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REPORT OF THE 6TH MEETING OF CLIVAR ATLANTIC IMPLEMENTATION PANEL

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Action Items

- 1) Provide input to WGOMD through D. Wright on the proposed WGOMD-CORE (Coordinated Ocean Reference Experiments) activities
(All)
- 2) Further develop the Metrics of Atlantic Climate Variability and provide the inputs to WGOMD for ocean model verification
(D.Wright, D.Stammer and B.Johns)
- 3) Encourage WCRP/CliC to move ahead with the formation of the CliC/CLIVAR Arctic Climate Panel, subject to CLIVAR SSG agreement.
(M.Visbeck and R.Boscolo)
- 4) Update the panel on the development of the CliC/CLIVAR Arctic Climate Panel
(C.Mauritzen)
- 5) Explore better linkages with the ICES WGOH group
(S.Bacon, C.Mauritzen, D.Stammer and R.Boscolo)
- 6) Inform the panel about the planned and proposed process studies and observations in the North Atlantic subpolar area
(T.Haine and R.Boscolo)
- 7) Suggest opportunities for interaction with the paleo community to the panel.
(N.Koc and R.Boscolo)
- 8) Update the panel on the outcome of the THC workshop
(M.Visbeck, D.Stammer, C.Mauritzen and R.Boscolo)
- 9) Identify a new panel liaison for formulating CLIVAR data management needs
(M.Visbeck and all)
- 10) Encourage the further development of a plan for the 25°S MOC observing system and liaise with WGOMD and WGCM on the observing system design.
(A.Piola, C.Reason, W.Hazeleger and B.Johns)
- 11) Update the panel on the status of the PIRATA SW extension
(B. Bourles and I.Wainer)
- 12) Communicate the review of GOODHOPE to the proposers and SO panel chairs
(D.Marshall)
- 13) Encourage the writing of an article for the next CLIVAR Exchanges on the output of the last Tropical Atlantic Variability meeting held in De Bilt, NL, June 2004.
(W.Hazeleger)
- 14) Encourage the revision of the Executive Summary for TACE
(R.Sutton, B.Johns, W.Hazeleger and B.Bourles)
- 15) Review the final version of the TACE White Paper
(R.Sutton, J.Hurrell, I.Wainer and C.Zhang)
- 16) Submit the final TACE White Paper to the SSG for endorsement
(M.Visbeck and R.Boscolo)

- 17) Report on the SSG deliberations about the assessment of the Atlantic Panel and future directions of CLIVAR
(M.Visbeck)
- 18) Submit list of new members to the panel for input and submit final list to SSG
(M.Visbeck and R.Boscolo)
- 19) Encourage the panel members to propose topical workshops
(all)
- 20) Suggest modifications to the current panel Terms of Reference to Boscolo
(all)
- 21) Explore the possibility of holding the next panel meeting in conjunction with an international science meeting preferably on ACC
(M.Visbeck and R.Boscolo)
- 22) Invite Geir Ottersen (GLOBEC rep.) to our next meeting
(R.Boscolo)

1. Background

The CLIVAR Atlantic Implementation Panel (AIP) is a part of the CLIVAR organization. The panel is in charge of implementing the CLIVAR science plan in the Atlantic sector. More specifically its Terms of Reference are:

1. To recommend and oversee the implementation of observations in the Atlantic Ocean sector, in order to meet the objectives outlined in CLIVAR's Science and Initial Implementation Plans, particularly with respect to the Principal Research Areas D1 (North Atlantic Oscillation), D2 (Tropical Atlantic Variability) and D3 (Atlantic Thermohaline Circulation).
2. To collaborate with the JSC/CLIVAR Working Group on Coupled Modelling and CLIVAR Working Group on Seasonal-to-Interannual Prediction, in order to design appropriate numerical experiments, and to be aware of requirements set by these groups for data sets needed to validate models.
3. To liaise with the relevant CLIVAR panels, in particular The CLIVAR Ocean Observation Panel and the PIRATA Steering Group, to ensure that best use is made of resources from the global and equatorial research programs.
4. To liaise with Ocean Observation Panel for Climate and other relevant groups to ensure that CLIVAR benefits from and contributes to observations in GOOS and GCOS.
5. To report to the CLIVAR Scientific Steering Group (SSG).

