Newsletter of the Climate Variability and Predictability Programme (CLIVAR)

Exchanges

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Important Notice:

From January 1st, 1999, please direct all correspondence with the ICPO to:

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The International CLIVAR Conference - A gratifying response -

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CLIVAR held its International Conference in Paris December 2-4 1998. The response and enthusiasm shown by the 250 delegates representing 63 countries was a very gratifying endorsement of both the interest in CLIVAR science and in the conference format. This was an opening day of talks introducing the various areas of CLIVAR science, a second day in which countries made brief presentations of their national plans and finally a day of panel questions and answers and some concluding forward-looking talks.

In the whole Conference it is perhaps inappropriate to single out any particular highlights but Bert Bolin (a past Chairman of IPCC) got us off to an excellent start with his overview of the need for international research projects to address pressing climate issues, Ants Leetmaa reviewed the most recent El Niño/La Niña event and our ability to predict its progress and impacts and we ended with a rousing encouragement from Mike Hall of NOAA to go out and implement CLIVAR. His title was “CLIVAR - realising the vision”.

That indeed is now our most pressing task. Many of the countries represented in Paris (and some others who could not attend) have established national CLIVAR projects and oversight committees and are eager to contribute. There are many science areas (e.g. ENSO observation and modelling, North Atlantic decadal variability, monsoonal studies) that are relatively mature and will proceed quickly. However work in the Atlantic in particular, where many countries wish to contribute, will need Implementation Panels to help make most efficient use of the national resources. These regional panels are being established, as is a task team to work on the de-

tailed development of the data system that CLIVAR will need to ensure timely delivery of data sets to researchers and their ultimate safe archive (see article in this issue).

The Conference endorsed a statement that summarised the main conclusions. It is reproduced here.

International CLIVAR Conference
Paris, December 2-4, 1998
Conference Statement

Preamble

Delegates from 63 countries met in Paris on 2-4 December 1998 to consider the implementation of the World Climate Research Programme (WCRP) project on Climate Variability and Predictability (CLIVAR).

Floods, droughts, storms and heat waves have brought major social and economic distress to communities around the world in recent years. In 1997-98 we experienced one of the largest El-Niño events ever recorded. There has also been an increasing and wider awareness of the importance of climate-related phenomena. 1998 is emerging as the warmest year in the instrumental record. A new assessment of the scientific evidence for global warming by the Intergovernmental Panel on Climate Change (IPCC) is now under way. Governments everywhere are focusing attention on the potential impacts of climate change and how they can be mitigated. The Framework Convention on Climate Change and the Kyoto Protocol include Articles referring to the need for research and systematic observations.

Scientific activity over the past few years has increased confidence in our ability to understand the functioning of the climate system and to make useful predictions. Recently many meteorological agencies and scientific institutions have begun to issue regular climate predictions. Improved monitoring and global models enabled scientists to predict the onset and development of the recent El Niño, thus protecting lives and livelihoods. CLIVAR will be the foremost research project in these important areas.

The Scientific Challenge

The climate of the Earth exhibits natural variability on all time scales. We need to understand, and to the extent possible, predict this variability and quantify long-term climate change. The Conference endorsed the overall scientific objectives of CLIVAR which are to:

- *Describe and understand the physical processes responsible for climate variability and predictability on seasonal, interannual, decadal and centennial time scales, through the collection and analysis of observations and the development and application of models of the climate system;*
- *Extend the record of climate variability over the time scales of interest, through the assembly of quality-controlled paleoclimate and instrumental data;*
- *Extend the range and accuracy of seasonal to interannual climate prediction through the improvement of global and regional climate models; and*
- *Understand and project the response of the climate system to increases of greenhouse gases and aerosols and to compare these projections with the observed climate record in order to detect any anthropogenic modification of the natural climate signal.*

Commitments Required

To achieve these objectives the Conference considered that it essential that there must be:

