

INTERNATIONAL
COUNCIL FOR SCIENCE

INTERGOVERNMENTAL
OCEANOGRAPHIC
COMMISSION

WORLD
METEOROLOGICAL
ORGANIZATION

WORLD CLIMATE RESEARCH PROGRAMME



Report of the 7th Session of the CLIVAR Atlantic Implementation Panel (AIP)

20 – 21st October 2005

January 2006

ICPO Publication Series No.99

WCRP Informal Report No.1/2006

CLIVAR is a component of the World Climate Research Programme (WCRP). WCRP is sponsored by the World Meteorological Organisation, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO. The scientific planning and development of CLIVAR is under the guidance of the JSC Scientific Steering Group for CLIVAR assisted by the CLIVAR International Project Office. The Joint Scientific Committee (JSC) is the main body of WMO-ICSU-IOC formulating overall WCRP scientific concepts.

Bibliographic Citation

INTERNATIONAL CLIVAR PROJECT OFFICE, 2005: Report of the 7th Session of the CLIVAR Atlantic Implementation Panel. December. International CLIVAR Project Office, CLIVAR Publication Series No. 99. (not peer reviewed).

CONTENTS

	Action Items	4
2	Opening and Introduction	6
3	US CLIVAR Reorganisation	6
4	Status of CLIVAR related projects in North Atlantic	7
5	CLIVAR related issues and activities in Tropical Atlantic	9
6	South Atlantic activities and plans	12
7	AIP Links with CLIVAR and WCRP activities	12
8	AIP links with international activities	15
9	Involvement of AIP in future relevant events	17
10	CLIVAR assessment and new challenges for AIP	18
11	Memberships and future meetings	19
	Appendix A: List of attendees	20
	Appendix B: Agenda	21

Action Items

- 1) Provide feedback to US CLIVAR on the reorganization (*M. Visbeck and W. Hazeleger*)
- 2) Clarify the status of the CLIVAR endorsement for the CliC Arctic Climate Panel (*R. Boscolo and M. Visbeck*)
- 3) Define the topics of intersection between the ACP and AIP (*C. Mauritzen and M. Visbeck*)
- 4) Write a joint letter with ACP to ASOF encouraging the development of plans to continue sustaining the existing arrays (*C. Mauritzen and M. Visbeck*)
- 5) Provide feedback to the proposed RAPID program continuation (*M. Visbeck*)
- 6) Provide feedback to CLIMODE about the program and sustained observations (*M. Visbeck*)
- 7) Write two paragraphs on the relevance of ENSEMBLES to the AIP (*L. Terray*)
- 8) Enquire via VACS about the climate component of AMMA (*C. Reason and M. Visbeck*)
- 9) Put together a CLIVAR team for the review of the joint OOPC/CLIVAR PIRATA program (*W. Hazeleger*).
- 10) Review the PIRATA program before July 2006 (*W. Hazeleger and the review team*)
- 11) Reformulate TACE goals and rewrite synopsis accordingly (*B. Johns, W. Hazeleger, P. Nobre, M. McPhaden and B. Bourles*)
- 12) Send a letter to CLIVAR and PIRATA SSGs on timetable/strategy to revise TACE (*W. Hazeleger*)
- 13) Get in contact with VAMOS on possibility of a joint SACZ program (*P. Nobre and W. Hazeleger*)
- 14) Contact BCLME and show support for PIRATA extension (*C. Reason, M. Visbeck and W. Hazeleger*)
- 15) Send a list of indices and associated metrics relevant to the evaluation of climate variability in ocean models to Detlef Stammer for input to GSOP (*D. Wright*)
- 16) Finalize the previously produced table and report on Atlantic metrics and put it on the web (*D. Wright and R. Boscolo*)
- 17) Respond to GLOBEC questions (*R. Boscolo*)
- 18) Endorse the RAPID workshop, and recommend AIP members for the steering committee (*R. Boscolo, D. Marshall and R. Sutton*)
- 19) Enquire with ICPO who endorses workshops within CLIVAR (*R. Boscolo*)
- 20) Send feedback to the proposal for an international workshop on multidecadal to centennial global climate variability (*R. Sutton, L. Terray and W. Hazeleger*)
- 21) Encourage planning for the workshop in Tanzania (*C. Reason*)
- 22) Ensure that AIP and ACP topics are addressed at the Polar Dynamics workshop (*C. Mauritzen, M. Visbeck and N. Koc*)
- 23) Provide input to the next TAV meeting (*W. Hazeleger, B. Johns, L. Terray and P. Nobre*)

- 24) Write a draft on future directions of the Atlantic Panel (*W. Hazeleger*)
- 25) Write a new set of terms of references and send it to the panel members for comments (*W. Hazeleger*)
- 26) Enquire about the possibility to lobby the EU for funding CLIVAR AIP related activities (*M. Visbeck, R. Sutton, C. Mauritzen, W. Hazeleger and L. Terray*)
- 27) Propose replacement for Wainer and Reason (*M. Visbeck and W. Hazeleger*)
- 28) Send names and short description of possible new panel members 2007 (*Panel*)
- 29) Compile list and matrix for possible new members 2007 (*R. Boscolo and W. Hazeleger*)
- 30) Explore the possibility to hold the next AIP meeting in Kiel, March 2007, in association with a workshop on Atlantic Subpolar Gyre (*R. Boscolo*)

2. Opening And Introduction

The 7th session of the CLIVAR Atlantic Implementation Panel (AIP) followed the 3-day CLIVAR workshop on Tropical Atlantic Ocean Dynamics (http://www.clivar.org/organization/atlantic/wksp_trop_atl.htm) co-sponsored by NOAA and held in the same venue. M. Visbeck, AIP co-chair, opened the meeting by welcoming the participants (see APPENDIX A), especially the new panel member L. Terray, and thanking the outgoing member, P. Koltermann for serving the AIP for the last 4 years.

The strategy of CLIVAR in the Atlantic Sector is to promote a balanced approach to describe, understand and assess predictability of climate phenomena using:

- Observations (joined with the Ocean Observations Panel for Climate (OOPC) and GSOP)
 - Sustained observations: those acquired on a permanent basis throughout the lifetime of CLIVAR and presumably beyond (PIRATA, ARGO, Surface Drifter, XBT...)
 - Regionally enhanced observations: those that are needed to fill important gaps between the “sustained” and “process study” categories. Two types of enhanced monitoring can be envisioned: enhancements needed in either time or space to resolve features that have importance for climate modelling and forecasting, and enhancements to study processes that require more than a short-term “process” study to fully understand
 - Process studies: those that are required to augment the network of sustained observations to improve understanding of particular regions and/or key processes
- Modelling and Theory (joined with WGOMD and WGCM)
 - Global and regional GCMs
 - Process models
 - Climate projections
- Synthesis (joined with GSOP and WGSIP)
 - Empirical studies
 - Atmosphere/ocean/(land) reanalysis
 - Predictability

The particular goals of the 7th AIP meeting were to:

- Assess progress and problems in the continued implementation of CLIVAR research in the Atlantic Sector and valuable interactions with relevant groups
- Discuss the value and possible types of performance metrics and climate indices within the Atlantic Sector
- Think about the role of the AIP in the “second phase” of CLIVAR

The introduction to the meeting concluded with the review of the agenda (see Appendix B) and the action items from last year’s meeting (see http://www.clivar.org/publications/wg_reports/atlantic/AIP6.pdf)

3. US CLIVAR Reorganization

J. Hurrell gave a presentation on the US CLIVAR reorganization (<http://www.usclivar.org/Reorganization/reorganization.html>) on behalf of D. Legler, US CLIVAR director, who couldn’t attend. The motivation for the reorganization came from different sources, but it was especially recognized that there was a need to better map the US CLIVAR objectives into the new research agencies strategic plan in order to remain competitive in a tighter resourcing situation. The new US CLIVAR organization aims to address elements and infrastructure not well embodied in the regional organizational approach as well as expand the US CLIVAR research community.

