U.S. CLIVAR

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VARIATIONS

Summit Review

by David M. Legler, Director

This year has been an exciting one for U.S. CLIVAR, and the next several months promise to be even more interesting. The annual U.S. CLIVAR Summit, in Annapolis in July (the weather turned out to be delightfully pleasant and we had a super meeting hotel), provided the opportunity to hear from our Working Groups: Ocean Salinity (their final report has been issued - see the article on page 9), MJO, Drought, and Western Boundary Currents, as well as from the Panels on their activities over the past year. We had informative presentations and a discussion on progress and research challenges on decadal variability and predictability, particularly in reflecting on research progress over the past 10 years since the 1999 NRC Dec-Cen Report was written (see the related article in this issue on this page summarizing the presentations). The questions from the 1999 Report are still valid; but the research agenda that was once focused on characterizing and exploiting natural climate predictability has now changed in recognition of the roles of both internal and forced climate changes.

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Decadal Variability and Predictability

Summary by: D.J. Vimont, University of Wisconsin, and
M. Newman, NOAA Climate Diagnostics Center

Understanding how to distinguish between natural and anthropogenic influences upon past and future decadal variability, and how they may interact, is crucial...

The 2007 CLIVAR Summit included a discussion forum of advances in understanding decadal variability and predictability over the last decade. Four presentations were made covering decadal variability in the Pacific and Atlantic, and a question and answer session followed. We focus on the following main points in this summary:

- Decadal variance in the Pacific is well simulated by simple stochastic models involving the surface mixed layer and wind-driven circulation. Variability in the Atlantic involves the meridional overturning circulation (MOC) that is excited by atmospheric variability. Though more complicated theories exist that may generate potentially predictable decadal variability in both basins, it is difficult to verify their importance in the observed record or in model simulations.

- In the recent past and near future, decadal variance will be produced by both natural and anthropogenic signals; separating these signals is imperative for honing existing theories of decadal variability as well as projecting future climate change.

- Directions, and even objectives, of decadal predictability are not well defined; it is not clear whether the "phenomenon / mechanism" paradigm for ENSO prediction will be applicable.

Observed decadal variability in the Pacific and Atlantic

In the midlatitude Pacific and Atlantic basins, sea surface temperature (SST) variability is reasonable well described by a stochastic model in which the ocean integrates forcing from the midlatitude atmosphere. The resulting SST red noise will have substantial variance on decadal timescales even in the absence of physical processes that act on decadal timescales. Moreover, the fraction of variance on decadal timescales can be enhanced by relatively minor extensions of this "null hypothesis", such as by letting midlatitude atmospheric variability include not only random chaotic weather but also an interannual component forced by El Niño – Southern Oscillation (ENSO), and by noting that wintertime reemergence increases the year-to-year persistence of upper ocean thermal anomalies. On the other hand, there are physical processes in both the Tropics and midlatitudes, both internal to the ocean and coupled air-sea interactions, acting on decadal (or at least longer than annual) timescales that might be expected to produce variance above the red noise background. This suggests an important scientific issue: a distinction needs to be made between decadal variance, or the integrated power of SST spectra for periods greater than about 10 years, and decadal variability, or that portion of the variance due to physical processes with

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The three U.S. CLIVAR Panels identified many new scientific research ideas that address our two foci: drought and decadal variability/predictability, continued their pursuit of developing a set of "best practices" in a number of research areas, stimulated ideas for potential new Working Groups, and proceeded to devise a course of panel activities over the next year. We also recognized the importance of increasing the communication between U.S. CLIVAR and the research agencies. The outlook of activities and opportunities looks bright for the next year.

Over the next several months we will be very busy helping initiate a new research program for the Atlantic Meridional Overturning Circulation (AMOC) (see related article in this issue), soliciting new U.S. CLIVAR Working Groups, identifying how our international CLIVAR colleagues can better coordinate their plans with U.S. CLIVAR; and planning for a drought-related workshop to be held Fall 2008.

New opportunities to become involved with U.S. CLIVAR are coming up; prospectuses for new U.S. CLIVAR Working Groups and requests for new Panel members will be solicited very soon. U.S. CLIVAR is making great progress and has developed remarkable momentum. Stay tuned...

Variations

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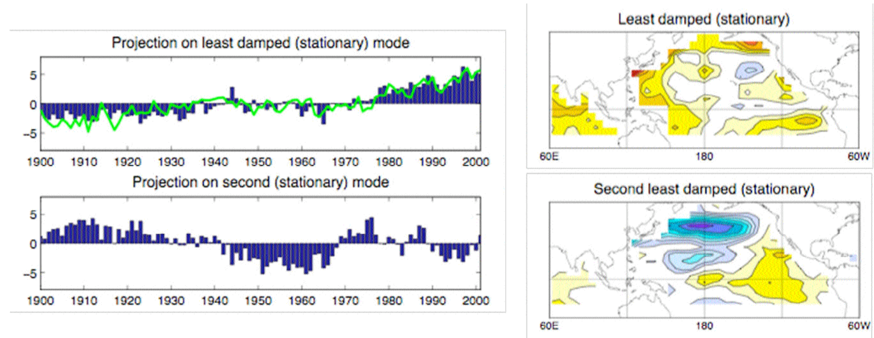

Figure 1. Leading eigenmodes of the one-year lag regression of annual-mean SST (right), along with their corresponding timeseries (left). The green line represents the annual mean GISS global mean surface temperature. Adapted from Newman (2007).

intrinsically decadal timescales. An answer to this problem could then allow determination of decadal predictability; that is, an evaluation of potential long-range forecast skill given the presence of both decadal red noise and physical processes.