- *continuation of the collaboration of scientists around the world that led to the successful implementation of previous WCRP programmes and projects;*
- *full and open exchange of data (in keeping with World Meteorological Organisation Cg-XII Resolution 40) as well as of research results;*
- *long-term systematic climate observations, both space-based and in-situ, such as the Global Climate, Ocean and Terrestrial Observing Systems (GCOS/GOOS/GTOS), as are being advocated by the agencies collaborating in the Climate Agenda, complemented by the observing activities and assembly of research data sets as fostered by the WCRP;*
- *experimental extension of existing observing networks;*
- *regional and global-scale experiments including modelling, statistical studies and observations in order to understand key climate processes;*
- *comprehensive analysis of observations and empirical/diagnostic studies as well as expanded efforts to rehabilitate climate data sets and to document past climate variability through paleo-studies;*
- *the development of improved regional and global-scale models and of computers with the power to run them;*
- *continuing links with programmes on the application of climate knowledge, such as the WMO Cli-*

mate Information and Prediction Service (CLIPS), for government, business and public policy and decision-making;

- *expanded collaboration with other international activities including relevant core projects (e.g. on Past Global Changes, PAGES) of the International Geosphere-Biosphere Programme (IGBP), and the International Human Dimensions Programme (IHDP);*
- *continuing links between CLIVAR and programmes for infrastructure and capacity building in developing countries, such as the Global Change System for Analysis, Research and Training (START), so that all nations can benefit.*

Conference Conclusions

The Conference reaffirmed that wise investments by countries in monitoring and research into the climate system will benefit their citizens and economies.

The Conference commended the work that had been done by the scientists involved in planning the programme and concluded that the Implementation Plan provided a solid basis for work to begin. Contributions and reports by many countries demonstrated a willingness to participate in the programme and to become full partners in its implementation. Improved seasonal to interannual prediction, and particularly for the monsoons, as well as longer-term variability, most notably in the Atlantic, can be singled out as foci for which strong support was indicated by many countries.

The Conference urged government sponsors of research, operational meteorological agencies, and satellite operators to marshal their best efforts to ensure the success of CLIVAR. In particular it called on a broad range of funding agencies to provide support for research, systematic observations, data systems and the infrastructure needed to co-ordinate the programme effectively.

Finally I want to express thanks to some of the many people who made the Conference such a success - to Art Alexiou and the IOC staff who provided the local logistical arrangements and especially to Andreas Villwock who prepared a magnificent set of posters showing the science of the CLIVAR Principal Research Areas. Many people have asked for copies of these and of the information poster that was produced for the Conference. Finally I must thank Dave Carson who chaired the Conference Organising Committee and who helped to steer the Conference to its successful conclusion.

The ICPO is now compiling the Conference report that will contain synopses of all the science and national presentations. Many of these national statements are already accessible via the ICPO WWW site.

In Paris we made a presentation to Anne Stephan (see photo below) who at the end of 1998 stepped down as the CLIVAR administrator in Ham-

Anne Stephan between her two former bosses: John Gould (left) and Michael Coughlan (right)

The ICPO staff at a meeting at the new CLIVAR Project Office location in Southampton (from left to right): John Gould, Fredrick Semazzi, Valery Determmerman (JPS, Geneva), Sandy Grapes and Andreas Villwock (Hamburg)

burg. At a small dinner party Anne was presented with a book on Portugal and a fine leather wallet/passport cover in recognition of her past work for CLIVAR. We wish her well for the future.

Other news

At the start of the year all the Project Office staff (including Prof. Fred Semazzi who joined the ICPO at the start of January and Valery Detemmerman from the WCRP Office Geneva) met in Southampton to plan the coming year's work (Photo above).

As well as carrying out actions triggered by the Conference, the ICPO staff are preparing for a number of important meetings in the coming months. In mid-March the WCRP's oversight committee (the Joint Scientific Committee) will meet in Kiel, Germany and will review the progress of all the WCRP component projects. The CLIVAR presentation will highlight three areas of science - the 1997/8 ENSO, science related to the American monsoon system and reconstructions of the climate variability of the past 1000years. The second meeting of the VAMOS panel will be in Buenos Aires the same week. In May the CLIVAR SSG will meet in Southampton and will concentrate on implementation issues.

SHIVA: A European Programme for Monsoon Research

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Introduction

As a major component of the global circulation, it is essential that seasonal and climate prediction models are able to simulate the mean evolution and the interannual and intraseasonal variability of the Asian Summer Monsoon. Due to its well known sensitivity to the phase of the El Niño/ Southern Oscillation (ENSO), it is also recognized that the monsoon may be predictable on seasonal to interannual timescales. In 1996, a European Union funded programme, Studies of the Hydrology, Influence and Variability of the Asian Summer Monsoon (SHIVA), commenced which focused on documenting the observed behaviour of the monsoon, on improving its simulation in climate models, and on assessing the predictability of

the system and the factors that might determine that predictability.

