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Report of the First CLIVAR Data Planning Meeting, focussing on Ocean Observations

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The First CLIVAR Data Planning Meeting, focussing on Ocean Observations

Summary of Actions

1) *CLIVAR requirements and CLIVAR data:*

- 1) ACTION: Reanalysis workshop organizers should consider inviting relevant DAC reps. (GSOP)
- 2) ACTION: DACS are encouraged to regularly post on their websites reports on availability of new and revised data at intervals (e.g. monthly, quarterly) consistent with the processing and posting of data (**DACs**).
- 3) ACTION: Collectively, the DACs must help the Panels and GSOP draft a requirements document for CLIVAR data management activities. It was recommended that a template should be developed by the DACs specifying what information they need from the Panels and the CLIVAR GSOP (David and Katy will initiate discussion over email by end of April - Gary Meyers will act as a sounding board for the final drafts. Katy will collate information). With the aim of completing a requirements document by the end of 2004 – Howard and David will discuss a strategy to engage the panels (**Legler, Hill/ICPO**)
- 4) ACTION: Basin panels (SO to start) will be asked to identify what observations are being taken in regional process studies as well as what moorings are currently of benefit to CLIVAR and identify what specific observations are being taken, where data are going, how data can be accessed, and points of contact for the data. The ICPO and DL's will develop strawman tables from basin observation pages and other sources of information. The DL's will coordinate completion of tables with panels – ICPO to then disseminate to DACs (**ICPO and DL's**)

2 & 3 *Tracking CLIVAR Data*

- 5) ACTION: Write a justification to JCOMMOPS (and also to POGO, and funding agencies) on the importance of research vessel T and S profile observations for Argo and for ocean reanalysis activities, proposing JCOMMOPS begin to track these data. (**John Gould, Dean Roemmich on benefits to Argo; Shawn Smith on importance of underway data.**)
- 6) ACTION: Develop requirements for a DIU function (GSOP and basin panels): Not all data important for CLIVAR is currently tracked, especially observations taken between the end of WOCE (2002) and now (mid-2004). Observations in the period and those observations being planned (especially those that will not be tracked by the proposed new function of JCOMMOPS), need to be tracked to insure these data reach designated DACs and are accessible to CLIVAR. An assessment of the manpower needed and resources available to track these data is needed (**ICPO**)

4) *Integration across Data Streams*

- 7) ACTION: To ensure accessibility, all DACs are encouraged to set up OpenDAP, Ftp, and LAS servers (**DACs – Bindoff to Consult**).
- 8) ACTION: It was recommended that DACS should provide to GODAE suitable delayed mode QC procedures that could be automated to allow GODAE to implement and test them in real-time data processing (**DACS, Cummings/GODAE**).
- 9) ACTION: A pilot project for integration was suggested by Bob Keeley –Profile DACs to discuss making data available through OPeNDAP, using Thredds to integrate metadata, and serve integrated data on GODAE Server (**Bindoff, Keeley, Cummings/GODAE**)
- 10) ACTION: SSS DAC, Surface Met DAC, and ADCP DAC to compare their needs and pursue further integration and cross referencing (**Smith, Keeley, Caldwell**)
- 11) ACTION: It was suggested that DACs brand their websites with CLIVAR, clarify mandates and improve cross links between websites and check to insure the CLIVAR Data pages (<http://www.clivar.org/data/>) have direct links to all data (**DACs, Hill/ICPO**).

5) *P.I's (Institutions?) not willing to give up their Data*

- 12) ACTION: Write a framework for a statement on importance of making data available and communicate to specific groups (**Gould**)

6) *Products and Value Added Summaries*

- 13) ACTION: It was pointed out that compiling and QC'ing historical data will be a critical precursor for an ocean reanalysis. QC needs to be applied consistently and globally, for example, WOCE

data sets were inconsistent across basins and the Levitus data has problems too. This was flagged as an issue the reanalysis workshop should address (**co-chairs to communicate to workshop organizers**).

- 14) ACTION: Because of their intrinsic value to the climate community and to the ARGO team, historical PALACE float data (available on the WOCE V3 DVD) should undergo ARGO QC (**Co-Chairs to recommend this Action to GSOP**)
- 15) ACTION: The workshop welcomed news that the INCOIS/INGOOS Secretariat office (and APDRC?) may be able to help meet some of CLIVAR's data needs. Gary Meyers (and Wenju Cai?) and to indicate that CLIVAR would like to discuss this issue further, especially meeting the needs of the India ocean/ Pacific sector (**Meyers, Cai**)

7) *DAC Specific Issues*

- 16) ACTION: The WHP Methods and Practices manual needs revising to encourage submission of accurate CLIVAR CTD data in an easier to manage data format (**WHPO to consider**)
- 17) ACTION: The drifter DACs indicated that the Japanese have stopped sending drifting buoy data since WOCE ended. The workshop recommends the SSG consider contacting appropriate Japanese officials to encourage release of these data. (**Mayra to clarify the issue and identify appropriate Japanese officials**). (**Pazos, SSG**)
- 18) ACTION: The workshop recommended the Mooring DAC consider a broad remit and accommodate all measurements (including sediment traps, microcats, etc.) associated with CLIVAR moorings. Data Liaisons to provide guidance on process studies and mooring activities to be managed (**Mowat/ Moored CM DAC, Data Liaisons**).
- 19) ACTION: The Mooring DAC (BODC) should establish linkages with the Time Series Data Management team as well with others (i.e. PMEL) handling the sustained TAO-Triton and PIRATA mooring data to work together on integration issues (**Mowat/Moored CM DAC, ICPO**).
- 20) ACTION: The sea-level DACs will include on their home pages a more straightforward introduction to the differences between their two DACs and to the Permanent Service for Mean Sea Level. Additionally, some broken links were noted on the sites. (**Bradshaw, Kilonsky/Sea Level DACs**)
- 21) ACTION: The sea level DACs will indicate data from GPS-equipped sites on their websites (**Bradshaw, Kilonsky/Sea Level DACs**).

Follow-up Meetings / Reporting

- 22) ACTION: It was recommended that there be 1-2 representatives from the DPM1 meeting attend the GSOP Panel Meeting to present the DPM1 findings. (**co-chairs to resolve**)
- 23) ACTION: It was agreed that any further coordinated efforts tracking CLIVAR data, assessing the progress of DACs, and integrating data important for CLIVAR, would require the managers of the CLIVAR DACs to meet. Thus it was recommended this group (plus a few others that were not invited to this meeting) meet on a regular basis (15-mon?) to pursue these issues (**Co-Chairs to approach SSG**).

