Newsletter of the Climate Variability and Predictability Programme (CLIVAR)

Exchanges

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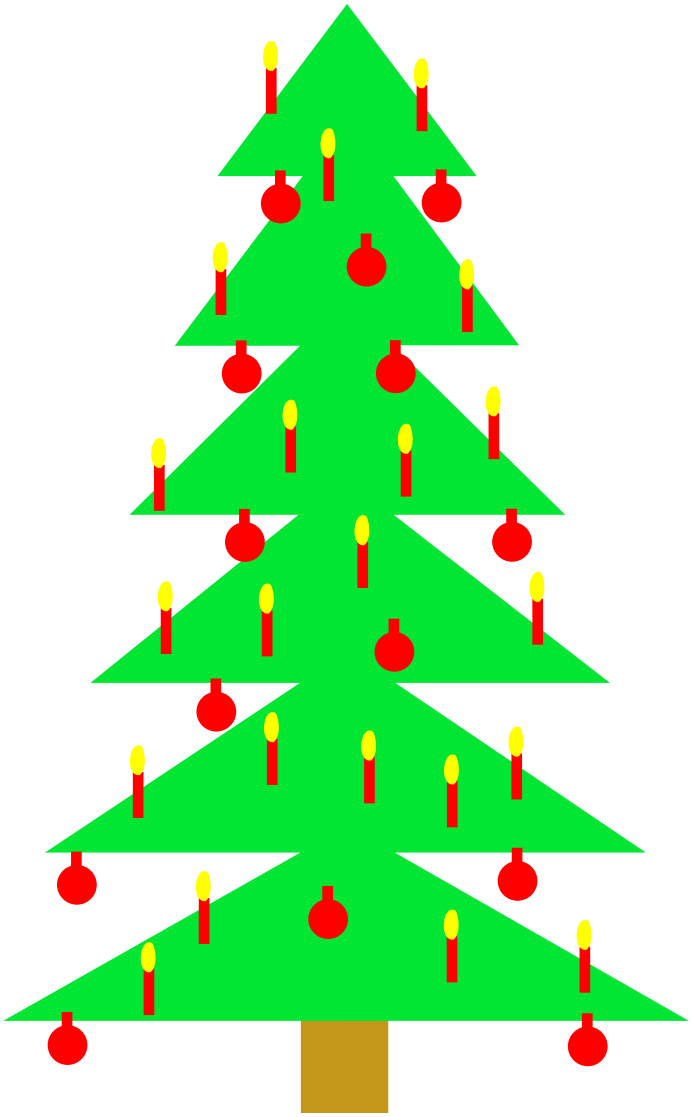
In this issue:

Merry Christmas and Happy New Year

from the CLIVAR IPO



News from the CLIVAR IPO

The year 1997 has been by far the busiest year for CLIVAR as well as for the CLIVAR International Project Office (IPO). The key issue for the CLIVAR IPO and the scientists who are active in CLIVAR panels and working groups was the drafting of the Initial CLIVAR Implementation Plan. We started with a raw scaffolding of the plan which was drawn up in December 1996. The concept of the plan called for 12 (now 11) core projects (called Principal Research Areas) which are supported by a number of unifying global themes and scientific approaches. A relatively small number of scientists compiled the first draft trying to integrate the outcome of several workshops which had taken place during the years before. This first draft (in two volumes) was tabled at the 17th Session of the Joint Scientific Committee in Toronto and the 6th Session of the CLIVAR Scientific Steering Group (SSG) in Washington.

Although the document was very much welcomed by both committees, a number of revisions and iterations were necessary to finalize it. The CLIVAR SSG recommended to publish the Initial CLIVAR Implementation Plan in two steps. A brochure serving as an executive summary document for the implementation plan was presented at the WCRP conference in Geneva. The two volumes tabled in the first draft were merged to one, containing the descriptions of the Principal Research Areas as well as a part on the Unifying Themes and Approaches. This second document was then reviewed and revised by a number of CLIVAR 'key scientists' and the draft was circulated. In August our panel and working group members were invited to comment until late autumn. At that time we managed to enlist the help of Dr. George Needler on board who will serve as the formal editor for the implementation plan. Dr. Needler brings in his experience from WOCE and will try, with the help of the authors, to improve the document with a special emphasis on implementation issues.

The final document will be printed and distributed early in 1998, in time for the preparations for the First CLIVAR Conference. This conference had been scheduled for April 1998 but has now been postponed due to conflicts in the CLIVAR schedule to December 1 - 3, 1998 in Paris. As we already pointed out in the last issue of Exchanges this conference will be held in form of an intergovernmental conference to seek for national commitments in support of the initial stage of the CLIVAR programme.

In 1997 CLIVAR has expanded its infrastructure by setting up two new groups which are concerned with the co-ordination and implementation of the CLIVAR principal research areas on the Variability of the American Monsoon System (VAMOS) and the African Climate System. The VAMOS group will hold its first planning meeting in January 1998. A study group with a limited term of two years has been charged working out a scientific programme on African Climate Variability under CLIVAR.