SHIVA has supported a number of scientists working in the major European climate modelling centres (CNRM, ECMWF, LMD, MPI, UGAMP, UKMO and University of Reading).

Themes

The project has three main themes which address (i) the mean evolution of the monsoon, and its variability on (ii) intraseasonal and (iii) interannual timescales; these themes project strongly on to the principal goals of the CLIVAR G2 Implementation Plan. In addition, several supporting programmes have been identified which cover observational studies for model validation, ensemble techniques, paleoclimate studies, and analysis of coupled model results. The paleoclimate studies have provided a broader parameter space within which to test physical parameterisations and potential mechanisms for monsoon variability. Again, these supporting programmes strongly reflect the unifying themes and approaches identified within CLIVAR.

Results

SHIVA has supported the development of websites which provide important links between scientists within the SHIVA project, as well as those working on monsoon research throughout the world. See:

http://www.met.rdg.ac.uk/shiva/shiva.html

http://www.met.rdg.ac.uk/~daves/Monsoon/main.html

Up-to-date information on current monsoon behaviour, basic information on the monsoon and its predictability are covered. The sites have become a major source of monsoon information and are heavily used by the international community.

During the last 3 years, progress has been made in a wide range of topics and only a fraction of them can be summarised here. Further information is available in the references to this article and from the SHIVA websites.

Using reanalyses from ECMWF and NCEP, a comprehensive description of the mean monsoon and its variability has been developed (Annamalai et al., 1999). This has shown the complex behaviour of monsoon variability on the regional and large scale, as well as the importance of the interaction between the intraseasonal and interannual timescales. The results have been compiled in an atlas which is available electronically from the SHIVA website. This provides the most comprehensive diagnosis of monsoon behaviour currently available.

During the season the monsoon fluctuates between active (wet) and break (dry) spells which may significantly influence the seasonal mean rainfall amounts. A key question is whether the low frequency forcing (e.g. ENSO) can alter these fluctuations in a predictable manner. Preliminary results from reanalyses and model integrations suggest that the behaviour of active/break cycles may be chaotic and therefore inherently unpredictable (Ferranti et al., 1997; Annamalai et al., 1999). A substantial amount of rainfall variability can be due to extreme, rapid and unpredictable events. It has been found that more robust, improved ensemble forecasts can be obtained by non-linearly transforming the daily rainfall amounts (Stephenson et al., 1999).

The physical mechanisms involved in the phenomenology of active/break cycles have been investigated using sensitivity experiments with GCMs. Results suggest that the coupling between the atmosphere and the land surface hydrology may be important by influencing the timescale of the oscillations rather than by altering their basic structure (Ferranti et al., 1999).

In collaboration with the EU programme on Seasonal Prediction (PROVOST), the predictability of the Indian Summer Monsoon has been investigated by using the summer ensemble of ECMWF seasonal forecasts. The results suggest that the current level of predictability is low, certainly much lower than that suggested by statistical methods. However, the model displays considerable systematic errors in its basic simulation of the monsoon's rainfall distribution which may be influencing the result. Studies of the sensitivity of model simulations to horizontal resolution have shown that systematic biases are evident at all resolutions from which it can be concluded that the major systematic errors are most likely associated with physical parameterisations (Martin, 1999; Stephenson et al., 1998). It is important that the level of predictability is continually reassessed as models improve.

Whilst the SHIVA results have confirmed the importance of ENSO for monsoon interannual variability, they have also provided evidence that the Indian Ocean, the Eurasian continent and the stratospheric Quasi-Biennial Oscillation (QBO) may play crucial roles (Giorgetta et al., 1999). Modelling studies have suggested that the monsoon is stronger during the westerly phase of the QBO and weaker during the

easterly phase, and support the hypothesis that the mechanism behind this association is primarily through changes in the lower stratospheric vertical circulation which affects the height of the tropopause and hence the depth of convection.

The influence of Eurasian snow cover on monsoon interannual variability remains a contentious issue. Evidence has emerged that land surface anomalies, which develop during the winter and spring preceding the monsoon season, are themselves a remote response to El Niño (Soman and Slingo, 1997; Dong and Valdes, 1998). During the warm phase of El Niño, the Asian subtropical jet tends to be displaced equatorwards with consequently above normal snow amounts over the Eurasian continent. Preliminary results from a range of sensitivity experiments suggest that the impact of land surface anomalies is secondary to that of direct SST forcing, although the land surface anomalies can affect the onset behaviour of the monsoon.