Introduction

Welcome and Local Arrangements

The meeting was held at Scripps Institute of Oceanography from the 24-26th March 2004 and was co-chaired by the director of US CLIVAR, Dr. David Legler, and the co-chair of the CLIVAR Global Synthesis and Observations Panel (GSOP), Dr. Dean Roemmich. Dr. Roemmich and local host Dr. Jim Swift opened the meeting at 9am on 24th March 2004, by welcoming the attendees to Scripps and outlining local arrangements.

SESSION I. CLIVAR Requirements

1. Introduction to CLIVAR Data Management

1.1. Overview of Data Management needs in CLIVAR

To set the scene, the director of the International CLIVAR project office, Dr Howard Cattle, presented an overview of CLIVAR, as well as a background to the data and information management issues of CLIVAR. A summary report can be found in appendix 1.1. In his talk, Dr. Cattle highlighted the difficulties in identifying CLIVAR “owned” and CLIVAR “relevant” datasets, categories of CLIVAR data that had been distinguished in the CLIVAR implementation plan. However, in the following discussions, it was suggested that a better approach would be to identify “key” data sets, i.e. data of central importance to CLIVAR, and “relevant” datasets, other data which CLIVAR would like access to. This would help CLIVAR identify its priorities in terms of data management.

Problems may arise with the key data sets that CLIVAR has no control or influence over – therefore key datasets should be identified by the CLIVAR science panels as a matter of urgency. For instance, atmospheric reanalyses should be identified as key CLIVAR data rather than CLIVAR related data. However, there are variables which CLIVAR feels should be included in available reanalysis datasets and aren't. CLIVAR should articulate its needs in this area and actively push for them to be included. The Data Liaisons clearly have a role in articulating the needs of their respective panels, which the IPO can then communicate to the relevant groups.

There is also an issue of CLIVAR's identity at a regional level – there are many national level activities that are not recognised (stamped) as CLIVAR activities. The basin panels have been encouraging representatives from nations who are active in that region to submit a report on what they feel are the national contributions to the CLIVAR program.

1.2. Overview of meeting Objectives

Dr. Legler outlined the objectives of the meeting as:

- 1) Articulate the needs/requirements of CLIVAR science for provision of ocean observation data (what, when, and how observations data should be provided?).
- 2) Assess current status of CLIVAR DACs and their data management activities through input from DAC representatives.
- 3) Provide an overview of other plans and developing activities that can contribute towards meeting CLIVAR's needs.
- 4) Identify gaps between capabilities and abilities of existing data structures (DACs) to meet CLIVAR science requirements. What follow-up activities can be undertaken to address these gaps?

To articulate CLIVAR's needs, input to the meeting was sought from representatives from the CLIVAR regional panels as well as some from the synthesis and ocean prediction communities (see appendix 2). Conversely, CLIVAR needs to know what data are the DACs collecting and what guidance they need from the CLIVAR community. In addition, an overview of how and when they make data available (i.e. Formats, timeframes for real-time and delayed mode data availability), as well as overlaps with other efforts, and the status on development of systems to meet CLIVAR needs was requested prior to the meeting (see appendix 4).

More specifically, it was hoped that this meeting would provide specific requirements with regards to variables and information of interest, provision of data (content, organization, timeliness, etc) and identification of areas where current data management activities are falling short. Conversely, an updated description of data collected (and not collected), and data management activities is needed as well as an identification of issues that prevent the CLIVAR DACs from providing the required data and information. From this, plans for CLIVAR data management activities should be developed that will complement and not duplicate other activities and specific follow-up activities should be identified that can and should be undertaken to address CLIVAR data needs.

1.3. Progress and developments in Data Management

Dr Legler then provided some background, outlining relevant activities in the run up to this meeting.

First, to put the meeting into context, the successes of the WOCE Data System were outlined. These included:

- 1) 2-DVD set of all WOCE and other relevant physical ocean data
- 2) Online data retrieval of all WOCE data
- 3) Developed and utilized a uniform data model as well as standards and conventions for data and metadata across all data streams
- 4) Improved QC practices and their documentation across all major data streams
- 5) Standardized reporting practices

This has to be seen in the context of CLIVAR. CLIVAR is driven by scientific and monitoring requirements (e.g. prediction, detection, synthesis, understanding) of the climate system. This mandate is broader and far less defined than that of WOCE.

There have been innumerable delays in initiating a data management focus within CLIVAR. While CLIVAR's data and information requirements are significant as well as diverse, for now the focus should be where CLIVAR can make an impact and with limited resources, i.e. ocean observations, and we need to ensure that the observational data is accessible. Ultimately, CLIVAR can be a strong advocate and engage in the development of an ocean data management system that meets the needs of climate science, including providing the necessary products. No other group will develop an ocean data management system for climate research.

Recent events leading up to this meeting include:

- 2002: WOCE DACs were designated as CLIVAR DACs through 12/05, new DACs added to fill gaps
- 2003: CLIVAR SSG agreed to form a Global Synthesis and Observations Panel (GSOP), whose charge includes issues of data management
- 2004: GSOP formed

In terms of data management support efforts, there are many activities that CLIVAR could utilize. Unlike the situation with WOCE, CLIVAR does not have a leading role in the planning and development of data management activities. Advances in technology are enabling new capabilities. US-IOOS, GODAE, ARGO, IODE, JCOMM, OTI, and many others are all now contributing plans, ideas, pilot projects etc for management of ocean observations (see session 3). There is no sense (and no resource) for CLIVAR to reinvent the wheel; however, there is a need to carefully assess the efforts in progress and work closely with and in partnership with other efforts and where it is prudent to do so, while focussing on critical tasks. Finally, there is a need for CLIVAR to identify follow-on Actions, pilot projects, and activities that will improve the ability of the evolving ocean data management system to meet its needs.

Other issues and questions that need to be addressed include:

- 1) What is the CLIVAR vision of an end-to-end data system (data and info collection/assembly through data search & provision)?
- 2) What organizational infrastructure is required to meet this need?
- 3) How are DACs (in their current form) meeting the needs of CLIVAR? What more does CLIVAR need (e.g. regional data/product servers or Data Information Units (DIUs))?
- 4) What mechanisms and/or groups will organize and coordinate activities that follow this meeting?

Co-Chair Dr. Dean Roemmich emphasised that the meeting will be providing input to the GSOP panel. He therefore expected the outcomes to include the identification of elements of the ocean data management system which is working well, and which data are in danger and therefore need attention.

