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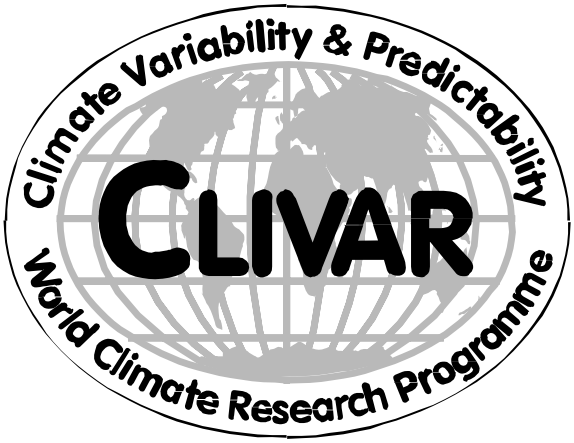
WORLD CLIMATE RESEARCH PROGRAMME



CLIVAR Working Group on Seasonal to Interannual Prediction

Report of the 6th Session

5-7. November 2001, Budapest, Hungary

May 2002

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CLIVAR is a component of the World Climate Research Programme (WCRP), which was established by WMO and ICSU, and is carried out in association with IOC and SCOR. The scientific planning and development of CLIVAR is under the guidance of the JSC Scientific Steering Group for CLIVAR assisted by the CLIVAR International Project Office. The Joint Scientific Committee (JSC) is the main body of WMO-ICSU-IOC formulating overall WCRP scientific concepts.

Bibliographic Citation

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1. Action Items/Recommendations

WGSIP-6 Action Items:

- **Scope of WGSIP**: WGSIP has been very much Pacific oriented in the past and should broaden the scope, i.e. by defining model intercomparison studies in the Atlantic using intermediate and fully coupled models (B. Kirtman)

- **DEMETER project**: The public access to the DEMETER data should be improved. T. Stockdale to make an informal approach at ECMWF. If this is not successful, WGSIP should enforce this on a higher level.

- **Climate events and forecasts of the preceding year**: All participants should prepare some examples ahead of the meeting for a more in depth discussion. S. Zebiak (or other designated panel member) will circulate the few target seasons/regions/events ahead of time to allow participants to do analysis and compile results.

- **Model experimentation and output standards project**: WGSIP to determine an initial set of indices and diagnostic variables for a pilot phase (lead: B. Kirtman, with S. Power, and S. Zebiak). Issues such as definition of anomalies, specification of lead times, gridding, output formats at individual centers to be included. To be carried out over the next two months. ICPO to explore options to develop a web-based interactive system for this purpose (A. Villwock). M. Harrison to draft a rationale statement for the project (within next month).

- **Monsoon predictability**: List of publications related to this project to display on the WGSIP webpage (A. Villwock)

- **SMIP2/HFP**; G. Boer and M.Sugi to work toward further implementation and engagement of additional groups.

- **Downscaling/regional models**: WGSIP endorsed the report on Atmospheric regional climate models by the WGCM/WGNE ad hoc RCM panel. Ensure that this is discussed again at WGCM (A. Villwock). S. Zebiak to access materials prepared at IRI for recommended downscaling methodology/validation research plan; will forward to WGSIP for possible revision and endorsement.

- **Downscaling/regional models**: WGSIP to explore the possibilities for a tropical 'big brother' experiment (B. Kirtman). M. Harrison to raise the issues of data needs in upcoming meetings in Geneva.

- **Ocean observing system for Seasonal Prediction**: T. Stockdale and P. Delecluse to develop and distribute a draft plan by December 10, 2001 to be discussed and endorsed by WGSIP and forwarded to SSG at end of the year.

- **Membership**: Replacement for M. Ji has to be found (WGSIP to send suggestions to S. Zebiak)

- **Meetings**: WGSIP to plan a Workshop on Ensemble Prediction for 2003.

- **Meetings**: Explore the possibility to meet in South Africa, eventually with the VACS group (Zebiak, Villwock).

- **Meetings**: S. Zebiak to discuss with M. Visbeck about coordination for a workshop on tropical Atlantic predictability/prediction.

- **WGSIP report**: publish report of WGSIP-5 (A. Villwock).

- **Reports**: ICPO to distribute agenda and minutes to the WG-chairs (A. Villwock).

- **Webpages**: ICPO and WGSIP to update the information in the SPRINT database and the WGSIP pages.

2. Introduction:

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 liase with JSC/CLIVAR Working Group on Coupled Modelling and the JSC/CAS Working Group on Numerical Experimentation.

The Working Group comprises:

S. Zebiak (chair)	Lamont-Doherty Earth Observatory, Palisades, USA
G. Boer	U. Victoria, Victoria, Canada
M.K. Davey	UK Met. Office, Bracknell, UK
M. Harrison	UK Met. Office, Bracknell, UK
I.S. Kang	Seoul National University, Seoul, Korea
R. Kleeman	Courant Institute, New York University, New York, USA
B. Kirtman	COLA, Calverton, USA
R. Koster	NASA/GSFC, Greenbelt, USA
M. Ji	NOAA Office of Global Programs, Silver Spring, USA
T. Stockdale	ECMWF, Reading, UK
M. Sugi	Meteorological Research Institute, Tsukuba, Japan

3. Report of the Meeting

The 6th session of the CLIVAR Working Group on Seasonal-to-Interannual Prediction (WGSIP; previously known as CLIVAR NEG-1) was held at, at the Hungarian Meteorological Service, Budapest, Hungary, 5-7 November 2001. Dr. Sandor Szalai from the Hungarian Meteorological Service was the local host for the meeting. Dr. Steve Zebiak (Chairman of the WGSIP Panel) presided over the discussions. The list of participants is given in appendix (A).

3.1. Opening session

Dr. Steve Zebiak (Chairman of the WGSIP Panel) opened the session and welcomed the Panel members, invited experts, and local participants. The agenda was accepted with minor changes. Drs. Newson, Koster, Rienecker, Davey had sent apologies for being unable to attend the meeting.

During the three-day meeting there was extensive review of WGSIP research projects, discussions of plans for new initiatives, and other related international research activities.

3.2. Review of relevant developments and activities

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 Buenos Aires, Argentina, 1-3 November 2000 (ICPO Publication Series No. 50).

1. **Staff changes in the CLIVAR IPO**
   The International CLIVAR Project Office (ICPO) has undergone some staff changes throughout this year. End of last year, Fred Semazzi, who was, amongst other tasks, responsible for WGSIP left the ICPO. In summer and early autumn, two scientists joined the ICPO: Dr. Zhongwei Yan and Dr. Daniela Turk. Dr. Yan will be responsible for issues related to the Asian-Australian Monsoon and Climate Change Detection, Dr. Turk will use her expertise for the Pacific Implementation Panel and ocean carbon. In addition, two other scientists dedicate part of their time to CLIVAR: Dr. Mike Sparrow, the new editor of the WOCE NL is also responsible for the recently formed CLIVAR Southern Ocean. Dr. Roberta Boscolo, now in Vigo, Spain is responsible for the CLIVAR Atlantic Implementation Panel. Dr. Andreas Villwock, now at the Institut für Meereskunde in Kiel, Germany continues his work for the ICPO. Apart from his responsibilities for the CLIVAR Website and the Newsletter, he is looking after the CLIVAR modelling activities and the link with the paleo community.
   Dr. J. Gould, presently director of the CLIVAR and WOCE IPO will retire next year. His post has been advertised recently.

2. **CLIVAR SPRINT (Searchable PRograme INformaTion).**
   The former CLIVAR Tracking Project, a searchable data base for CLIVAR projects has been renamed to CLIVAR Sprint (Searchable PRograme InformaTion, now accessible under: http://sprint.clivar.org/
   This database should provide up-to-date information about CLIVAR projects and activities.

3. **Organizational structure of CLIVAR almost complete**
   The Organizational structure of the CLIVAR programme is now almost complete. Most recently, the CLIVAR Southern Ocean panel has been formed and the Pacific Implementation panel will be in place by end of the year. Unfortunately, the CLIVAR Data Task Team has recently been disbanded. We are currently exploring a more successful mechanism to implement a data management system for CLIVAR.

4. **CLIVAR Open Science Conference planned for 2003**
   In international open science meeting to review the first period of the programme is planned for fall 2003, spring 2004. The venue and format of the meeting are currently under discussion. The scientific organising committee consists of:

Anthony Busalacchi	tonyb@essic.umd.edu
Jonathan Overpeck	jto@u.arizona.edu
Tim Palmer	nez@ecmwf.int
Jagadish Shukla	shukla@cola.iges.org
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Kevin Trenberth	trenbert@ncar.ucar.edu
Jürgen Willebrand	jwillebrand@ifm.uni-kiel.de
Guoxiong Wu	gxwu@lasgsgi4.iap.ac.cn

The ex officio members are

Valery Detemmermann	(WCRP JPS)	Detemmerman_V@gateway.wmo.ch
John Gould	(Director ICPO)	wjg@soc.soton.ac.uk
Andreas Villwock	(ICPO staff)	avillwock@ifm.uni-kiel.de.

CLIVAR Scientific Steering Group 10th session, Toulouse, May 2000

Thereafter, Dr. Steve Zebiak reported about the action items from the last session of the CLIVAR Scientific Steering Group. There were 3 action items with relevance to CLIVAR WGSIP, namely:

- All CLIVAR panels chairs and SSG members to collect information on status of implementation and transmit it in a timely manner to the ICPO which will be responsible for making this info available through the web; ICPO to seek feedback from SSG and Panels on tracking system – how effective, complete? (ICPO, SSG Members and Panel Chairs)

- SSG encourages pursuit of the strategy articulated by the WGSIP, particularly to provide useful feedback to model developers. WGSIP emphasis in coming year should be on:
  - research on ensembles; data assimilation, coupling strategies;
  - experimentation focused around specific science questions or phenomena. (WGSIP)

- WGSIP to provide guidance to basin panels and OOP prior to end 2001 on priorities for
  a. Real time observations in support of SIP
  b. Delayed mode observations
  c. Process studies. (WGSIP)

Dr. Zebiak suggested to address the last action item in more depth under agenda item 4.

CLIVAR VAMOS

Dr. Villwock reported briefly about the recent activities of the panel. The last meeting (VPM4) took place in Montevideo, Uruguay in March 2001. The meeting focused mainly on the development of a VAMOS project for the La Plata River Basin, called PLATIN. It is going to be an integrative, interdisciplinary CLIVAR - GEWEX project. At VPM4 the VAMOS group tried to establish a strong link into the applications side (agriculture, hydropower management) for the PLATIN project. PLATIN is planned for the second half this decade. This VAMOS component will most likely need a modelling component addressing the problem of seasonal climate predictions in this area.
The first VAMOS activity will be the Low Level Jet experiment. It will directly addresses the question of moisture influx into the La Plata basin and can be regarded as a first phase of PLATIN. The operational phase of this process study is planned for last 2002/early 2003.
For the next meeting, scheduled for March 2002 in Costa Rica, the VAMOS panel is planning to focus on the North American Monsoon Experiment (NAME).

CLIVAR Asian-Australian Monsoon Panel

Dr. Kang reported about the last meeting of the Asian-Australian Monsoon panel that took place in late August in Reading, UK. The panel has been reconstituted under the leadership of Dr.s. J. Slingo and P. Webster. In particular, he mentioned a proposal for a cross-CLIVAR modelling workshop with involvement of different regional CLIVAR panels

(e.g. VAMOS, VACS, A.-A. Monsoon) and WGSIP. The monsoon panel proposed to establish an ad-hoc planning group by November 2001 to formulate a proposal in time for the next CLIVAR SSG in May 2002. If the SSG welcomes the proposal, an organizing committee would be formed in June and the workshop would be scheduled for spring 2003. The panel discussed the proposal briefly and recommended to the ad-hoc working group to specify more explicitly the goals and objectives of such an activity.

CLIVAR Atlantic Implementation Panel

Dr. Villwock reported that the CLIVAR Atlantic Implementation Panel wants to approach WGSIP to explore the option of having a meeting back-to-back with the next WGSIP meeting. A focus on MOC (Meridional Overturning Circulation) and global climate change issues was agreed upon. The panel stated that although the focus of the group will broaden towards the Atlantic and other regions, possible interactions should be regarded to be in a very early stage.