We are pleased to be able to report that throughout the year the CLIVAR IPO staff was able to welcome a number of visitors. Amongst them we were very grateful to discuss CLIVAR related issues with Prof. S. Gadgil from Bangalore, India (JSC member) who presented the planning document on CLIVAR related research in India, Profs. C. Li (SSG member) and R.-H. Hui, Beijing, China and Dr. P. Chapman (U.S. WOCE office). In addition, we would like to acknowledge the help of Dr. A. Frische (WOCE IPO) with the preparation of the CLIVAR brochure. We would like to encourage everybody interested in CLIVAR to contact us and we are looking forward to stimulating discussions in the coming year.

We apologize that due to the heavy publishing schedule on the CLIVAR IPO and financial restrictions we were not able to produce four issues of ***Exchanges***. We hope to get back to the normal schedule in 1998, although the next year is expected to be very busy as well, especially in the second half heading up to the CLIVAR conference.

During 1997 CLIVAR has reached an important milestone by finalizing the Initial Implementation Plan. The largest part of the infrastructure is now in place. I would like to take this opportunity to thank all of those scientists and agency representatives who helped CLIVAR move forward by offering their time and expertise. In particular we would like to thank BMBF (Federal Ministery on Education and Research, Germany), NSF (National Science Foundation, USA), NOAA (National Ocean Atmosphere Administration, USA), DoE (Department of Energy, USA), NASA (National Aeronautics and Space Administration, USA), JAMSTEC (Japan Marine Science and Technology Center, Japan) and CSIRO (Commenwealth Scientific and Industrial Research Organisation, Australia) for their support for the CLIVAR IPO.

On behalf of the CLIVAR Scientific Steering Group and the staff of the CLIVAR IPO, I wish you all a Merry Christmas and a Happy New Year and look forward to working with you in the future.

L. Dümenil, Acting Director, CLIVAR IPO

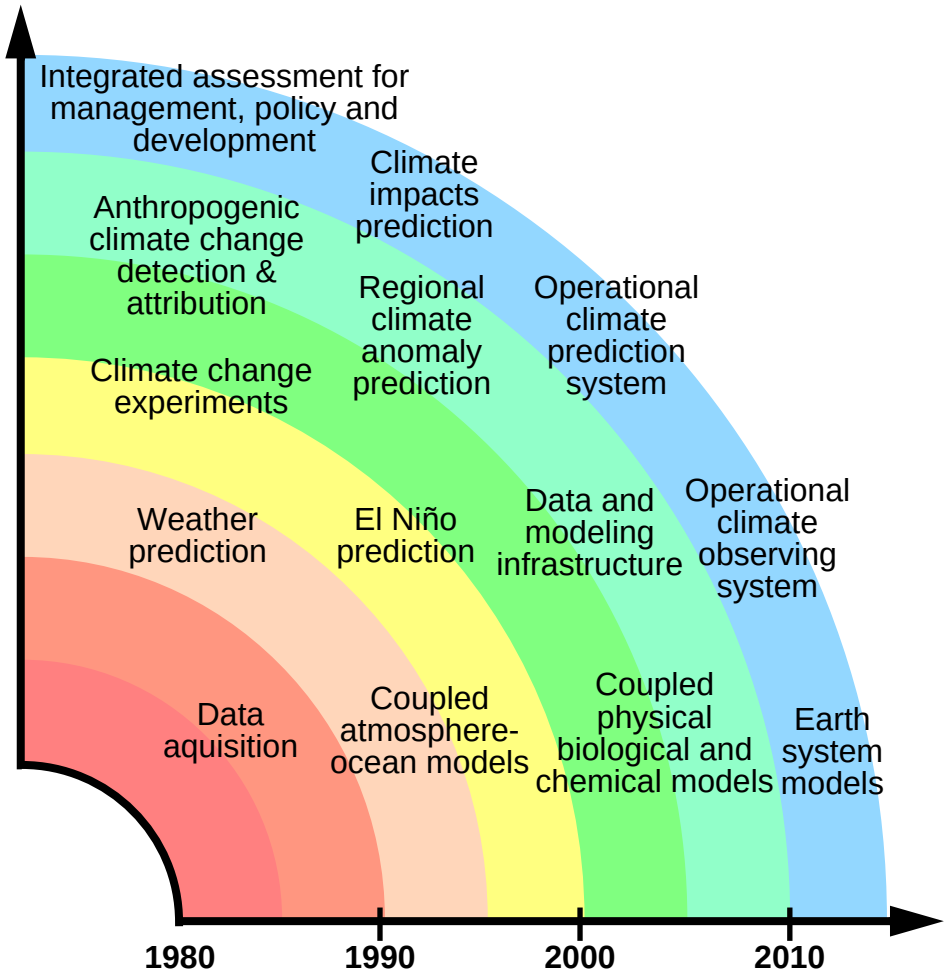
Message from the Chairman of the Joint Scientific Committee

I am very pleased to have been asked to contribute to ***Exchanges***, and thereby to express my views of CLIVAR to the community. CLIVAR is potentially the largest and most far-reaching of the WCRP projects, and its successful execution will require the international coordination of climate research on an unprecedented scale.