Paleomonsoon research has proved to be very helpful in understanding the processes that determine monsoon evolution and interannual variability. 6K and 115K BP simulations have been used to investigate the response of the monsoon to changes in insolation. For 6kBP, the monsoon is generally enhanced, associated with warmer central Asia temperatures and reduced winter snow mass. Conversely for 115kBP, where the insolation changes were opposite to those for 6kBP, the response gives a weaker monsoon, colder central Asia temperatures and larger winter snow mass. The similarity between the rainfall anomaly patterns associated with El Niño/ La Niña and those for 115kBP/6kBP is notable. Bearing in mind that the 115kBP/6kBP patterns are associated with land surface anomalies, this supports the idea that land surface anomalies may play a part in the relationship between monsoon interannual variability and ENSO.

Whether the monsoon is a broadcaster or receptor of ENSO remains an open question which SHIVA has begun to address. The seasonality in the relationship between the monsoon and ENSO has been studied using observed SSTs and AIR (Harzallah and Sadourny, 1997). Lag/lead correlations suggest that the monsoon leads ENSO with maximum correlations being seen in September to November (SON), indicative of weak monsoons tending to occur in years with a developing El Niño. Atmosphere-only models show a much weaker correlation pattern in SON, whereas coupled models show a much stronger link, suggesting that the two-way interaction between the atmosphere and the ocean may be important for monsoon-ENSO relationships (Arpe et al., 1998). In the paleomonsoon simulations, the introduction of an interactive ocean provided a good example of how the time lag (~ 2 months) in the response of the ocean to atmospheric forcing can modulate the seasonal evolution of the monsoon and its response to changes in boundary forcing (Hewitt et al., 1998), highlighting again the importance of coupled ocean-atmosphere processes for monsoon simulation.

SHIVA, as a funded programme, ends in February 1999, but it is hoped that the research and the links between the various groups will continue. Whilst SHIVA has answered many questions, many more remain unanswered. The need to continually improve the basic simulation of the monsoon is very evident. The potential for coupled ocean-atmosphere processes to influence monsoon variability on timescales from days to decades has become increasingly apparent and much of our future research will focus on understanding these processes. The monsoon arises from land-sea contrasts and it is clear that land surface processes have a key role to play. More research is needed to understand properly the role of the Eurasian continent, particularly snow cover and hydrology. Finally, the goal of providing skilful seasonal forecasts for the monsoon still eludes us. We do not yet have a clear idea of how predictable the system is likely to be, or how much the apparently chaotic behaviour of the intraseasonal variability may limit that predictability.

Acknowledgement

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Retrospective on the 1997/1998 El Niño Event

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The years 1997 and 1998 were marked by one of the strongest El Niño events in modern history. The consequent pattern of anomalous global weather and associated extreme climatic events resulted in devastating natural disasters in many areas of the world with huge human, material, economic, and environmental losses.

In December 1997 the United Nations General Assembly passed a resolution (52/200) on international cooperation to reduce the impact of the El Niño phenomenon. In response to that resolution, a task force of several UN agencies, led by the Secretariat for the International Decade for Natural Disaster Reduction (IDNDR) organised an "International Seminar on El Niño: Evaluation and Projections", which was held in Guayaquil, Ecuador from 9 to 13 November 1998.

This intergovernmental meeting of experts provided a first international platform for a scientific and technical retrospective analysis of the 1997/98 El Niño event. This analysis included a global description of the El Niño/Southern Oscillation phenomenon, an overview of the climate anomalies and first-order impacts for those regions affected by the 1997-1998 El Niño, the present state of climate predictability, and methods for applying seasonal predictions most effectively to decision making situations. Around the time of the Guayaquil conference, Central America and large areas of China and Bangladesh were reeling from the effects of enormous flooding events. The extent to which these events were linked to the retreat of the El Niño phase and the onset of the La Niña phase also received some attention.

The Guayaquil conference was designed to bring together in a synergistic forum representatives of the climate sciences that underpin emerging early warning systems on seasonal to interannual time scales, and representatives of those organisations concerned with disaster preparedness and relief operations. The common goal was to determine how best to identify and address the concerns of the many communities throughout the world that are now recognised as being especially vulnerable to El Niño related impacts. This goal was achieved with the conduct of four discussion panels on economic, environmental, developmental, and social concerns, which followed the scientific and technical analysis of the 1997/98 El Niño event.