CLIVAR VACS (Variability of the African Climate System) Panel

The first meeting of the VACS panel was held at the Drought Monitoring Centre (DMC) in Nairobi, 29-31 January 2001. Chair of the group is Dr. Chris Throncroft (U. Albany, USA). The VACS panel discussed in depth a research agenda for a CLIVAR Africa programme. The main interaction with WGSIP will likely to be on the field of regional seasonal predictions. No specific cooperations have been formulated so far. The panel tasked the ICPO to explore the possibility to foster the cooperation through a joint meeting of both groups end of 2002 in Southern Africa.

JSC/CLIVAR Working Group on Coupled Modelling (WGCM)

The 5th meeting of the joint JSC/CLIVAR Working Group on Coupled Modelling scheduled for mid of September had to be postphoned due to the impact of the terror attacks on international travel. It has been rescheduled to early February 2002 in Bracknell, UK. In this context the group discussed briefly the report of the ad hoc WGCM-WGNE-WGSIP Panel on regional climate models. WGSIP endorsed the report and tasked Dr. Villwock to ensure that this is discussed again at WGCM.

National Reports and Projects

- **Japan**

  Earth Simulator Project
  Dr. Sugi reported about the progress of the Earth Simulator Project. The building of the computer is expected to be complete in spring 2002. The computational power will be about 40Tflops. The software development is lacking somewhat behind. Japan is currently running two climate models, at MRI/JMA and CCSR/NIES

- **Canada**
  Dr Boer report about recent developments in the Canadian CLIVAR programme. Canada recently formed the Canadian CLIVAR Network, for better and closer cooperation of the various institutions participating in CLIVAR projects The network has three overarching themes: 1. Seasonal to interannual Variability and Predictability (Leaders: Derome, Boer), 2. Decadal to Centennial Variability and Predictability (Leaders: Greatbatch, Fyfe), and 3. Anthropogenic Climate Change (Leaders: Weaver, Zwiers). (http://www.clivar.ca/network/home.htm)

- **Australia:**
  Dr. Power gave a comprehensive review of various activities in Australia.

  Model Development & Initialisation

  BMRC is conducting experiments aimed at improving the initialisation of the coupled prediction system by assimilating pre-balanced subsurface ocean temperature data. In the tests conducted so far, the method improves the current structure in the west but makes the temperature structure in the east worse. Nevertheless

the method shows great promise and tests are continuing. A new CGCM has been developed in conjunction with CSIRO Marine Research and this will become operational during 2002. Contacts: Oscar Alves and Guomin Wang, BMRC.
Please see http://www.bom.gov.au/bmrc/ocean/staff/fzt/CM/page1.html

CSIRO (Atmospheric Research) has developed a CGCM forecasting system, http://www.dar.csiro.au/res/cm/coca.htm, and have benchmarked it against other prediction systems including CLIPER. Contacts: Ian Smith and Steve Wilson, CSIRO (Atmospheric Research).

Verification

The Bureau of Meteorology is participating in the WMO/CBS experimental exchange of "Long-range forecast" verification information. The focus of this project is on ensuring that outlooks made available to the public are verified using standardized methods and that the verification information is also made available.

Variables verified at the Bureau thus far include seasonal values of rainfall, surface air temperature and NINO, for leads of 0-9 months. The full set of variables and regions covered by the original document produced by the Expert Team coordinating the exchange system (http://www.wmo.ch/web/www/DPS/SVS-for-LRF.html) is extremely large. Discussion of the arrangements and methods are continuing. Contacts: Terry Hart (CBS Expert Team leader) and Andrew Watkins.

The Bureau of Meteorology provides some verification information in an easily understood fashion as part of a separate project funded by the Climate Variability in Agriculture Programme. Please see http://www.bom.gov.au/silo/products/verif.

Improving Prediction Services

Market research tells us that many people do not make the distinctions we (scientists) make between weather and climate and that information for particular locations is of most interest. The SILO web-site (a cost-recovery registered user service) addresses this by providing a clickable map which then provides access to a large number of web-based products relevant to that location, ranging from radar images through to seasonal climate outlooks from a variety of sources (see http://www.bom.gov.au/silo/SILO2).

The Bureau hosted several events to get a better understanding of what users think of the climate prediction services we provide and to gather ideas for future services. This includes climate outlook fora with small groups of key users for in-depth discussion, and a conference called Cli-Manage2000, which was attended by approximately 120 people from Australia and New Zealand from a range of industries. A report on Cli-Manage2000 is available.

Downscaling

BMRC has developed a statistical downscaling analogue technique which uses daily synoptic structures and simple pattern recognition to determine daily analogues which are used to provide seasonal forecasts of station rainfall and temperature. The method is being evaluated using forecasts from a number of different CGCMs. A simpler "statistical bridging" method based on dynamical predictions of tropical Pacific Ocean SST and historical observations is also under investigation. Contacts: Bertrand Timbal and Scott Power, BMRC.

Modelling studies – large-scale

The Regional Model Intercomparison Project (RMIP), is an intercomparison of regional models over a large Asian domain (about 50E-150E and 5N-60N), run for an 18-month period (March 1997 to August 1998) at a resolution of about 60 km. Eleven models have run the simulations with lateral boundary forcing supplied by NCEP reanalyses. John McGregor and Jack Katzfey (CSIRO Atmospheric Research) have submitted 2 runs, one for DARLAM and one for the CSIRO conformal-cubic (C-C) model (using a stretched global grid). RMIP is an APN project. Results are being analysed by Congbin Fu's group at IAP in Beijing. An interesting

result is that most, but not all, models have a tendency to shift the East Asia monsoonal rainfall too far northwards.

Stuart Godfrey, Rui-Jin Hu and Andreas Schiller (CSIRO Marine Research) are exploring the *dynamics and thermodynamics of the Indian Ocean* in their global MOM model, to better understand what sets long-term mean surface heat fluxes and SST variations within it. They find that mixing within the Somali Current, down to depths of 1000m or so, sets the depth and temperature distribution of the entire Indian Ocean north of the Indonesian Throughflow at 7°S. This in turn sets the depth distribution of the zonal Indonesian Throughflow jet via geostrophy, which then supplies the western boundary current feeding the Somali Current. Hence mixing events in the Somali Current determine the long-term mean heat transport and surface heat flux into the northern Indian Ocean, rather than the other way round. This may have implications for the design of an ocean monitoring system for climate, in the Indian Ocean.

Coupled model of Indian-Pacific Ocean. Jaci Brown and Stuart Godfrey (CSIRO Marine Research) are working on extending the Kleeman intermediate coupled model of the Pacific Ocean to include the Indian Ocean.

Diagnostic & predictability studies

BMRC is studying the *coherence and predictability* of seasonal rainfall in the maritime continent. Seasonal variations appear to be predictable during the dry season in this region, but not generally during the wet season (eg, "Spatial coherence and predictability of Indonesian wet season rainfall", Haylock & McBride, J. Climate, in press). Further evidence of this seasonal/spatial variation in predictability emerged at the Third Workshop on Regional Climate Prediction and Applications – Tropical Pacific Islands and Rim (University of Oklahoma, April-June 2001). Contact: John McBride, BMRC.

BMRC continues investigations of the possible *effects of Indian Ocean sea surface temperatures* on the climate of Australia and the surrounding region. This work indicates that an Indian Ocean Dipole, independent of the El Niño - Southern Oscillation, is rare. Most "dipole-like" behaviour of the Indian Ocean appears to be a response to the El Niño - Southern Oscillation. A paper discussing some of this work was presented at the AMS Annual Meeting in January, and an article has been submitted to CLIVAR-Exchanges. Contact: Neville Nicholls, BMRC.

Analysis and Interpretation of ocean thermal structure. Susan Wijffels and Gary Meyers (CSIRO Marine Research) are documenting variability of mass, temperature and salinity transport of Indonesian throughflow (ITF) and its relationship to winds over the Pacific and Indian Oceans. A key result is that heave of the thermocline along the northern side of ITF (i.e. Indonesian coast) affects SST by upwelling, and this is driven by winds over the Indian Ocean. Ming Feng, Susan Wijffels and Gary Meyers are analysing the large scale propagating features seen in altimeter and XBT data. Tara Ansell (a PhD student at Melbourne University) is using XBT data and ocean-model results to identify the mechanisms that cause SST variability in the eastern and western Indian Ocean.

Observations from the twentieth century suggested that the IPO (Interdecadal Pacific Oscillation) may play a role in modulating both the vigour of ENSO variability and the teleconnections ENSO has with Australia (Power et al. 1999, Climate Dynamics). This is being tested using perturbation experiments in the BMRC CGCM. The control integration, like the observations, exhibits large fluctuations in ENSO variability and in the association between ENSO and Australia on interdecadal time-scales. However, preliminary analysis of the experiments suggests that the modulation in the model is an unpredictable process. Contact: Scott Power

Applications and Impacts

A new book entitled "Applications of Seasonal Climate Forecasting in Agricultural and Natural Ecosystems. The Australian Experience" (G.L. Hammer, N. Nicholls, C. Mitchell, Eds.) provides a summary of research activities in Australia aimed at improving the benefits of applying climate predictions. More recent applications include an in-depth study with the sugar industry to determine where in the

production/supply/marketing chain seasonal climate forecasting can be used to benefit decision-making. Contact: Roger Stone, Queensland Centre for Climate Applications.

Several international collaborative projects focussed on the application of seasonal climate predictions for agriculture, health, and environmental management, have commenced. Some of the agricultural projects (eg., in Pakistan, India) are organised through the START CLIMAG program Contact: Holger Meinke, Department of Primary Industry, Queensland.

The effects of the ENSO on marine animals (dugongs) and birds are being studied by Neville Nicholls, BMRC.

A pilot project titled "Capturing the Benefits of Seasonal Forecasts in agricultural management" has been carried out under the Australian Centre for International Agricultural Research. This 3-year program involved field sites in Matopos Zimbabwe (grazing management), Tamil Nadu India (farm decision making), and Mataram Indonesia (Water and Crop management). The lead scientists in Australia are drawn from the Queensland Department of Primary Industries, the Queensland Department of Natural Resources and BMRCContact e.g. J. McBride, BMRC.

A proposal called Res Agricola (Latin for "Farmers' business") has been developed by QDPI, the IRI and others which follows on from the successful OGP South Asia project aimed at using seasonal forecasts to assist agricultural decision-making from farm to policy level. Contact: Holger Meinke, QDPI

Oceans to Farms: This multi-disciplinary project is a study of the way seasonal climate forecasts can best be used to manage farming and farm-related industries. A lagged statistical relationship is established between ocean surface temperatures and variables such as plant growth.. The forecast system is tailored for specific regions, industries and decision points in the farming cycle. Contact: Peter McIntosh, CSIRO Marine Research.

Sustained observations

The *Darwin Climate Monitoring and Research Station* (DCMRS) provides a basis for research activities in a tropical monsoon environment, including support for TRMM and the Atmospheric Radiation Measurement (ARM) program of the US Dept of Energy. The DCMRS undertakes climatological observations and research relevant to the systematic measurement of tropical rainfall, cloud properties and their impact on radiation in the monsoon environment. Emphasis is on providing ground truth data for TRMM and ARM, and process studies including special observing projects on the four-dimensional structure, dynamics and microphysical properties of tropical convection and associated radiation. Contact: Tom Keenan, BMRC.

Indian Ocean Sustained Observations - XBT Network. The lines IX1, 12, 22, 29 and PX2 (Banda Sea) were started in 1983-1986. The lines are now operational (i.e. long-term maintenance assured in an appropriation budget) under direction of the Joint Australian (CMR/BMRC) Facility for Ocean Observing Systems (JAFOOS). JAFOOS also operates the WOCE Upper Ocean Thermal Data Assembly Centre, where all Indian Ocean XBT data are assembled annually and given scientific quality control following published standards and procedures. The assembled data sets are available now for 1990-97. JAFOOS and International Pacific Research Centre (IPRC) are jointly proposing to use the WOCE procedure to QC all T(Z) data in the Indian Ocean for the 20th century. The panel is requested to consider and endorse the idea in principle, pending review of the final draft of the proposal. Contact: Gary Meyers, CSIRO Marine Research.