The members of the CLIVAR Atlantic Implementation Panel are:

M. Visbeck (Chair)	Lamont-Doherty Earth Observatory, Palisades, USA
B. Bourles	Centre IRD de Brest, France
W. Hazeleger	KNMI, de Bilt, The Netherlands
J. Hurrell	NCAR, Boulder, USA
W. Johns	RSMAS, Miami, USA
N. Koc	Norwegian Polar Institute, Tromso Norway
K.-P. Koltermann	Bundesamt Seeschifffahrt Hydrographie, Hamburg, Germany
D. Marshall	Dept. Meteorology, Uni. Reading, UK
C. Mauritzen	Norwegian Meteorological Institute, Norway
A. Piola	Servicio de Hidrografia Naval, Buenos Aires, Argentina
C. Reason	University of Cape Town, South Africa
D. Stammer	Institut für Meereskunde, Hamburg, Germany
R. Sutton	Centre for Global Atmospheric Modelling, Uni. Reading, UK
I. Wainer	University of São Paulo, São Paulo, Brazil
D. Wright	Bedford Inst. of Oceanography, Dartmouth Canada
C. Zhang	RSMAS, Miami USA

ICPO Representative is:

R. Boscolo	ICPO SOC Southampton UK and IIM-CSIC Vigo Spain
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2. Opening and Welcome

Martin Visbeck (Chair) opened the 6th session of the CLIVAR Atlantic Panel by welcoming the participants (Appendix A) and thanking the JOSS staff for their organizational support. A special thank you was directed to the outgoing members: T. Busalacchi, T. Delworth, Y. Kushnir and F. Schott for their devoted work towards the CLIVAR Atlantic objectives. A warm welcome was given to the new members of the panel: B. Bourles, W. Hazeleger, N. Koc, D. Stammer and C. Zhang that will serve for the next 4 years. Apologies were accepted from B. Bourles, P. Koltermann and C. Reason for being unable to attend the meeting.

Martin Visbeck then reviewed the terms of reference of the CLIVAR Atlantic Panel. The goals and strategy of this panel were summarized in four points:

- Describe and model coupled atmosphere-ocean-land interactions in the Atlantic sector, quantify their influences on and interaction with the regional and global climate system, and determine their predictability
- Assemble quantitative historical, proxy and real time data sets that may be used to test, improve and initialize models of coupled Atlantic climate variability

- Investigate the sensitivity of the ocean's meridional overturning circulation (MOC) to changes in surface forcing
- Assess the likelihood of abrupt climate change
-

The CLIVAR Atlantic panel plays an important role in coordinating the large number of process studies / programs that address different aspects of the climate variability and predictability in the Atlantic sector, most of them not directly initiated under CLIVAR (www.clivar.org/organization/atlantic/IMPL/proc-stud.html).

Martin Visbeck revised the agenda of the meeting (Appendix B) and included a briefing on the WGOMD session (15, 18, 19 June 2004) by Dan Wright and a discussion item on the interaction between the newly formed panel CLIVAR Global Synthesis and Observations Panel (GSOP) and the basin panels by request of Detlef Stammer. Finally the panel was briefed on the status of the Action Items of the previous meeting.

3. Update on recent CLIVAR and WCRP activities

Roberta Boscolo reported on the relevant CLIVAR and WCRP activities. First she noted that Andreas Villwock, after serving the ICPO for 9 years, has left his duties within CLIVAR to take on some responsibilities directly with WCRP. Andreas acted as ICPO representative for WGOMD since its establishment and this role has now been taken over by Roberta Boscolo. In the last year two new CLIVAR panels have been formed: the Indian Ocean Panel (IOP) and the GSOP. The IOP addresses the need for high-quality ocean observations and applications in the Indian Ocean. The IOP is supported by CLIVAR and GOOS (through Indian Ocean GOOS and the Perth Office of the IOC) with the following terms of reference

- To provide scientific and technical oversight for a sustained ocean observing system for the Indian Ocean and Indonesian Throughflow in order to provide ocean observations needed for climate variability research and to underpin operational ocean applications and services relevant to the region, particularly with regard to ocean-state estimation and climate prediction.
- To develop, coordinate and implement a plan for a sustained ocean observing system for the Indian Ocean to (a) meet the common requirement of CLIVAR research themes and regional initiatives, particularly those identified by AAMP and VACS and the CLIVAR modelling panels, (b) satisfy the common requirements of GOOS and its modules, and (c) coordinate implementation activities in collaboration with relevant regional and global bodies and IOGOOS and JCOMM in particular.
- Liaise with relevant research Panels of CLIVAR and implementation Panels of GOOS and JCOMM and provide a focal point for coordination of ocean observing networks in the region.

An Indian Ocean Modelling workshop has been organized at IPRC, Honolulu USA on 29 Nov. – 3 Dec. 2004 (<http://www.clivar.org/organization/indian/docs/IOM1stCircular.htm>).