Some preliminary progress might be made by addressing the predictability problem empirically, even before a full understanding of the physical processes giving rise to that predictability. Newman (2007) employed one such empirical approach by modeling observed Pacific SSTs with multivariate red noise, an extension of the simpler univariate red noise that allows for the presence of both stationary and oscillatory eigenmodes of spatiotemporal variability as well as predictability estimates for each mode. This analysis found modes similar to ENSO and the Pacific Decadal Oscillation (PDO) with long periods but short decay times and thus limited predictability on the order of a year or two, but also found two distinct patterns (shown in Figure 1) with encouraging levels of multi-year potential forecast skill. However, the leading eigenmode corresponds to the centennial trend that might represent anthropogenic effects, and while the other eigenmode is potentially "natural," current coupled models poorly simulate it. This raises another key question critical to the predictability problem: can we (and if so, how do we) distinguish between natural and anthropogenic origins of decadal variability?

Tropical Pacific decadal variability bears a strong resemblance to interannual ENSO variations, suggesting that the two phenomena are related. This relationship is made clear by attempts to reconstruct tropical Pacific decadal variability using spatial structures associated with interannual variability (Vimont, 2005). This exercise reveals that the spatial structure of "ENSO-like" decadal variability is reproduced by averaging over precursor, peak, and antecedent variability associated with the interannual ENSO cycle (Figure 2). This includes an influence of midlatitude atmospheric variability on ENSO through subtropical ocean / atmosphere interactions. This relationship between Pacific interannual and decadal variability provides a null hypothesis for tropical Pacific decadal variability, and a metric for testing model simulations of decadal variability.

Decadal to multi-decadal variations in the Atlantic basin appear in the observed record and in coupled model simulations, and are characterized by broad-scale warming over the entire Atlantic north of the equator that varies irregularly on a roughly interdecadal time scale. Model analyses suggest that the variability is linked to the meridional overturning circulation (MOC), which also appears to set the interdecadal time scale. One strong influence on this variability appears to be the North Atlantic Oscillation (NAO), which excites the variability via both mechanical and buoyancy forcing, and through forcing of deep convection through surface fluxes (Figure 3; see, also, Dong and Sutton, 2005). Deep convection, in turn, is heavily influenced by advection of salinity anomalies into the

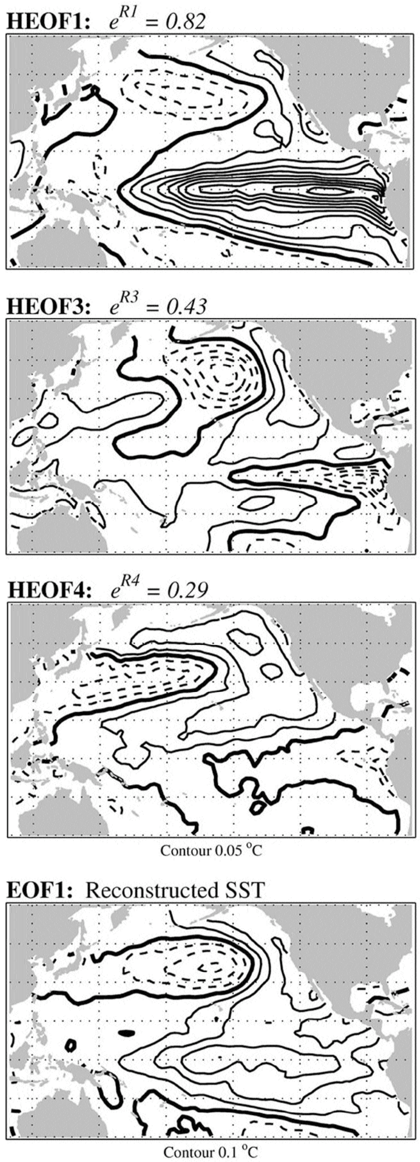

Figure 2. Reconstruction of the spatial pattern of ENSO-like decadal variability (bottom panel) using spatial information from interannual time scales only (top three panels; the bottom panel is nearly identically the sum of the top three panels). Results indicate that the meridionally broadened pattern of ENSO-like decadal variability is well reconstructed as an average over the peak of an ENSO event (top panel), the residual structure after an ENSO event (second panel from top), and precursors to ENSO events (third panel from the top). (Adapted from Vimont, 2005)

convective regions. Uncoupled ocean model simulations with more realistic surface forcing are unable to reproduce the lag-lead relationships between the gyre circulation and the MOC that are found in coupled models, showing instead an in-phase behavior (Deshayes and Frankignoul, submitted). Reconciling different time scales and physical relationships in studies of North Atlantic interdecadal variability will require improved model simulations, better theoretical understanding of western boundary currents, improved observations and assimilation of salinity into ocean reanalyses. In addition, the increased availability and analysis of proxy records is crucial for furthering our understanding of such low frequency variability.

Whatever natural decadal variations do exist will soon be mixed with anthropogenically induced climate variability, if they are not already. As a poignant example of the importance of distinguishing between these two sources of decadal variability, ensemble simulations of Atlantic variability were presented (Figure 4), some of which show large decadal variations. A trajectory that includes a large cooling trend over the next few years (due to natural decadal variations) would likely generate a very different societal response than a trajectory that includes warming over the next few years. This motivates additional understanding of the source of decadal climate variations, regardless of whether these natural variations will ever be predictable.

The Decadal Variability and Prediction Problem

In contrast with the seasonal and interannual prediction problem, the decadal prediction problem is in its infancy. One obstacle in proceeding towards decadal prediction is the difficulty in applying the paradigm of interannual variability and prediction to the decadal variability and prediction problem. On interannual time scales, ENSO provides a very well defined phenomeon that may be understood as the result of a defined mechanism (e.g. delayed oscillator theory, recharge-discharge). Whether intentional or not, interannual prediction developed out of this phenomenon / mechanism paradigm.