The new structure consists of an overarching U.S. CLIVAR Committee that will steer the U.S. CLIVAR research enterprise, three new Panels (committees) to guide and implement the program in the broad functional goals of predictability/prediction; process and model improvement, and phenomena/observations/synthesis. The third tier consists in limited term Working Groups that will be in the front lines of coordinating and implementing focused components of the climate variability/predictability research enterprise. The Panels will develop and coordinate research plans and activities, and provide input to agency programs. In response to increased demands on research programs to document progress, these

Panels will also be asked to consider how best to describe their plans and assess achievements using measurable performance metrics (e.g. milestones).

The new structure is being implemented: the three Panels have been formed and the terms of reference and goals for each Panel are under formulation. A new strategy document is under discussion, which will receive a final approval at the next summit meeting that will be held in August 2006. Some challenges are currently being addressed:

- Prioritization across the program
- Coordination of plans across the panels, with international community and with other international/national programs
- Links with International CLIVAR through cross membership, inputs from international panels

The AIP identified three main concerns: how will this new structure affect the AIP? How well AIP can map its plans into the new US structure? How best can the AIP engage the US panels?

ACTION ITEM 1. Provide feedback to US CLIVAR on the reorganization (*M. Visbeck and W. Hazeleger*)

4. Status of CLIVAR Related Projects in North Atlantic

C. Mauritzen reported on the progress toward establishing a CliC/CLIVAR Arctic Climate Panel (ACP). After the controversial issues with the Arctic Ocean Science Board (AOSB) on the role of an ACP were cleared, C. Mauritzen was given the task to appoint the members of the panel. The formed ACP was presented at the CliC SSG meeting in October 2004 and received the CliC (Climate and Cryosphere programme) endorsement. The ACP also asked for the CLIVAR endorsement, which hasn't been granted yet. C. Mauritzen asked the AIP to support and help with the process of making the ACP a joint CliC and CLIVAR panel.

ACTION ITEM 2. Clarify the status of the CLIVAR endorsement for the CliC Arctic Climate Panel (*R. Boscolo and M. Visbeck*)

The ACP held its first meeting in April 2005. The members discussed the science issues to address and planned future actions. The panel builds on the legacy of ACSYS (the WCRP Arctic Climate System Study) and will liaise with the other WCRP global communities (SPARC, CLIVAR Atlantic and Pacific, WGCM). ACP will also take a role in promoting and coordinating activities for the International Polar Year (IPY). C. Mauritzen (CliC) and J.C. Gascard (AOSB) submitted an IPY proposal called Integrated Arctic Ocean Observing System (iAOOS) that promotes the coordination of observations of ice, ocean and atmosphere in the Arctic Ocean. New measurements will be performed by the EU Integrated Project DAMOCLES (Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies), a 16M euros project for 4 years.

ACTION ITEM 3. Define the topics of intersection between the ACP and AIP (*C. Mauritzen and M. Visbeck*)

R. Boscolo updated the AIP on the activities carried out under the ASOF (Arctic Subarctic Ocean Fluxes, <http://asof.npolar.no/>) project and future plans. One effort undertaken by the group last year was to give new estimates of the freshwater fluxes through Arctic and Subarctic Seas. Also the main three factors that will determine the variability of these estimated were identified:

- Decreasing of Arctic Ocean sea-ice
- Increase discharge of major Eurasian rivers
- Increase of freshwater flux from Greenland

Some arrays in the eastern part of the ASOF domain are funded till 2006 and it is still uncertain how they are going to be sustained in the future. Some of them will continue under DAMOCLES and IPY initiatives while some others will seek institutional support until ASOF is able to secure more funding for maintaining the measurements

ACTION ITEM 4. Write a joint letter with ACP to ASOF encouraging the development of plans to continue sustaining the existing arrays (*C. Mauritzen and M. Visbeck*)

An update on the UK project RAPID (<http://www.soc.soton.ac.uk/rapid/rapid.php>) was given by D. Marshall. RAPID is a 20M pounds project funded by NERC for the period 2001-2007 aiming at:

- Design of a cost-effective operational monitoring system for the Atlantic Meridional Overturning Circulation (MOC)
- Identify the main drivers of ThermoHaline Circulation (THC) variability
- Identify the consequences for climate of rapid change of THC, including scenarios for use in risk assessments
- Improve paleo-climate data sets with associated error estimates and sufficient temporal resolution to identify variability and rapid change on annual to centennial time-scales
- Improve methods for using paleo-climate data for quantitative testing of models
- Assess the ability of climate models to simulate rapid change and the role of THC variability in such change, and recommend model development to reduce uncertainty in projections of THC and other rapid changes in climate and their impacts

The deployed prototype array for MOC monitoring consists of two components: the basin-wide array at 26.5N and the array at 3 locations along deep western margin. RAPID was successful at engaging other countries in co-funding RAPID sub-projects, namely: US (NSF, NOAA), Norway (RCN), Netherlands (NWO).

A proposal to continue the RAPID MOC monitoring is under preparation and will be submitted to NERC in November 2005. The proposed activities under RAPID2 are:

- Continue monitoring the MOC across 26.5N and along the western boundary to establish its variability and mechanisms of change on time-scales up to a decade (with international partners).
- Assess the need for a long-term operational MOC monitoring system, and oversee its transition to operational status by the end of RAPID2 in 2014. Initial evaluation of prototype array in 2007 (end RAPID1); full evaluation in 2011.
- Improve predictions and work towards an “early warning” system by determining how to use RAPID2 data with other observations to estimate MOC and heat transport and to initialize and assimilate data into models.
- Use statistical and modelling approaches to determine the probability and magnitude of rapid climate change, with associated uncertainties.
- Synthesise observational, modelling and statistical results to produce indicators of change (e.g. MOC time series) and products (e.g. impacts of rapid MOC change on UK) that will inform policy makers and stakeholders

D. Marshall announced the opportunity for AIP to provide a steer on specific issues in this phase of preparation of the proposal.