1.4. Overview of the WOCE DAC system and challenges for CLIVAR

Dr John Gould former director of both WOCE and CLIVAR, gave an overview of WOCE and the WOCE DAC system and the different challenges that CLIVAR faces. He began by emphasising that WOCE was much simpler as it was an ocean only project. It also had the luxury of a detailed implementation plan, something that CLIVAR doesn't have. Successful data tracking was achieved through the DIU also a resource that CLIVAR doesn't have. Dr. Jim Crease ran the DIU at the University of Delaware. In addition to this, Dr. Bert Thompson took on the role of Data Coordinator.

The role of the DIU was set out in the WOCE Implementation plan:

"3.7 Data Information Unit

Objectives

(1) *To disseminate, as available, summaries of the progress of WOCE and of the data products from data assembly and analysis centres and from other relevant centres.*

(2) *To maintain a record of the disposition and availability of data sets collected as part of WOCE or which are directly relevant to WOCE goals.*

This implementation plan calls for the establishment of a number of WOCE data centres. Data will become available from them at widely varying times. These times will be, in part, dependent on the internal priorities of individual national and multi-national projects in WOCE and partly on the nature of the specific data. The Data Information Unit, by maintaining effective contact with these centres and with national projects, will summarize and post in catalogues the progress of the data acquisition and analysis. It will also maintain a bibliography of WOCE related documents. The catalogues will be on-line and will indicate the simplest way of accessing the data.

(3) *To maintain summaries of WOCE projects, and related projects including their aims, participating scientists, expected data types and volumes, and a bibliography of the experiment.*

(4) *To document the standards and procedures as agreed by the SSG and its working groups. As in previous large field experiments (e.g. MODE, GATE, JASIN), during the course of the planning there will be recommendations on the preferred ways to carry out operations to achieve common and high standards in sampling and data processing. The prolonged duration of WOCE relative to past programmes implies that there will be a considerable evolution of agreements on the way to carry out the work. There will be a need for easily accessible statements of the up-to-date position.*

(5) *To disseminate intended cruise tracks and programmes well in advance the object being to permit maximum use of available ship time and to set up useful intercalibration studies between different groups.*

(6) *To set up and maintain a directory of WOCE participants, working groups, etc. including, for example, addresses, mailboxes, telephone numbers, in order to facilitate communications in WOCE."*

(Extract from the WOCE Implementation Plan, Vol 1 section 3.7)

During WOCE the focus was primarily on delayed mode as the objective was completeness and quality – timeliness was a secondary objective. CLIVAR on the other hand has increasing demands for real-time data. However, with these new demands, CLIVAR also has new resources available. In particular, at the beginning of WOCE, the Internet was not available. If one weakness of WOCE could be identified, it would be integration. Data streams were only integrated right at the end of WOCE, which turned out to be a mammoth task. CLIVAR needs to address this at a much earlier stage, and the technology and expertise is now available to aid this effort.

Another challenge is the tracking of data. This is currently limited and fragmented. Dedicated resources are needed, and panels need to identify their requirements. CLIVAR implementation is regionally focussed and GSOP will hopefully play a role in integrating across panels and supporting these activities.

In terms of the retrieval and assembly of data, WOCE had a very defined definition of what success was, and there was a certain amount of accountability – in particular to the DIU. With CLIVAR, it is very

difficult to measure success if you do not have any objectives. CLIVAR has science objectives, but has not defined any deliverables. This could be done quite easily i.e. Decadal variability – needs to be broken down into data requirements.

Dr Jim Swift continued where Dr Gould left off, outlining the strengths and weaknesses of WOCE from a DAC viewpoint and the WOCE-CLIVAR transition (see appendix 1.3). The WOCE Hydrographic Project Office (WHPO) is transitioning into the CLIVAR Carbon Hydrographic Data Office (CCHDO). Activities at the CCHDO have continued along lines of the guidance they received at the last WOCE Data Products Committee, and feel that the need guidance from CLIVAR on priorities. A key challenge for GSOP would be to assess how well the DACs are working. For instance, CCHDO are unsure whether they are expected to collect all international CTD data, or simply that which is CLIVAR sanctioned? At the moment, they are only collecting some US and international data.

Moving on to the way WOCE DACs worked, Dr Swift emphasised that scientific oversight was crucial in getting funds for the DAC activities. As WOCE evolved, new technology gave us new measurements, some of which were never managed. These include Lowered ADCP data, and Palace floats.

During the discussions, there was a clear message that WOCE succeeded because there was a clear link between the science and the data management. CLIVAR needs to ensure that the DACs get the guidance they need from the CLIVAR science panels to help them set priorities.

2. The CLIVAR Basin Panels.

To help articulate CLIVAR requirements, presentations were made by the data liaisons of the CLIVAR Basin panels. These were Dr. Peter Koltermann representing the Atlantic panel, Dr Gary Meyers representing the Indian Ocean Panel, Dr Wenju Cai representing the Pacific Panel, and Dr Nathan Bindoff standing in for the data liaisons of the Southern Ocean panel who were unavailable at the time of the meeting. Reports of their input to the meeting can be found in appendix 2. Presentations were also received from Dr Detlef Stammer, co-chair of the CLIVAR GSOP panel who outlined the requirements of the ocean reanalysis community and Dr Jim Cummings on real time ocean forecasting (see appendix 3).

The representatives were asked to answer the following questions in their reports to the meeting, and highlight the specific issues as part of their presentation:

1. What are your requirements for real-time and delayed-mode (define your time scales) management of ocean data?
2. What data streams are most important? What types of data quality information are of value?
3. How much of the data you depend on comes from non-CLIVAR funded activities?
4. To what extent are your data management needs being/not being met, and what are your highest priorities for enhancements or changes to the data management system ?

2.1 The CLIVAR Atlantic Panel

Before answering the questions set, Dr Peter Koltermann outlined the main components of the Atlantic sustained observing system, and their status (see report in appendix 2.1). In particular, the Pirata array, complimented by other mooring arrays to measure transport in key regions of the Atlantic basin and as well as air sea flux moorings. Dr Koltermann also showed maps of the XBT network, Sea level stations, and planned repeat Carbon/Hydrographic cruises.