In contrast, there does not appear to be so clearly a defined decadal "phenomenon". Large scale patterns, such as the PDO, do not dominate decadal variability to the same degree as ENSO dominates interannual variability, and moreover may represent the superposition and/or convolution of a few mechanisms (e.g., Schneider and Cornuelle 2005; Newman 2007) rather than the result of one identifiable physical process. Furthermore, models are not yet able to consistently reproduce the spatial and temporal structure of decadal variability in the observed

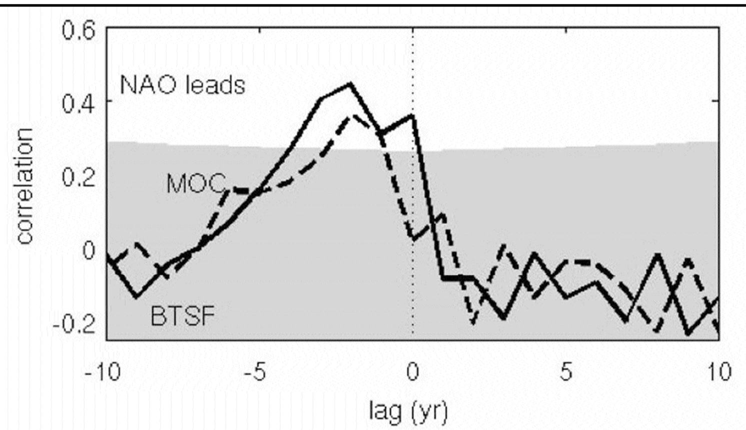

Figure 3. Correlation between the main mode of variability of the barotropic stream function (an intensification of the strength of the subpolar and subtropical gyres), that of the meridional overturning circulation (also an intensification) and the North Atlantic Oscillation in a 50-year hindcast with a North Atlantic model (from Deshayes and Frankignoul, submitted)

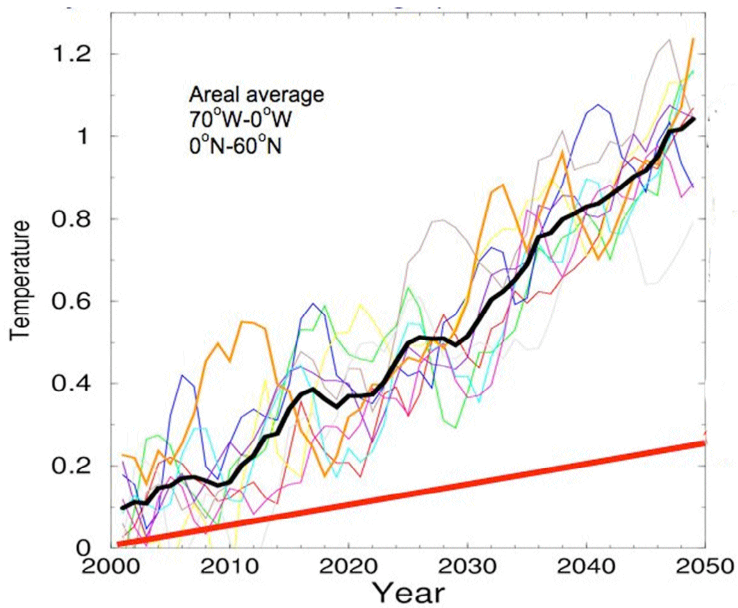

Figure 4. Evolution of annual mean Atlantic SST (averaged over 70W-0W,0N-60N) in an ensemble of simulations using the GFDL CM2.1 coupled model (model described in Delworth et al., 2006). All ensemble members (differing colored lines) are forced with identical changes in radiative forcing using the A1B scenario as used in the recent IPCC AR4 assessment. This scenario includes changes in both aerosols and greenhouse gases. The ensemble members differ only in their initial conditions, which are taken from multiple simulations of the 20th century, ending in 2000. Thus, the ensemble members differ only by virtue of their independent realizations of internal variability. The thick black line represents the ensemble mean. Units are K, and are expressed as the deviations from the simulated mean over the period 1991-2000. Red line is the observed trend from 1950 - 2004.

record, making it difficult to distinguish between various definitions of, or mechanisms responsible for, decadal variability in nature. It is not clear whether the decadal variability and predictability problem can or should be addressed with the phenomenon / mechanism approach, yet a better approach is also not immediately obvious.

Decadal prediction will undoubtedly require a new set of expectations, tools, and deliverables to supplement those currently employed for seasonal to interannual prediction. Some examples include: identification of expectations (from user and science communities) for deliverable decadal predictions, incorporation of boundary forcing (anthropogenic and random) and the "initial value" into prediction experiments, improvements in theory and model simulations of decadal variability, sustained ocean observation systems, improved ocean assimilation, and better quantification of the anthropogenic contribution to decadal variability. In particular, the anthropogenic contribution to decadal variability may have been profound in the past, so that defining natural decadal variability from the short observational record is quite difficult. Yet the current generation of coupled models does not appear to adequately simulate observed decadal variability, likely limiting skill of future decadal projections that must include both anthropogenic and natural components. Understanding how to distinguish between natural and anthropogenic influences upon past and future decadal variability, and how they may interact, is a crucial – and perhaps even the central – problem for decadal prediction.