ACTION ITEM 5. Provide feedback to the proposed RAPID program continuation (*M. Visbeck*)

Another relevant process study in the Atlantic is CLIMODE (CLIVar Mode water Dynamics Experiment, <http://www.climode.org/>), a US funded project for the period 2005-2009. CLIMODE will focus on the formation, subduction & dispersal of 18 degree water (EDW), the principal water mass of the subtropical North Atlantic Ocean –one of the Subtropical Mode Waters that are invariably found equatorward of major zonal currents, like the Antarctic Circumpolar Current, Kurushio and Gulf Stream. The project will address the formation mechanisms and air-sea interaction, the EDW evolution, storage and dispersal as well as the large-scale consequences. The relevant outcomes are:

- Improved parametrization of lateral processes in the mixed layer for climate models
- Improved air-sea flux parametrization in regions of high wind and large latent heat loss
- Better understanding of MODE Water processes for global ocean where MODE Waters are inevitably found equatorward of strong current
- Improved understanding of the mid-latitude air-sea coupling

The fieldwork consists of several cruises, moorings and floats deployments. Air-sea interaction measurements will be performed with surface moorings, radiosonde and aircraft flights. It seems that the survey area have a low coverage of ARGO floats. Since CLIMODE would benefit from a higher resolution, the PIs wonder whether the AIP could help to improve the situation.

ACTION ITEM 6. Provide feedback to CLIMODE about the program and sustained observations (*M. Visbeck*)

C. Boening reminded the Panel that a CLIVAR workshop on North Atlantic Thermohaline Circulation Variability took place in Kiel, Germany, from 13-16 September 2004. The workshop brought together expertise from physical oceanographers, geochemists, and ocean and climate modellers, to discuss recent advances and outstanding problems in our understanding of the mechanisms of deep water formation in the subpolar North Atlantic, their relation to decadal variability of the meridional overturning circulation (MOC) and impact on the uptake of anthropogenic trace gases, and the future of the MOC under changing climate conditions. There were about 150 participants, from 49 different institutions and organizations of 16 countries.

The growing body of evidence from a variety of ocean-atmosphere model studies shows, that the MOC may have some predictability for lead times up to several decades. There is no consensus, however, on the extent to which these MOC variations lead to useful predictability of SSTs and the associated atmospheric response, although some encouraging evidence of useful predictability is beginning to emerge. There is need for a much more detailed understanding of which aspects of ocean conditions most constrain the future behaviour of the MOC and related aspects of climate. The roles of air-sea exchanges of buoyancy and momentum, convective mixing, overflows, boundary waves and advective processes in setting the time scale and predictability of changes in the MOC have to be clarified.

Changing external forcing, whether natural or anthropogenic, also influences climate on short and long time scales and is a further source of potential predictability. Many of the issues are global but there is a clear need to improve understanding of the factors that determine climate change at a regional scale. In the Atlantic Sector the interaction between initial conditions (notably in the MOC) and the effect of changing forcing is crucial. For predictions with lead times in the range of 1-30 years both factors are likely to be important.

More specifically the following research questions emerged:

- Basin scale and global modelling have become a major resource to study MOC variability and predictability. However, there is a continuing need to foster a dialogue and close collaboration between the modelling and observational communities to assess and advance the modelling capabilities.
- Models, in particular with data assimilative capabilities are gaining traction with the general ocean research community. While several technical aspects are still under development, one needs to make a reasonable guess at the needs of a future sustained observing system.
- While several models and a handful of observations have documented MOC variability, there are still a number of outstanding research issues that need to be addressed:
 - Which local processes are relevant for generating low-frequency variability in large-scale transports?
 - What is the relationship between the deep water formation processes and MOC/heat transport variability at 25N?
 - What is the role of boundary waves in the MOC adjustment process on decadal time scales?
 - How significant are changes in the overflows compared to variability in the convective centres of the Labrador and Irminger Seas?

5. CLIVAR Related Issues And Activities In Tropical Atlantic

L. Terray introduced some important issues related to the Atlantic tropical-extratropical teleconnections. The identified key regions and processes that are involved in the teleconnections are: the western part of the tropical North Atlantic, the Sahel region, the fluctuation of the ITCZ and associated upper (lower) tropospheric divergence (convergence). Such teleconnections were related to events like: the storms in 1999, the European precipitations of Autumn 2000 and the European heat wave in 2003. They also influence the seasonal to decadal forcing of the NAO or related atmospheric regimes and hence the mid-to-high latitude climate. They represent a source of potential predictability (warm/cold SSTs, impact on diabatic heating) under ENSO forcing influence.

The importance of data assimilation for model validation was stressed. AIP should encourage data assimilation activities like those promoted under the French MERCATOR and EU ENSEMBLES projects. They give indications on model biases and initial conditions for predictability experiments. However it was noted that good initial conditions are not enough if air-sea processes (e.g. heat flux feedback) are not well represented in coupled models. Detection studies (climate change) are also useful for model validation; AIP

should encourage the use of high-resolution atmospheric models at regional scale and analysis of new datasets.

There is the need to improve communication between the data assimilation community and coupled-modellers as to well as promote detection studies for the Atlantic

ACTION ITEM 7. Write two paragraphs on the relevance of ENSEMBLES to the AIP (*L. Terray*)

An update on AMMA (African Monsoon Multidisciplinary Analysis <http://amma.mediasfrance.org/>) activities was given by B. Bourles. The project plans several oceanic campaigns. Measurements from open ocean will help to understand the oceanic processes involved in the West African Monsoon onset as well as study the air-sea exchanges. Within AMMA France funded 6 cruises (EGEE), 2 per year in 2005, 2006 and 2007 for intra-annual and interannual variability. Additional German and US cruises are planned in the same period under the framework of CLIVAR/SOLAS/AMMA/PIRATA.

The EGEE 3 cruise will be performed during the first Special Observational Period (SOP1) of AMMA. The first objective is to provide a closed surface heat and salinity budget of the Gulf of Guinea, during the monsoon onset, at a fine spatial and temporal resolution. The second objective is to realistically simulate the oceanic upper layers during this period: to get a view of the different processes at play and to indirectly validate the sea-surface fluxes. The EGEE 3 experiment aims at documenting the marine atmospheric boundary layer (MABL) depth, the cloudiness variation and structure in the North-South direction as well as evaluating the impact of coastal upwelling on the monsoon flux (local winds generated by the upwelling structure of MABL). During the EGEE 3 there will be in-situ measurements, radio-soundings along the ship trajectory and 2 simultaneous aircraft surveys along 2.5°S.

ACTION ITEM 8. Enquire via VACS about the climate component of AMMA (*C. Reason and M. Visbeck*)

The PIRATA (Pilot Research moored Array in the Tropical Atlantic, <http://www.pmel.noaa.gov/pirata/>) array is still operating thanks to the commitments of NOAA (US), INPE (Brazil) and IRD/MeteoFrance (France). PIRATA is the main permanent observation program in the Tropical Atlantic which will contribute to the overall goals of TACE (Tropical Atlantic Climate Experiment) and AMMA. The current consolidation phase will end in 2006, however there is the possibility that it will be extended until February 2008. At the last PIRATA meeting (Toulouse, October 14-16, 2005) the Program Resource Board (PRB) was charged to draft a new Memorandum of Understanding that would sustain PIRATA in an operational mode from 2008 onward.

At the last meeting the following extensions were endorsed:

- SW extension consisting of three ATLAS buoys deployed by Brazil in summer 2005
- SE extension (BCLME -South Africa, Namibia and Angola), if funded, 1 buoy will be deployed during EGEE 3

Potential extensions (North and North-East) are planned by US-AMMA with a deployment in boreal spring 2006, however the proposal is under review by the PIRATA SSC and it will be sent to external reviewers before getting the PIRATA endorsement.