The GSOP was established in order to:

- Develop, promote and seek to implement strategies for a synthesis of global ocean, atmosphere and coupled climate information through analysis and reanalysis efforts and through the use of other techniques where appropriate. Initial emphasis will be on global ocean synthesis efforts, building on previous experiences and developments.
- Be responsible for the definition and fulfilment of CLIVAR's global needs for sustained observations and for the development of a strategy for their evolution/optimization based on new science and reanalysis insights, and fostering the use of resulting data sets in global synthesis efforts.
- Promote activities to develop the surface flux data sets required by CLIVAR in liaison with the WGNE, global atmospheric reanalysis efforts and the WCRP Working Group on Surface Fluxes.
- Provide an overview of and directions to CLIVAR data management and information activities in collaboration with other WCRP projects and in liaison with CLIVAR-relevant data centres and DACS and the ICPO.
- Liaise and collaborate with CLIVAR Panels and Working Groups in identifying the requirements for and coordinating the development of an observing system for CLIVAR.

GSOP is planning to hold a CLIVAR Ocean Reanalysis workshop at NCAR Boulder USA on 8-10 November 2004 (http://www.clivar.org/organization/gsop/implementation/ocean_reanalysis.html).

The ICPO has initiated a mid-term self-assessment in order to measure the achievements to date against the CLIVAR objectives and to provide the SSG with input to determine what steps might be necessary to ensure future progress. The review has been organized by CLIVAR streams: GOALS, DecCen and ACC and by unifying themes, i.e. "Data and Modelling". Each panel/group provided some background information to the reviewers (F. Schott for the Atlantic Panel), based on a common set of questions. The reviewers will comment on relevance/progress and assess the effectiveness of the organizational structure at the next SSG meeting in Baltimore 2004.

At the last meeting of the Joint Scientific Committee (JSC) for WCRP, (Moscow, 1-6 March 2004) Tim Palmer was nominated to be the new CLIVAR co-chair to replace Jurgen Willebrand, who finished his term. Tony Busalacchi accepted to continue co-chairing the CLIVAR SSG for another two years. A substantial part of the JSC meeting was devoted to further develop of the concept of the WCRP Coordinated Observation and Prediction of the Earth System (COPEs) strategy. COPEs was first conceived as a major overarching and integrating initiative that would set future directions for WCRP. Now COPEs represents a new strategy of WCRP for the period 2005-2015, reflecting the existing needs and possibilities and the maturity of WCRP's development, to convert theoretical and practical achievements into tangible support to governance on the basis of a global seamless observing, forecasting and prediction system spanning timescales from weeks to centuries. The main aim is to facilitate prediction of climate variability and change so as to strengthen and broaden the range of applications of direct relevance, benefit and value to society. The two goals are:

- to provide society with tangible results on what is, and what is not, predictable at weekly, seasonal, interannual, decadal and centennial time scales.
- to provide the research community with a central theme for building climate observation systems, developing climate system models and climate data assimilation techniques, and computing and data processing systems.

Specific objectives include:

- to determine the feasibility and expected skill of seasonal climate prediction in all regions of the globe with currently available models and data (this important exercise should be repeated periodically as observational systems and models evolve)
- to further develop and test the techniques for ensemble prediction of climate variability and change
- to determine the scientific basis for, the best approaches to, and current skill of projections of regional climate change at several time-scales
- to develop well-tested, detailed chemistry-climate prediction and projection models and related procedures (IGBP-IGAC)

A Task Force on Seasonal Prediction has been established under the chairmanship of B. Kirtman. He has already organized a workshop on seasonal prediction in Hawaii in November 2003. Also a task force (chairs B. Hoskins and J. Church) has been recently established to further develop the COPEs strategic framework. WCRP is planning a major international conference as part of its 25th anniversary where COPEs will be officially launched.

4. Report from the WGOMD 5th session

Dan Wright acted as the Atlantic panel representative at the last WGOMD meeting, GFDL Princeton USA. The meeting followed the CLIVAR ocean climate modelling workshop, which was structured in 4 sessions:

1. state of the art in ocean climate models used for IPCC
2. common practices and protocols for global ocean/ice experiments
3. physical processes and parameterizations in ocean climate models
4. future research and development directions

The workshop discussions and debate lead to recommendations for the WGOMD to help establish a set of core ocean reference experiments for use by global ocean/climate modellers.

The new approach was motivated by projects like AMIP and CMIP that are built on "standard practice" experimental designs. Model runs are part of regular model development and testing. It was suggested that an "OMIP" involving a large cross-section of modelling groups would be facilitated by established "standard practice" or "reference" experiments including comprehensive surface forcing for global ocean and ocean-ice models. WGOMD therefore proposed to establish protocols for a series of "Co-ordinated Ocean Reference Experiments" (CORE) anticipating that this will form the basis for PI driven collaborations and future ocean model intercomparison activity of the AMIP/CMIP class.

