M. Davey)
3.4 Dynamical seasonal prediction project: Progress of "SMIP-2" as a follow-on to phase 1 (SMIP). (G. Boer, M. Sugi);
3.5 AA-Monsoon update (I. Kang)
3.6 Down-scaling/regional models: (J. Syktus; invited presentation; S. Zebiak)
3.7 Interactions with GEWEX (R. Koster)
3.8 Multi-model ensemble techniques, include. Workshop update (G. Boer)

4. Contributions from University of Hawaii and IPRC

5. Developments in coupled seasonal/interannual forecasting systems

Participants will be given the opportunity to summarise briefly developments in coupled seasonal/interannual forecasting systems at their home institutions (if not already covered in previous discussion); (all)

6. Other business

6.1 Membership
6.2 Terms of reference
6.3 Next session.

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