A*rgo network*. Australia has initiated an Argo float network to collect temperature and salinity profiles to a depth of 2000m. Initially 10 floats were placed in the eastern Indian Ocean between NW Australia and Indonesia. Resources are available to maintain and extend the array southward to the SW corner of Australia and about 1000 km offshore. Contact: Neville Smith, BMRC.

- **USA**

Dr. Zebiak introduced the US – CLIVAR structure to the participants. The US has developed a similar programme infrastructure as international CLIVAR in terms of panels and working groups. For an overview see http://www.usclivar.org/. There is a strong collaboration with GEWEX for issues related to land interactions. Dr. Kirtman reported about recent development in the US Asian-Australian Monsoon panel. The group drafted a Science Plan that will be presented to the US-CLIVAR SSC in December.

1. **ESMF (Earth System Modelling Framework)**
   This new activity in the US, funded by NASA, involving major weather/climate centres and several universities, has the goal to develop a common framework for Earth System Modelling. It is somehow a complement to the European PRISM project (Progamme for Integrated Earth System Modelling) (see below).

2. **Applied Research Center (ARC) of IRI**
   The first period of these collaborative projects has been completed. See http://iri.columbia.edu/climate/research/arcs/ for an example. Dr. Zebiak gave an update on the coupled model forecasting project. Using the same ocean model (MOM3), different AGCM's are used (COLA, GFDL, NCAR, NCEP, IRI) for climate predictions. The data access is based on the DODS (Distributed Oceanographic Data System) system (http://www.unidata.ucar.edu/packages/dods/) Preliminary results show that
   - For 3-6 months prediction periods persistence is better than coupled model runs.
   - Integrations starting in January have in general lower skill than those starting in July.
   - Autocorrelation of the models is much lower than for observations

   A companion set of forecasts was produced with two systems, with a lower resolution version of the OGCM (global 1.5 degree, scaling to _ degree in latitude at equator, 25 levels; as opposed to global 1degree, scaling to 1/3 degree at equator, 40 levels). The overall skill results were remarkably similar to the higher resolution case, although individual forecasts showed significant differences.

   Future plans encompass a re-evaluation of the project, possible usage of an alternative ocean model with coupled initialisation

- **Germany**

Dr. Villwock gave an overview about the current status of German CLIVAR activities. The first CLIVAR project is 'Marine CLIVAR', a WOCE follow on ocean oriented programme. that is already funded by BMBF (Ministry for Education and Research) for more than two years. Recently, in a new programme called 'DEKLIM' a number of CLIVAR related projects have been funded by BMBF. In addition, the 'Deutsche Forschungsgemeinschaft (DFG) is funding CLIVAR related research, esp. through a number of 'Sonderforschungsbereiche' (SFB) (Special Research Projects). Currently, there is no specific organizational infrastructure for CLIVAR in Germany. Coordination of climate research is mainly done through the National Global Change Committee. Apart from these national activities, German scientists are heavily involved in several European funded projects.

- **France**

Dr. Delecluse reported briefly about ENACT, a French programme on ocean data assimilation and the French involvement in the DEMETER project (see below).

- **European Union**

1. **PRISM (Progamme for Integrated Earth System Modelling)**
   PRISM is a new European funded infrastructure project with the central objective to develop a flexible model structure with interchangable model components exchanging information through standard interfaces with a universal coupler or directly with the other model components. The project, involving 21 partners including scientific institutions, universities, operational centres and commercial computer manufactures, will start by end of the year.

2. **DEMETER**

Dr. Stockdale gave an update on the European DEMETER project, a EU funded activity on multi-model seasonal forecasting. The project with 12 participating partners is funded for the period April 2000-March 2003. Six comprehensive global coupled atmosphere-ocean models that exist in Europe will be installed at ECMWF. The use of a multi-model ensemble system will allow for uncertainties in model formulation to be included in the estimation of seasonal forecast probabilities. An extensive set of 6-monthly hindcast ensemble integrations will be generated using the DEMETER system. These will be run four times a year over a period of 30 years. Each model will produce nine members of the multi-model ensemble. ERA40 reanalysis are used as initial conditions. Thus, this project to strongly tied to the performance of ERA40 which has currently completed 7 years and 4 months (09/86 – 12/93).

More information is available through the DEMETER website (http://www.ecmwf.int/research/demeter/)
Some participants were not satisfied with the current access to DEMETER results and data. Dr. Stockdale volunteered to explore options to make more information on this site public (**Action item**).
In this context, Dr. Stockdale provided the panel with some information about GloSea (Global Seasonal coupled prediction model). The GloSea model had been developed for real time seasonal forecasting and for the DEMETER project, to explore the potential of multi-model ensemble forecast systems. The model is based on the Hadley Centre Climate Model (2.5^ox3.85^o L19 AGCM, 1.25^ox1.25^o L20 OGCM) with enhancements for seasonal forecasting purposes such as a stretched meridional ocean grid, 0.3^o resolution at the equator, 40 ocean levels and coastal tiling, enabling specification of coastline at ocean resolution.
The GloaSea model is used in ocean only mode. Optimal interpolation (OI) type scheme is used with thermal profile data. The SST is relaxed to observed values. The model is forced with ERA 40 (DEMETER) or ERA15/ECMWF (GloaSea) daily fluxes. Ensembles of analyses are generated from wind perturbations: 3 for DEMETER, 5 for GloSea. The hindcasts are used to correct forecasts biases. Thus, >10 years analyses are needed for each perturbation.

3. **ENACT (Enhanced Ocean Data Assimilation and Climate Prediction)**

This new EU project, starting end of 2001/ beginning 2002 will focus on the development of new methods for ocean data assimilation. The main aims are:

a) to enhance ocean data assimilation systems and produce improved practical global ocean analyses
b) to use the analyses to improve seasonal climate prediction and investigate ocean climate

Partners are: ECMWF, LMD, CERFACS, KNMI, MPI, Hadley Centre, SMIH, IMG and KNMI. The project will assimilate ocean data from 1957 until present.

- **Asian-Pacific Economic Cooperation Climate Network (APCN)**

Dr. Kang reported about this multinational activity in the Pacific region. APCN's goals are:

- The establishment of a climate network for the exchange of regional climate information, particularly climate forecast information, among member economies.
- Production of multi-model ensemble seasonal forecasts and dissemination of the forecasts to member countries.

The project that started with its two year experimental phase in 2001 Participating countries are: Australia, Canada, China, Japan, Korea, Russia and the USA. The implementation phase of the project will start in 2004.

- **Dynamical Seasonal Prediction (DSP)**

The DSP project, originally invented by J. Shukla, expanded in SMIP and PROVOST (EU IV Framework programme), covered only cases for JFM 82-99. Dr. Kirtman reported new results for the transition seasons MAM (82-99). Participating partners where COLA, NSIPP, and NCEP. Results show some potential predictability for the US midlat. sector for the MAM season and some agreement for NE Brazil rainfall. Nevertheless esp. in the 90's some significant differences occurred, although observed SST was used. Furthermore, phase 3 of the DSP project has shown that month to month variability (JFM) in the western Pacific has an effect on the seasonal variability over North America.

- **Global Ocean Data Assimilation Experiment (GODAE)**

On behalf of Dr. Rienecker (NASA, Goddard), Dr. Zebiak summarized the outcome of a GODAE Pacific Workshop in July. It was proposed to perform an OMIP type study for the Pacific.

- **Developments at the International Research Institute (IRI)**

Dr. Zebiak outlined the major developments, which had taken place over the past year at IRI. He noted that the primary emphasis of the IRI mission is to produce useable climate-related information through targeted research, applications programs, capacity building and training, utilizing appropriate partnerships. Among the achievements over the past year are:

(i) The Secretariat for International Affaires and Development (http://iri.columbia.edu/secretariat/) is now in place. Director is Dr. Roberto Lenton. The initial staff positions at IRI are mainly filled now, in total about 70 employees.

(ii) Development of additional monitoring products merging climate and impacts information; eg, a real-time drought vulnerability analysis.

(iii) Development of training/education materials on prediction, seasonal forecasting, downscaling, probabilistic information, use of forecast information in sector decision systems.

(iv) Multidiscliplinary analysis of the severe drought situation in SW Asia in context of current natural/social/political scenario.

(v) 3-month training course developed and conducted for climate modelling and regional climate modelling/downscaling; trainees from Africa, S. and C. America, Asia.

(vi) Conducted a workshop on Media and climate information; run in Jinja, Uganda.

(vii) Further development of specific and broad integrated applications projects/programs, including regions in Americas, Africa and Asia; and covering public health, fisheries, water resources, extreme events, and agriculture. Launching of a broad project for the northeast of Brazil.

(viii) Collaboration with WMO/ISDR on development and periodic update of synthesis El Nino assessments.

Links with the applications global change projects

Dr. Harrison (UK Met Office) informed the panel about recent developments in several applications programmes relevant to CLIVAR:

Climate Prediction and Agriculture (CLIMAG): The goal of CLIMAG is to utilize the ability to predict climate variability on the scale of months to a year to improve management and decision-making in respect of crop production at farm and up to national scales. Knowledge of the past and current state, such as soil conditions, is of enormous value for agriculture and prediction of crop yields regardless of future climatic conditions. Examples were given for rice production in Asia, other projects reside within Africa and South America. One successful project has been run in Bangladesh, but to date this has not used seasonal forecasts. Instead the project has used the APSRU Longpaddock approach, under the management of Holger Meinke (see report from Australia earlier). The *Res Agricola* proposal has, in part, been developed from the success of this project.

Global Environmental Change and Food Systems (GECaFS): The GECaFS project is a joint venture involving IGBP, IHDP and WCRP. Its goal is to estimate the impacts of Global Environmental Change on food production, availability and accessibility across biophysical and socio-economic systems from regional to global scales, and to analyse the effectiveness of adaptive strategies to reduce societal vulnerability. The planning of the project is presently underpinned by three foci; Focus 1 - Impacts: Effects of Global Environmental Change on Food Provision, Focus 2 - Vulnerability and Adaptations: Global Environmental Change and Options for Enhancing Food Provision, and Focus 3

- Feedbacks: Environmental and Socio-economic Consequences of Adapting Food Systems. It is envisaged that the project will likely be implemented as a set of commissioned studies within the context provided by questions that frame the study.

The CLIPS Survey of Operational Seasonal Forecasting. Dr. Harrison reported about a survey on the use of Seasonal-to-Interannual Predictions by NMHS (National Meteorological and Hydrologic Services)prepared by the CLIPS rapporteur to CCl (Y. Kimura). NMHSs were grouped into those that at the time of the survey owned an operational capability for providing forecasts (Class A), those that planned to commission a system in the near future (Class B), and those that had no current plans for any system at present (Class C). In total 82 responses were received (WMO has 185 members plus a number of specialised centres, some of which cooperated in the survey), as summarised by WMO Region in Table 1 (RA I – Africa; RA II – Asia; RA III – South America; RA IV – North and Central America and the Caribbean; RA V – Pacific; RA VI – Europe).

Table 1 Issuance of official climate forecasts

	RA I	RA II	RA III	RA IV	RA V	RA VI	Global
yes (Class A)	15	9	4	4	7	10	49
planned (Class B)	7	2	0	0	0	5	14
no (Class C)	0	6	0	0	1	12	19
Total	22	17	4	4	8	27	82

Thus about three quarters of the respondents, or about one-third of the WMO membership, owns or plans to own seasonal to interannual prediction systems. In reality the total is much higher as many known systems are not included in the table. For example the majority of the 54 African members of WMO own systems following development activities linked to Regional Climate Outlook Forums (RCOFs) across most Sub-Saharan countries. It can be expected that a substantial majority of WMO Members will own predictive systems of some form in the near future; this contrasts markedly against the position for short-range forecasts where only a relatively small number of global centres have the resources to produce operational predictions.

The majority of systems produce forecasts out to one season, although some predict over a year ahead (Table 2). Most of the longer-range systems are based on coupled models, but statistical systems using CCA are also present.

Table 2 Period covered by forecasts

Forecast period	Number of forecasts	
	Class A	Class B
1 month	22	3
2 months	3	1
3 months	23	6
3-6 months	7	2
6 months	12	1
1 year or longer	6	0

Deterministic predictions are the most popular, although an encouraging proportion are provided in probabilistic terms, a format encouraged by the RCOF process mentioned above (Table 3).