The experiments include a normal year forcing control, an interannually varying forcing and a climate perturbation experiment addressing the response to perturbation in freshwater fluxes over the subarctic Atlantic. The forcing fields build on the reanalysis/remote sensing data set of Large and Yeager. They provide a well documented, comprehensive forcing data set including both a "normal year" and interannually varying forcing. Advice on experiment designs will be requested from basin panels (presumably in the form of comments on WGOMD proposals). WGOMD plans to publish protocol in the December issue of the CLIVAR Exchanges along with selected analyses from experiments run under the protocol

ACTION ITEM 1. Provide input to WGOMD through D. Wright on the proposed WGOMD-CORE (Coordinated Ocean Reference Experiments) activities (*All*)

ACTION ITEM 2 Further develop the Metrics of Atlantic Climate Variability and provide inputs to WGOMD for ocean model verification (*D. Wright, D. Stammer and B. Johns*)

5. WCRP Climate and Cryosphere (CliC) Activities and Intersections with CLIVAR

At the 5th CLIVAR AIP meeting Cecilia Mauritzen was charged to liaise with the Arctic Sub-arctic Ocean Flux study (ASOF) on the issue of the CLIVAR/CliC role in the Arctic Ocean. The reason was that the WCRP's CliC is cryospherically based and doesn't properly include the full system. The CLIVAR SSG had also pointed out the lack of an international planning activity as far as the Arctic Ocean is concerned. Cecilia Mauritzen then approached CliC, proposing a joint working group under the CliC/CLIVAR sponsorship and CliC accepted to take the lead on the Arctic Ocean with support from CLIVAR. The CliC SSG liked the idea of an Arctic Panel - 'Arctic Climate Panel'? - and asked Cecilia Mauritzen to establish it, along with Eberhard Fahrbach, and with support from Vladimir Ryabinin and CIPO. Also they invited Dr Mauritzen to formal membership of the CliC SSG.

The Arctic Climate Panel (ACP) should have its main focus on Arctic Climate, including ice, atmosphere but not land. In order to ensure no gap between CLIVAR and CliC, the domain includes the Nordic Seas and the Canadian Archipelago. The ACP will be scientifically oriented rather than method oriented, and with large-scale perspective (global connections).

The creation of the ACP was well received at the WCRP/JSC but not well understood at the Arctic Science Summit Week (April 2004). The Arctic Ocean Science Board (AOSB) had just endorsed the creation of an International SEARCH committee whose ToRs were overlapping with those proposed for ACP. However, they signaled the willingness for further discussions on this topic.

Cecilia Mauritzen raised the issue of an Arctic Ocean Observing System (AOOS), which might receive a great boost from the International Polar Year. IPY could lay the foundation for a future AOOS, which includes floats, gliders and transponders, equipped with SOFAR/RAFOS long-range acoustic capacity for underwater navigation and acoustic modems for short-range data transfer. The Arctic Ocean cannot be considered separately from the ice and atmosphere above. We need simultaneous, coordinated observations of the first-order variables, including the deep Arctic Ocean.

Future actions for ACP will include inviting members to join the panel, defining the science themes and recommending an international workshop for developing an observing system implementation plan for IPY.

ACTION ITEM 3. Encourage WCRP/CliC to move ahead with the formation of the CliC/CLIVAR Arctic Climate Panel, subject to the CLIVAR SSG agreement. (*M.Visbeck and R.Boscolo*)

ACTION ITEM 4 Update the panel on the development of the CliC/CLIVAR Arctic Climate Panel (*C.Mauritzen*)

6. Updates on activities and plans in the North Atlantic

David Marshall reported on the progress of the UK Rapid Climate Change (RAPID) programme. RAPID will develop a prototype observational system for monitoring the MOC. Four projects have been funded on this theme:

- Monitoring the Atlantic Meridional Overturning Circulation at 26.5N
- Measuring the Meridional Overturning Circulation from space: feasibility study
- Time series of transient tracers in North Atlantic deep waters
- A monitoring array along the western margin of the Atlantic

David Marshall is involved in monitoring the propagation of overturning signals along the western margin of the North Atlantic. Three lines of bottom pressure recorders, inverted echo-sounders and profiling CTDs will be deployed in 2004 at depths of 2-4.5 km at 38N, 69W, 42N, 60W and 43N, 52W. The data will identify temporal changes in the Deep Western Boundary Current and reveal how coherent the changes are along the slope. The results from these projects will form the basis for designing a sustained observational system.