Dr Koltermann reinforced the point that CLIVAR is lagging behind on setting its requirements. For instance, the International Ocean Carbon Coordination Project (IOCCP) has clear guidelines, recommending that carbon/hydrographic section be repeated every 7-10 years, but for CLIVAR's needs, these sections should be repeated every 2-3. This is one instance where carbon requirements differ from the hydrographic requirements. This needs to be articulated as funders will be getting mixed signals.

In discussion, Dr Roemmich felt that perhaps only 50% of hydrographic lines were represented on the Carbon-Hydrographic sections map. Other cruises may not be full depth or eddy resolving, but still of interest to CLIVAR. This example highlights the need for a DIU function. The science panels are not

equipped to find out about the range of ocean observational activities of relevance to CLIVAR. There may be a role for JCOMM in this sort of activity.

There was also some feeling that the funding of XBT activities may be at risk as the Argo array develops. However, XBTs and Argo complement not replace each other. For instance, Argo is not designed to observe transports. The Argo network also needs profile data for QC activities. It was recommended that CLIVAR and JCOMM send a clear message to funding agencies advocating the continuing support of XBT activities.

Surface meteorology was also highlighted as a problem area. Observations are being submitted to national and regional centres, and eventually end up in COADS, but it is not easy to gain access to comprehensive marine surface observations regardless of platform type. The Marine surface met DAC currently only collects shipboard surface meteorology measurements. In the GSN surface met network, ocean observations tend to be island based.

Real time data availability is becoming increasingly important to the CLIVAR community. Documentation, accuracy and precision are second to timeliness for real-time data. Gaps in coverage are the biggest problem.

2.2. *The CLIVAR Pacific Panel*

Dr. Cai outlined the Pacific Panel's interests, which are currently oriented around process studies before answering the questions set (see report in appendix 2.2). To date, the Panel's interests currently don't extend beyond some 500m depth, focussing more on data product requirements, links with modelling activities and planning process studies with little attention to the needs for hydrographic cruise activities. The panel has however, developed a partnership with the Asia Pacific Data Research Center, in Hawaii (<http://apdrc.soest.hawaii.edu/>) to archive process study data, and provide the panel with the products they require.

2.3. *The CLIVAR Indian Ocean Panel*

Dr Meyers outlined the CLIVAR/IOC Indian Ocean Panel activities (see report in appendix 2.3). The panel is still in its infancy having only met once. However, plans for an Indian Ocean Observing System are already being developed in association with IOGOOS. In the following discussion it was noted that numerous mooring deployments were planned. The panel will focus on developing a sustained observation system for the Indian Ocean; Hydrography will be dealt with in the long term.

Quality controlling Historical data archives, specifically Temperature/Salinity profile(T/S) data was highlighted as an issue to address. In terms of expertise, the UOT DACs might be able to take this on. At present, CSIRO and APDRC have NOAA funding to Quality Control (QC) Temperature data, but not Salinity data at this stage.

It seems that data availability is the biggest problem in this region. CLIVAR needs to work on improving data release from Indian Rim countries to improve the products that are available to them.

The group responded positively to the Indian Ocean Panel's proposal to adopt the Indian National Centre for Ocean Information Services (INCOIS) as their regional data centre. This group already serves as the regional Argo centre. INCOIS are a well-resourced centre, and are expected to grow. It was suggested that perhaps INCOIS/IOGOOS secretariat could take on some sort of regional DIU function. In response to this, Gary Meyers thought that they were open to suggestions and are keen to support CLIVAR activities.

2.4. *The CLIVAR Southern Ocean Panel*

Dr. Bindoff gave an overview of the Southern Ocean Panel's activities and plans (see appendix 2.4). It was noted that there are numerous process studies and observation activities underway and in the planning stages in the Southern Ocean region, and the panel were not involved in coordinating the data management. It was presumed that the data would be managed in the same way as for WOCE, even for the process studies. Concern was expressed that CLIVAR needs to ensure that this data is quality

controlled and archived according to CLIVAR's requirements. However, in the main, CLIVAR's requirements are yet to be articulated.

3. Other CLIVAR Requirements

3.1. Data Assimilation

Dr Stammer gave a presentation on data assimilation and data requirements (see appendix 2.5). Data assimilation will be a key CLIVAR activity in the coming years, starting with the CLIVAR Ocean Reanalysis Workshop being held in Baltimore in November of this year. CLIVAR's Data management may have to evolve to meet the needs of this growing effort, specifically due to the volumes of data required for these activities.

Dr Stammer reinforced earlier discussions on hydrographic data. Firstly, every profile counts, therefore CLIVAR needs to include all high quality hydrographic sections, even if they are not eddy resolving or full depth. This again highlights the need for a data tracking effort, specifically for shipboard data. It was suggested that CLIVAR could use ship operators to keep tabs on what Cruises are being run.

Quality Control and updated datasets were also highlighted as causing difficulties, especially with satellite data, as it is very difficult to know which version to use. Quality reviewed datasets are required.

ACTION: DACS are encouraged to regularly post on their websites reports on availability of new and revised data at intervals (e.g. monthly, quarterly) consistent with the processing and posting of data.

The visibility and interlinking of the CLIVAR and DAC websites needs to be increased to build awareness of CLIVAR's ocean observation data management activities. It also became apparent that the assimilation community might require data to be packaged in a different way to that used during WOCE, due to the large amounts of data they require.

ACTION: Reanalysis workshop organizers should consider inviting relevant DAC reps. (GSOP)

3.2 Real time Ocean Forecasting

Dr. Cummings made the final presentation of this session on Real-time Ocean Forecasting, using the NRL Ocean Data Assimilation System as an example (see appendix 2.6). Dr Cummings highlighted that computing resource limitations, meant compromises had to be made to generate real time forecast products; most notably a completely automated ocean data quality step, and an efficient ocean data assimilation component.

At the present time, there are no routine operational sources of delayed mode data, and Dr Cummings felt that CLIVAR could provide this. This would greatly help with hindcast runs, which are used to evaluate model/assimilation changes. In particular, an operational source of hydrographic data was deemed to be extremely useful, if it could be provided within a day or two of collection as this is the only way to explicitly correct model errors at depth. This highlights a disparity in what people define as delayed mode – during WOCE, P.I's were required to provide hydrographic data within 2 years.

Lastly, the GODAE quality control pilot project is looking to define quality control metadata flags that can be shared among users. This should be expanded to include delayed mode QC that is being done within CLIVAR and the national data centres.

SESSION I: Summary

At the end of the session, the chair Dr Roemmich summarised the issues as follows:

- 1) From the presentations, there is a clear lack of Basin panel – DAC engagement
- 2) Attention needs to be given to the identification of CLIVAR – relevant data, especially CTD/Hydrography. It was suggested that an activity similar to that of the WOCE DIU was needed to identify and track CLIVAR and CLIVAR - relevant observations.