A Working Group on Decadal Prediction

There is great interest, both in the scientific and user communities, in determining prospects for decadal prediction. Based on this interest, a Working Group on Decadal Predictability in the Pacific (WG) was discussed at the U.S. CLIVAR Summit. Although there was broad support for a WG, it ultimately was not adopted as there was disagreement about its intended scope and objectives. Issues discussed included (these questions may also be addressed by the WG):

- What is a "decadal prediction"?
- Should the WG adopt a Pacific focus (which seemed arbitrary) or a global perspective (which seemed too ambitious)?
- Should the WG focus on phenomena and mechanisms of decadal variability? What other approaches could be taken?
- What specific deliverables would the group propose?

It was agreed that progress toward understanding prospects for decadal prediction would benefit from better understanding of (a) the definition of "decadal prediction", (b) objectives of decadal prediction, and (c) possible directions for determining the feasibility of decadal predictions. It was decided that a meeting should be held to better define the scope and objectives of the working group.

Acknowledgements

Thanks to T. Delworth and C. Frankignoul for their contributions to this summary. Presentations were given by M. Newman, D. Vimont, T. Delworth, and T. Joyce in place of C. Frankignoul.

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U.S. CLIVAR Atlantic Meridional Overturning Circulation Science Team

In January 2007, the US National Science and Technology Council's Joint Subcommittee on Ocean Science and Technology (JSOST) released its Ocean Research Priorities Plan (ORPP - http://ocean.ceq.gov/about/docs/orpp12607.pdf). This plan identified Atlantic Meridional Overturning Circulation (AMOC) and its relationship to sudden climate change as one of four near-term (5 year) research priorities.

Fortunately, within US CLIVAR we have had discussions over the past two years about the potentially important role of Atlantic ocean decadal-scale variability on climate, predictability within the Atlantic basin, and developing experimental prediction capabilities (see Variations V4N3; report from an Atlantic Decadal Variability Workshop, Miami, January 2007 - http://www.usclivar.org/science_status/AMOC/AOML_DecadalWorkshopReport_Final.pdf; and a workshop on an AMOC monitoring system for the South Atlantic, Argentina, March 2007 – report in press).

In response to the ORPP, a US inter-agency group, coordinated through the US CLIVAR Office, established an AMOC Planning Team to develop a 5-yr phased AMOC Implementation Plan addressing relevant goals outlined in the ORPP. This AMOC Planning Team, co-chaired by Drs Susan Lozier (Duke University) and Katherine Kelly (University of Washington), has completed a draft of this Plan (currently in review draft form). This plan should be released by the end of September 2007.

The plan suggests a 5-year activity plan that addresses five key research questions:

- **What is the current state of the AMOC?**
- **How has the AMOC varied in the past on interannual to centennial time scales?**
- **What governs AMOC changes?**
- **Is the AMOC predictable on 10-100 year timescales?**
- **What are the impacts of AMOC variability and change?**

The AMOC Plan also recommends a Science Team (a la NASA) approach be employed to coordinate program activities, address program milestones, and guide program implementation. Coordination with the UK RAPID/RAPID-WATCH, and the developing EU 7th Framework AMOC research activities are a critical and important first-year goal.

The AMOC initiative is the best opportunity for new research funds in some time. The Administration supported the development of the ORPP. Top-down Administration engagement has been excellent. OMB and OSTP are already on-board, and thus the hard part of "selling" an AMOC initiative to senior high-level funding decision-makers has already happened. Another hopeful sign of progress is the recent release of AMOC research announcements for FY08. There are positive indications that agencies will receive some budgetary resources in future years to support the AMOC research initiative.

More details about the AMOC Planning Team, the AMOC Implementation Plan, and linkages to relevant program documents and workshops can be found at:

http://www.usclivar.org/Organization/AMOC_PT.html

Climate Prediction Applications Postdoctoral Program (CPAPP)

– An Experiment in Interfacing Climate and Society

By Lisa Goddard, International Research Institute for Climate;
Kelly Redmond, Desert Research Institute, and
Meg Austin, University Corporation for Atmospheric Research

This program was conceived and developed by the U.S. CLIVAR panel on Predictability, Prediction and Application Interface (PPAI). The mission of the PPAI panel is to encourage improved practices in the provision, validation and use of climate forecast information on sub-seasonal to centennial time scales through broad but coordinated participation within the US and active collaboration with the international climate and climate applications communities.

A primary goal of this panel (http://usclivar.org/Organization/PPAIpanel.html) is, "To enable the use of CLIVAR science for improved decision support". Within this goal, we sought to

- Develop integrated linkages to interdisciplinary programs: NOAA RISA and CPO, IRI, IPCC, CCSP, NASA efforts, NSF NEON / CUAHSI / CLEANR / ORION, Ocean Observing Systems, public entities such as the Western and National Governors Associations (WGA / NGA).
- Promote/support projects that link climate observations, forecasts, and scenarios with resource assessments and forecasts
- Promote sustained interactions with other disciplines and research communities to ensure delivery of "usable science"
- Emphasize spatial and temporal scales of information needed for applications. Contribute support for the development, use, interpretation, and evaluation of tools (e.g. downscaling) employed by applications.

Making progress in interfacing climate science with decision and information systems requires more than just good climate information; it requires a dedicated effort to understanding the problems and possibilities on both sides. To complement strategies tried in the past (hosting meetings of climate scientists and decision makers; trans-disciplinary research), which although useful reach a limited and finite audience, we sought a new approach. The idea was to develop a new population of individuals qualified to work closely with both the climate research and decision making communities, through a targeted and trans-disciplinary postdoctoral program.