As a member of the CLIVAR Study Group (chaired by L. Bengtsson) that met during 1991-1993 to develop the initial concepts for a new WCRP project focused on climate variability and predictability, I can testify to the wide-ranging discussions, the arguments, and the eventual consensus on the need, value and timeliness of such a project. Accordingly, in 1993 the JSC decided to initiate the Climate Variability and Predictability (CLIVAR) project and appointed a Scientific Steering Group (SSG) which first met that same year.

After two years' work by the SSG, a comprehensive CLIVAR Science Plan was published in 1995, and both an overview version and a detailed draft of the Initial CLIVAR Implementation Plan were prepared in 1997. These documents provide an authoritative description of the CLIVAR project, and deserve the attention of the entire climate research community.

Because of its potential size and complexity, CLIVAR is prone to being viewed as a project serving a particular disciplinary interest. Oceanographers, for example, sometimes regard CLIVAR as the continuation of WOCE, while specialists in large-scale air-



A generalized view of the past, present and possible future research aim of the World Climate Research Programme as a function of time (indicated by the coloured bands).

sea interaction often regard it as the extension of TOGA. The community of climate modellers, on the other hand, frequently view CLIVAR as focused on the design and use of global coupled models to simulate the climate's response to future scenarios of atmospheric greenhouse gases and aerosols. In fact, CLIVAR is all of these and more, embracing as it does the problems of assembling the observations, formulating the hypotheses, integrating the models, and interpreting the results for climate variability and predictability and for the detection and attribution of climate change on seasonal to centennial time scales. Is CLIVAR too broad? I don't think so, although it certainly calls for a new level of collaboration among those concerned with observing, modelling and diagnosing. The variation and possible prediction of climate lie at the heart of the WCRP's objectives, and the time has clearly come for a unified and comprehensive study of these issues. As research progresses, it is foreseen that CLIVAR's division into components focused on shorter and longer climate time scales may be abandoned, and that CLIVAR will have to be more closely integrated with its companion projects in GEWEX, ACSYS, SPARC and WOCE. CLIVAR will also have to cooperate extensively with relevant projects in the IGBP, WCP and GCOS.

Although many of CLIVAR's projects are currently framed in terms of regional processes and phenomena, as experience and understanding increases it is foreseen that CLIVAR will merge these components into a progressively global portrayal of the regional dependence of climate variability and predictability. It seems likely, however, that climate variations in some regions will be less predictable than others, and that predictability on local scales will be less than that on larger scales. CLIVAR's role in the overall WCRP mission may be appreciated from Fig. 1, in which I have sketched the principal WCRP activities in a generalized fashion over time. (A figure showing each project's specific activities and interactions would be hopelessly complicated.) In this "rainbow" diagram, CLIVAR is making a key contribution to the development of coupled models and their use in climate change experiments and El Niño prediction during the 1990s, and during the first decade of the next century CLIVAR is projected to play a central role in the continuing development of climate system models, in the detection and attribution of anthropogenic climate change, and in the exploration of the limits of regional climate anomaly prediction. Beyond 2010 (or thereabout) lie a suite of practical operational climate-related activities whose implementation will rest upon the successful accomplishment of this research.

The key unifying element in CLIVAR, and in the WCRP as a whole, is coupled modelling. This is attested to by the JSC's recent designation of the former CLIVAR NEG-2 as a joint JSC/CLIVAR Working Group on Coupled Modelling (WGCM). The WGCM is seen as playing a leading role in the development of an international climate modelling infrastructure, whereby the development, diagnosis and application of coupled models can be accelerated and improved in a systematic manner in coordination with CLIVAR. The WGCM is also seen as the WCRP's principal interface with GAIM and the IPCC, as the models are extended to include progressively more components of the climate system and as their results are assessed in terms of regional impacts.

The challenges facing CLIVAR are great, but so are the potential scientific and practical rewards. CLIVAR's success will depend upon the imagination and vision of its leaders, the ingenuity, skill and persistence of its participants, and the confidence and support of its sponsors. The JSC stands ready to assist and nurture the CLIVAR enterprise in any way it can.

W. Lawrence Gates, Chairman, JSC

JSC/CLIVAR Working Group on Coupled Modelling

Paris, 22-25 September 1997

The JSC/CLIVAR Working Group on Coupled Modelling (WGCM) is not yet another modelling group! For various reasons, the Joint Scientific Committee for the WCRP decided to reconstitute the group originally established as "CLIVAR NEG-2", dealing primarily with the development and application of numerical models on decadal to centennial time-scales and anthropogenic aspects of CLIVAR, as a joint JSC/CLIVAR group. In this new existence, the WGCM will continue to play exactly the same role as CLIVAR NEG-2 in CLIVAR, but will also undertake, on behalf of the JSC, a co-ordinating role for modelling activities in the WCRP as a whole and act as an interface with the IPCC Science Assessment Working Group (WG I). The first session of WGCM (which would have been the third session of CLIVAR NEG-2!) was kindly hosted by the Laboratoire de Meteorologie Dynamique, Ecole Normale Superieure in Paris. All participants appreciated the typically high standard of French hospitality.