- 3) Data Accessibility issues and EEZ issues continue to be a problem, where certain P.I.'s, Institutions or countries are reluctant to release their data. This is a problem, especially in the Indian Ocean i.e. Tide gauges.
- 4) Cross DAC integration of single data streams needs to be promoted. At the moment, there are many different sources of on data type (regardless of platform) i.e. temperature profile data.
- 5) Data integrators have been identified for some, but not all basins. – i.e. APDRC for the Pacific and INCOIS for the Indian Ocean. Could we put them to work on the more fundamental issues of information and availability of data.?
- 6) Panels and users would benefit from updates on data availability and versions (esp. for profile data) from DACs – a new requirement.
- 7) What are the delays currently in terms of data availability from DACs and other key data streams, and what are we aiming for?
- 8) Interactions between analysis and QC activities need to be developed to improve products.
- 9) How are time series data tracked and managed? There are remaining problems with historical data and QC activities. Which DACs are involved in these activities?

SESSION II: Data Acquisition and QC/Documentation

4. Status of Activities of CLIVAR DACs

The second session outlined the status of activities of CLIVAR DACs, as well as other efforts deemed highly relevant to CLIVAR activities.

4.1. Surface Meteorology and Sea Surface Temperature: Marine Surface Meteorology DAC.

Mr Shawn Smith from Florida State University gave an overview of the status of the Shipboard Surface Meteorology DAC (appendix 4.1). The group welcomed news that the DAC was expanding its activities to include VOS data as well as the research vessel data. To help with this, the DAC are establishing connections with JCOMM. There is also potential interest to expand activities to include air-sea carbon fluxes.

It is clear that the Surface Met DAC needs additional guidance from the CLIVAR community as they are currently working on priorities set at the OceanObs99 report. In particular, they need information on countries and regions to target (at the moment, they are focusing efforts on US ships) and whether CLIVAR wanted the surface met DAC to expand activities to other platforms. Lastly, a reasonable estimate of the number of cruises to be managed is needed, so that the DAC can seek adequate funding. At the moment, there are no dedicated funds for CLIVAR activities.

4.2. Upper Thermal and Salinity

4.2.a. Upper Ocean Thermal DACs

Mr Bob Keeley from the Canadian Marine Environmental Data Service gave a presentation on the status of the Upper Ocean Thermal DAC activities (see appendix 4.2a). The UOT DAC still works as a distributed system with MEDS, Ifremer and the US National Oceanographic Data Center (NODC) acting as the data centre components responsible for data assembly. The final repository is at NODC. There are also 3 regional Science Centres responsible for scientific QC of the data (AOML for the Atlantic, CSIRO for the Indian and Scripps for the Pacific). Improved interaction of final repositories with and between science centres would help make QC activities more consistent.

Looking to the future, integration of all profile data will be a key activity for this group i.e. integrating real-time XBT data with Argo. It was felt that it would be worthwhile for profile groups to provide a single face to CLIVAR. Integrating activities may also improve QC of individual data. One disadvantage is that difficulties may be experienced in tracing data back to the original P.I, institution or data stream.

4.2.b. Sea Surface Salinity DAC

Dr Keeley and Dr Carval (standing in for Dr Thierry Delcroix) also represented the Sea Surface Salinity DAC (appendix 4.2b). In the main, SSS DAC activities are under the auspices of the Global Ocean Surface Underway Data Project (GOSUD), which is a joint IODE/JCOMM programme. They plan to organise activities in a similar way to the UOT DAC with science centres performing regional analyses.

One key push is historical data. They would like to integrate TOGA SSS data as well as data from member countries into the GOSUD dataset.

A key goal for CLIVAR would be to improve coverage at high latitudes. One way of doing this would be to actively encourage the submission of data. They would like to integrate the TOGA SSS data into GOSUD. The present emphasis is to identify and work with vessels that collect surface data to get the data into GOSUD as soon as possible after collection.

4.3. Deep Hydrography and Carbon

Dr Jim Swift from the CLIVAR Carbon Hydrographic Data Office (formerly the WOCE hydrographic project office) outlined their activities (appendix 4.3). In general, they have continued with activities since the end of WOCE, but they are now handling ocean carbon data in collaboration with CCHDO. Dr Swift felt that their activities were seriously hampered by the lack of a DIU and a shortage of QC experts. CLIVAR's support is needed to encourage submission of data, as many PI's are still reluctant to do so.

The CCHDO has been updating the WHP data manual, which outlines formats, documentation, etc but is not updating the methods manual at this time. This is something that CLIVAR should encourage.

ACTION: The WHP Methods and Practices manual needs revising to encourage submission of accurate CLIVAR CTD data in an easier to manage data format (CCHDO to consider)

Dr Detlef Stammer felt that packaging data by individual profile or parameter was difficult to ingest into models. The CCHDO are able to provide a file containing data from one cruise, or even one basin, but would like some guidance from the community on how they would like data packaged. Dr Stammer requested that all Hydrography data be provided as one file. However, NetCDF, the format chosen for both WOCE and Argo data, is not the solution for aggregating data for whole basins as the resulting files become too large and therefore difficult to manage and store. At the moment, the DACs are continuing to provide data in NetCDF format as CLIVAR has not specified a preferred data format. CLIVAR needs to determine what data formats would best serve the community.

4.4. Currents (Profiling, Moored and Surface)

4.4.a. ADCP DACS

Dr Patrick Caldwell gave an overview of ADCP DAC activities, which are split between the University of Hawaii and JODC, represented by Dr Satoshi Sato (appendix 4.4a). ADCP DAC is capable of handling some 10 cruises per year at a maximum. However, a lot of ADCP data is collected, and it is not clear where it all goes. The ADCP DACs are keen to hear suggestions from CLIVAR on how to lay claim on data not collected under a CLIVAR banner. However the DACs cannot accept uncalibrated data – calibration and QC is expected to be carried out by P.I's. Eric Firing's lab, the "Currents" group at SOEST, University of Hawaii, has taken on uncalibrated data in the past for specific cruises. CLIVAR could request this activity is expanded. Ultimately, the limited time resources of the DACs must be considered. They cannot take on any development issues at this time.