Background:

Demand for research and guidance in climate-related risk management and decision-making has increased in recent years. This is due in part to the work of those involved in the NOAA RISA (Regional Integrated Sciences and Assessments) program and to the efforts of a relatively small group of scientists who are working at the interface between climate science and its application. A growing number of people and institutions are emerging to work at this interface, but the demand for these people far exceeds the supply. Demand also stems from constant advances within climate science, including better understanding of predictability, better prediction ability, and higher resolution of prediction products. These scientific advances make sustained efforts at the applications interface all the more imperative, since individuals are needed who understand both climate science and the needs of decision-makers. Increasing interest in communities such as decision support and risk/disaster management makes this an opportune time to launch a postdoctoral program to meet this demand. We see renewed societal interest that provides a broad base from which potential candidates could be recruited. One approach to growing the pool of climate scientists who can work effectively at the boundary between climate and society is to encourage talented recent PhDs with expertise in climate science to work directly with risk management and decision-making institutions affected by climate. This developing body of professionals will be scientifically and technically knowledgeable in the field of climate with an understanding of the needs and issues of decision-makers. All participants will inevitably gain new perspective on the opportunities and limitations of incorporating climate information into decision making. This program offers a process for recruiting and training individuals with a focus on practical experience, and offers the prestige that comes from a participation in a nationally recognized and coordinated program. Clearly, this program will attract individuals who are interested in what is a highly rewarding, but currently a non-standard career in science.

The PPAI panel hopes that this program will yield real progress in bringing research to operations or policy, and establish as direct a connection to actual users of climate information as possible. The program is designed around explicit partnership between a climate research institution (CR partner) and an applications or decision making institution (DM partner). The post-docs will be dual-supervised, working closely with both institutions to bring advances in climate science to bear on the real questions and needs of the DM partner. One of hooks of this program that we felt was essential to the committed participation of the DM partners was that they contribute 50% of the cost of the post-doc, and this is how the program is currently configured. The other 50% will be covered by national funding agencies. As a US CLIVAR initiative, it is envisioned that the program will eventually draw funding from all the major agencies funding basic climate (DOE, NASA, NOAA, and NSF). In this initial pilot phase of the program, NOAA's Climate Program Office (CPO) has committed support to cover 50% of three postdoctoral researchers. Once the program is up and running, additional support will be sought from the other agencies.

NOAA CPO head Chet Koblinsky also requested that a Steering Committee be formed to develop and oversee the program. UCAR is administering the program, and the Committee (Lisa Goddard (IRI), Kelly Redmond (DRI/WRCC), Ben Kirtman (COLA), Eileen Shea (IDEA Center), Ed Sarachik (Univ WA), and Brad Udall (Univ CO & NOAA Western Water) is responsible for scoping the participating partner institutions and funding agencies, vetting the postdoctoral applicant pool, participating in the proposal and progress review process, and promoting the program, as appropriate.

Here is how the CPAPP program currently is envisaged to work. There are two time lines – one for the postdoctoral researchers and one for the institutional partners.

Timeline for Post-docs:

- Mid-to-lateSeptember:

Announcement of opportunity released stating the thematic areas of interest to the currently participating institutions.

- Mid December: Post-doc application due
- Mid January: Applicants notified whether or not to submit more detailed letter of intent. Short-listed candidates receive more detailed information on DM Partners and contact persons at that time.
- Mid March: Coordinated research plan due from short-listed candidates
- Ranking listed institutions (if more than) by post-docs
- Early April: Winners notified
- Post-doctoral appointments to begin NO LATER than beginning October

Timeline for CR and DM institutional partners:

- Mid January: Announcement of opportunity released for recruiting next round of CR and DM Partners
- Early July: Joint 2-page statement of intent due to Steering Committee
- Early August: Steering Committee review of 2-page statements
- Early September: Determination of institutional partners that will participate in post-doc AO released that mid-to-late September.

Many interested parties will be watching to see how this program unfolds, and the Steering Committee will be carefully noting where the program can be improved as it moves forward. We are extremely interested in growing this program and possibly developing a parallel branch that could extend to international interests, particularly serving developing countries. In this case, the funding might come from national or regional agencies in addition to NGOs, bilateral or multi-lateral development agencies and even private interests.

For more information on this program, please watch for the upcoming announcements, or contact one of the authors of this report.

Decadal Changes Evident from CLIVAR Repeat Hydrography Section I9N:

More Women Oceanographers at Sea!

By Janet Sprintall, Scripps Institution of Oceanography and Sabine Mecking, Applied Physics Laboratory, University of Washington

On 22 March 2007 at 1600 local time the R/V Roger Revelle departed Fremantle, Western Australia to begin sampling along 95°E in the Indian Ocean on CLIVAR/CO2 cruise I9N. This cruise was part of the NSF/NOAA supported U.S. Global Ocean Carbon and Repeat Hydrography Program which focuses on the need to monitor inventories of CO2, heat, freshwater and their transports in the ocean using baseline observational fields measured during WOCE. Our surface-to-bottom station sampling included a host of carbon-related parameters, as well as temperature, salinity, dissolved oxygen, nutrients, velocity, chlorofluorocarbons, helium, tritium, trace metals, and several types of biological samples. The measurements reveal the changing patterns in these parameters since the last occupation of the I9N transect in 1995 during WOCE. Hopefully this will provide us with a better understanding of the ocean's role in climate variability and the uptake of anthropogenic CO2.

Apart from the changes in ocean properties, our 2007 cruise also provided evidence of another significant change that seemed to have taken place since WOCE I9N: more female participants at sea! We do not have the information on hand to determine whether this "decadal change" is an across-the-board difference between the WOCE occupations and the CLIVAR/CO2 repeat lines. But at least for the I9N transect, only five women made up the 26 member science party in 1995, while in 2007, half (16) of the 32 member science party in addition to the Revelle's Second Mate, were all female. On the 2007 CLIVAR/CO2 I9N cruise, the women participants were quite a diverse group. We came from many different institutions all over the United States, were at different stages of our career paths, and covered many different jobs. Our at-sea functions included chief and co-chief scientists (the authors of this article), hydrographic data management, technical and sampling support as well as analyses of the samples taken. Our present at-home careers include physical and chemical oceanography, marine technical support, post-doctoral fellows, graduate or undergraduate student and even entomology.