Under the leadership of its chairman, Dr. Lennart Bengtsson, much of the work of the session was

devoted to the further development of the projects and activities initiated by CLIVAR NEG-2 (see Exchanges, Vol. 1. No. 1, February 1996; Vol. 1, No. 4, December 1996).

The Coupled Model Intercomparison Project (CMIP) is one of the most important of these and is the subject of a separate detailed article in this "Exchanges". The planning of the second phase of CMIP, an intercomparison of global coupled model experiments with a standard rate of increasing CO_2 and the careful documentation and diagnosis of results, was considered in detail. WGCM agreed that a CMIP/global coupled model workshop to review the results of CMIP so far should be held in Melbourne, Australia in October 1998.

Interesting results are also beginning to emerge from the study of the uncertainty in climate sensitivity experiments linked with atmospheric feedbacks by intercomparing equilibrium doubled CO_2 experiments from an atmospheric model and slab ocean. The changes in the top-of-the-atmosphere fluxes in the doubled CO_2 case show little consistency between models especially for changes in the long-wave component of the cloud radiative forcing. Cloud-climate feedbacks continue to appear to be a major contribution in the uncertainty in the model-simulated response to CO_2 increase and WGCM plans to examine, in conjunction with the WCRP Global Energy and Water Cycle Experiment (GEWEX), aspects of parameterizations which have a substantial effect on climate sensitivity and the use of observations where appropriate to constrain the range of these parameterizations.

On behalf of WGCM, Ron Stouffer and Keith Dixon (GFDL) had completed a comprehensive review of the initializations of coupled models for use in climate studies. A wide variety of schemes are being employed, but the degree of climate drift can be very sensitive to apparently minor model changes. The full text of this review will be included in the report of the WGCM session and in the annual "blue-cover" report "Research Activities in Atmospheric and Oceanic Modelling" produced by the WCRP.

The question of the representation of the ocean component in coupled climate models was also reviewed extensively. A joint CLIVAR/WOCE Workshop on Ocean Modelling for Climate Studies is being organized in Boulder, CO, USA next August (see separate announcement in this volume) with the specific objective of developing a current view of how well different aspects of ocean dynamics need to be represented in order to achieve realistic simulations of the ocean's role in climate variability.

WGCM was fortunate also that Dr. Berrien Moore, Chairman of the GAIM Task Force (and Chairman-elect of the IGBP Scientific Committee) participated in the session. Modelling within the WCRP and GAIM will certainly come together more and more in the next few years. Sulphate aerosol distributions are, of course, already being incorporated into climate change assessment studies and more advanced schemes with comprehensive chemical treatment of sulphates and ozone are being developed. Furthermore, it is becoming increasingly important to include the carbon cycle in climate change integrations, and WGCM will consider a strategic paper on this issue at its next session.

R. Newson, JPS

The Coupled Model Intercomparison Project (CMIP)

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The Coupled ocean-atmosphere Model Intercomparison Project (CMIP) was initiated in 1995 under the auspices of the JSC/CLIVAR Working Group on Coupled Models (WGCM, former NEG-2). CMIP aims to assemble and analyse comprehensive data sets of output from global coupled ocean- atmosphere general circulation models (Meehl et al., 1997). These models are used to predict (some would say "project") future climate, including human influences such as greenhouse gas and aerosol production. With significant international agreements on fossil fuel use now developing from model-based science, the need to better understand model strengths and weaknesses is obvious.

CMIP is analogous to the Atmospheric Model Intercomparison Project (AMIP; see Gates et al. 1998). It is more ambitious than AMIP in the sense of embracing the full physical climate system, as opposed to AMIP's purview of atmospheric models in which both sea surface temperature and sea ice are prescribed to match observations. At present, however, CMIP has collected only a small subset of the many output fields produced by coupled models, in order to limit the level of effort required from participating groups.

The first step of CMIP (CMIP1) has collected

output from 18 model "control runs" representing the present-day climate -- or, to be more precise, the pre-industrial climate. In these runs external forcing such as atmospheric carbon dioxide and aerosol concentrations remain fixed. The main object of CMIP1 is to document systematic simulation errors by comparing model output with observations of climate. About half the coupled models in CMIP1 use ad hoc "flux adjustments" (also referred to as "flux corrections") to modify air-sea transfer of energy and water, in order to bring the climate simulation into better agreement with observations. The CMIP database thus provides an opportunity to examine the effects of this controversial technique on model behaviour.

Surprisingly, preliminary examination has not revealed a strong correlation of model performance with the presence or absence of flux adjustments. For both model types, seasonal cycles (measured by the difference between July and January surface air temperature) generally differ from observations by an amount that is not much greater than the observational uncertainty. Ocean heat transports exhibit large inter-model differences, but the output characteristics are not correlated with the use of flux correction.

The CMIP1 database can also be used to assess the ability of current coupled models to simulate the variability of surface air temperature on interannual to decadal time scales. Quantifying natural climate variability is a prerequisite for separating any human-induced changes from the "background noise." A careful comparison of model simulations with observations inferred from paleodata would help to determine if model-derived estimates of natural variability can be trusted in such studies.