The PIRATA steering committee (SSC) proposed to undertake a CLIVAR/OOPC review. A self-assessment document will be produced reporting on what has been done since 1997: is PIRATA a success for science, operational oceanography and operational meteorology? What are the future objectives of PIRATA? The first draft of the document will be ready in January 2006. The final version should be available to CLIVAR and OOPC in March 2006.

With respect to the Tropical Atlantic Climate Experiment (TACE), the PIRATA-SSC regrets that TACE is mostly oriented towards the eastern tropical Atlantic and strongly suggests TACE to consider also the western and mostly the southern tropical Atlantic basins. For example TACE could address the sparse observations in the southern Atlantic in the framework of PIRATA. Likewise PIRATA is willing to contribute to the overall objectives of TACE by enhancing the vertical resolution of T and S sensors on the ATLAS buoys and also to install some current sensors in the mixed layer

ACTION ITEM 9. Put together a CLIVAR team for the review of the joint OOPC/CLIVAR PIRATA program (*W. Hazeleger*).

ACTION ITEM 10. Review the PIRATA program before July 2006 (*W. Hazeleger and the review team*)

W. Johns presented the progress on the CLIVAR proposed TACE (<http://www.clivar.org/organization/atlantic/TACE/>). TACE is planned as a 6-year (2007-2012) enhanced monitoring study, ultimately leading to specification of the sustained observations network in the tropical Atlantic needed to meet CLIVAR goals. TACE held an implementation workshop in Miami, February 2005, where the participants recognized the relevance of such project and suggested enhancements:

- More focus on western equatorial region to improve equatorial SST predictions (additional moorings across the equatorial waveguide at 35°W)
- To address the data void in the southwestern tropical Atlantic (extend the 23°W array to at least 10°S)
- Better observational coverage in the eastern Gulf of Guinea, including south of the equator (enhance profiling float coverage.)

Overall a more focused effort on model development and intercomparison for the Tropical Atlantic is needed. An initial step would be to organize a comparison experiment of currently available high-resolution data assimilation models of the region (MERCATOR, HYCOM etc.),

Two TACE working groups were proposed:

- An “Observational Working Group” in charge of coordinating observational logistics, evaluate effectiveness of the observational network and develop needed enhancements)
- A “Modelling and Synthesis Working Group” in charge of establishing links with WGOMD and WGSIP in order to coordinate modelling efforts, encourage collaboration between research modellers and operational centres and provide “transitions” to operational centres.

P. Nobre noted that the TACE focus on the eastern tropical Atlantic is a limitation to meet the overall objectives. By focusing on the eastern tropical Atlantic upwelling zones, TACE is not addressing climate variability and predictability issues of the whole tropical Atlantic. Unfortunately, due to limitations in prospective resources, at this point TACE cannot address the western tropical Atlantic, a region important for hurricane growth and teleconnections to the midlatitudes, also it cannot address the South Atlantic Convergence Zone, a key region of interest for climate forecasts over South America. However, it was discussed that there is a strong need for an additional project or activity in the western tropical Atlantic to meet the overarching TACE goal. Both VAMOS and AIP should consider proposing such a project for the western tropical Atlantic in the near future.

ACTION ITEM 11. Reformulate TACE goals and rewrite synopsis accordingly (B. Johns, W. Hazeleger, P. Nobre, M. McPhaden and B. Bourles)

ACTION ITEM 12. Send a letter to CLIVAR and PIRATA SSGs on timetable/strategy to revise TACE (W. Hazeleger)

ACTION ITEM 13. Get in contact with VAMOS on possibility of a joint SACZ program (P. Nobre and W. Hazeleger)

Finally W. Hazeleger gave an overview on the outputs of the Tropical Atlantic Ocean Dynamics workshop that preceded the AIP meeting. About 40 participants met in Venice on 17-19 October 2005 to address the overall objectives:

- Take stock of our understanding of the ocean’s role in the Tropical Atlantic Variability
- Compare state of the art of ocean and climate models with observations

The presentations were grouped under three main topics:

- Atlantic Tropical Circulation
- Tropical interactions with subtropics, MOC and STC (subtropical cells)
- Upper ocean processes interactions with the atmosphere, NAO, ENSO and upwelling

The workshop highlighted the fundamental disagreements between models, observations and assimilation products at intraseasonal, seasonal and interannual scales of variability. The main issues are:

- The need to confirm the role of the heat budget in high-resolution coupled models and ocean-only models; promote studies to improve parametrizations
- Promote experiments with regional coupled models for addressing the cold bias/double ITCZ; improve mixed layer climatology with ARGO and PIRATA data
- That the STC appears to have little influence on decadal TAV; the role of MOC is still unclear for the decadal timescale however there is paleoclimatic evidence for large impact

6. South Atlantic Activities And Plans

C. Reason reported on several activities going on in South Atlantic which are related to southern Africa. The Benguela Current Large Marine Ecosystem (BCLME) project is considering supporting the PIRATA SE extension: a pilot mooring at 5S-5E. A feasibility study was funded two years ago and the formal proposal is under review now. BCLME intends to develop an early warning system for Benguela Niño events, and the Angola-Benguela frontal zone. The ability to predict the local winds on short time-scales is particularly important for forecasting shifts in the frontal zone and for HAB (Harmful Algal Bloom) events in the southern Benguela. The monitoring plans include the development of a “state of environment information system”. Inputs from CLIVAR, GOOS and international bodies are welcome.

ACTION ITEM 14. Contact BCLME and show support for PIRATA extension (*C. Reason, M. Visbeck and W. Hazeleger*)

Cape Town (SA) hosted the South Atlantic ARGO Regional Data Centre meeting in May 2005. The workshop addressed the floats logistics and deployment opportunities as well as data management, quality control and applications.

Discussions took place between S. Africa and Brazil on organizing a South Atlantic Climate workshop in April 2006 after the Southern Hemisphere Meteorology and Oceanography conference. The objectives include reviewing the state of knowledge, taking forward the SACOS recommendations and agreeing on feasible outcomes. Some of the proposed issues are:

- Air-sea flux monitoring in central S. Atlantic
- XBT lines across S. Atlantic, ARGO floats deployments
- Easterly waves generated over tropical southern Africa and propagation towards Brazil
- SACZ variability and influence on S. America and southern Africa climate
- S. Atlantic MOC monitoring

The GoodHOPE cruises are ongoing, the first occupation was made in Feb/Mar 2004. The fourth occupation will be made in Nov. 2005: XBTs, drifters and ARGO floats will be deployed along the track.