For a few of the women it was their first experience on a scientific research cruise. Among those of us who had prior sea-going experience, none of us remember ever having sailed with such a strong female contingent before. Some of us remember not too long ago at the beginning of our oceanographic careers, being one of only two women on board ship. In those days, when women were "allowed" on board it was always in pairs, supposedly so as not to waste the shared two-bunk cabin space. In fact, in the very early years of observational oceanography, one often cited impediment to having any women on board was the lack of "facilities". The implication was that a bathroom would have to be dedicated solely to female use, as unlike at home, it was proposed that women could not possibly share "heads" with men. In those days, it was also not uncommon to be lectured about the need for "appropriate" behavior and dress-code at sea. Thankfully, times change. While it is true that the standard protocol for single-sex sharing of the two-bunk cabin arrangement was followed aboard the R/V Revelle, both male and female participants shared the same heads at least in the common areas of the vessel without problem. Indeed this was almost a necessity so as not to disturb a possibly sleeping cabin-mate who may have been standing an opposite watch. As to changing on-board behavioral conduct, we feel that this was pretty much a non-issue during our cruise, just as it has been on many other cruises in the past. Furthermore the high percentage of women that made up the science party probably helped facilitate the ease of conduct on board. The presence of a woman during the six-week cruise just was not unusual, whether it was in tee-shirt and shorts during those hot halcyon days crossing the equator, or in full rain gear and orange life-vest when deploying the rosette on a cold, wet and windy 2 a.m. station in the subtropics!

Back row (left to right): Elisa Wallner (UCSB); Mary Johnson (ODF/SIO); Kristin Sanborn (ODF/SIO); Janet Sprintall (SIO); Kyla Drushka (SIO); Mareva Chansen (RSMAS); Nancy Williams (Umiami); Kati Gosnell (FSU); Suzanne Rab Green (LDEO); Chantal Swan (UCSB)
Front Row (left to right): Melissa (R/V Revelle); Sabine Mecking (UW); Debra Tillinger (LDEO); Mindy Kelley (ODF/SIO); Mariko Hatta (UH); Sue Reynolds (ODF/SIO); Erica Key (RSMAS)

In fact, the gender balance during our cruise was probably fairly similar to what it is in our workplaces at home whether it be at a university, laboratory or other facility. Just as happens back at our normal workplaces, men and women cruise participants interacted on both a social and a professional level to help get the job done. Whether the job be recovering the CTD package; the seemingly endless sampling of the Niskin bottles around the rosette; analyzing the water samples; helping King Neptune welcome the uninitiated pollywogs into his realm during the equator crossing ceremony; or just hanging out shooting the breeze on the aft deck watching the fabulous sunsets and sunrises, both men and women science members participated equally and equally well! Not only was our I9N cruise a scientific achievement in completing our sampling plan of 111 surface-to-bottom stations, but also Captain Dave Murline and the science and crew members alike, commented on how enjoyable the cruise was and specifically related this to the more balanced number of men and women scientists. A successful cruise from all angles!

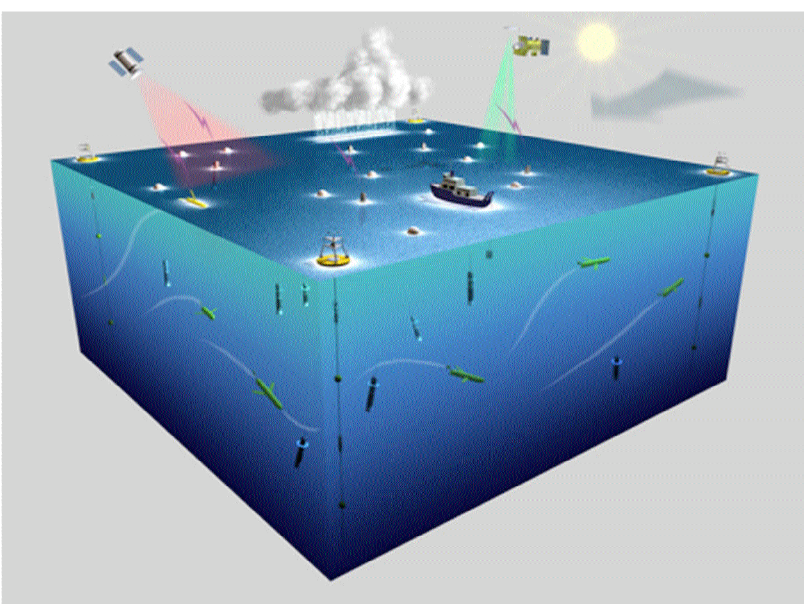
The number of women science party members on our cruise hopefully reflects a growing interest by women in the observational aspect of oceanography. One learns a lot of oceanography by going to sea that sometimes just cannot be gained from books or lectures. More than just learning the need for designing specific experimental plans to capture specific oceanographic phenomena, or acquiring the feel for the limitations of instrumental measurements, or coping with the improvisations needed for weather or other interruptions to the cruise schedule, one gains an almost visual perspective of the data collected that helps with the interpretation and analysis of that same data when back in the office. At sea, it is almost a magical occurrence watching the ocean properties take shape and change in their vertical and horizontal extent as they are measured directly under your feet, so to speak. Furthermore, the intensity and the sense of community that develops at sea resulting from the shared experience is not as easily or so quickly replicated in the home office environment. By necessity, scientific conversations frequently develop among students, technicians and senior personnel about the interpretation of the measurements being collected. Ship-board life lends itself as a natural environment for the mentoring of young oceanographers, forging relationships that often continue long after the cruise has finished. Obviously these unique advantages of the sea-going experience are not gender specific – they are beneficial to both men and women oceanographers alike.