The principal conclusions of the many discussions, which were embodied in the Guayaquil Declaration presented at the end of the Conference, are as follows:

- The global pattern of climate extremes associated with the 1997-1998 El Niño event caused loss of life, the destruction of shelter and food reserves, the disruption of food production and transport systems, and sudden exposure to extreme health risks; these extremes imposed continuing poverty on peoples and set back development in many parts of the globe.
- Natural disaster reduction forms an integral part of sustainable development strategies at all levels, and must take into full consideration the interrelationship between climate variations, such as the El Niño and the La Niña phenomena, the consequences of global climate change and the risks to which all communities are likely to be exposed.
- There is a need for more synergistic interaction between science and technology, public and private sector decision makers and planners, as well as the public at large, in order to ensure the effective planning and implementation of measures that would prevent the negative impacts of the El Niño phenomenon and similar climate variations.
- Integrated approaches are required to identify posi-

tive effects of anomalous climatic phenomena such as the El Niño, in order to determine how to draw maximum benefits, where possible.

- Enhanced support is essential for interdisciplinary studies and multi-sectoral research in the climate sciences, on related technologies, and on preventative actions, which are provided by the programmes supported by agencies represented on the United Nations Inter Agency Task Force on El Niño

The Conference further concluded that the following specific urgent actions are required to strengthen many existing intergovernmental programmes to achieve the objectives of United Nations General Assembly Resolution 52/200:

- Improved monitoring of the climate system, especially through the development of regional networks and the implementation of operational systems that have demonstrated proven value from research. Commitment of new funding for multi-purpose space based systems and in-situ observing networks of the Global Climate Observing System is necessary to achieve this objective.
- Expanded ongoing research directed towards improved prediction of climate variability on seasonal to interannual time-scales. The World Climate Research Programme has demonstrated its effectiveness as a research framework, and commitment of new funds to the Climate Variability and Predictability Programme (CLIVAR) will give an important impetus to this established activity.
- Development and implementation of new climate early warning systems at the regional levels where required, and the strengthening of existing systems. The technological infrastructure, including specialised observing networks and regional communications and computing capabilities for data collection, analysis and prediction are costly and beyond the financial reach of most developing countries. Commitment of new funds will be necessary to establish a network of national and regional centres, and is essential for supporting national climate services in countries of the developing world.
- Ensuring that the information needs of national sectors vulnerable to climate extremes are met through regional and sector specific studies to develop knowledge of vulnerability and sensitivity that is essential to underpin sound planning for protection, prevention and mitigation of negative impacts of El Niño and related events. Commitment of new funds for the purpose of impact assessments and the development of appropriate response strategies are required to reduce climate risk and establish safe community habitats.
- Support for capacity building projects, e.g. CLIPS[1], at regional and national levels in the areas of observational techniques, data management and processing and in the use and interpretation of climate information and predictions for the early warning and prevention of natural disasters.

As a follow-up to the Conference, the World Meteorological Organization, the Intergovernmental Oceanographic Commission of UNESCO and the United Nations Environment Programmes are pooling resources to produce a publication that will draw on the wealth of material presented at the Conference and assembled subsequently. It is anticipated that scientists within the CLIVAR community will play a significant role in the drafting and review of this publication, which will form a major part of the report of the UN Task Force to the United Nations General Assembly towards the end of 1999.

CLIVAR NEG-1 - Report from the third Session -

Roger Newson, JPS for WCRP, Geneva, Switzerland

The third session of the CLIVAR numerical experimentation group concerned with seasonal to interannual prediction studies (hitherto known as CLIVAR NEG-1) was kindly hosted by the International Research Institute for Climate Research (IRI)/Lamont-Doherty Earth Observatory at the Lamont-Doherty Earth Observatory, Palisades, NY, USA, from 9-12 November 1998. The name, terms of reference and membership of CLIVAR NEG-1 have been the subject of considerable discussion over recent months and the group will now give increased emphasis to work underpinning the development of operational seasonal to interannual predictions, improving the skill of probabilistic seasonal forecasts (e.g. by exploiting ensemble prediction, including multi-model ensembles), examining the dependence of model predictions on the data used for forecast initialization and data assimilation issues, and the consideration of relevant observing systems and their effectiveness. This also requires fostering research into relevant modes of variability and predictability characteristics of the global climate system on seasonal-to-interannual