Table 3 Types of forecast format

Forecast format	Number of NMHSs	
	Class A	Class B
qualitative description	4	1
deterministic categorical forecast	25	4
probabilistic forecast	22	6
forecast represented in numerical quantities	17	3
no reply	2	3

By far the majority of systems are based on empirical methods (Table 4). There is no reason to expect this position to change as most NMHSs do not have the current capacity to run numerical models. Experience suggests that NMHSs

that have their own models tend to give their forecasts higher weight than those from the global modelling systems.

For the foreseeable future the majority of operational long range predictions used in applications will be provided empirical, rather than numerical, systems.

Table 4 Methods employed in climate forecasting

Forecast method	Number of NMHSs	
	Class A	Class B
Empirical-statistical method		
synoptic analysis	6	0
analogue method	14	0
time-series analysis	4	0
correlation analysis	3	0
multiple linear regression	24	5
optimal climate normals	3	0
discriminant analysis	4	0
canonical correlation analysis	7	1
climatic anomalies associated with ENSO	4	0
Dynamical method		
atmospheric general circulation model	6	1
coupled ocean-atmosphere general circulation model	1	1
two-tired	1	0

Verification of issued forecasts

Most NMHSs of Class A, 38 of 49, answered "yes" to the inquiry regarding the verification of issued forecasts. On the other hand, nine answered that they do not verify issued forecasts. (The remaining two did not reply to this inquiry.) A significant range of verification approaches are used, not all retaining desirable rigour.

Intercommission Task Team on Regional Climate Centres (ICTT)

This group with representation from a number of the Technical Commissions of WMO agreed at its April 2001 meeting that Regional Climate Centres (RCCs) should be developed in principle. The roles of these RCCs will depend on regional requirements and will be built as far as possible on existing structures (e.g. DMC's and ACMAD).Forecast inputs to theseCentres is expected to come from a network of Global Production Centres (such as NCEP, ECMWF, IRI UKMO), although most Centres may have in-house forecast production facilities also. With respect to the forecast aspect, WGSIP has an underpinning role in the concept of the RCC in terms of ensuring forecast quality and in terms of advising on optimal methods for forecast selection or consensus building across a variety of inputs.

Possible Roles of RCCs according to the ICTT are

1. Operational activities including:
   - Interpretation and assessment of outputs from global centres
   - Forecast tailoring, including downscaling
   - Verification
   - Product distribution
   - Role related to RCOFs

2. Coordination Functions including:
   - Strengthening regional collaboration on observations, communications, computing
   - Coordination with end users, including holding end user workshops
   - Assist in development of media strategy
   - To represent the needs of associated NMHSs

3. Data Services including:
   - Rescue of climate data sets

- Data base and archiving services
- Assist in development and maintenance of software
- Advising on data quality management

4. Training and Capacity Building including:
   - Training of NMHS staff in SIP
   - Assist in training of end users
   - Assist in introduction of decision models
   - Assist in technical capacity building

5. Research and Development including:
   - Development of research agenda
   - Regional climate variability, predictability and impact studies
   - Consensus practices
   - SIP validation procedures
   - Regional models, downscaling, and interpretation of global models
   - Application and value research

The ICTT also agreed:
An end-user requirement(from the perspective of RCCs and NMHSs with the responsibility to provide operational predictions for use in applications) for operational SIP products covering:

- Forecast Products
- Observational Data and Products
- Training

In addition, Dr. Harrison brought to the attention of the panel that there exists already a CBS (Commission of Basic Systems)-created list called 'Draft Observational Requirements for Seasonal and Inter-Annual Forecasting. It would be useful for WGSIP to comment on this list. Dr Harrison also noted that the CBS Expert Team on Infrastructure for Long Range Forecasting will meet in Geneva, 12-16 November 2001. (**Action item**).

It is expected that the WMO Commission for Climatology (CCl) will be restructured at the Commission Meeting later this month. Three new OPAGs (Open Programme Area Groups) are expected to be formed, one of which will concentrate on climate data and a second on climate variability (particularly climate change). The third OPAG will cover seasonal predictions and applications and is expected to include the following Teams plus additional Rapporteurs on various applications areas::

- Implementation/Coordination Team (ICT)
- Expert Team (ET) on Research Needs
- ET on Operations including Product Generation
- ET on Verification
-
- ET on Capacity Building
- ET on Applications/End User Liaison
- ET on Operational Heat/Health Warnings
- ET on Health-related climate indices
- ET on Training on Urban Climatology
- ET on climate services for energy

Finally, Dr. Harrison reported on the Review Meeting of the Regional Climate Outlook Forum (RCOF) that was held in Pretoria, South Africa, October 2000. The goal was a major review of the RCOF process to improve outputs and to examine sustainability. Currently there are two lines of action: local and international. The international actions include research agenda creation, new products, downscaling and verification. CLIPS ETs will assist in part but WGSIP also has a role. The final report of this meeting is in press.

3.3 WGSIP activities

Topics that were taken up under this agenda item included consideration of the status of the initiatives inherited from CLIVAR NEG-1, as well as a number of new issues and activities (including points raised by the CLIVAR Scientific Steering Group).

Climate events and forecasts of the preceding year

Dr. Zebiak summarized briefly last years major climate anomalies. Highlights are severe droughts in the Middle East (Iran, Afghanistan) for the last two years, mid-summer (JJA) drought in Central America, and below average precipitation in New Zealand. For temperature winter anomalies were positive over wide parts of Europe, over Alaska and cold in central / east US and Siberia.

IRI Forecasts: The forecast of the JFM precipitation over East Asia failed, esp. for India, but for AMJ the forecasts did a better job. Part of the midsummer drought in central America could be predicted but not to the observed extent.
Successful predictions have been performed for the drought in New Zealand (AMJ from March initial conditions) and for western Australia and the Indonesian region, whereas predictions for central and eastern Australia failed.
The JFM temperature forecast for North America made in December totally failed, e.g. Canada was warm, whereas the forecast was on the cold side. Dr. Cavalcanti reported that forecasts performed at CPTEC were able to capture the dry conditions over NE-Brazil but not those over SE Brazil caused by a weak SACZ (South Atlantic Convergence Zone).

In general, Dr. Zebiak pointed out that the current probabilistic forecasts tend to be conservative, i.e. the observed changes tend to be typically higher than the forecasts.

The group agreed that all participants should prepare some examples ahead of the meeting for a more in depth discussion. S. Zebiak (or other designated panel member) will circulate the few target seasons/regions/events ahead of time to allow participants to do analysis and compile results (**Action item**).

Model experimentation and output standards experiment

This new activity had been initiated on the last meeting of WGSIP. Little progress has been made during the past year. The panel had some discussion how to start this activity. There were two main issues identified:

a) to define standards and
b) to agree upon methods to make the (meta)data available.

It was concluded from the discussion that WGSIP will determine an initial set of indices and diagnostic variables for a pilot phase (lead: B. Kirtman, with S. Power, and S. Zebiak). Issues such as definition of anomalies, specification of lead times, gridding, output formats at individual centres to be included. This should be carried out over the next two months. In the meantime, the ICPO should explore options to develop a web-based interactive system for this purpose (A. Villwock). M. Harrison will draft a rationale statement for the project (within next month). (**Action item**).

SMIP2 / HFP (Historical Forecast Project)

Dr. Boer reported about the progress of the SMIP-2 experiment which had been initiated about a year ago. SMIP-2 is a follow–on experiment of the Seasonal Prediction Model Intercomparison Project (SMIP) which began in 1996 as a program organized by the CLIVAR NEG-1 (now known as the CLIVAR Working Group on Seasonal to Interannual Prediction, WGSIP). In SMIP-1, 4-month ensemble forecasts for 5 (or 9) initial conditions were carried out with respect to the winters (December-March) of 1982-83, 1986-87, 1987-88, and 1992-93, and the summers (June-September) 1987, 1988, 1993, and 1994. The second phase of SMIP, proposed by WGSIP on its 4th session in Bologna, 1999, should investigate the potential forecast skill using observed boundary conditions. The objectives of SMIP-2 are:

- to extend atmospheric GCM DSP experiments to more complete cases, including the evaluation of "second" season predictability
- to initialise and/or nudge ground surface conditions in collaboration with the GSWP (Global Soil Wetness Project)
- to perform seasonal prediction experiments with coupled ocean-atmosphere models

The experimental design for this study can be found under: http://www-pcmdi.llnl.gov/smip/smip_exd.html

So far, only 4 institutions (CCC, MRI/JMA, NCEP/SPM and SNU/KMA) plan to participate.

SMIP-2/HFP (historical forecast project) is a second component of SMIP-2 and aims to investigate the actual 1-season forecast skill that can be obtained using current model-based objective methods. Thus, SMIP-2/HFP compliments the standard SMIP-2 experiment which assesses the "potential" forecast skill that could be obtained if a perfect forecast of ocean and sea-ice conditions were available.
The specific objectives of SMIP-2/HPF are to:

- establish the "actual" 1-season forecast skill that is currently possible in a realistic operational, objective context
- provide a hindcast data set that has been produced with a uniform approach and which may be used to:
  - demonstrate currently achievable 1-season forecast skill for a range of variables
  - support the development and application of probability forecast methods including measures of reliability
  - encourage the further development and application of ensemble methods including super-ensemble approaches
- provide a benchmark against which to demonstrate improvement and to justify changes in operational 1-season forecast approaches and methods

Details of the experimental design can be found under http://www-pcmdi.llnl.gov/smip/smiphfp_exd.html

WGSIP welcomed this activity and encouraged G. Boer and M. Sugi to work toward further implementation and engagement of additional groups. The deadline for participation in this project should be extended to Dec. 2002 to allow participation of European groups active in the DEMETER project. (Action item).

Monsoon Predictability

Dr. I.-S. Kang gave an overview about the Monsoon Predictability project. Results of this AGCM intercomparison project are now in the process of being published. (list will be attached).

Predictability on Decadal Time-scales

D. G. Boer reported about the Decadal Predictability Workshop that was held in Scripps Institution of Oceanography, Oct. 4-6, 2000, jointly organized by WGCM and WGSIP. More than 30 participants from 18 institutions attended.

NINO3 intercomparison project

Dr. Kirtman informed the panel that the NINO-3 project has been completed. A report on the project is found at the CLIVAR website [http://www.clivar.org/]. Dr. Villwock (ICPO) agreed to publish the report in the CLIVAR IPO publication series (**action item**). The report will be provided electronically in pdf-format. Because of the large number of colored figures the printing and distribution of hardcopies through the ICPO is not affordable.

Study of Tropical Oceans In Coupled models (STOIC): Study of the variability of the tropical oceans on seasonal and interannual time scales other than ENSO

The STOIC project has been completed the report is accepted and in press in Climate Dynamics. Copies can be obtained through the CLIVAR Website from M. Davey.

Regional Climate Models and downscaling

A major focus of this WGSIP meeting was on downscaling and regional climate modelling. Dr. Hans v. Storch, director of the Institute for Coastal Research at the GKSS Research Centre Geesthacht, Germany, gave an invited presentation on several problems in regional modelling and downscaling. He presented results to the following topics:

1. Validation – the „Big Brother“ experiment of Denis and Laprise
2. The problem of regional noise – indeterminacy
3. Boundary value problem or information recovery problem? – spectral nudging
4. What is the added value?

1. Validation – the „Big Brother“ experiment (BBE) of Denis and Laprise

This dynamical downscaling experiment, described in detail by Denis et al, 2001, demonstrates that

- A regional atmospheric model is able to recover the small scale structures as a response to internal dynamics and small scale physiographic details,
- Jumps between large-scale and regional-scale up to 12:1 are acceptable (at least in the presented BBE set-up).

V. Storch concluded that RCMs do what they are constructed for.

Reference:

Denis, B., R**.** Laprise, D. Caya and J. Cote, 2001: Downscaling ability of one-way nested regional climate models: The Big Brother Experiment. **Climate Dyn**., (in press).