Sheldon Bacon reported on the activities of the ICES (International Council for the Exploration of the Sea) Working Group on Ocean Hydrography (WGOH). ICES is an intergovernmental organisation established in 1902 to "promote and encourage research ... for the study of the sea, particularly the living resources thereof", with a focus on the North Atlantic and adjacent seas. It provides advice to governments and other bodies on matters such as fisheries and pollution. Within ICES, the WGOH is the group that provides expertise on physical oceanography and particularly on climate and variability in the ICES region. The WGOH is an amalgam of 'fisheries' and 'research' physicists with a common interest in climate trends and variability (http://www.soc.soton.ac.uk/JRD/ICES_WGOH/). WGOH development plans include:

- Starting to include additional data sources (remote-sensed; profiling floats)
- Developing analytical framework for annual reporting
- Contributing WGOH output to the wider international "climate scene"

The group expects scientific progress over the next couple of years and seeks an international framework within which it might more widely promulgate its scientific resources.

ACTION ITEM 5 Explore better linkages with the ICES WGOH group (*S.Bacon, C.Mauritzen, D.Stammer and R.Boscolo*)

An update on ASOF activities was given by Bob Dickson (<http://asof.npolar.no/>). Almost all the task groups met in 2004 and the next ISSG meeting is scheduled for October 2004 in Spain. For the next meeting the main focus themes are:

- How well can we now predict the flux of warm saline water west of Norway and through the Barents Sea?
- Perspectives on the Denmark Strait Overflow
- How well can we model hydrographic change in Subpolar Gyre of the NW Atlantic?
- Estimating freshwater flux through Arctic and Subarctic Seas

A few new projects will start in 2005, like the 3-year Davis Strait array (C. Lee UW) and part of the ASOF observing system will be included in the AOSB observing plan for the IPY (2007/8).

As part of the ASOF task 5 activities, Tom Haine is preparing a white paper on the status and prospects in the Subpolar gyre. The aims are to review and prioritize fieldwork, to identify gaps in coverage, to promote relevant process studies and to foster collaboration with other programs. For the observing array

the importance of maintaining the excellent moored network in the Labrador Sea and Newfoundland Slope (threatened to disappear in summer 2005) and ensuring that the AR7W transect is occupied annually with secure long-term funding were highlighted.

The understanding of basic processes involving heat and freshwater in this area is still immature. To address this gap, ASOF task 5 promotes process studies that:

- Measure and model shelf-basin exchange south of Denmark Strait
- Explore the impact of sea-ice variability on upper ocean salinity
- Investigate meso-scale atmospheric weather systems in the area and their air-sea fluxes.

ACTION ITEM 6 Inform the panel about the planned and proposed process studies and observations in the North Atlantic subpolar area (*T.Haine and R.Boscolo*)

7. Updates on related meetings and workshops

Nalan Koc reported on the Euroconference on North Atlantic Climate Variability held in S. Feliu de Guixols, Spain, 11-16 October 2003. The conference focused on Achieving Climate Predictability using Paleoclimate Data and was sponsored by IGBP/PAGES and WCRP/CLIVAR. The two conveners, T. Stocker and M. Visbeck, put together a program that highlighted the recent advances in high-resolution reconstruction of climate changes from paleoclimate records and in understanding the temporal and spatial characteristics of natural climate variability in the North Atlantic region on time scales from decadal to centennial.

This conference was the second of a series with the goal to bring these two communities working on problems of climate dynamics closer together. The conference was structured in 4 sessions:

- Paleo variability of the North Atlantic and beyond – data and models
- Modern circulation in the North Atlantic – data and models
- The North Atlantic Oscillation, past, present and future
- Potential future North Atlantic circulation changes and climate predictability

ACTION ITEM 7 Suggest to the panel on opportunities for interaction with the paleo community (*N.Koc and R.Boscolo*)

The CLIVAR workshop on North Atlantic Thermohaline Circulation Variability is scheduled for September 13-16 2004 in Kiel Germany. The workshop has been proposed by both the Atlantic and WGOMD panels with Martin Visbeck and Claus Boening as conveners. The agenda includes 6 sessions:

1. THC variability and climate (W. Willebrand, C. Boening)
2. THC variability and the carbon cycle (D. Wallace)
3. Water mass transformation processes in the North Atlantic (U. Send and C. Mauritzen)
4. Characteristics and mechanisms of THC variability in the North Atlantic (A.-M.Treguier, D. Stammer and W. Johns)
5. The THC in a changing climate (R. Wood and M. Latif)
6. Future programs (M. Visbeck and E. Chassignet)

ACTION ITEM 8 Update the panel on the outcome of the THC workshop (*M.Visbeck, D.Stammer, C.Mauritzen and R.Boscolo*)

David Marshall acted as the CLIVAR Atlantic rep. at the last Ocean Observations Panel for Climate (OOPC) session held in Southampton on 7-10 June 2004. David presented the white paper on a Tropical Atlantic Climate Experiment (TACE) and the feedback was very positive. OOPC insisted on the need for coordination between PIRATA and TACE: sustained funding for all elements of PIRATA remains a challenge. The OOPC in discussions urged a review of PIRATA as it approached the end of its pilot phase. It asked the CLIVAR Atlantic Panel to take the lead on this issue. At the OOPC meeting Edmo Campos gave a briefing on the results of the South Atlantic Climate Observation System (SACOS) (see section 9 also). He said that several cooperative projects have grown out of the workshop, including a research program on river discharge influence on shelf circulation (PLATA, Brazil, Argentina, Uruguay), Brazil and Argentina have joined the Argo program, and a GOOS regional alliance has been formed.