4.4.b. Drifter DACs

Dr. Mayra Pazos from AOML summarised the status of the Drifter DACs (appendix 4.4b). AOML serves as the data assembly and QC centre and Dr Keeley at MEDS provides the archival. Dr Pazos highlighted that one key issue since the end of WOCE is that partners have been lost from the programme. This includes Japan, who haven't released float data since WOCE finished. CLIVAR needs to establish an agreement by which Japan will provide and tag these data.

ACTION: The drifter DACs indicated that the Japanese have stopped sending drifting buoy data since WOCE ended. The workshop recommends the ICPO consider contacting appropriate Japanese officials to encourage release of these data. (Pazos to clarify the issue and identify appropriate Japanese officials). (Pazos, ICPO)

4.4.c Moored Current Meter DAC

Ms Mary Mowat from BODC provided an overview of the Moored Current Meter DAC activities (appendix 4.4c), which BODC took over from the Oregon State University Buoy Group. The group suggested that activities should perhaps be expanded to moored instruments of interest to CLIVAR, which aren't already managed by the Tropical Moored Buoy Implementation Panel (TIP), and the OceanSites (formerly Ocean Timeseries) group. The TIP mainly focus on the development of the tropical mooring array, and are thus the logical home for managing the data from the planned Indian Ocean moorings as they already manage TAO/TRITON for the Pacific and PIRATA for the Atlantic. The OceanSites team is concerned more with the development of a permanent moored observing system. This would allow the DAC to focus on the mooring data from CLIVAR process studies and temporary/semi-permanent time series activities. The DAC will need guidance from basin panels to determine the range of parameters to be managed, and identify observations efforts and process studies.

Moored Current Meter DAC will need to collaborate with other time series efforts such as the TIP, and the OceanSites group to ensure interoperability and prevent too much overlap of efforts. There is also an issue of integration between these groups, which CLIVAR will need to address. For instance, users such as data assimilators will expect to go to one site and download all moored time series data

ACTION: The workshop recommended the Mooring DAC consider a broad remit and accommodate all measurements (including sediment traps, microcats, etc.) associated with CLIVAR moorings. Data Liaisons to provide guidance on process studies and mooring activities to be managed (Mowat/MooredCM DAC, Data Liaisons).

ACTION: The Mooring DAC (BODC) should establish linkages with the TimeSites Data Management team as well with others (i.e. PMEL) handling the sustained TAO-Triton and PIRATA mooring data to work together on integration issues (Mowat/Moored Instrument DAC, ICPO).

4.5. Sea Level DACs

Ms Elizabeth Bradshaw, from BODC gave a presentation on the Delayed Mode Sea Level DAC (appendix 4.5b), while Dr Bernie Kilonsky from the University of Hawaii represented the Fast Delivery Sea Level DAC (appendix 4.5a). The two DACs compliment each other. The fast delivery DAC corrects data for tides and distributes it. The delayed mode DAC flags data for QC. The Delayed mode DAC concentrates on sites where there is no fast delivery real time data, and receives fast delivery data for QC from the fast delivery site. Bernie acknowledged that there are problems getting data released from some countries. By emphasising how data are being used, the DACs are encouraging people to provide their data and get involved in the global network.

ACTION: The sea level DACs will include on their home pages a more straightforward introduction to the differences between their two DACs and to the Permanent Service for Mean Sea Level (Bradshaw, Kilonsky/Sea Level DACs).

ACTION: The sea level DACs will indicate data from GPS-equipped sites on their websites (Bradshaw,Kilonsky/Sea Level DACs).

4.6. Satellite data

4.6.a. PO.DAAC

The Task Scientist from PO.DAAC, Dr. Jorge Vazquez, provided an overview of PO.DAAC's activities (see appendix 4.6a). A number of issues were raised in the following discussion. In particular,

- The increasing volumes of satellite data produced make the archival of satellite data expensive and the distribution of large volumes of satellite data is no small task, especially at operational timescales.
- Anomaly products in particular are becoming difficult to manage. Many different climatologies are used so resulting anomaly products from the same time frame can be very different.
- PO.DAAC therefore needs feedback from the community to help set priorities so that resources are used optimally.

- There are plans to promote a consistent climatology of SST that everyone uses to define anomalies. This would be particularly useful for ENSO monitoring.
- What climate data records and data holdings could PO.DAAC provide to CLIVAR?

4.6.b. Satellite Winds DAC

Dr Thierry Carval provided an overview of the Satellite Winds DAC at CERSAT (appendix 4.6b). The group is soon to be involved in SST data as well, as they are the European partners in the GODAE High Resolution Sea Surface Temperature project (GHRSSST). CERSAT can provide both global and regional fields. Global Fields would be a priority for CLIVAR's needs.

4.7. Argo float data: Argo GDAC.

Dr Thierry Carval, representing one of the Argo Global DACs, provided an overview of Argo Data Management (see appendix 4.2c). The GDACs keep a mix of real time plus delayed mode when available, forming a mixed dataset. Generally temperature data doesn't change much between real-time and delayed-mode. However, there are known to be drift problems with salinity data on around 10% of floats. Therefore, it is recommended that real-time Argo data is not used for mid depth climate variability studies, and salinity profiles are adjusted to climatology to correct for this.

WOCE was not able to manage Palace float data and it was asked whether Argo would be willing to take on the historical QC of these data. In response, Dean Roemmich, chair of the Argo science team felt that Argo would be reluctant to divert funds from deployment to the cleaning up of historical data. However, for CLIVAR needs, historical data is important and Argo should be interested in extending the profile database.

ACTION: Because of their intrinsic value to the climate community and to the ARGO team, historical PALACE float data (available on the WOCE V3 DVD) should undergo ARGO QC (Co-Chairs to recommend this Action to GSOP)

Reanalysis activities would need the provision of a streamlined Argo dataset, where suspicious floats have been removed. At the moment, the facilities are not in place to provide this sort of product.

Following the DAC presentations, Dr Legler outlined what he felt were the main issues arising:

- 1) CLIVAR requirements for Data Management need to be explicit to include aims, data streams, timeliness, accessibility, reporting, metrics, products, etc.
- 2) CLIVAR designation of non-sustained data (ship-based data and moorings).
- 3) Tracking for some data streams is needed, i.e. process studies (specific plans for cruises and deployments; what has been completed, data flow and follow-up).
- 4) Integration across DACs and data streams: many opportunities – plan now.
- 5) Some PI's (institutions?) not willing to give up data in a timely fashion.
- 6) The need for products and value added summaries.
- 7) Some DAC-specific issues (Sea level, moored current meter).

These issues were discussed in depth in the second half of session 3.