2. The problem of regional noise – indeterminacy

The development in the interior of the limited domain is only partially controlled by the lateral boundary conditions. Instead, the nonlinear chaotic processes acting on all spatial scales have a marked impact on the development. Small disturbances, be they in the initial conditions, lateral boundary conditions, or in the parameterizations introduce the potential of divergent evolution at any time. The stronger the influence of the large-scale state, the smaller the potential for divergence.

Not only in global GCMs but also in regional GCMs variations unrelated to external causes (noise) are formed.

The assessment of a paired model experiment, in which the effect of a methodology or parameterization is studied, needs discrimination between the effect of the process and noise.

Dr. v. Storch gave the following example to prove the relevance of the sea state on the atmospheric variability

Hypothesis: The dynamical state of the ocean waves (specifically the shape of the spectra, or age) affect in a physically significant way the state of the overlying atmosphere. Growing (young) waves suck momentum from the wind field, thereby damping the formation of storms.

Experimental design: Regional atmospheric model (HIRLAM) covering the North Atlantic. Two runs were performed: a control experiment where the roughness of sea surface parameterized by the Charnock formula.

In the anomaly experiment the roughness of sea surface determined from wave spectra simulated interactively with wave model WAM. In each configuration one full year was simulated (conventional setup.) Additionally, another 20 months were simulated with HIRLAM.

For each configuration, control (Charnock) and anomaly (WAM model coupled), 5 Januaries and 5 Junes were simulated. They differed only with respect to the initial state, which was taken from the year-long simulation one day apart (e.g. 2, 3, 4, 5 and 6 January).

Thus for the basic experiment, two ensembles of 6 „control“ and „anomaly“ members each were available to assess the internal variability (noise) and the systematic difference (signal). The results of these experiments show that

1. Also in regional climate models internal variability is formed; only part of the variability is related to varying boundary forcing.
2. Numerical experiments with RCMs need to discriminate between noise and signal, like in global GCM experiments.
3. The noise in RCMs is not stationary so that its statistics can hardly be extracted from extended simulations; instead sufficiently large ensembles are needed.

Reference:

Weisse, R., H. Heyen and H. von Storch, 2000: Sensitivity of a regional atmospheric model to a sea state dependent roughness and the need of ensemble calculations. *Mon. Wea. Rev*. **128**, 3631-3642.

3. Boundary value problem or information recovery problem? – Spectral nudging

In the third part of his presentation, Dr. v. Storch addressed that question whether the quality of regional model simulations is determined by the transfer of information at the boundaries or more through an information recovery problem over the entire domain. Usually, a regional model is forced only in a „sponge zone“ along the lateral boundaries. („standard“). Here a„large-scale nudging“ is used instead, i.e., additionally to the lateral forcing the large-scale (spectrally filtered) analysed state is imposed in the interior as well.

V. Storch concluded that

1. Regional atmospheric modelling is not a boundary value problem but a problem of efficiently combining

empirical knowledge and theoretical insight.

2. Regional atmospheric modelling aims at modelling regional scales while satisfying large-scale constraints.
3. Spectral nudging is one method to deal with the problem. It prevents the formation of regional-scale chaos in simulations (not shown).

References:

von Storch, H., H. Langenberg and F. Feser, 2000: A spectral nudging technique for dynamical downscaling purposes. *Mon. Wea. Rev.*, **128**, 3664-3673.

Feser, F., R. Weisse and H. von Storch, 2001: Multidecadal atmospheric modelling for Europe yields multi-purpose data. *EOS*, **82**, 305+310.

Finally, Dr. v. Storch summarised the work of the Joint WGCM/WGNE ad hoc Panel on Regional Climate Modelling. A paper called "Atmospheric regional climate models (RCMs): A multiple purpose tool? Edited by R. Jones, B. Kirtman, R. Laprise, H. von Storch, and W. Wergen, was presented to WGSIP. The main conclusions of the report are:

1. Obviously, all models suffer from various defects. In fact, trivially, numerical models are a reduced image of a considerably more complex reality. In this sense, all models are wrong and can be made more realistic in very many different ways. Therefore the process of improving models should be guided by the needs of the specific applications.
2. The reduction of errors in the driving GCMs should remain a priority for climate modellers.
3. The assessment of RCM climate simulations continues to be hampered by the lack of high-resolution observed gridded climate data over many regions of the globe. Regional data re-analysis projects using observations from national archives should be encouraged.
4. An international RCM Workshop should be organised bringing together, not only RCM modellers, but also global climate modellers, diagnosticians and dynamicists, users of RCM results, research managers and funding agencies, under the theme "The added value of Regional Climate Model simulations" in many applications. Time-wise, this Workshop could take place around March 2003, after passing the levels of recommendation and approval by JSC, WGNE, WGCM and WGSIP.
5. Long, multi-decadal RCM simulations nested within Operational Analyses and forced by observed SST could be made to assess the RCM skill to reproduce fine-scale features associated with large-scale year-to-year anomalies. This would constitute a RMIP, analogous to AMIP for global models.

When intended for climate-change projections, the RCM should be validated in different climate regimes in order to establish their general applicability. It would be most useful to carry a co-ordinated international modelling effort to nest a number of RCMs with a number of GCM-simulated data sets over a few regions.

The participants thanked Dr. v. Storch for his thoughtful and comprehensive review on the current status of regional modelling and downscaling. WGSIP welcomed the report of the ad-hoc Panel on Regional Climate Modelling and endorsed the idea of a workshop on regional climate modelling. In addition, WGSIP will explore the possibilities for a tropical 'big brother' experiment (Kirtman) (**action item**). M. Harrison will raise the issues of data needs in upcoming meetings in Geneva (**action item**). The outcome of the ad-hoc panel will also be discussed at the next WGCM meeting in Feb. 2002. There was agreement that while Big Brother indicated potential value adding through regional models in short to medium range predictions in the extra tropics, and that RCMs appeared to assist with climate change work, there is no evidence to suggest that regional models add value on seasonal to interannual time scales for any part of the globe or that they added value in the tropics on any time scale other than those for climate change. It was further agreed that further work, particularly re seasonal predictions in the tropics, needs to be undertaken as a matter of priority, and the WG supported the use of the Big Brother approach in this work.

Ocean Models Intercomparison Project (OMIP)

Dr. Pascal Delecluse presented preliminary results of the Ocean Model Intercomparison Project (OMIP) and outlined the current status in the planning of a CLIVAR/WGSIP Ocean models intercomparison experiment. The project will compare data from the TAO network and model output over the period 1994-1996. In the pilot phase intercomparisons are mainly done for temperature and due to the limited amount of data partly for salinity. On a later stage, currents should be intercompared as well. A preliminary website has been set up under http://www.lodyc.jussieu.fr/~bdlod/Tsec/index.html

GEWEX Interactions

Dr. B. Kirtman briefed the group about relevant interactions with GEWEX activities.

Global Land/Atmosphere System Study (GLASS) is a Land-Atmosphere Feedback Study to investigate the impact of land surface local forcing on the atmosphere. A new generation of land surface schemes (LSS) is emerging. The schemes are evolving from general circulation model parameterizations that provide fluxes to the atmosphere into independent models that are increasingly being compared to models of hydrology, biogeochemistry and ecology. This expanding scope is driven by the growth of interdisciplinary studies of the earth system. GLASS aims to encourage these developments by coordinating the evaluation and intercomparison of this new generation of LSSs, and applying them to scientific queries of broad interest.

GLASS will also serve as an interface between the land-surface community and other GEWEX projects.

In this context one of activities related to GLASS is the Global Soil Wetness Project (GSWP) which is also an ongoing modelling activity of the International Satellite Land-Surface Climatology Project (ISLSCP) The GSWP is charged with producing a 2-year global data set of soil moisture, temperature, runoff, and surface fluxes by integrating one-way uncoupled land surface process models (LSPs) using externally specified surface forcings and standardized soil and vegetation distributions, namely, the ISLSCP Initiative I CD-ROM data.

For WGSIP, Dr. Randy Koster is the cross-link to these activities.

(Ocean) Observing System in support of Seasonal-to-interannual Prediction (SIP)

The CLIVAR Scientific Steering Group has asked WGSIP to provide guidance to basin panels and OOP prior to end 2001 on priorities for real time observations in support of SIP, delayed mode observations, process studies. (WGSIP). The panel discussed various elements of an observing system that would be required for SIP. Finally, Drs. T. Stockdale and P. Delecluse were task to draft a plan within the next month to be circulated within the group. (**action item**).

Theoretical study of the role of IC on climate predictability

Dr. Richard Kleeman reviewed his recent work concerning the role of initial conditions on interannual climate predictability. He uses singular vector technique to initialise coupled models for ensemble prediction construction, systematic sensitivity analysis and efficient 4-d var data assimilation using reduced state space techniques. To date this technique has been applied to 3 groups of models:

1. Intermediate coupled models (Battisti, Kleeman, Cane&Zebiak)
2. Statistical (Markov) Models (Penland, Xue)
3. Hybrid Coupled Models (LODYC OGCM with different simple atmospheres; MOM OGCM coupled to statistical atmospheres (Galanti and Tzipperman)

Results obtained by applying this technique for the tropical Pacific, i.e. ENSO prediction have shown robust and non-robust features:

1. The thermocline displacement pattern optimal in causing SST growth in 6-12 months is robust. It resembles the Wyrtki “build-up” (Reference ?).
2. SST pattern is robustly dipolar but the location of the dipole is not. Demonstrated in intermediate and hybrid coupled models that atmospheric “convection” physics are important to its location.
3. Galanti and Tzipperman show sensitivity of SST on long timescales to subtropical thermocline displacements
4. Spectrum strongly peaked (robust).

Climate prediction research activities in Hungary

Gregor Kiss, member of the Hungarian Met. Service, gave an overview about seasonal prediction methods used in Hungary. Because Hungary is a cooperative partner of the European Centre for Medium Range Weather Forecasting (ECMWF), the products of ECMWF can be used as a basis for additional national activities. The Hungarian Met. Service uses an analogue technique based on objective similar anomaly analysis. Observed anomaly patterns are compared with the Hess-Brezowsky macrosynoptic situations database to estimate the seasonal temperature and rainfall patterns for the next two seasons.

Other scientific presentations by the participants:

P. Delecluse

I. seasonal forecasting (DEMETER)
II. data assimilation – model evaluation (ENACT)
III. process studies

Example 1: 4-D var. experiment with the Pacific version of the OPA model. The assimilation has an impact on the ocean structure with a stronger thermocline. Sea level shows modest improvement. Next steps: apply the method in a global model, include assimilation of sea level and salinity.

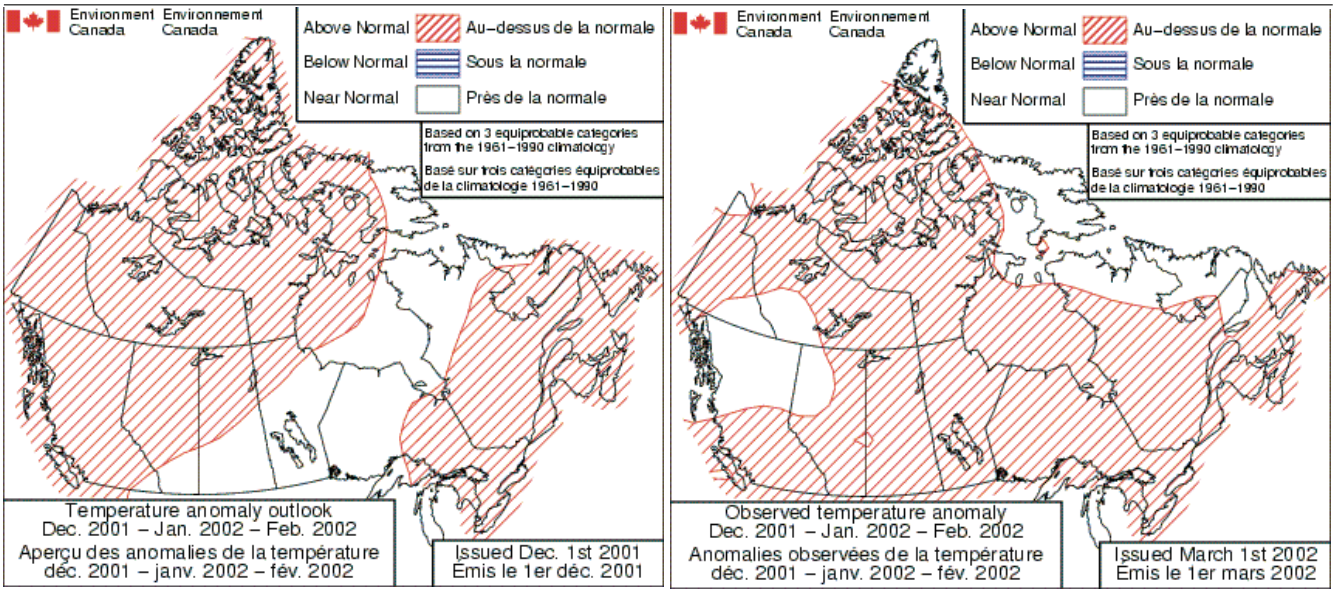
Example 2: ENSO events in the model: two different ENSO components "standard" and "abnormal" (e.g. 1997/98 more abnormal case). Mechanisms: recharging mechanism, local forcing, coupling with seasonal cycle).