The second step of CMIP (CMIP2) will extend the database to include output from models forced with a common scenario in which atmospheric carbon dioxide increases by 1% per year. A time sequence of parameters such as heat penetration into the oceans may allow some explanation of the widely differing amounts of global warming and hydrologic-cycle changes simulated by coupled models (Kattenberg et al., 1996). We expect the CMIP2 database to be largely complete by the beginning of 1998.

Facilitating data analysis by the climate research community is a key principle of CMIP. We have welcomed proposals for diagnostic subprojects that use the CMIP database, though no direct funding from CMIP is available. For a listing of the fields collected for CMIP, details on initiating subprojects, and descriptions of required participation and collaboration protocols, please visit our World-Wide Web site at http://www-pcmdi.llnl.gov/cmip.

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TAO Implementation Panel - 6th Session

Reading, UK, November 4-6, 1997

The European Centre for Medium Range Forecasting (ECMWF) in Reading, England hosted the sixth session of the TAO Implementation Panel (TIP-6) which was held from 4 to 6 November 1997. The purposes of TIP-6 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 scientific and operational use of the TAO data. An additional purpose of TIP-6, and the reason for holding it at ECMWF, was to foster improved communication between the TAO Project and operational weather and climate prediction centres. Participants from eight nations attended this session.

TIP-6 opened with an update on the strong El Niño/Southern Oscillation event presently under way in the tropical Pacific. The panel then turned to discussing issues of instrumentation, array maintenance, and data dissemination.There are TAO moorings at 64 sites across the equatorial Pacific including 6 sites where current measurements are being made and 13 sites where standard ATLAS moorings have been replaced with next generation ATLAS moorings. The next generation ATLAS is based on inductive coupling technology and provides increased temporal resolution, increased accuracy for ocean temperature, and flexibility to add additional sensors such as rainfall, radiation, and ocean conductivity. Discussion topics included shiptime requirements, vandalism and damage to the buoys, outreach efforts to the fishing communities, ocean velocity and salinity measurements, and data dissemination updates on the World

Wide Web. The throughput of TAO data on the GTS was also discussed.

Updates were presented on Japan's TRITON array of moored buoys scheduled to be deployed in the western Pacific starting in March 1998, the PIRATA array which has begun with two moored buoys deployed in September 1997 in the tropical Atlantic (France, Brazil, and U.S.), Taiwan's mooring in the South China Sea deployed in April 1997 as part of the South China Sea Monsoon Experiment (SCSMEX), and India's National Data Buoy Programme which deployed four moored buoys in the Bay of Bengal in 1997 with plans to augment these with six buoys in the Arabian Sea in 1998. Information on a proposed new climate-related mooring program JASMINE (Australia and the United States) was also presented.

Presentations on international and national climate programs included updates on CLIVAR, GOOS, OOPC, NOAA's Office of Global Programs, International Research Institute for Climate Prediction, Pan American Climate Studies, Atmospheric Radiation Measurements Program, and the Tropical Rainfall Measuring Mission. A review of the Data Buoy Cooperation Panel (DBCP) was also presented and it was requested that the TAO Implementation Panel consider becoming an action group of the DBCP. Scientific presentations highlighted the impact and assimilation of TAO data in the operational weather prediction centres of ECMWF, NCEP, Meteo France, and the U.S. Navy. Additional presentations focused on surface flux and salinity measurements in the tropical oceans, ocean colour, and large-scale current fluctuations.

Several recommendations from TIP-6 emerged during discussions following the presentations. The importance of salinity measurements was recognized for improving ocean general circulation models and for initializing short term climate forecasts. It was suggested that additional surface and subsurface salinity sensors be added to selected moorings as a contribution to an emerging salinity monitoring effort which includes VOS, S-PALACE, and other platforms. A second recommendation was to accurately measure surface fluxes at selected sites in order to verify flux climatologies and to improve coupled models. Two other recommendations were made regarding the GTS data stream. With the importance of boundary layer moisture in atmospheric model calculations of flux, it was recommended that relative humidity measurements from the TAO buoys be placed on the GTS. Finally, due to the sparseness of measurements from the Indian Ocean, it was recommended that an effort be made to make the data from the National Data BUoy Programme of India available on the GTS.

M. McPhaden, Chair TIP

Euroclivar Committee Meeting - 4th Session

The fourth Euroclivar committee meeting in Bologna, on 9 and 10 October 1997, discussed priorities for a European contribution to CLIVAR. The result is a document, which covers both natural variability and the prediction and detection of anthropogenic climate change. It puts a focus on European and Atlantic Climate Variability, but the case for studying climate variability elsewhere is clearly made, and recommendations for European research on ENSO, on the Asian monsoon and on African Climate are included. The document can be found on http://www.knmi.nl/euroclivar/recsum.html.

It is primarily written for presentation to the European Union, but it will be distributed widely to stimulate the discussion among European scientists. The Euroclivar ideas will be presented at the next meeting of the European Geophysical Society in Nice (20 - 24 April 1998).