Finally C. Reason identified potential activities that provide an intersection with VACS panel:

- NAO links with the West African monsoon
- TACE links with Benguela Niño

AIP inputs on VACS planned workshop and events are welcome

7. AIP Links with CLIVAR and WCRP activities

7.1 COPEs

M. Visbeck outlined the recent progresses with the WCRP COPEs (Coordinated Observation and Prediction of the Earth System (<http://copes.ipsl.jussieu.fr/>)). COPEs is the WCRP strategic framework for 2005-2015, it was proposed by the WMO/ICSU/IOC Joint Scientific Committee (JSC) after the 25 years of WCRP activities in determining the predictability of climate and the effect of human activities on climate. The scientific challenges are the seamless prediction problem, the prediction of the broader climate/Earth system (including atmospheric chemistry, carbon cycle and marine eco-system), the analysis of climate system behaviour and the application of WCRP science to socio-economic problems (demonstration of the usefulness of WCRP-enabled analysis and predictions). The core projects such as CLIVAR will remain central to COPEs modus operandi and will continue to play an essential role in determining and pursuing the objectives of WCRP. However a new level of coordination has been introduced as part of the new strategic framework. Two WCRP panels have been formed: The Modelling Panel (WMP promotes coordinates and integrates modelling activities across WCRP) and the Observations and Assimilation Panel (WOAP provides a focus on and coordination of the observational aspects of WCRPs activities).

7.2 WGOMD

WGOMD has recently proposed a tool to explore ocean models under a common surface forcing. The new activity called CORE, Coordinated Ocean Reference Experiments, proposes a baseline experimental design for global ocean-ice modelling with bulk formulae for computing turbulent fluxes as function of SST and

prescribed atmospheric state. The forcing data set combines NCEP/NCAR reanalysis and remote sensing products (Large and Yeager, 2004). There are three set of experiments proposed:

1. Long-term (500 yr) integrations with a “normal-year” forcing
2. Ocean hindcasts with interannual varying forcing
3. Response to increased Arctic meltwater runoff

CORE experiments help to identify sensitivities in ocean model simulations. For example the MOC is strongly dependant on details of Arctic freshwater while the (inter)-decadal transport changes are pretty robust. The atmospheric forcing remains the most critical choice.

In 2002 the AIP established a subgroup to provide inputs to WGOMD on Atlantic metrics and indices of climate variability as well as to identify and/or develop model experiments to explore MOC sensitivity. D. Wright prepared a document with a list of available data sets and/or data products that models should be confronted with while T. Delworth prepared metrics of Atlantic climate variability with a focus on the MOC and basin-scale water mass properties. Both documents were presented at the joint AIP-WGOMD meeting in April 2003 and distributed widely. Further interaction with WGOMD resulted in suggested model experiments to study the :

- Sensitivity to horizontal resolution of processes relevant for MOC variability and change. One such experiment could focus on the dependence on resolution of signal propagation along the western boundary
- Adjustment of models to surface perturbations. One such experiment is already underway; there is an existing CMIP project to examine the response of coupled models to imposed freshwater forcing, and to CO₂ increase. Another potential experiment could be the response of models to perturbations associated with stronger or weaker NAO states, or to altered NAO spatial structures

There are still several issues in the Atlantic that could be addressed with model experiments, for example to provide conclusive evidence of the role of the MOC in decadal climate variability. The identification of indices of MOC (and heat flux) variability would be very useful, particularly if such an index could be obtained from historical sea level and hydrographic observations. The AIP also would like to get guidance from ocean models on how to design an appropriate sustained climate observation program: robust correlations under realistic forcing conditions between variables that are of climate relevance and variables that are more easily monitored.

Further D. Wright recently solicited specific information on metrics from observationalists. Unfortunately very few responses were received. However, they were collated and circulated to the meeting participants.

ACTION ITEM 15. Send a list of indices and associated metrics relevant to the evaluation of climate variability in ocean models to Detlef Stammer for input to GSOP (*D. Wright*)

ACTION ITEM 16. Finalize the previously produced table and report on Atlantic metrics and put it on the web (*D. Wright and R. Boscolo*)

7.3 GSOP

The CLIVAR GSOP (Global Synthesis and Observations Panel

<http://www.clivar.org/organization/gsop/index.htm>) was formed with the aim to help CLIVAR to design data integration and archiving, hierarchy of synthesis systems and coordination with existing efforts and other programs. GSOP was tasked with:

- Being the primary CLIVAR interface with the COPES WOAP
- Leading the ocean reanalysis for WCRP
- Setting the agenda to satisfy CLIVAR needs for global synthesis
- Being the primary link with OOPC and explore potential for cooperation and collaboration with JCOMM
- Working closely with modelling and basin panels to develop a strategy on how they should interact in the future
- Identifying joint initiatives with SOLAS, the carbon program and WGSF

The first GSOP meeting followed immediately after the CLIVAR reanalysis workshop held in November 2004. The workshop and the meeting set a fundamental challenge for CLIVAR: to promote the development and wider use of global ocean reanalysis to adequately address climate-related questions and for applications with significant societal relevance. CLIVAR reanalysis will help to:

- develop improved (more coherent, better organised, more widely available and more useful) databases and reference data sets for the climate community;
- provide a basis to study the climate dynamics of the ocean, and the interaction of the ocean with the atmosphere and cryosphere over the last several decades.
- provide the basis for the initialization of coupled models on seasonal-to-interannual and decadal and longer time scales.
- provide a global framework to bring regional and basin scale research efforts back into a global climate context.
- provide guidance on the effectiveness of the ocean observing system for monitoring climate variability and climate change, in order to address CLIVAR needs.

GSOP will form two working groups: one on data quality requirements for reanalysis and ocean data systems and another on intercomparison of reanalysis (together with GODAE and WGOMD). Also, a preparation of recommendations for model standard and surface fluxes is underway that should be used for reanalysis efforts (together with WGOMD and the WCRP Working Group on Surface Fluxes). There are several ocean simulation and data assimilation products available today that differ substantially in their underlying assimilation schemes and, accordingly, in their quality. Some of the existing simulation and assimilation products span the period of the past several decades (e.g., the SODA product and the on-going multi-decadal ECCO reanalysis product) while others cover only the period from 1992 to present. A concerted reanalysis evaluation framework is required for determining the skills of existing ocean reanalysis products through detailed model-data comparison studies. Several regional inter-comparison efforts of assimilation products are currently being undertaken under the GODAE initiative, however, these focus primarily on operational and near-real time ocean assimilation efforts. CLIVAR focus is on a global reanalysis evaluation effort for climate relevant purposes and such evaluation needs to be done in close collaboration with CLIVAR's basin panels. The tasks are:

- Evaluate the quality and skill of available global reanalysis products and determine their usefulness for CLIVAR.
- Identify the common strengths and weaknesses of these systems and the differences among them, as well as to identify which application can be best served by which reanalysis products.
- Define climate-indices and products that should be produced in a regular manner by each reanalysis effort to support regional and global CLIVAR analyses and process studies alike and thereby to facilitate applications of reanalysis products by the climate research community.

Various fields will be computed from existing reanalysis efforts. These will be evaluated against each other and especially against CLIVAR reference data sets, including inter alia in situ and satellite data as well as surface flux reference data. All those diagnostics are expected to be provided/computed by individual reanalysis efforts and results will be made available to the public through the CLIVAR/GSOP web pages and through CLIVAR/GODAE data servers. Details will depend on suggestions provided by CLIVAR basin panels and by WGOMD.