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timescales, including particularly extra-tropical and seasonal interactions and their effects on monsoonal flows. New formal terms of reference have been drawn up for the group which will in the future be known as the CLIVAR Working Group on Seasonal-to-Interannual Prediction (WGSIP). The meeting location at the International Research Institute for Climate Research, which is now making significant strides towards its basic objective "to foster the improvement, production and use of global forecasts of seasonal-to-interannual variability for the explicit benefit of society", was a very appropriate venue in view of the transition in CLIVAR NEG-1's activities. It was certainly anticipated there would be close co-operation with IRI in the co-ordinated modelling studies of the type undertaken by CLIVAR NEG-1 and in such areas as analysis of multi-model ensembles.

True to the task of evaluating seasonal to interannual predictions, the group together with representatives from IRI took time to review the results and skill achieved in forecasts of the 1997/1998 El Niño. The sobering conclusion reached was that present models only demonstrated relatively limited ability in exploiting the predictability of ENSO. Generally, neither the onset nor the amplitude of the event were well predicted and the overall treatment of the evolution (growth, decay) was mixed. On the whole, the more comprehensive (primitive-equation) coupled models gave better and more useful results. However, as also found in the project intercomparing ENSO simulations in coupled models (ENSIP) (see below), many models continue to have major shortcomings in representing the variability of the coupled ocean-atmosphere system and the further refinement of models is a major challenge. Regarding the initialization of the forecasts, although it seemed that several different methods could be employed, there was evidence that the use of sub-surface temperatures were critical for dynamical forecasts. There remain several outstanding questions concerning the sensitivity of tropical ocean models and climate forecasts to surface winds.

CLIVAR NEG-1 went on to review progress in the projects that had been initiated earlier, several of which are now reaching maturity. In ENSIP (as noted above), almost all the models examined, even those employing flux corrections, had problems in representing the basic sea surface temperature climatology and annual cycle, although some improvements from earlier studies were apparent. Only a few models simulated ENSO realistically in terms of equatorial sea surface temperature anomalies, but many overestimated the variability in the western tropical Pacific. A full description of ENSIP and the results obtained will be published in the refereed literature during 1999. In the companion study of the variability of the tropical oceans on seasonal and interannual timescales other than ENSO (STOIC), substantial (mainly cool) biases are apparent in sea surface temperature. As found in ENSIP, there were generally large differences between the simulated and observed changes in sea surface temperatures and even the basic annual cycle is not usually well reproduced. Zonal wind stress fields have also been examined and, among the preliminary results, there is a scatter in model simulations in the Pacific ranging from much too strong easterlies to much too weak for the annual mean in the 5°N-5°S equatorial strip. In the Indian Ocean, the easterlies were too weak in all models, as also in most models in the Atlantic. STOIC is also nearing completion and a full report will be prepared during 1999.

In the dynamical seasonal prediction study, in view of the substantial requirement for computing resources to carry out the specified experiments, only a relatively small number of groups had been able to participate. On the basis of the limited results that had been collected, it appeared that a high degree of predictability was apparent in the seasonally-meaned flow during marked El Niño periods, but forecasts were less skilful and of lower consistency at other times. The seasonal mean ensembles generally looked reasonable, but there were substantial differences in the degree of variance in the ensembles from different models.

The intercomparison of Niño-3 predictions and predictability has also given interesting results. Particularly striking is that a consensus of predictions from three separate systems appears more skilful than any of the systems individually. It was found that both dynamical and statistical models successfully captured the peak phase of warm and cold events up to two seasons in advance, but none represented adequately the detailed life cycle of ENSO events (cf. results from ENSIP above). An EOF analysis of forecasts revealed that dynamical models produced "modes" that grew with time (as expected from observations) whereas statistical models showed only damped modes. A full report of this work is now being prepared. CLIVAR NEG-1 recommended that this study should be extended by collection in quasi-real time of forecasts of sea surface temperature from seasonal/interannual prediction systems out to lead times of twelve months.