G. Boer: Climate forecasting in Canada

The development of climate forecasting in Canada is proceeding via a loose collaboration of University and Government and weather forecasting and climate modelling investigators. The production aspects of developing and producing seasonal forecasts is centralized at the Canadian Meteorological Centre (CMC). The research, operational, and management tasks are supported by an annual seasonal forecasting "Forum". Forecasts are based on objective methods providing quantitative results and accompanied by measures of skill. Changes in forecast procedures require *objective* evidence of improvement. Operational seasonal forecasts for Canada are available at *http://weatheroffice.ec.gc.ca/saisons/index_e.html*.

The Historical Forecasting Project (HFP) is analogous to the "reanalysis" projects of major weather centres. The HFP uses a stable forecast system to produce historical seasonal forecasts (i.e. hindcasts). Results are described in Derome et al. (2001). The HFP hindcasts are produced in an operational context where no future information is available, are based on a 2- tier approach with separately forecast SST anomalies and AGCM responses, and are used to develop bias correction and statistical combination methods for ensembles of forecasts from two different models.

Figure 1



Forecasts of temperature and precipitation anomalies over Canada are produced and disseminated for each season. The three-category temperature forecast for the Winter (December-February) of 2001-2 and the verifying observations are shown in Figure 1. The forecast for above normal conditions over much of Canada is generally successful. The subsequent Spring (March-May) forecast is shown in Figure 2. Perhaps surprisingly, the objectively produced forecast for Spring calls for below normal temperatures over Canada in contrast to the Winter forecast of above normal temperatures almost everywhere. Maps of historical skill are always attached to the forecasts.

Experimental three-category probability forecasts are also produced as shown in Figure 3.

The current forecasts are “multi-model” ensemble forecasts, albeit with an ensemble of only two models, one of which is the CCCma climate model and the other of which is an RPN forecast model. A second HFP is under way using new versions of both the climate and forecast models. Depending on results, the newer models will replace or be combined with current models in the ensemble.

Multi-model ensemble approaches are under investigation in a variety of contexts. Lambert and Boer (2001) show that the simple ensemble mean of results from a collection of coupled models from the Climate Modelling Intercomparison Project (CMIP) is generally closer to the observed climate than the result of any individual model. In a forecast oriented study, Kharin and Zwiers, (2002) use AMIP2 results to investigate multi-model ensemble approaches. Results are illustrated in Figure 4 where the MSE skill measure is related to climatology and is negative for forecast that are worse than climatology. A weighted combinations of model results (green bars) provides little improvement where forecasts are skilful (i.e. in the tropics for Z500, not shown), while global skill increases when a modest number of models are used but subsequently decreases as the number of models (and hence weights that must be determined) increases. Overall, weighting the ensemble mean of the models (red bars) appears to be preferable and can be superior to individually weighting models in some regions, such as for the PNA region shown on the right of the Figure.

Multi-season forecasts are currently produced by statistical methods. Development work is under way to produce interannual forecasts based on the CCCma coupled climate model (Flato and Boer, 2001). A coupled model HFP (or CHFP) will be required before such forecasts can become operation. The efforts in this context are in the development stage.

Figure 2. MAM "deterministic" forecast

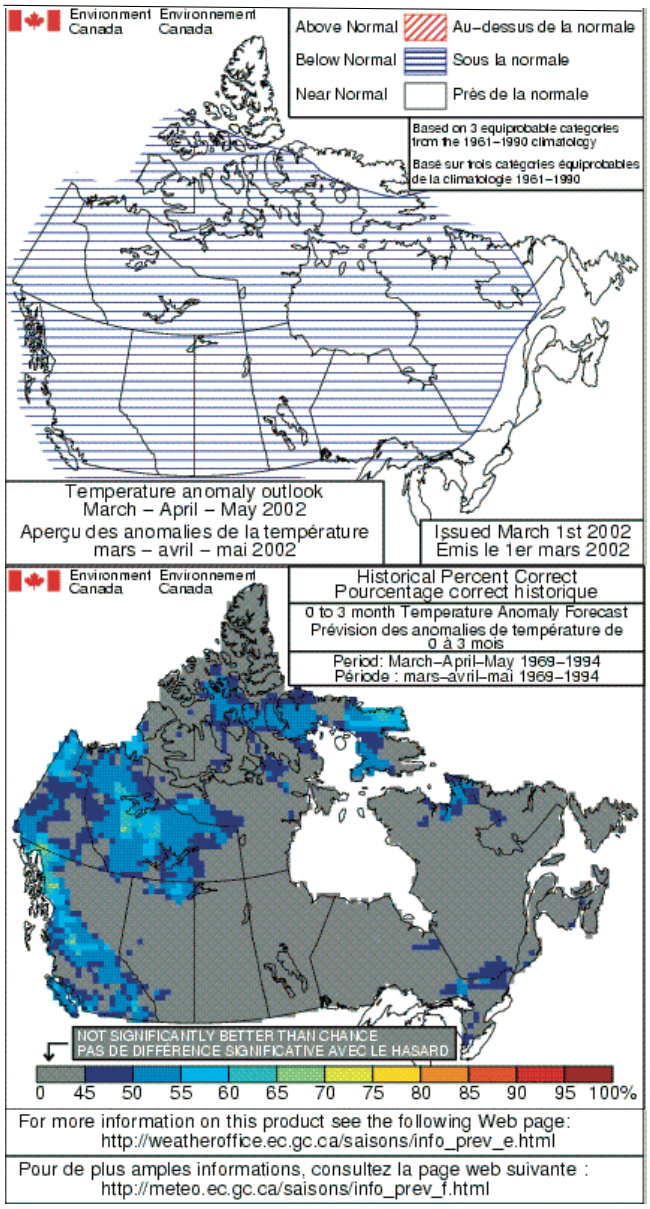
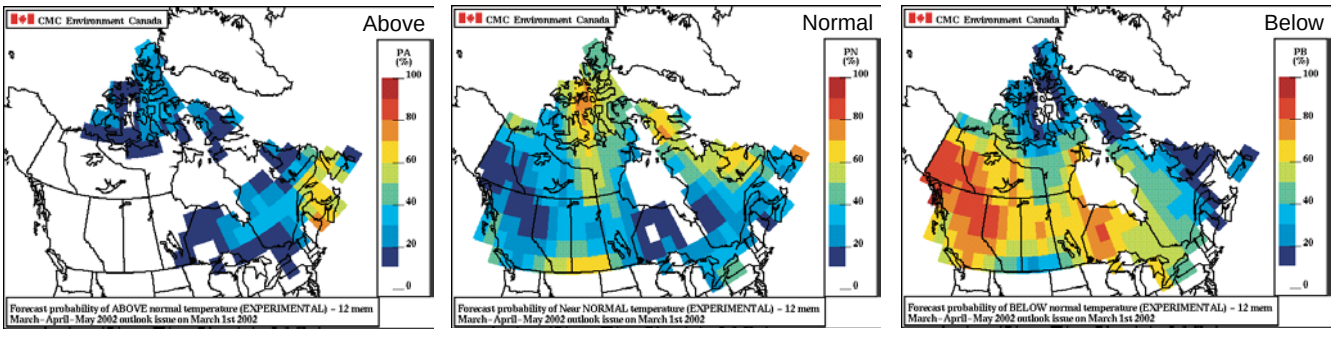
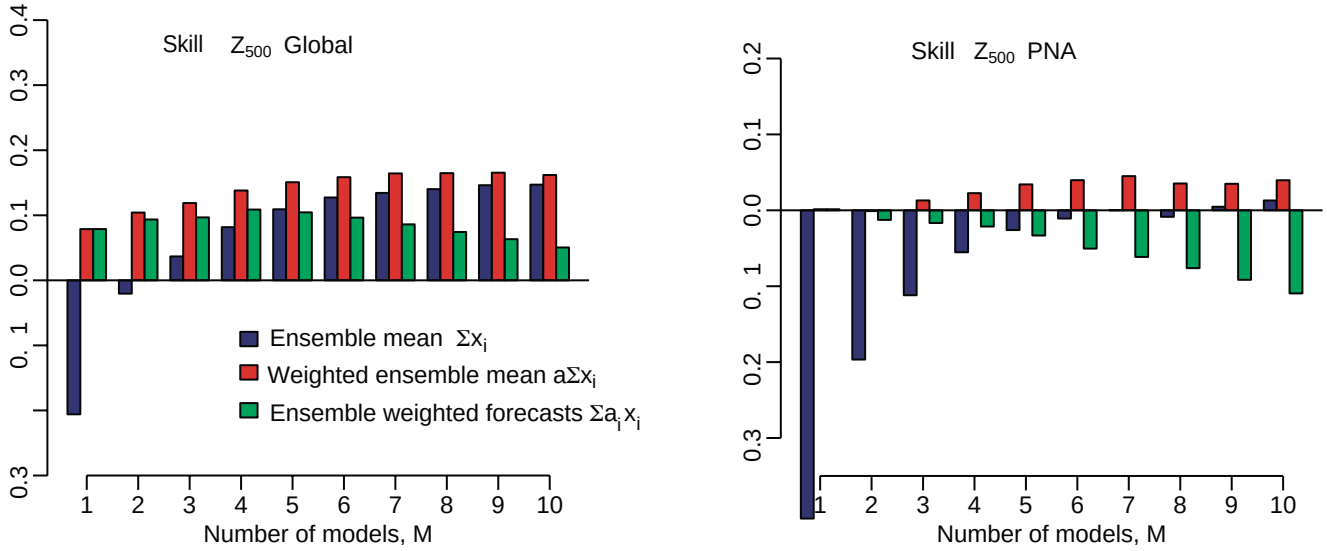


Figure 3. Experimental probability forecast for MAM



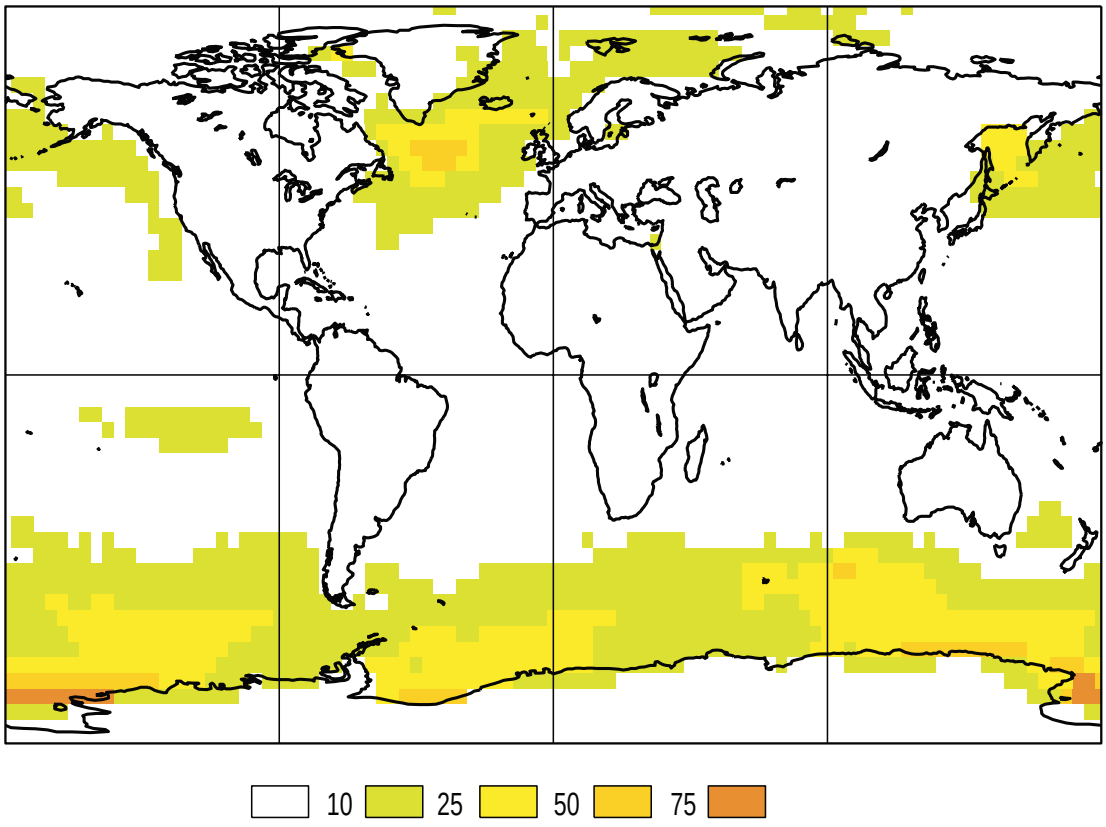
Finally we may ask if there is predictability at even longer timescales? The joint WGCM/ WGSIP Workshop on Decadal Predictability (Boer et al., 2001) concluded that there was modest evidence that skilful predictions might be possible at decadal time scales. One line of evidence is indicated in Figure 5 which gives the "potentially predictable fraction" of surface air temperature variance for decadal means obtained from the CMIP ensemble of coupled models.