7.4 OOPC

After a brief look at the existing observational network

(<http://www.clivar.org/organization/atlantic/IMPL/index.htm>), M. Visbeck raised several issues:

- How to maintain existing networks? CLIVAR is one of the scientific users of the existing networks, but all the users should speak with one voice when it comes to defend observing systems. Will OOPC be the voice with input from CLIVAR when needed? How to evaluate the overall usefulness of a particular array in the context of other data and a variety of users?
- How to transition pilot efforts to sustained? CLIVAR has several pilot projects in the water that, if proven useful, should be sustained. How will we accomplish that?
- How to come to a global/regional synthesis given the rich mixture of data types? How to manage data?

There are several sustained observations in support of decadal (ocean) signals that could become operational:

- MOC: overflow measurements (Denmark Strait, FS Channel) and boundary currents (transport, water masses: Labrador Sea outflow, 26N RAPID/MOCA & cable, NADW deep eddies, 20-30S)
- Potential Energy time series (Labrador Sea, Bermuda, Irminger Sea, Porcupine Bank, Cape Verde)
- Tropical Atlantic Variability: PIRATA + Extensions/replacements and TACE (enhanced surface drifter & ARGO & PIRATA)

8. AIP links with International Activities

8.1 GLOBEC

The IGBP GLOBEC (Global Ocean Ecosystem Dynamics (<http://www.pml.ac.uk/globec/>)) has recently expressed an interest in having close links with CLIVAR basin panels. A GLOBEC representative, K. Drinkwater was invited to attend the AIP meeting as a first step towards establishing a regular exchange of information between the two projects. There are several GLOBEC regional programs that focus on ecosystem changes related to climate variability. These include:

- Cod and Climate Change: to understand the role of physical forcing on the life history of cod, with special emphasis on the comparative approach.
- Small Pelagic Fish and Climate Change: to understand and predict climate-induced changes in the fish production of marine ecosystems, especially small pelagic fish
- Ecosystem Studies of Sub-Arctic Seas: to compare, quantify and predict the impact of climate variability and global change on the productivity and sustainability of Sub-Arctic marine ecosystems.
- CLIOTOP: to identifying the impact of both climate variability (at various scales) and fishing on the structure and function of open ocean pelagic ecosystems and their top predator species, especially tuna. Its emphasis will be on the tropical Atlantic and Pacific, but not exclusively.

In addition there are several ongoing national programs (Norway, Germany, France, Spain, Portugal, UK and USA) that contribute to GLOBEC.

GLOBEC raised several issues and questions where CLIVAR inputs would be very helpful, namely:

- Atmospheric Teleconnections between the Atlantic and Pacific appear to be driving ecosystem changes, especially noticeable in upwelling systems. What are the links? Will they change under global warming?
- Many ecosystem changes in the North Atlantic reflect the variability in the NAO, e.g. primary production, individual growth rates of fish, recruitment, etc. What determines the variability in the NAO? What is the link between the NAO and regional processes? What is the relative importance of various teleconnections on the NAO, e.g. Indian Ocean forcing vs. snow over Eurasia?
- Multidecadal Variability in the physical environment leads to major ecosystem shifts such as distribution and production (e.g. upwelling areas, 1920-1960 warming in North Atlantic). What controls this multidecadal variability? What are the changes in the ocean circulation on these time scales?
- Better parameterization of the shelf-open ocean exchanges are needed to help understand the exchange of plankton and larvae between these regions. This is needed to determine the movement of zooplankton, such as *Calanus finmarchicus*, that overwinter in the deep waters but are important prey for larval and juvenile fish on the shelves during the spring and summer. There is also a need to better link global ocean-atmosphere-ice models with ecosystem models.
- One of the objectives of GLOBEC is to predict what will happen to marine ecosystems on annual to decadal scales. This is especially important given the relatively recent decision by governments to adapt to Ecosystem Based Management. Good atmospheric and oceanographic scenarios are needed upon which to base these predictions.
- GLOBEC needs future climate scenarios, especially for the ocean on regional scales, in order to predict possible ecosystem responses to anthropogenic forced climate change. Changes to the wind and wind forcing will be critical for many shelf regions as will what will happen to the MOC. Seasonal changes will be extremely important as they may lead to shifts in primary production with ripple effects throughout the upper trophic levels.
- The GLOBEC Ecosystem Studies of Sub-Arctic Seas (ESSAS) is heading an IPY cluster that focuses on climate variability on subarctic and arctic ecosystems, from phytoplankton to seabirds. Cooperation with CLIVAR on IPY programs, perhaps even sharing resources (ship time, moorings, etc.) could be useful to both parties.
- GLOBEC would also like to know how representative the present day ecosystems are compared to what existed previous, especially under different climate or climate variability regimes. This can only be answered by paleo studies. Another question of interest that paleo studies can shed light on is how robust is the multi-decadal variability.
- GLOBEC studies often require time series of many atmospheric and oceanic variables, either observed or from model outputs. In the atmosphere they are: atmospheric reanalysis products for

regional studies, air temperature, air pressure, winds, P-E, air-sea fluxes, clouds etc. In the ocean they are: circulation fields, temperature, salinity, turbulence levels, O₂, light levels, MLD, intensity of stratification, nutrients, etc. The GLOBEC WG3 on modelling asked whether there is an inventory of available model data or if there are any plans to work on such an inventory.

Possible ways forward in terms of cooperation and collaboration between CLIVAR and GLOBEC include:

- Information Exchanges (e.g. CLIVAR panels meetings, joint newsletters, Jim Hurrell being on GLOBEC's SSC, etc.)
- Combined meetings/workshop on specific issues.
- Joint programs.
- Shared data products.

ACTION ITEM 17. Respond to GLOBEC questions (*R. Boscolo*)

8.2 SOLAS and IMBER

As part of maintaining a link with the ocean carbon research community A. Koertzing was invited to give a presentation on recent programmatic developments. Within the new science structure of IGBP (<http://www.igbp.kva.se/>) there are two new major research programmes: SOLAS (Surface Ocean Lower Atmosphere Study <http://www.uea.ac.uk/env/solas/>) and IMBER (Integrated Marine Biogeochemistry and Ecosystem Research, <http://www.imber.info/>). SOLAS is co-sponsored by WCRP and aims to achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and the atmosphere, and how this coupled system affects and is affected by climate and environmental change. One of the foci of SOLAS which is relevant to CLIVAR is the air-sea flux of CO₂ and other long-lived radiatively-active gases. IMBER is co-sponsored by SCOR and its vision is to develop an understanding of how interactions between biogeochemical cycles and ecosystems respond to and force global change. At the last CO₂ conference (Boulder, USA, Spet. 2005) a joint SOLAS-IMBER Carbon Implementation Group was formed.

The International Ocean Carbon Coordination Project (IOCCP, <http://ioc.unesco.org/ioccp/>) provides communication and coordination service for the international ocean carbon community. The carbon and tracers global survey (2001-2012, <http://ioc.unesco.org/ioccp/HydrographyMap.htm>) is a CLIVAR/IOCCP joint activity and is meant to be the continuation of the WOCE/JGOFS survey. 25 lines are already completed and 24 are planned for 2006-2012, while the global synthesis is underway. Early results from this new survey suggest that global uptake by the ocean may be slowing down. The IOCCP is promoting the development of new sensors for ocean interior carbon to provide appropriate sampling coverage and frequency. Autonomous profiling float sensors currently under development include O₂, POC/PIC, DIC, Alk, pH.