8. The new Global Synthesis and Observations Panel (GSOP) and CLIVAR Data Issues

In 2003 the CLIVAR SSG prompted the formation of GSOP under the chairmanship of Detlef Stammer and Dean Roemmich (<http://www.clivar.org/organization/gsop/index.htm>). GSOP will have its first meeting in Colorado, USA from 10-12 November 2004 immediately following the CLIVAR Reanalysis Workshop (see below). GSOP will count on the links with the CLIVAR basin panels and in particular will build upon the work that the Atlantic panel has done in tracking observations, data and activities.

In making his presentation, Detlef Stammer expressed particular concern with the formation of the COPEX WGOA (Working Group on Observations and Assimilation). Apparently the terms of reference for WGOA overlap with those of the CLIVAR GSOP. He hoped to discuss the issue at the CLIVAR Conference and at the following CLIVAR SSG.

Dr Stammer reported on the CLIVAR Data Planning Meeting, which was held in S. Diego on 24-25 March 2004. The objectives of the meeting were to:

- Articulate the needs/requirements of CLIVAR science for provision of ocean observation data (what, when, and how observational data should be provided?).
- Assess the current status of CLIVAR Data Assembly Centres (DACs) and their data management activities through input from DAC representatives.
- Provide an overview of other plans and developing activities that can contribute towards meeting CLIVAR's needs.
- 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?

Issues, which had arisen, included the following:

- Lack of basin panel DAC engagement
- Identification of CLIVAR relevant data, esp. CTD/Hydro (DIU activity) needed
- Data Accessibility issues and EEZ issues, esp. Indian Ocean. i.e. Tide gauges.
- Cross DAC integration of single data streams.
- Data integrators for some, but not all basins. i.e. APDRC, INCOIS. Could we put them to work on the more fundamental issues of information and availability of data?
- Updates on data availability and versions (especially for profile data) a new requirement.
- What are the delays currently in terms of data availability and what are we aiming for?
- Interactions between analysis and QC activities.
- How are time series data tracked and managed? Remaining problems with historical data and QC activities. Which DACs are involved in these activities?
- CLIVAR requirements for Data Management need to be articulated to include aims, data streams, timeliness, accessibility, reporting, metrics, products etc.
- CLIVAR designation of non-sustained data (ship-based data and moorings)
- The need for tracking of some data streams, i.e. process-studies (specific plans for cruises and deployments; what has been completed? data flow monitoring & follow up)
- Integration across DACs and streams: many opportunities; plan now
- Some PIs (institutions?) not willing to give up data in timely fashion
- Need for products and value-added summaries
- Some DAC-specific issues (Sea Level, Moored Current Meter)

Basin panels (Southern Ocean 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.

ACTION ITEM 9. Identify a new panel liaison for formulating CLIVAR data management needs (*M.Visbeck and all*)

CLIVAR is also organizing a workshop on Reanalysis. The workshop is planned for November 8-10 in Boulder USA. The objectives of the meeting are:

- Establish the requirements for ocean reanalysis within the remit of CLIVAR (quality, data input, output).
- Review the state and usage of ongoing and planned ocean reanalysis efforts.

- Stimulate new applications of existing ocean reanalyses for ocean studies, surface flux analyses, and initialization of coupled models.
- Review the synergy between ocean and atmospheric reanalysis activities.
- Review long-term observing system strategies, and designs.
- Identify model improvements required for ocean and coupled reanalyses, including surface fluxes and it's the ice component.

9. Follow up on SACOS workshop and observational activities in the S. Atlantic

A sub-group of the Atlantic Panel (Dan Wright together with D. Marshall, C. Mauritzen and B. Johns) had been tasked to review the main outcomes of the South Atlantic Climate Observing System (SACOS) workshop, which was held in Angra dos Reis (Brazil) on February 6-8, 2003. The SACOS workshop report can be downloaded from: <http://www.clivar.org/organization/atlantic/index.htm#PUBS>. The objectives of the workshop were:

- Provide an overview of the scientific understanding of the influence of the South Atlantic (SA) Ocean on the regional and global climate
- Discuss existing and identify new elements for a SA observing system required for a more complete understanding of the climate system in regional and global scales
- Identify social and economic regional impacts of the climate change and prediction
 - Integrate the region's diagnostic, modelling and observational communities
 - Develop joint actions and principles for a long-term observing strategy
- Identify potential funding sources and associated operational partners
- Discuss data management activities, including historical data
- Development of multinational action plan