A number of new issues and activities were also discussed, including particularly the informal co-operative investigation of atmosphere-ocean predictability on decadal timescales being planned jointly with the JSC/CLIVAR Working Group on Coupled Mod-

elling (see also Exchanges, Vol. 3, No. 4, November 1998, p 10). An ensemble of at least three, but preferably more, "forecasts" up to 25 years in length should be performed with global coupled atmosphere/ocean models and a range of predictability measures collected. CLIVAR NEG-1 pointed out that any predictability which was apparent at these timescales could be sensitive to the way the initial states for the ensembles were specified. Careful consideration was needed but, as a minimum, perturbations should be introduced in all the dynamical variables in both the atmospheric and oceanic components. Another topic taken up was the application of downscaling (mainly using nested models) of predictions from a global model to provide much more regional detail. Although there are a number of questions on the basic scientific validity of the techniques involved (which are being specifically taken up by the JSC/CAS Working Group on Numerical Experimentation), CLIVAR NEG-1 considered that the application of regional models to seasonal prediction was potentially extremely important in improving the value and application of forecasts. Efforts that should be made in this area will be considered at the next session of the group. Finally, an issue which arose repeatedly during the meeting was the relationship, between ENSO and intraseasonal variability (e.g. westerly wind bursts, the Madden-Julian oscillation). There are many outstanding questions that need to be taken up and suggestions for possible internationally-co-ordinated activity under the auspices of CLIVAR NEG-1 would be put forward at the next session of the group. In the meantime, it was proposed that interested groups may wish to try experimentation with and without, for example, MJO activity. Other promising lines of research include identification of singular vectors or optimals in coupled models important on intraseasonal timescales. This approach offers new perspectives in understanding intraseasonal variability and the sensitivity of the coupled system, including the role of ENSO, to such variability.

TAO Implementation Panel - Report from the 7th Session -

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The seventh session of the TAO Implementation Panel (TIP-7) was held at the Hotel Golf Intercontinental in Abidjan, Ivory Coast, on 11-13 November 1998. The meeting was held in conjunction with the fifth session of the Pilot Research Moored Array in the Tropical Atlantic (PIRATA) which took place at the same location on 9-10 November 1998. The meetings were hosted by l'Institut Francais de Recherche pour le Developpement (IRD-ORSTOM), and by the Centre Ivorien de Recherche Oceanographique (CRO). The purposes of TIP-7 were to review the present status of the TAO array; to address technical and logistic issues related to its maintenance; to provide a forum for discussion of enhancements and expansions of the array to other tropical oceans; and to promote the use of the TAO data for research and operational activities. An additional purpose of TIP-7 was to examine the dual themes of the hydrologic cycle over the ocean, and the importance of salinity variability in the climate system. Over 40 participants from 14 nations attended TIP-7.

The meeting opened with a review of variations in the tropical Pacific since TIP-6 (held in November 1997). In the past year, the tropical Pacific has switched from extreme warm El Niño conditions to cold La Niña conditions. Data from the TAO array captured the dramatic termination of the 1997-98 El Niño in May-June 1998, when an unprecedented 8C drop occurred in 30 days in the equatorial cold tongue. ENSO Forecast models suggest cold La Niña conditions will persist through boreal spring 1999.

The panel discussed issues of instrumentation, array maintenance, ship time requirements, vandalism and damage to the buoys, outreach efforts to fishing communities, ocean velocity and salinity measurements, TAO enhancements and expansions, and data dissemination via the World Wide Web and the Global Telecommunications System (GTS). Updates were presented on Japan's TRITON array of moored buoys, the first four of which were deployed in the western Pacific in March 1998; on the PIRATA array (supported by France, Brazil, and the U.S.) with 5 of 12 planned sites occupied in the tropical Atlantic during 1998; and on Taiwan's moored buoy programmes part of the South China Sea Monsoon Experiment (SCSMEX). The panel was also briefed on a multi-year mooring programme along the Pacific Coast of Chile, and on the status of Indian National Data Buoy Programme. In response to a recommendation from the sixth session of the TAO Implementation Panel (TIP-6), it was reported that surface meteorological data from Indian moored buoys in the Bay of Bengal and the Arabian Sea will be available on the GTS by the end of 1998.

Presentations on national and international climate programmes included CLIVAR, GOOS, and the Tropical Rainfall Measuring Mission (TRMM). Science presentations addressed variability associated with the 1997-98 ENSO cycle, ENSO forecasting, the

Madden and Julian Oscillation, salinity variability in all three tropical oceans, satellite and in situ rainfall measurements in the tropical Pacific, model development and validation using TAO data, and large scale ocean current dynamics.