Regarding the pCO₂ survey (<http://ioc.unesco.org/ioccp/UWglobalM.htm>), long-term time series observations in the North Atlantic show a growing divergence between surface mixed layer uptake and increases of dissolved inorganic carbon in deeper water, most likely responding to changes in NAO variability and subtropical mode water formation. Studies of *global* autocorrelations scales of pCO₂ indicate that the lack of long-term time series stations makes identifying temporal relations between pCO₂ and atmospheric/ocean processes rather difficult. Reducing uncertainty in pCO₂ correlation structure will require more and targeted measurements over the entire globe. There are currently 13 time series stations and 31 underway lines operating, with 3 surface drifting buoys operating in the Southern Ocean. Next steps will include identifying and prioritizing areas requiring increased coverage and developing a multi-platform observation strategy as well as encouraging further development of data assimilation models and interpolation techniques. Real-time carbon measurements are given by:

- long-term interdisciplinary moorings
- Voluntary Observing Ships
- Profiling drifters
- Autonomous gliders

8.3 Palaeo community

The panel discussed potential links with the Palaeo community. N. Koc was asked to inform the members on paleo activities that would benefit from a synergy with AIP and vice versa. Several initiatives were identified as well as opportunities for initiating links and proposing cross memberships. N. Koc asked the panel what paleoclimate information is useful for helping the AIP to achieve its goals.

9. Involvement of AIP in future relevant events

The UK RAPID program is planning to hold an international workshop on 24-27 October 2006. The workshop aims to attract about 250-300 attendees with only 50% being involved in the project. The first announcement will come out in November 2005 however the format and invited talks are not yet decided. The workshop has been endorsed by CLIVAR/PAGES Intersection Panel but is seeking the AIP and wider CLIVAR approval too.

ACTION ITEM 18. Endorse the RAPID workshop, and recommend AIP members for the steering committee (*R. Boscolo, D. Marshall and R. Sutton*)

ACTION ITEM 19. Enquire with ICPO who endorses workshops within CLIVAR (*R. Boscolo*)

ASOF will hold a science conference on 28 June-1 July 2006 in the Faroe Islands (http://asof.npolar.no/NEWS/ASOF_conf.html). The objectives are to describe our changing ideas and capabilities since pre EU VEINS (Variability of Exchanges In the Northern Seas) and to give a modern account of the cutting-edge questions regarding the role of the Northern Seas in climate at the outset of the IPY. The agenda features all invited talks that will be chapters of an ASOF book edited by B. Dickson, J. Meincke and P. Rhines.

The IfM-GEOMAR in Kiel, Germany is planning to hold a workshop in March 2007 in order to celebrate the termination of the SFB 460 research project (<http://www.ifm.uni-kiel.de/allgemein/research/projects/sfb460/sfb460-e.htm>). SFB 460 is a huge effort (undertaken mainly by the University of Kiel with the majority of its research located at IfM Kiel) towards the study of fluctuations of water mass formation and transport processes in the subpolar North Atlantic. SFB 460 aimed at gaining a better understanding of the significance of these for the dynamics of thermohaline overturning and oceanic uptake of anthropogenic CO₂. The workshop will be a showcase for the scientists involved in SFB 460 as well as an opportunity to review achievements and challenges in the understanding of THC variability and Atlantic subpolar dynamics.

A. Timmerman and colleagues at IPRC (USA) are planning to organize a workshop in November 2006 on Multidecadal to Centennial Global Climate Variability. This workshop will address both Atlantic and Indo-Pacific variability mechanisms as well as mechanisms to synchronize Atlantic-Pacific variability. It will also focus on novel techniques and theoretical approaches to the centennial-scale climate problem. It is thought to be a great opportunity to bring together the Pacific and Atlantic community and expose students and young researchers to more global perspectives of climate dynamics. The venue is Honolulu, Hawaii (USA).

ACTION ITEM 20. Send feedback to the proposal for an international workshop on multidecadal to centennial global climate variability (*R. Sutton, L. Terray and W. Hazeleger*)

In summer 2006 NCAR is planning to host an international workshop relevant to CLIVAR, GLOBEC and fisheries management. The goals of the workshop are:

- Build bridges from physical climate through to marine resource policy
- Identify the role of coupled modeling and coupled climate-ecosystem models in building those bridges
- Identify goals for improved coupled (climate-marine ecosystem) models
- Provide a focused activity linking the physical, biological and social science communities together

The CLIVAR panel VACS is organizing a workshop on African climate predictability and impacts of regional ocean variability with focus on Eastern and Southern Africa. The workshop was initially planned for February 2006 in Tanzania but has recently been postponed to June 2006. The objective of the workshop is to explore the predictability of the African regional climate in the 1997-present period, highlighting the nature of the variations, the multiplicity of possible causes, the realized and potential predictability, the adequacy of observations for monitoring and prediction, and considering societal awareness and response. An examination of the significance of this period against the longer record of African climate variability will also be considered, as will climate prediction methods relevant for Africa.

ACTION ITEM 21. Encourage planning for the workshop in Tanzania (*C. Reason*)

An open science conference on Polar Dynamics: monitoring, understanding and prediction is planned for August 2007 in Bergen Norway (<http://web.gfi.uib.no/conference2007/info.htm>). The conference will commemorate the 90-year anniversary of the Geophysical Institute in Bergen and of the Norwegian Geophysical Society, both founded in 1917. The aim of the conference is to provide an overview of ongoing and emerging monitoring programs; recent advances in process studies and understanding, and new opportunities for prediction based on state-of-the-art regional or general circulation models of the high-latitude systems. Both C. Mauritzen and M. Visbeck have been invited to be part of the scientific committee.

ACTION ITEM 22. Ensure that AIP and ACP topics are addressed at the Polar Dynamics workshop (*C. Mauritzen, M. Visbeck and N. Koc*)

W. Hazeleger announced that the next TAV workshop is likely to be held in Paris in September 2006.

ACTION ITEM 23. Provide input to the next TAV meeting (*W. Hazeleger, B. Johns, L. Terray and P. Nobre*)

10. CLIVAR Assessment and new challenges for AIP

M. Visbeck reported on the output of last-year's CLIVAR assessment exercise. The assessor noted that the Atlantic is historically a well-studied basin, with decadal variability being considered important long before the outset of CLIVAR. Hence, a number of studies on decadal variability in the basin were and still are going on independently of CLIVAR. However considerable progress has been made since the formation of the Atlantic Panel and the SSG wished to recognise in particular the efforts of the Chair and the ICPO staff liaison. The panel has a healthy mix of atmospheric, oceanic, modelling and observational expertise. The panel has established a good track record for collaborating with other CLIVAR panels, e.g., WGCM, WGOMD, VACS, and VAMOS. The SSG does not wish to tamper with the panel's success to date. Areas in need of clarification are the connection to Arctic Ocean issues, sustained observational requirements for decadal Atlantic variability, and the role/sustainability of tropical Atlantic surface moorings, i.e., PIRATA.