In 1998 a number of workshop will be held under the auspices of Euroclivar:

- “Attribution: Beyond Discernible?” Workshop on Climate Change Detection and Attribution, (Bracknell, UK, 9 - 12 March 1998)
- Climatic impact of scale interactions for the tropical ocean-atmosphere system, (Paris, France, 14 - 16 September 1998)
- The role of the Atlantic in climate variability, (Florence, Italy, 11-14 May 1998)
- Data assimilation in ocean models, (Bologna, Italy, early fall 1998)
- African Climate Variability, (Bologna, Italy, 3 - 5 June 1998)

G. Komen

The Global Ocean Data Assimilation Experiment (GODAE)

The Global Ocean Data Assimilation Experiment (GODAE) is an initiative of the GCOS/GOOS/WCRP Ocean Observations Panel for Climate.

The objective of GODAE is to demonstrate the practicality and feasibility of routine, real-time global ocean data assimilation and prediction. GODAE is founded on the belief that such a demonstration is vi-

tal if we are to ever realise a permanent, global ocean observing network and prediction system, with all components functional and operating on a global domain, and delivering useful products in a timely manner. GODAE will emphasise integration of the remote and direct data streams, and the use of models and data assimilation to draw maximum benefit from the observations.

The concept of GODAE is fired by both opportunity and need. The opportunities arise because of

- the development and maturity of remote and direct observing systems, making global real-time observation feasible;
- the steady advances in scientific knowledge and our ability to model the global ocean and assimilate data at fine space and time scales;
- the genuine enthusiasm of the community and, in particular, the remote sensing community, to promote and implement integrated global observing systems; and
- the critical advances provided by research programmes like TOGA and WOCE.

From the user side, many opportunities exist for (near) real-time ocean products, including coastal prediction, open-ocean analysis and prediction, and climate forecasts. GODAE is also required for the future. The transition of research systems into operational mode demands demonstrations of utility and value, as do the global ocean aspects of GOOS and GCOS. Future research must be able to develop, safe in the knowledge that a scientific quality basic system is available as a foundation, and that this in turn will maintain an appropriate observing network. Operational meteorology and, in particular, FGGE provide a powerful and alluring analogy.

The general objective of GODAE is

To provide a practical demonstration of real-time global ocean data assimilation in order to provide regular, complete depictions of the ocean circulation, at high temporal and spatial resolution, and consistent with a suite of space and direct measurements and appropriate dynamical and physical constraints.

The word "experiment" implies a test of the viability and practicality of global remote and direct observing systems, and the exercise of new and original real-time data processing methods. The keywords that distinguish GODAE from other endeavours are "real-time", "assimilation", "global" and "practical".

GODAE is not a research programme, but a practical test of our ability to deliver useful products, derived from a global ocean data set but assimilated into a skilful model in order to extract greater benefit from the information, and delivered in a timely manner. "Real-time" will vary depending upon the application and processing. For climate applications, delays of several months may be tolerable (though not desirable), so long as this is matched by improved quality. For surface products lead times will range from a few days to several weeks, again depending upon the nature of the particular applications.

Although GODAE is not a research programme, it has strong linkages into the research community, e.g. through the wide range of ongoing activities on ocean data assimilation and seasonal forecasting projects under the scope of programmes like WOCE and CLIVAR.

CLIVAR has a vital interest on the success of GODAE for a number of reasons:

- The GODAE "Experiment", planned for 2003-2005, must be preceeded by a period of intensive research, development and testing of ocean data assimilation systems. Part of this research and development inevitably will be undertaken in programmes like CLIVAR and WOCE and, in turn, GODAE is likely to inspire research and applications of interest to these research programmes.
- GODAE supports the recommendations made by research programmes like CLIVAR to establish and maintain a basic ocean observing system.This system would satisfy the common requirements of research and operational activities. GODAE is founded on the belief that long term commitments to this fundamental system will only come through emphatic demonstrations of utility and practicality.
- CLIVAR will benefit from GODAE primarily through its products which can be used as the basis for model validation and development and as a foundation for more intensive observing and process studies. It will also benefit from the long-term investment in the observing and processing systems of GODAE.
- The scientific and technical strategy of GODAE will be built around several initial projects which overlap with a number of core projects of CLIVAR, e.g.
  - (a) Real-time North Atlantic Ocean data assimilation;
  - (b) North Pacific Ocean analysis and prediction, with initial focus on the western Pacific, the Kuroshio, and Pacific open-ocean systems.
  - (c) Using the Equatorial Pacific as a test bed for testing estimation, observing networks,

etc.

(d) The development of appropriate global surface fields.

(e) Encouraging prototype global assimilation systems.

Like CLIVAR, GODAE has a long term perspective; after the definition of the experiment and feasibility studies and scoping until end of 1999, a pre-operational test phase follows until 2002. The realisation of GODAE is planned in a timeframe of 2003-2005.

Detailed information on the conception of GODAE, an initial "prospectus", and a draft "Strategy" can be accessed on the Web at http://www.bom.gov.au/bmrc/mrlr/nrs/oopc/godae/homepage.html.