Figure 4



Increased interest, increased computer power, and evidence of modest skill at seasonal to decadal timescales have led to an increased interest in extended range forecasting with multi- model ensemble forecast methods offering the possibility of combining the efforts and expertise of groups both within Canada and in the wider scientific community.

Figure 5. Eleven model ensemble percentage of "potential predictability" for decadal means



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Kahrin, V. and F. Zwiers, 2002: Climate Predictions with Multimodel Ensembles. *J. of Clim.*, **15**, 793-799.
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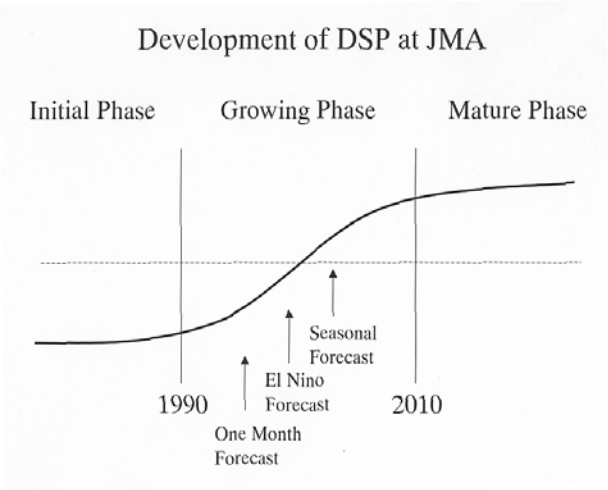
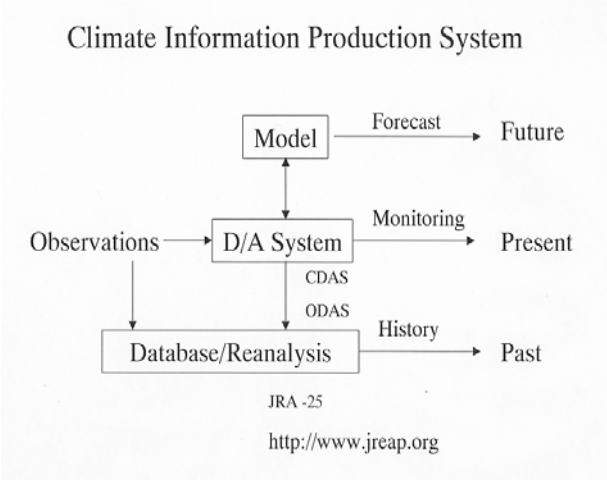
I.-S- Kang: Seasonal Prediction System in Korea

Statistical prediction system and dynamical-statistical predictions system (using downscaling technique)
AMIP and SMIP type prediction using super-ensemble technique, very encouraging forecast of North Pacific SST.
Dynamical model: T102, 21 levels, predictability very low, using downscaling technique leads to a substantial improvement.
Superensemble: statistical model & dynamical model better than the single approaches.

M. Sugi: Development of Dynamical Seasonal Prediction at JMA

The twenty-year period: 1990-2010 is considered to be the growing / developing period for DSP at JMA (see diagram below), which may be compared to the growing period of NWP in 1970's and 80's. Starting from one-month forecasts, ENSO prediction with a coupled model is currently in operation. In 2003 dynamical three-month and six-month seasonal forecasts will be started at JMA. The SST forecast is essential for the DSP. Currently, for short-time scales persistence is better, in a 3-6 months time frame the coupled model has some skill in the equatorial Pacific. Results from SMIP 1979-93 integrations have indicated a potential skill of DSP but the quality is strongly varying. For a comprehensive and consistent climate information, Climate Information Production System (see the schematic diagram below) should be developed. Recognizing that the reanalysis is the essential component of the system, the Japanese Reanalysis Project has been started in 2001. More information for the project under http://www.jreap.org/indexe.html





B. Kirtman: What limits ENSO Predictability?

- Nonlinear deterministic chaos
- External uncoupled “weather noise”

Is the coupled system damped or self sustained? Is noise the driver? One motivation for the study was that the COLA model has too much noise.

Investigations with AMIP-type integrations. More ensemble members lead to a reduction of the model variance.
An “interactive ensemble” system has been introduced, in which an ocean model is coupled to the ensemble mean fluxes from several parallel running AGCMs. The interactive ensemble variability did not die-out with this approach, but the duration of the ENSO events remained too short. The SST dominant EOF pattern improved (pattern is now broader, improvement esp. off-equatorial and in the Indian Ocean). The relationship of Indian Ocean and Pacific SST is negative (wrong) in the traditional coupled model gets the wrong, but the interactive ensemble gives a better relationship. The monsoon-ENSO relationship also improves significantly.

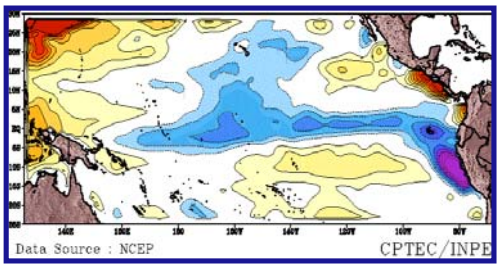
Seasonal Prediction and Developments at CPTEC/INPE

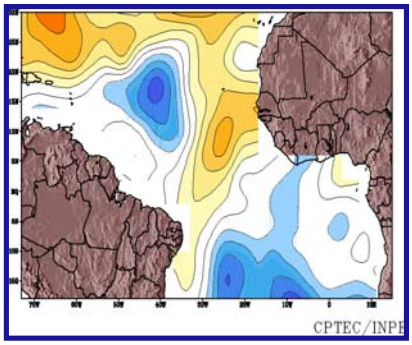
Dr. Iracema F.A Cavalcanti, from Weather Forecast Center and Climate Studies at CPTEC/INPE, Brasil, presented a summary on seasonal prediction activities at CPTEC.
Seasonal prediction is performed monthly at CPTEC using the CPTEC/COLA Atmospheric Global Circulation Model with resolution T62 L28. Boundary forcing conditions are the Sea Surface Temperature prepared in two fields, one with the persisted SST anomaly of the last month observed SST, and other with the predicted SST in the Pacific and Atlantic Oceans. Predicted Pacific SST are obtained from NCEP and the predicted Atlantic Ocean SST is obtained from a statistical model, SIMOC (Pezzi, 1998) (Fig.1). 25 initial conditions are used to run the model with the two sets of SST, and the results are two ensembles of 25 members each.

Results of the model are displayed as tri-monthly averages of the ensemble mean, and also as spatial averages in some specific areas (Fig.2 and 3). Although the model is global, focus is given to South America and specific areas which requires climate attention. These results are presented and discussed in climate meetings that occur monthly at CPTEC, when the global atmospheric and oceanic conditions and regional features occurrences of the previous month are also discussed. Preliminary results using the regional Eta model have been discussed during the recent meetings. These are performed to predict 30 days and give detailed rainfall fields, as the resolution is 40km. Considering the predictability of several regions of South America, season, the intensity of the SST forcing, and verifying the consistence with other GCMs, a seasonal prediction consensus is performed based on the models results (Fig.4).

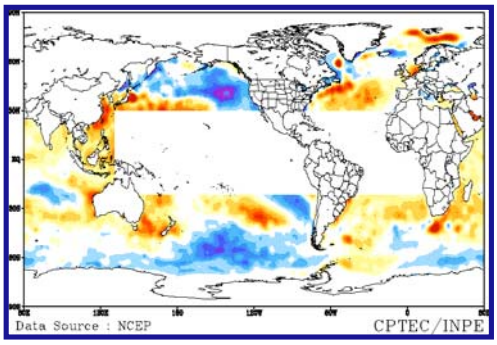
Tropical Atlantic SST Anomalies

Tropical Pacific SST Anomalies
NCEP SSTA Forecast





Global SST Anomalies
NCEP



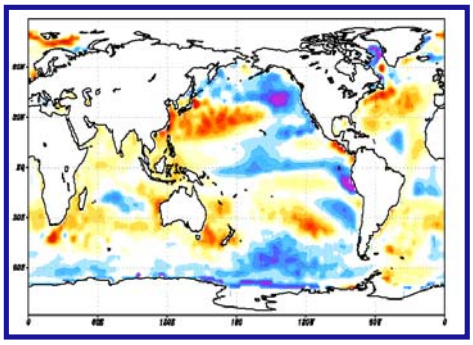


Fig.1: SST boundary conditions (Tropical Pacific SST predicted by NCEP (left), and Tropical Atlantic SST predicted by SIMOC) (right).

It was already noticed, in studies of the interannual variability in a climate simulation with the CPTEC/COLA AGCM, that the model responds very well when the SST anomalous forcing is very strong, as in ENSO years. Thus, the confidence in the model is very high during these periods. The predictability of several regions using the CPTEC/COLA AGCM was already established through many statistical analyses and studies of the climatological behaviour of the model during the seasons, as well as through the experience of 6 years in applying this model in climate prediction at CPTEC. The region of South America which has the highest predictability is the Northeast Region of Brazil, a region that has been found with high predictability also by other models. Other regions with a medium degree of predictability are Southern Brazil and Northern South America (Fig.5). The model results considering predictions or simulations, show the southeastern of Brazil as the most unpredictable region of South America. This is a transition region between the tropical regime to the north, where the convection is strongly related to the SST forcing, and the extra-tropical regime to the south, where it is frequent the action of middle latitude synoptic systems. Sometimes the region is affected by the tropical regime, and sometimes by the extra-tropical regime, and the model can not capture these changes. Research is in development at CPTEC to analyse the ability of the model to represent the synoptic scale systems that occur in the six month run that are related to the seasonal prediction results. Initially, daily results from a long simulation (10 years) are being analysed to investigate the relation of the high frequency disturbances to the final precipitation results over South America, and also to investigate the intraseasonal variability that affect the climate over the continent.