Two recommendations emerged from TIP-7 regarding salinity. One dealt with a pilot project for assembling all available ship-based thermosalinograph data in the tropical Pacific for 1991-98 at ORSTOM/ Noumea. The other is for GOOS, GCOS, and CLIVAR to endorse proposed surface salinity satellite missions. These recommendations built on similar recommendations from TIP-6 calling for additional surface and subsurface salinity sensors be added to selected moorings as a contribution an emerging salinity monitoring effort which includes VOS, S-PALACE, and other platforms. A third recommendation called for a UN resolution to help alleviate the serious loss of mooring data and equipment that is plaguing TAO, PIRATA and other climate-oriented mooring programmes.

CLIVAR Data Task Team formed

John Gould, Director ICPO, Southampton, United Kingdom

A CLIVAR Data Task Team has recently been formed to

1. define CLIVAR's requirements for a data and information system
2. assess the extent to which existing data management systems meet the CLIVAR requirements
   - for the rapid, responsive delivery of data and data products
   - for the secure but accessible archival of CLIVAR data
   - for the delivery of information on the location and availability of CLIVAR data
3. make recommendations on actions that need to be taken to ensure an adequate CLIVAR data and information system
4. report firstly to the WOCE/CLIVAR Data Products Committee and thereafter also to the CLIVAR Scientific Steering Group.

The members of the CLIVAR Task Team are:

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The WOCE Data Products Committee (which has offered to act as an interim Committee with responsibility for both WOCE and CLIVAR) will meet at the British Oceanographic Data Centre April 12-15 1999 and will devote the whole of April 14 to a discussion of CLIVAR data issues. The CLIVAR Scientific Steering Group will meet in Southampton UK May 10-14. It is clear therefore that progress needs to be made in the run-up to these meetings.

The first task will be the documentation of the data streams that will be needed by CLIVAR and the data centres/delivery/archival systems that are presently involved in handling these streams. (TORs 1) and 2) above).

It is reasonably clear from the ocean measurement side (based on the experience of WOCE and of the data system presently dealing with data from the TAO array) what is available. However decisions need to be made on the extent to which the real-time and delayed data delivery modes can be met (and indeed to define the likely time scales that the terms real-time and delayed mode mean).

The situation regarding atmospheric, hydrology and paleo data sets is less clear and it is in this area that substantial work needs to be done.

The first request to the members of the task team is

- To list the key data sets/streams/products that are relevant to CLIVAR.
- To identify the data delivery mechanisms that are in place
  a) from data collector to the data management system and
  b) from the data management system back to other researchers
- To specify the approximate timeframe on which the data/products can be made available to researchers and
- To identify any limitations on data availability

A second stage will be to assess the adequacy of these existing systems to meet the needs of CLIVAR researchers.

CLIVAR Calendar

1999	Meeting	Location	Attendance
March 15 - 19	Joint Scientific Committee of WCRP, 20th Session	Kiel, Germany	Invitation
March 15 - 19	VAMOS Panel, 2nd Session	Buenos Aires, Argentina	Invitation
April 14 - 16	WOCE/CLIVAR Data Products Committee - 12th Session	Birkenhead, UK	Invitation
April 19 - 23	24th General Assembly European Geophysical Society	Den Haag, The Netherlands	Open
May 10 - 15	CLIVAR Scientific Steering Group, 8thSession	Southampton, UK	Invitation
May 17 - 21	CLIVAR Upper Ocean Panel, 4th Session joint with OOPC	Woods Hole, UK	Invitation
May 31 - June 4	AGU Spring Meeting	Boston, USA	Open
June 7 - 11	Third WMO International Symposium on Assimilation of Observations in Meteorology and Oceanography	Quebec City, Canada	Open
July 19 - 30	IUGG/IAPSO	Birmingham, UK	Open
August 23 - 27	2nd International Conference on Reanalysis	Reading, UK	Open
August 23 - 27	WOCE North Atlantic Workshop	Kiel, Germany	Limited
September 13 - 17	4th Conference on Modelling of Global Climate Change and Variability	Hamburg, Germany	Open
October 18 - 22	OOPC/CLIVAR Conference on Ocean Observations for Climate	Saint Raphael, France	Invitation
November 8 - 12	PAGES/CLIVAR Meeting	Venice, Italy	Invitation

For more information, please contact the ICPO or check out our web-page: **http://www.dkrz.de/clivar/latest.html**

Please return to the International CLIVAR Project Office by mail or email (**icpo@soc.soton.ac.uk**)

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