Neville Smith, Interim Chair of GODAE, co-chair CLIVAR NEG-1

A Global Ocean Observing System Center at NOAA's Atlantic Oceanographic and Meteorological Laboratory

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The National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce has inaugurated a Global Ocean Observing System (GOOS) Center at NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML). The initial objectives of the Center are (1) directed at coordinating NOAA's global and regional observing network efforts in order to maximize the quality and quantity of data available to users and (2) to evaluate new observing methods for incorporation into existing networks.

NOAA's present global operations include AOML managed: (1) Volunteer Observing Ship (VOS) network that provides surface marine meteorological observations; (2) VOS network that provides upper ocean temperature and salinity data; and (3) surface drifter array that provides surface current, temperature and meteorological data. Regional networks include the TAO array, operated by NOAA's Pacific Marine Environmental Laboratory, that provides upper ocean and surface meteorological data in the tropical Pacific Ocean.

The data provided by these networks are used by NOAA's weather and climate forecast groups. Thus, the GOOS Center will direct it's efforts at the real-time, in situ, upper ocean and surface meteorological data needed by the NOAA forecasters. The Center activities will require that the operators of the individual networks continue to collect, quality control and disseminate their data.

Specific Center objectives include:

1. insure a continuous "pipeline" of data from sensor to user: Data pipelines will be defined for each of the data networks. The pipelines will be "tapped" at various locations to ensure that data are flowing continuously. Breaks in the pipeline will be identified and corrected. The final taps will be placed at the modeling centres. This monitoring node will determine if data reaching the prediction center are being used in the forecasts. If not, a determination will be made discriminating between problems with the observations versus problems with the assimilation/modeling methodology.
2. evaluate and implement, after verification, new observing networks:

(a) The ability to obtain and transmit high quality surface salinity data will be developed. Thermosalinograph (TSG) sensors will be placed on NOAA's research fleet to obtain in real-time, surface salinity data. Methods for sensor upkeep, data transmission and data quality control are being evaluated. Once these evaluations are completed, collection of TSG data from the U.S. research fleet and additional VOS will be implemented.

(b) In the immediate near-term, expendable conductivity temperature depth (XCTD) probes will be used to obtain temperature and salinity profiles on a limited number of VOS. As is the case for the TSG observations, data transmission and quality control procedures must be developed for the XCTD data.

(c) The ability to obtain temperature and salinity profiles from PALACE floats is under consideration using data from a large WOCE deployment in the North Atlantic.

(d) The ability to obtain surface wind observations from satellite tracked surface drifters is being evaluated through deployments in "hurricane alley" of the tropical and subtropical North Atlantic.

3. develop new products that incorporate data from the diverse observing networks:
   New products will be developed to provide a portrait of the characteristics of the upper ocean and

CLIVAR travels

Dr. Lydia Dümenil and a group of other CLIVAR scientists attended the "International conference on Science & Technology for the Assessment of Global Environmental Change and its Impact on the Maritime Continent of Indonesia", held in Jakarta November 10-12, 1997. After their presentations the chairmen of the sessions presented a souvenir from Indonesia to each of the speakers. Dr. John Mc Bride, Dr. Lydia Dümenil and Dr. Antonio Moura received their gift from Dr. Peter Webster who co-chaired the session on "Seasonal to Interannual Climate Variability Research and Prediction".
On the far left Dr. Tien Sribimawati who has recently been named as the Indonesian CLIVAR representative and on the far right Dr. Sri Diharto, the director of the Indonesian Weather Service.

surface atmosphere. The products will combine data from the diverse observing networks to define the state of the surface air/sea boundary layers.

Letter to the CLIVAR Scientific Steering Group

The present El Niño episode, which has so greatly impacted Indonesia and other southeast Asian nations, prompted the Indonesian BPP Teknologi to sponsor a conference in Jakarta from 10-12 November 1997, entitled "International Conference on Science & Technology for the Assessment of Global Environmental Change and its Impact on the Maritime Continent of Indonesia".

As an indicator of the great concern placed on the present situation, the President of Indonesia opened the conference with an important statement 'opening' Indonesia waters to international research that will lead to improved prediction of El Niño events. As you know research access to Indonesian waters has been limited, so this is a particular welcome event.

In order to promptly respond to this opportunity we (the undersigned who attended the conference) recommend that CLIVAR establish under an appropriate panel a working group with the task of designing a monitoring array for ocean and associated atmospheric measurements within Indonesian waters that will aid in the study of climate variability, specifically ENSO events. The array must span several ENSO cycles, and be compatible with CLIVAR measurement programs in the western tropical Pacific and eastern Indian Ocean.

In view of the present level of attention, we urge that the working group begin their task as soon as possible, with the objective of having a plan ready by September 1998.

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Peter Webster, USA
Roger Lukas, USA
Robert Molcard, France
George Cresswell, Australia
Nancy Bray, Australia
Gani Ilahude, Indonesia
Tien Sribimawati, Indonesia
Nobutaka Kimura, Japan

US-CLIVAR Workshop on an Atlantic Climate Variability Experiment

February 2-4, 1998 in Dallas, TX, USA.