U.S. CLIVAR Salinity Working Group Report Issued

Salinity has long been recognized as an indicator of the strength of the hydrologic cycle. The salinity differences created by evaporation and precipitation in different areas are large enough to lead to significant density variations, often as large as or larger than the density differences due to temperature contrasts. Thus, salinity has important dynamical consequences for oceanic currents and mixing processes that directly impact the ocean's ability to absorb, transport and store heat, freshwater and carbon dioxide. Many of these processes are not yet represented in climate models. The need to understand the role of salinity in the modulation of upper-ocean mixing in both tropical and high-latitude regions is increasingly recognized. Models suggest that expanded monitoring of salinity will improve climate forecasts on inter-annual to decadal timescales. Similarly, there is an opportunity to use the expanding network of salinity measurements to improve our understanding of the role of the global water cycle in the climate system. Since most of the water cycle occurs over the oceans, this is an extremely important knowledge gap to be filled by the oceanographic community.

As part of their activities, the U.S. CLIVAR Salinity Working Group organized a special session at the 2006 Ocean Sciences meeting followed by an international workshop at Woods Hole in May 2006. A report of the summary of the findings and recommendations arising from these activities was published on 5 July 2007.

The report reviews observed salinity variations by region and their relation to other climate trends. A highlight of this summary is the striking evidence for decreasing salinity in the subpolar North Atlantic as well as in the southern polar ocean on decadal timescales. In contrast, near surface salinity in the subtropics has been increasing, providing the best available evidence for a changing water cycle. Superimposed on these long term trends are considerable variability, some of which at least is related to changes in surface meteorology. The report briefly describes modeling activities, and then reviews the current observing systems. The report concludes with recommendations for enhancements to the observing system.



Schematic showing floats, drifters, gliders, moorings, ships and satellites sampling a volume of ocean in sufficient density to constrain the upper ocean salinity budget and thus the surface freshwater flux. Gliders patrol the boundaries, floats and drifters monitor the interior and flux buoys and satellites assess air-sea interactions and ocean conditions. [U.S. CLIVAR Salinity Working Group Report]

Recommendations:

In response to limitations of the historical observing system we support the maintenance and expansion of the current in situ observing system, especially Argo and the Volunteer Observing Ship thermosalinographs. We recommend

Calendar of CLIVAR and CLIVAR-related meetings

Further details are available on the U.S. CLIVAR and International CLIVAR web sites: www.usclivar.org and www.clivar.org

CLIVAR SSG-15
11-14 September 2007
Geneva, Switzerland
Attendance: Invited
Contact: http://www.clivar.org

International Council for the Exploration of the Seas Annual Science Conference
17-21 September 2007
Helsinki, Finland
Attendance: Open
Contact:
http://www.ices.dk/iceswork/asc/2007/index.asp

AMS Conference on Satellite Meteorology and Oceanography and Ocean Vector Winds Science Team
24-28 September 2007
Amsterdam, Netherlands
Attendance: Open
Contact: http://www.conferences.eumetsat.int

2nd CLIVAR/GODAE Meeting on Ocean Synthesis Evaluation
24-25 September 2007
Cambridge, Massachusetts
Attendance: Invited
Contact: http://www.clivar.org

NOAA Climate Diagnostics and Prediction Workshop
22-26 October 2007
Tallahasee, Florida
Attendance: Open
Contact: http://www.cpc.ncep.noaa.gov

Climate Information: Responding to User Needs
22-23 October 2007
College Park, Maryland
Attendance: Open
Contact:
http:/www.climateneeds.umd.edu

PICES 16th Annual Meeting: The Changing North Pacific: Previous patterns, future projections and ecosystem impacts
26 October - 5 November 2007
Victoria, British Columbia
Attendance: Open
Contact: http://www.pices.int/meetings

U.S. CLIVAR MJO Workshop
5-7 November 2007
Irvin, California
Attendance: Limited
Contact: http://www.usclivar.org

GODAE-OOPC Meeting on Observing System Evaluation and Observing System Simulation Experiments
5-7 November 2007
Paris, France
Attendance:Open
Contact: http://www.ioc-goos.org

CLIVAR Workshop on Western Tropical Pacific: Hatchery for ENSO and Global Teleconnections
26-29 November 2007
Guangzhou, China
Attendance: Limited
Contact: http://www.clivar.org

CLIVAR Pacific Panel Meeting
29-30 November 2007
China
Attendance: Invited
Contact: http://www.clivar.org

2nd International AMMA Confernce joint with AMM-OCEAN/TACE/PIRATA meeting
26-30 November 2007
Karlsruhe-Leopoldshafen, Germany
Attendance: Open
Contact: http://www.amma-international.org/

CLIVAR Global Synthesis and Observations Panel Velocity workshop
5-6 December 2007
La Jolla, California
Attendance: Invited
Contact: http://www.clivar.org/organization/gsop/velocity/velocity.php

AGU Fall Meeting
10-14 December 2007
San Francisco, California
Attendance: Open
Contact: http://www.agu.org

The Monsoon System: Prediction of Change and Variability
2-12 January 2008
Honolulu, Hawaii
Attendance: Open
Contact: http://www.start.org

AMS Annual Meeting
20-24 January 2008
New Orleans, Louisiana
Attendance: Open
Contact: http://www.ametsoc.org

3rd Reanaylsis Conference
28-30 January 2008
Tokyo, Japan
Attendance: Open
Contact:
http://www.jra.kishou.go.jp/3rac_en.html

2008 Ocean Sciences Meeting
3-7 March 2008
Orlando, Florida
Attendance: Open
Contact: http://www.aslo.org

enhancements to the global observing system specifically directed towards improved estimation of sea surface salinity:

• Expand the Argo instrument suite to include Surface Argo Salinity Measurements (Upper 5-m sensor) to allow a more precise calibration of AQUARIUS.