SESSION III: PERSPECTIVES, UPDATES AND FUTURE DIRECTIONS

5. *Updates on key data management planning efforts.*

5.1 *OCEAN.US DMAC Plan*

Dr Legler provided an introduction to the US DMAC Data Management effort (appendix 5.1). The group acknowledged that this is a highly ambitious plan, which could be very useful to CLIVAR. CLIVAR could have particular influence on QC developments and would find harvesting tools very useful.

5.2 *Global Ocean Data Assimilation Experiment (GODAE)*

Dr Jim Cummings then provided an update on GODAE programme activities (see appendix 5.2). During discussions, it was suggested that perhaps CLIVAR data could be served on the GODAE server, a

possibility that would be beneficial to explore further. GODAE are currently only working with real-time data with automated QC, but GODAE would like to expand to delayed mode.

ACTION: It was recommended that DACS should provide to GODAE suitable delayed mode QC procedures that could be automated to allow GODAE to implement and test them in real-time data processing (DACS, Cummings/GODAE).

5.3. IOC International Ocean Data Exchange (IODE)

Dr. Lesley Rickards, chair of the IOC International Ocean Data Exchange (IODE) gave an overview of IODE activities (appendix 5.4a). John Gould suggested that maybe the IODE could provide information on what data is being measured, similar to a DIU function. Lesley seemed to think that IODE can help encourage groups to release their data holdings, but it is a slow process.

5.4. Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

Bob Keeley gave an overview of JCOMM activities (5.4b). Increased cooperation between CLIVAR and JCOMM would be highly desirable, and JCOMM are keen to hear whether its needs are being met.

5.4. Discussion

To address the issues and determine a clear way forward, the meeting was then opened to the floor to discuss the 7 issues which David Legler had outlined at the end of session 2.

1. **CLIVAR requirements and CLIVAR Data** (aims, timeliness, accessibility, reporting, metrics):
It became clear that CLIVAR's requirements needed articulating and that the basin panels are currently not set up to fulfil this role. The members felt strongly that the only way to address this would be through a Data Committee – possibly as a subgroup to GSOP. The committee would also be responsible for collating information on the different requirements of the various panels. To do this, the panels will need guidance from the DACs on what information they need.

ACTION: Collectively, the DACs must help the Panels and GSOP draft a requirements document for CLIVAR data management activities. It was recommended that a template should be developed by the DACs specifying what information they need from the Panels and the CLIVAR GSOP (David Legler and Katy Hill will initiate discussion over email by end of April - Gary Meyers will act as a sounding board for the final drafts. Katy Hill will collate information). With the aim of completing a requirements document by the end of 2004 - Howard Cattle and David Legler will discuss a strategy to engage the panels (Legler, Hill/ICPO)

ACTION: Basin panels (SO to start) will be asked to identify what observations are being taken in regional process studies as well as what moorings are currently of benefit to CLIVAR and identify what specific observations are being taken, where data are going, how data can be accessed, and points of contact for the data. The ICPO and DL's will develop strawman tables from basin observations pages and other sources of information. The Data Liaisons (DL's) will coordinate completion of tables with panels – ICPO to then disseminate to DACs (ICPO and DLs)

- 2) **CLIVAR designation of non-sustained Data** (ship based and moorings).
- &
- 3) **Tracking CLIVAR Data** (Specific plans for cruises and deployments, what has been completed? Data flow monitoring and follow-up)

It was universally agreed that the best way to address both these issues would be to develop some sort of DIU function. There are two specific areas. Firstly, tackling the backlog since the end of WOCE, i.e. collating information on observations programmes which have already been completed and identifying the location of data that has been collected. This should be a limited timeline exercise coordinated through the basin panels and collated centrally. Secondly, a tracking function needs to be developed for the future.

Tracking of CTD data for T/S profiles should be a priority. As this data is important to Argo for validation purposes and the GODAE programme as well as other data assimilation projects, in the long term, there is a good argument for the remit of JCOMMOPS to be extended to CTD data collected by research vessels, due to its operational value. In the mean time, basin panels will need to identify known programs and groups around the world who routinely collect this sort of data.

The Partnership for the Observation of the Global Oceans (POGO) supports the development of a sustained observation system, so it should also be in their interests to track this information. It would therefore be useful to involve them in this activity.

ACTION: Write a justification to JCOMMOPS (and also to POGO, and funding agencies) on the importance of research vessel T and S profile observations for Argo and for ocean reanalysis activities, proposing JCOMMOPS begin to track these data. (John Gould, Dean Roemmich on benefits to Argo; Shawn Smith on importance of underway data.)

ACTION: Develop requirements for a DIU function (GSOP and basin panels): Not all data important for CLIVAR is currently tracked, especially observations taken between the end of WOCE (2002) and now (mid-2004). Observations in the period and those observations being planned (especially those that will not be tracked by the proposed new function of JCOMMOPS), need to be tracked to insure these data reach designated DACs and are accessible to CLIVAR. An assessment of the personnel needed and resources available to track these data is needed (ICPO)

4) **Integration across Data Streams**

In terms of integration, it is important that CLIVAR learns from WOCE. WOCE experienced many difficulties when it tried to integrate the WOCE data at the end and it was a time consuming process. CLIVAR need a structure to pursue integration. It would be useful to identify key datasets or a couple of data streams to form an integration pilot project, with some immediate objectives so that appropriate DACs can get started on the problems.

DODS servers are a potential model for integration. In principle it is possible for a third party to search through what a DAC has on a DODS server remotely. This means that the third party can search and collect the necessary metadata, with the advantage that there would be a centralised system to allow the user to search through metadata from all the CLIVAR DACs. DACs would, of course, still have to cooperate on reconcilers and metadata formats. Potential pilot studies could be set up for profile data, surface meteorological data, or time series data. The DACs need to discuss what they are able to do, and send a proposal to GSOP in time for the 1st GSOP panel meeting.

ACTION: To ensure accessibility, all DACs are encouraged to set up OpenDAP, Ftp, and LAS servers (DACs – Bindoff to Consult).

ACTION: A pilot project for integration was suggested by Bob Keeley -Profile DACs to discuss making data available through OPeNDAP, using Thredds to integrate metadata, and serve integrated data on GODAE Server (Bindoff, Keeley, Cummings/GODAE)

ACTION: SSS DAC, Surface Met DAC, and ADCP DAC to compare their needs and pursue further integration and cross referencing (Smith, Keeley, Caldwell)

ACTION: It was suggested that DACs brand their websites with CLIVAR, clarify mandates and improve cross links between websites and check to insure the CLIVAR Data pages (<http://www.clivar.org/data/>) have direct links to all data (DACs, Hill/ICPO).