The SSG agreed that it would be advisable to work to focus more clearly on four major themes for the whole of the programme, those already identified in the very early planning stages of CLIVAR, namely:

- ENSO
- Monsoons
- Decadal modes of variability and thermohaline circulation
- Anthropogenic climate change

The annual SSG meeting will be changed such that all CLIVAR panels and working groups would be asked to report to each SSG session on their contributions in these four major areas and the SSG would produce an annual report on overall CLIVAR progress organized around these themes. In the context of this regular self-assessment, the SSG will be playing a more active role in determining the progress to date of the various panels and working groups.

In view of this new reporting exercise, the AIP members discussed the new future challenges:

- Strengthening in anthropogenic climate change, in particular in relation to coupled modelling
- A greater focus on predictability
- Stronger relations with operational centres
- Greater interactions with VACS and VAMOS panels

It is essential to address needs of the society and establish a close relationship between research, applications and stakeholders. For this the AIP will take a specific focus on extreme events (e.g. hurricanes), predictability and anthropogenic climate change.

ACTION ITEM 24. Write a draft on future directions of the Atlantic Panel (*W. Hazeleger*)

The members also noted that some of the AIP terms of reference are outdated.

ACTION ITEM 25. Write a new set of terms of reference and send it to the panel members for comments (*W. Hazeleger*)

M. Visbeck proposed that all the European AIP members to explore the possibility of lobbying the EU on inclusions of some activities promoted by CLIVAR AIP in the next framework 7.

ACTION ITEM 26. Enquire about the possibility lobby the EU for funding CLIVAR AIP related activities (*M. Visbeck, R. Sutton, C. Mauritzen, W. Hazeleger and L. Terray*)

11. MEMBERSHIPS AND FUTURE MEETING

ACTION ITEM 27. Propose replacement for Wainer and Reason (*M. Visbeck and W. Hazeleger*)

ACTION ITEM 28. Send names and short description of possible new panel members 2007 (*Panel*)

ACTION ITEM 29. Compile list and matrix for possible new members 2007 (*R. Boscolo and W. Hazeleger*)

ACTION ITEM 30. Explore the possibility to hold the next AIP meeting in Kiel, March 2007, in association with a workshop on Atlantic Subpolar Gyre (*R. Boscolo*)

APPENDIX A: List of Attendees

Panel Members

Bourles Bernard	IRD, Brest FR	Bernard.Bourles@ird.fr
Hazeleger Wilco	KNMI, de Bilt NL	hazelege@knmi.nl
Hurrell Jim	NCAR, Boulder, USA	jhurrell@ucar.edu
Johns Bill	RSMAS, Miami, USA	wjohns@rsmas.miami.edu
Koc Nalan	NPI, Tromso NO	Nalan.Koc@npolar.no
Marshall David	Uni. Reading, UK	D.P.Marshall@reading.ac.uk
Mauritzen Cecilie	NMI, Oslo NO	C.Mauritzen@met.no
Reason Chris	Uni. Cape Town, SA	cjr@egs.uct.ac.za
Stammer Detlef	IfM, Hamburg, GER	stammer@ifm.uni-hamburg.de
Sutton Rowan	CGAM, Uni. Reading UK	rowan@met.reading.ac.uk
Terray Laurent	CERFACS, Toulouse FR	Laurent.Terray@cerfacs.fr,
Visbeck Martin	IfM, Kiel GER	mvisbeck@ifm-geomar.de
Wright Dan	BIO, Dartmouth, CA	WrightDG@mar.dfo-mpo.gc.ca
Zhang Chidong	RSMAS, Miami, USA	czhang@rsmas.miami.edu

Guests and Observers

Boening Claus	IfM, Kiel GER	cboening@ifm-geomar.de
Brandt Peter	IfM, Kiel GER	pbrandt@ifm-geomar.de
Drinkwater Ken	IMR, Bergen NO	ken.drinkwater@imr.
no		
Koertzinger Arne	IfM, Kiel GER	akoertzinger@ifm.uni-kiel.de
Nobre Paulo	Uni. Sao Paulo BR	pnobre@cptec.inpe.br
Todd Jim	NOAA-OGP, USA	james.todd@noaa.gov

ICPO

Boscolo Roberta	OOV, Villefranche s/m FR	rbos@obs-vlfr.fr
-----------------	--------------------------	------------------

APPENDIX B: Agenda

Day1: Thursday 20th of October 2005

- 9:00** Opening/Welcome (M. Visbeck)
- Introduction to the meeting
 - Review agenda
 - Review action items from last year
- 9:30** US CLIVAR Reorganization (J. Hurrell)
- 10:00** Update on CliC-CLIVAR Arctic Climate Panel and IPY plans (C. Mauritzen)
- 10:20** Brief update on ASOF and future plans (R. Boscolo)
- 10:30** *Coffee Break*
- 11:00** Brief update on UK Rapid (D. Marshall)
- 11:15** Report THC workshop (C. Böning)
- 11:30** Status on Atmospheric tropical-extratropical teleconnections + report on EU-ENSEMBLE (L. Terray)
- 11:50** Update on AMI (C. Zhang)
- 11:55** Update on AMMA (B. Bourles)
- 12:05** Update on PIRATA (B. Bourles)
- 12:25** Report on TACE Implementation (W. Johns)
- 12:50** The TAV workshop (W. Hazeleger)
- 13:00** *Lunch*
- 13:45** Update on South Atlantic plans (C. Reason)
- GoodHope
 - BCLME plans to support PIRATA SE extension
 - ARGO regional data centre
 - Interaction with VACS
- 14:20** Update on COPEs (M. Visbeck)
- 14:40** WGOMD CORE Experiments (C. Boening)
- 15:00** Report of OOPC last meeting (M. Visbeck)
- 15:10** Update and discussion on WGOMD/Metrics (D. Wright)
- 15:30** *Coffee break*
- 16:00** GSOP Reanalysis evaluation strategy and white paper (D. Stammer)
- 16:45** Links with GLOBEC (K. Drinkwater)
- 17:15** Links with IMBER + Carbon (A. Koertzinger)
- 17:45** *Adjourn*
- 20:00** Panel dinner

Day 2: Friday 21st of October 2005

- 9:00** Report on PAGES activities (N. Koc)
- 9:40** Plans for a RAPID workshop Oct. 2006 (D. Marshall)
- 9:50** Plans for a THC workshop in Kiel March 2007 (C. Böning)
- 10:00** Plans for a Workshop on multidecadal variability proposed by A. Timmermann (M. Visbeck)
- 10:10** Other planned workshops: VACS workshop summer 2006 and Polar Dynamics, Bergen 2007
- 10:15** *Coffee Break*
- 10:45** Rest of meeting exclusive for Atlantic Implementation Panel Members
- Role of AIP in view of CLIVAR review
 - New challenges for the panel during the “second phase of CLIVAR” 2007 – 2012
 - Membership
- 12:30 – 13:15** *Lunch*
- Proposal to change the Term of References
 - Define new action items
 - Future activities
 - Next panel meeting
 - Other business
- 15:30** *End of Meeting*

National Oceanography Centre, Southampton
University of Southampton Waterfront Campus
European Way, Southampton SO14 3ZH
United Kingdom
Tel: +44 (0) 23 8059 6777
Fax: +44 (0) 23 8059 6204
Email: icpo@noc.soton.ac.uk