Background

The North Atlantic Oscillation (NAO) and the Tropical Atlantic Variability (TAV) are primary expressions of decadal / hemispheric-scale climatic fluctuations in the atmosphere and ocean centred over the Atlantic. Although of fundamental importance to climate over the Americas and Europe, it is entirely unclear thus far which physical mechanisms are responsible for this variability in the atmosphere and the ocean, and if they are at all linked.

The general scientific issues is this context are:

- What are the modes of, and mechanisms responsi-

ble for, decadal-time scale variability in the atmosphere and ocean?
- What are the impacts of this climate variability on society?
- How predictable is climate variability in the Atlantic Sector?

The workshop announced here has the format of a 2 1/2 day meeting for 20-30 invited participants from both the oceanographic and meteorological community to home the scientific issues of Atlantic Sector variability and begin shaping an implementation plan. It will be formally open to all interested scientists in the community. The meeting will build on the international CLIVAR science plan, the US O-CLIVAR Implementation Planning report, recent documents reviewing North Atlantic modes of climate variability (Marshall et al., 1997; Wunsch et al., 1997) and preliminary informal discussions at MIT in April 1997 and during the September 1997 ACCP PI meeting at LDEO.

In particular, the latter informal discussions have proven valuable in formulating a list of urgent scientific issues that must be addressed to gain understanding of large-scale climate phenomena in the Atlantic. The goals of the workshop are:
- To identify and refine possible mechanisms and testable hypotheses of climate variability in the Atlantic Sector.
- To develop a strategy for improving current understanding of climate variability using a combination of historical data, theory and modeling, and new observations.
- To develop a strategy for improving predictive capabilities based on identified mechanisms of climate variability and improved understanding.
- To develop plans for a real-time observing network to assess the current and future climatic states of the Atlantic sector, and to test predictability strategies.

The specific scientific questions that need to be resolved in order to better understand climate variability in the Atlantic Sector are:
- Is the NAO a truly interactive, coupled atmosphere-ocean mode of variability?
- Is the Tropical Atlantic Variability connected to the NAO? To ENSO?
- Is the Arctic fresh water export coupled to the NAO?
- Is the NAO part of a global pattern of climate change?

A major product of the workshop will be a meeting report. This report will form the basis of a U.S. Atlantic (CLIVAR) implementation plan to be distributed to funding agencies and shared with our U.S. colleagues and to those in Europe who are developing their own implementation plans.

References

Marshall et al., 1997; "White paper on the NAO and Tropical Atlantic Variability" preprint available at http://www.ldeo.columbia.edu/NAO/

Wunsch et al. 1997: "The role of the North Atlantic Ocean in Climate Variability and Predictability", copies available from MIT.

Martin Visbeck, Detlef Stammer and John Toole

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CLIVAR Calendar

1998	Meeting	Location	Attendance
Jan. 12	CLIVAR VAMOS Planning Meeting	Phoenix, USA	Invitation
Feb. 2 - 4	US-CLIVAR Workshop on an Atlantic Climate Variability Experiment	Dallas, TX, USA	Invitation
Feb. 9 - 13	Ocean Science Meeting	San Diego, USA	Open
March 9 - 12	Euroclivar Workshop on Climate Change Detection and Attribution	Bracknell, UK	Invitation
March 16 - 21	Joint Scientific Committee of WCRP - 19th Session	Cape Town, South Africa	Invitation
April 20 - 24	23rd European Geophysical Society Meeting	Nice, France	Open
April 20 - 22	CLIVAR Asian - Australian Monsoon Panel, 2nd Session	Kyongju, Korea	Invitation
April 21 - 23	International Conference on Monsoon and Hydrologic Cycle	Kyongju, Korea	Open
April 27 - 30	CLIVAR Scientific Steering Group, 7th Session	Santiago de Chile, Chile	Invitation
May 11 - 14	Euroclivar Workshop on “The role of the Atlantic in climate variability”	Florence, Italy	Invitation
May 24 - 29	International WOCE Conference	Halifax, Canada	Open
May 25 - 29	9th Conference on Satellite Meteorology and Oceanography	Paris, France	Open
May 26 - 29	AGU Spring Meeting	Boston, USA	Open
June 3 - 5	Euroclivar Workshop on “African Climate Variability”	Bologna, Italy	Invitation
July 7 - 14	COARE 98	Boulder, CO, USA	Open
August 10 - 13	WOCE/CLIVAR Workshop on Ocean Modelling for Climate Studies	Boulder, CO, USA	Limited
August 17 - 21	International Conference on Satellites, Oceanography and Society (Expo '98)	Lisbon, Portugal	Open
September 14 - 16	Euroclivar Workshop on Climatic Impact of Scale Interactions for the tropical Ocean-Atmosphere System	Paris, France	Invitation
October 19-24	JSC/CLIVAR Working Group on Coupled Modeling, 2ndSession	Melbourne, Australia	Invitation
November 9 - 13	CLIVAR/GCOS TAO Implementation Panel, 7th Session, PIRATA-5	Abidjan, Ivory Coast	Invitation
December 1 - 3	International CLIVAR Conference	Paris, France	Limited

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

CLIVAR - Exchanges

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