5) **Data release issues**

There is a long-standing issue where by some P.I's and institutions are reluctant to release their data for open use. The issue of data release needs to be raised with the SSG, as well as with JCOMMOPS. A brief statement on the value of research data activities to underpin the operational observation system is needed, and the basin panels should reinforce this message. Observation groups such as Argo, and the Surface Meteorology network could underpin this message in terms of the specific importance for their

own observations system. This message needs to be targeted at funding agencies, POGO and research agencies. If a multi-pronged approach were used, the message would eventually get through. Ultimately, a cultural change is needed so that funding requirements state that data should be made available. “Making data available” also needs to be defined – is making it available on GTS enough? Or shipping a CD to NODC?

ACTION: Write a framework for a statement on importance of making data available and communicate to specific groups (Gould)

6) **Products and Value Added Summaries**

It was asked whether DACs would be able to provide products and value added summaries. DACs would need guidance from panels on what they require.

ACTION: It was pointed out that compiling and Quality Controlling historical data would be a critical precursor for an ocean reanalysis. QC needs to be applied consistently and globally, for example, WOCE data sets were inconsistent across basins and the Levitus data has problems too. This was flagged as an issue the reanalysis workshop should address (co-chairs to communicate to workshop organizers).

ACTION: The workshop welcomed news that the INCOIS/INGOOS Secretariat office and APDRRC may be able to help meet some of CLIVAR’s data needs. Gary Meyers and Wenju Cai to indicate that CLIVAR would like to discuss this issue further, especially meeting the needs of the India ocean/ Pacific sector (Meyers, Cai)

7) **DAC specific issues**

A number of issues relating to specific DACs arose during the meeting. Actions are outlined in the main text.

Follow-up Meetings / Reporting

ACTION: It was recommended that there be 1-2 representatives from the DPM1 meeting attend the GSOP Panel Meeting to present the DPM1 findings. (co-chairs to resolve)

ACTION: It was agreed that any further coordinated efforts tracking CLIVAR data, assessing the progress of DACs, and integrating data important for CLIVAR, would require the managers of the CLIVAR DACs to meet. Thus it was recommended this group (plus a few others that were not invited to this meeting) meet on a regular basis (15-mon?) to pursue these issues (meeting Co-Chairs to approach SSG).

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1st CLIVAR DATA PLANNING MEETING ON OCEAN OBSERVATIONS.**Objectives:**

- 1) **Assess status** of CLIVAR data management
- 2) **Further articulate** of CLIVAR data management requirements/objectives.
- 3) **Engage DACs** and the CLIVAR user community, and inform both of wider developments in data management activities.
- 4) **Identify and agree** on a set of activities to
 - a) Address problem areas
 - b) Address CLIVAR data objectives.

The meeting will be chaired by Dean Roemmich and David Legler.

Wednesday 24th March

08.30: Registration and coffee.

08.40: Welcome and Local Arrangements Roemmich/Swift

SESSION 1: CLIVAR REQUIREMENTS

08.50: Overview of Data Management needs in CLIVAR Cattle/Legler

09.30: Overview of meeting objectives Legler/Roemmich

10.00: Overview of WOCE DAC system (Strengths/Problems) Swift/Gould

10.30: COFFEE BREAK

Basin Panels – Requirements, status and plans from the perspective of the global ocean observing system (20 mins each plus 10 mins discussion)

11.00: Atlantic Panel Kolterman

11.30: Pacific Panel Cai

12.00: Indian Ocean Panel Meyers

12.30: Southern Ocean Panel Bindoff

13.00: LUNCH BREAK

Other user's requirements :

14.00: Data Assimilation Stammer

14.30: Real time ocean forecasting. Cummings

15.00: COFFEE BREAK

SESSION 2: DATA ACQUISITION AND QC/DOCUMENTATION

DACS – Status and plans (20 mins each plus 10 mins discussion). Summarize responses to questions:

15.30: Surface Met and SST Surface Met DAC (Smith)

16.00: Upper thermal and Salinity UOT/SSS DACs (Keely/Carval)

16.30: Argo **Carval/Keeley/Schmid**

17.00: Deep Hydrography and Carbon CCHDO (Swift)

17.45: END OF DAY

Evening Event: A BBQ extravaganza at Scripps, organised by CCHDO.

Thursday 25th March

08.30: Satellite Data PO. DAAC (**Vazquez/Zlotnicki**)

09.00: Currents (Profiling, Moored, Surface) ADCP DACs (Sato/Caldwell)

Drifter DACs (Keeley/Pazos)

10.00: Sea Level

10.30: COFFEE BREAK

SESSION 3: PERSPECTIVES, UPDATES AND FUTURE DIRECTIONS

Update on current data management planning efforts:

11.00: Ocean.us (DMAC Plan)

Legler
Cummings

11.30: GODAE

12.00: LUNCH

13.00: IOC IODE and JCOMM

Rickards/Keeley

13.30: Challenges, issues and possible future directions, discussion

Legler/Bindoff/Roemmich

14.30: COFFEE

15.00; Split into writing groups

Possible working groups:

WG1: Data collection and assembly; interaction with observing systems.

WG2: Developing better and useful data quality information.

WG3: Provision of data and products to the modelling/assimilation/climate community.

Possible Chairs: David Legler, John Gould, Nathan Bindoff?

Each working group should report in a 5-slide powerpoint responses to the following questions and follow-up after the meeting with a 1-2 page summary:

- 1) What are the needs/requirements of CLIVAR in this area?
- 2) What are some reasonable goals and expectations of what CLIVAR (and the centers represented at the meeting) can provide?
- 3) What are some of the particular problems and issues?
- 4) What are the logical next steps (ie. activities) in advancing towards these goals and how should they be organised (ie who will lead)?
- 5) Who are the partnering groups?

18.00: END OF DAY

Friday 26th March

8.30: Writing groups continue.

10.00: COFFEE BREAK

10.30: Plenary session, reports from Working Groups

11.30: LUNCH

12.30: Wrapping up, future direction and priorities: Identify next steps and assignments.

14.30: CLOSE OF MEETING

Outputs

The output of this meeting will be in the form of an agreed meeting report, which will feed into the discussions of the CLIVAR GSOP Panel on setting the strategy for CLIVAR data management when it meets in August 2004.

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