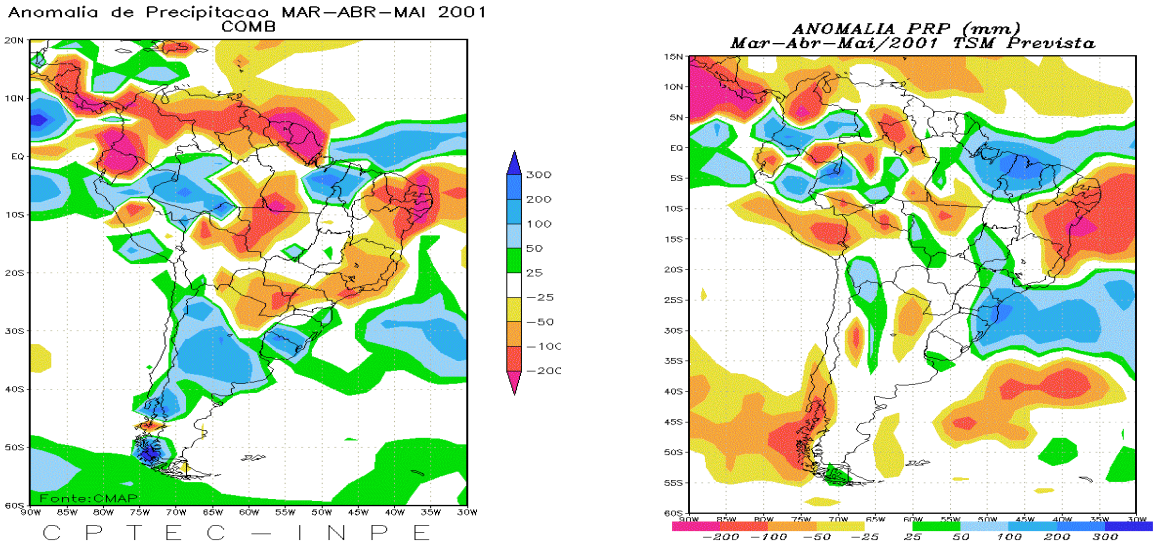


Fig. 2: Example of a seasonal precipitation anomaly (left) observed (CMAP) and (right) predicted by CPTEC/COLA AGCM (MAM 2001)

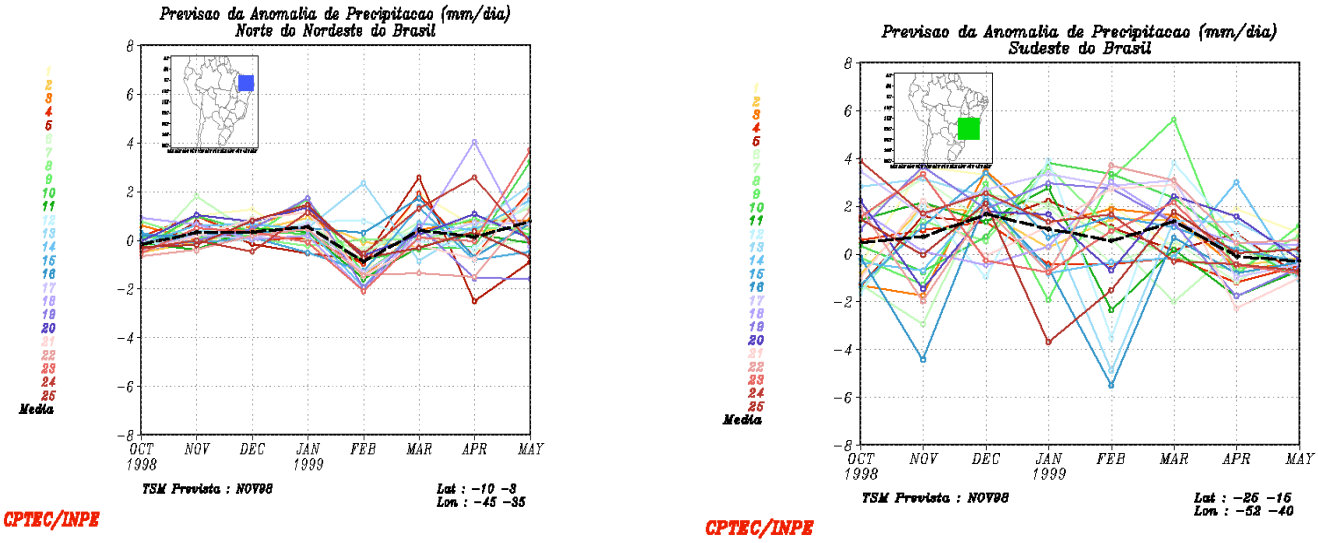


Fig.3: Examples of ensemble members dispersion for (left) Northeast Brazil and (right) Southeast Brazil.

Fig. 4: Example of the final prediction at CPTEC.

Other Experiments with the CPTEC/COLA AGCM have been conducted to investigate the role of the Pacific or the Atlantic Oceans on the precipitation over South America. The influence of the Pacific or the Atlantic depends on the region of South America and the signal of the forcing in the Pacific Ocean.

A Coupled Ocean-Atmosphere Global Circulation Model CPTEC/COLA is implemented at CPTEC and calibrations and experiments are in development. The oceanic model is MOM3 (GFDL) with 20 levels and resolution of 1.5 lat x 3.0 long. The atmospheric model is COLA T30L18.

Dissemination of results are displayed at the CPTEC homepage: http://www.cptec.inpe.br/ prediction of the following three month anomalous variables, the consensus map with rainfall probabilities and bulletins with the climate information. Predictions to the rainy season of Northeast Brazil (MAM) have been published twice a year, December and March issues of the Experimental Long -Lead Forecast Bulletin (Cavalcanti et al. 2000). CPTEC products are also used in Climate Forum meetings in South America.

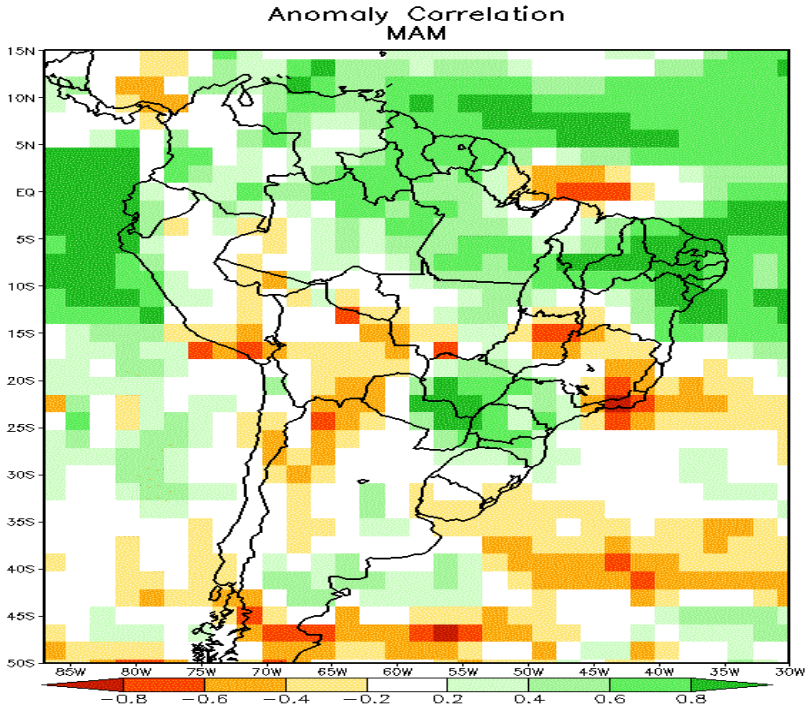


Fig.5: Correlation between observed and simulated precipitation anomaly, in MAM (1982-1991)

References

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Pezzi, L.P., C.A Repelli, P. Nobre, IFA Cavalcanti, G.Sampaio, 1998. Forecasts of Tropical Atlantic SST anomalies using a statistical ocean model at CPTEC/INPE-Brazil. Experimental Long-Lead Forecast Bulletin, 7, 1.

S. Power: What BoM is doing (see contribution page 7)

T. Stockdale: Seasonal forecasting at ECMWF

Current operational system: Ocean model: 1°, refinement to 0.3 at the equator, 29 levels; atmosphere: operational model, T95L40 (also used in ERA 40) & wave model.

40 ensemble members all started on the same day.

High resolution experimental system: 50 members for 1 months, atmosphere: T195, in place summer 2002, perturbation using singular vectors.

Results:

Nino3: no cooling drift but more complex signal, Nino4: weak cooling. Strong seasonal cycle of the anomaly correlation (lowest in June/July), substantial errors/spread already after one month.

The new system has larger systematic errors for the last 3 years (systematic errors). During the cold phase the model has difficulties to maintain cold conditions.

The forecast errors are structured for presently unknown reasons, system 1 and 2 have different errors but comparable skill. The new system is not as capable to predict the 1997/98 event. Sensitivity to initial conditions / analysing methods (OI/2D var has a strong impact on the forecast).
NWP model improvements due to usage of satellite data, esp. in the tropics. Future developments: model physics, esp. in the tropics, 4D var, more satellite data (esp. on the Southern Hemisphere).

S. Zebiak: Relevant research at IRI

Current routine forecasts are being produced in a 2-tier system based on two types of SST forecasts: persistence, and a hybrid of dynamical model SST forecast in the tropical Pacific (NCEP) and statistical predictions throughout the rest of tropics. Forecasts are made at one and two season lead (only one season for persistence). Ensembles generated from six different atmospheric models are used, each with at least 10 members, for the different SST forecast scenarios. Recently an assessment of real-time performance of IRI net assessment forecasts has been completed. The overall skill scores are modest, but definite improvements over benchmark forecasts such as persistence or ENSO phase-based statistical schemes.

Objective methods for multi-model superensemble forecasts have been developed and are now being used for the "official" forecast products. One method employs a Bayesian framework to combine categorical probabilistic forecasts. The assessments show that the objective scheme performs better than the subjective scheme earlier employed at IRI for temperature forecasts. It is not better for precipitation, most likely due to small scale noise issues in this field. A revision that treats spatial covariance is now being investigated.

Work has progressed on the topic of tropical cyclones. Methods of detecting and tracking analogues to real cyclones in low resolution GCMs have been developed, based on earlier work published in the literature. New aspects of the tracking algorithm and basin-dependent criteria appear to improve the performance of the scheme. A prototype cyclone prediction product is now being developed.

Extensive work is being conducted in evaluating several regional climate models for downscaling applications in South America, East Africa, East Asia, Central America, and Southeast Asia. Methodological issues have also been studied; e.g., the differences in running continuous simulations relative to restarting shorter simulations, boundary placement sensitivities, land surface parameterization sensitivities. Climatological downscaled simulations for several ensemble members over 30 years have been completed for east Africa and northern S. America.

Methods of post-processing of GCM fields to improve quality of regional predictions have been investigated. It is found that many areas of the tropics, at least,(eg, parts of India) can achieve much better skill in precipitation simulation/prediction with a correction to local precipitation based on the tropical oceanic precipitation patterns. The interpretation is that the actual precipitation in many of these regions relates to remote forcing over the tropical oceans, that is reasonably well captured by the model, and that the local precipitation is estimated poorly by errors associated with the teleconnection signal due to errors in the basic atmospheric structure. Such postprocessing methods are being investigated in the context of specific regional products for particular applications.

Methods of data assimilation and forecast initialisation are being studied with regard to impact on seasonal predictions. For ODA, a method of computing errors covariances based on a reduced set of EOFs from the model fields themselves is showing promise and will soon be tested in actual hindcasts. Sensitivity of simulations and predictions to particular aspects of the ocean model physics has also been studied. It has been possible to show that biases associated with the process of near-surface mixing in the MOM3 OGCM has significant impact on coupled variability and predictability.

WGSIP membership

Since the last meeting the membership of WGSIP has undergone some major changes. Thus, the present composition of the group should be preserved for the coming year with the exception of Ming Ji who would like to step down because of his new affiliation with NOAA/OGP. The group discussed possible candidates but did not find an appropriate solution on the spot. The discussion should be continued by e-mail during the next weeks (**Action item**).

Future Activities
For the near future, WGSIP will concentrate on the following activities: SMIP2/HFP, the 'standards' project and OMIP. In addition, contributions to the Workshop on regional modelling will be provided. It was also suggested to think about a workshop on ensemble predictions organized by WGSIP. The group welcomed the idea but would consider this workshop not before end of 2003 to include the findings of the DEMETER project.

4 Next WGSIP session

It was agreed that the next session of WGSIP should be at a location on the Southern Hemisphere. The preference of the group would be South Africa about one year from now. A possible interaction with the CLIVAR VACS (Variability of the African Climate System) panel should be explored. Dr. Villwock volunteered to contact Dr. C. Throncroft, chair of the VACS panel. (**Action item**).

Appendix A

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