Dan Wright summarized the workshop recommendations as:

- For the MOC:
 - Improve estimates of heat flux and its variability
 - Quantify the role of inter-ocean exchanges
 - Quantify importance of local water mass transformations on THC
- For regional climate:
 - Determination of local vs. remote forcing of climate variability
 - Need better representations of specific features in coupled models
 - Influence of tropic and subtropic SST anomalies on SA Convergence Zone
 - Influence of midlatitude SST on winter rainfall in SW South Africa
 - Influence of tropical SE Atlantic SST on rainfall in Namibia, Angola, etc
 - Interannual and decadal variability are largest in the subtropics; need improved monitoring of air-sea fluxes, SST and upper ocean variability

The review group had a number of comments on the workshop report for the SACOS Committee, which were discussed at length by the panel. Alberto Piola thanked the review group for their constructive comments on the report, assuring the meeting that this will be discussed with the SACOS steering committee. The main concern on the SA sparse observation network still remains. As shown in figure 1 the estimates of the SA meridional heat flux are very uncertain.

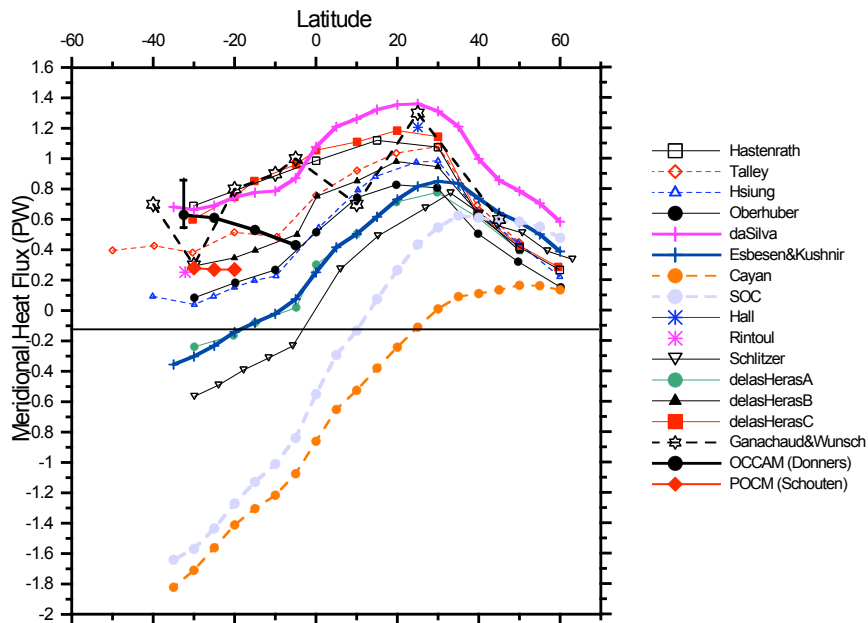


Figure 1. Estimates of South Atlantic meridional heat flux.

However no agencies are committed to fund the SACOS suggested observations (figure 2).

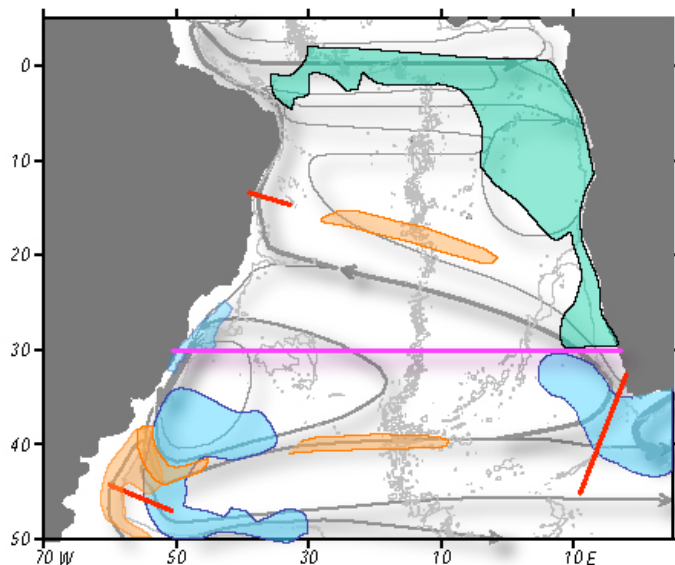


Figure 2. Regions identified as important for implementing a South Atlantic observing system for climate. The light blue shading indicates the high eddy kinetic energy regions in the Brazil/Malvinas Confluence and the Agulhas Retroflection. Light orange shading indicate the regions of convection and subduction. Light green shading areas of upwelling associated to the shallow tropical cells. Red lines depict areas of interest for monitoring the inter-ocean exchanges and the bifurcation of the South Equatorial Current and the purple line near 30°S region for monitoring the meridional mass and heat flux

The PIRATA SW extension will probably be funded by Brazil as it improves regional predictions NOAA maintains the XBT sections at 30°S. However the suggested observations for monitoring the MOC at 25°/30°S haven't yet been planned.