• Support development and testing of sea surface salinity sensors for deployment on the surface drifters of the Global Drifter Program.

The research reviewed in this report highlights the importance of accurate estimation of salt transport across key passages. Current technology based on CTD sections or innovative combinations of glider and mooring technology may be developed for this task, perhaps as part of a comprehensive program to monitor other parameters such as carbon transport.

The launch of AQUARIUS SAC/D, as well as improvements meteorological observing systems and models, offers the scientific community a unique opportunity to step beyond monitoring and to attempt to constrain the complete surface atmosphere/ocean hydrologic cycle based on observations. We propose a control-volume-type process experiment in which a volume of the upper ocean would be closely monitored in a defined geographic region, as illustrated in the figure on the previous page. Within this control volume a complementary suite of observing systems would be used to constrain the storage of freshwater and heat as well as the fluxes across the boundaries. A complementary modeling activity should provide the most rigorous test to date of the way in which our climate models handle hydrologic processes. Two types of oceanic regimes would be of interest for the geographic location of such an experiment. An evaporative subtropical gyre is of interest because precipitation, salt advection and eddy activity are weak, water properties are set for incorporation into the thermocline, and our observing systems and models are best able to quantitatively constrain the water cycle. Conversely, an experiment in a high precipitation tropical regime could potentially aid directly in improvement of seasonal to interannual forecasting.

Improved in situ monitoring and remote sensing capabilities for salinity have provided this generation with an opportunity to contribute significantly to understanding of the role of the ocean in the both the global water cycle and in climate system dynamics. The Salinity Working Group hopes that this report provides some motivation to exploit this opportunity.

The full report of the U.S. CLIVAR Salinity Working Group can be found online at: http://www.usclivar.org/Organization/SalinityWG.html.

Open Call for U.S. CLIVAR Panel Nominations

The U.S. CLIVAR program on Climate Variability and Predictability (http://www.usclivar.org) seeks qualified individuals to serve on its Panels. These Panels formulate goals and required strategies, catalyze and coordinate activities, and work with agencies and international partners to advance the progress of the climate research community, particularly with regard to addressing relevant goals of the US Climate Change Science Program, CLIVAR, and the World Climate Research Programme (WCRP). Qualified nominees are expected to represent the broader interests of the research community, be willing and able to engage in scientific as well as programmatic discussions leading to Panel activities, and work with other members of the CLIVAR organization.

Nominations are sought for three Panels: 1) Predictability, Prediction and Applications Interface Panel (PPAI), 2) Process Study Model Improvement Panel (PSMI), and 3) Phenomena, Observations and Synthesis Panel (POS). These panels each aid in developing and coordinating climate research plans and activities and also providing feedback to agency implementation. Further information and terms of reference for each of these panels can be found at www.usclivar.org/Organization.html. Each panel is seeking members to enhance their current expertise. The PPAI Panel hopes to expand their expertise and connect more strongly to applications of climate information and forecasts. The PSMI Panel is specifically looking for members with oceanic and atmospheric field programs and those with experience in climate model development and use. Finally, the POS Panel is seeking those with land surface processes experience and those with knowledge of large-scale atmospheric processes.

Panel members are expected to attend the annual U.S. CLIVAR Summit. The 2008 Summit will be held in mid-July at a location to be determined. Additional meetings are possible; however, most Panel activity is carried out through email and teleconferences. Members generally serve terms of 2-3 years.

To nominate (self nominations are welcome) and be considered for Panel membership, please submit the following:

- 2-page vitae noting the most relevant publications
- A paragraph describing qualifications, research interests, and the Panel of interest

Materials should be sent electronically to the U.S. CLIVAR Office (usco@usclivar.org) noting "Nomination" in the subject heading. The deadline for submission is 1 November 2007. The U.S. CLIVAR Committee, in consultation with agency representatives, will review applications. Accepted applicants will be notified by 10 January 2008.

Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES)

The goal of the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES), a joint project between the United States and the United Kingdom, is to develop better understanding of mixing in the Antarctic Circumpolar Current (ACC). Mixing appears critical to the dynamics of the global meridional overturning circulation (MOC). The Southern Ocean component of the MOC is particularly relevant for climate, because the Southern Ocean has been identified as a likely region of rapid climate change both in observations and in model predictions of anthropogenic climate change. Currently, the lack of extensive in situ observations of Southern Ocean mixing processes has made evaluation of mixing somewhat difficult.

The field phase of DIMES will take place in 2008/2009 and consists of a number of different activities including:

- Tracer release;
- Microstructure and Finestructure measurements;
- Isopycnal following RAFOS floats;
- Drake Passage mooring array;
- Analysis of POP and OCCAM model output;
- Hydrography, inverse modeling, and Bernoulli inverse;
- Analysis of satellite altimetry.

Additional information on DIMES can be found at: http://dimes.ucsd.edu/index.html.

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Subscription requests, and changes of address should be sent to the attention of the U.S. CLIVAR Office (cstephens@usclivar.org)

WCRP
World Climate Research Programme

U.S. CLIVAR contributes to the CLIVAR Program and is a member of the World Climate Research Programme