ACTION ITEM 10. Encourage the further development of a plan for the 25°S MOC observing system and liaise with WGOMD and WGCM on the observing system design. (A.Piola, C.Reason, W.Hazeleger and B.Johns)

ACTION ITEM 11 Update the panel on the status of the PIRATA SW extension (B. Bourles and I.Wainer)

A subgroup of the Atlantic panel also reviewed the GoodHope project. The GoodHope project covers one of the most important "hotspots" of the inter-ocean exchange. It is now clear from observations and models that the Indian to Atlantic transfer of thermocline and intermediate waters is important for the global thermohaline circulation (THC). Some models even predict that variability in this exchange may control the buoyancy flux of the upper limb of the THC and thus modulate the formation of NADW. Much work is needed to better quantify the inter-ocean exchanges between the South Atlantic and the Indian and Pacific. GoodHope aims are:

- A better understanding of Indo-Atlantic interocean exchanges (in terms of water masses, heat and fresh water budgets) and their impact on the global thermohaline circulation and present day climate.
- A better understanding of the impact of interocean exchanges on the local climate of the African continent.
- A monitoring of the variability of particular dynamical features of the Southern Ocean (Antarctic Circumpolar Current, frontal systems).
- A study of the local air-sea heat exchanges and their role on the global heat budget (with emphasis on the intense exchanges in the Agulhas Retroflexion region).

David Marshall together with Peter Koltermann and Alberto Piola provided some comments to the project's PIs on the behalf of the Atlantic panel. The GoodHope experiment is well designed, appropriately resourced and scientifically critical to achieving important and well-justified objectives relating to the Southern Atlantic THC and its up-source regions. The experimental design is probably not yet adequate to be considered a long-term monitoring array. However, it seems reasonable to expect that a long term monitoring strategy for the Indian-Atlantic transfers may emerge as part of the GoodHope results. A similarly well-coordinated activity of this nature is badly needed in the western South Atlantic!

It is good to see that GoodHope recognizes the importance of model-data synthesis as this will be crucial to the overall success of the project, and essential if GoodHope is to deliver on aim 2 (impacts on local African climate and there is a need to define precisely what will be done in this respect. It will be important to properly define and coordinate such modelling and synthesis activities at the upcoming GoodHope modelling meeting later this year. The GoodHope team should also be encouraged to take full advantage of the CLIVAR Global Synthesis and Observations Panel and its activities.

ACTION ITEM 12 Communicate the review of GOODHOPE to the proposers and SO panel chairs (*D.Marshall*)

10. Recommendations of the Atlantic Predictability Workshop

The workshop was held at the University of Reading, UK, from 19-22nd April 2004. It brought together scientists from operational forecasting agencies with academics and others involved in more basic research. Over 50 scientists from North and South America, Africa and Europe met to assess the current state of the art in predicting the climate of the continents that surround the Atlantic Ocean, and to make recommendations for future priorities. The focus was on climate predictions for time horizons of seasons to decades ahead. The workshop was organised by the CLIVAR Atlantic panel in collaboration with WGSIP. The organising committee were: Rowan Sutton, Yochanan Kushnir, Chris Reason, David Marshall (members of the CLIVAR Atlantic panel), Tim Stockdale, Paulo Nobre (members of WGSIP) and Lisa Goddard (IRI)

Generous financial support for the event was provided by the U.S. NOAA, the U.K. Met Office and the U.K. Natural Environment Research Council. It was hosted by the Centre for Global Atmospheric Modelling in the Department of Meteorology at the University of Reading.

The aims of the workshop were:

- To provide an up to date assessment of the state of knowledge concerning the predictability of climate in the Atlantic Sector, with particular emphasis on the role of the Atlantic Ocean.
- To improve communication between operational prediction centres and fora and the research community.
- To identify gaps in knowledge, and in observing systems, required for the further development of systems for forecasting Atlantic Sector climate.

- To recommend priorities for future research, observational programmes and development of prediction systems.

The workshop was divided into two main sessions. The first session focused on reports from the operational centres and similar organisations involved in routine climate forecasting. In the second session a series of 9 “White Papers” was presented. The purpose of these papers was to review the current state of the art and highlight important issues. There were two papers on the physical basis for climate prediction in the Atlantic Sector, two papers on the infrastructure for climate prediction: on the observing system and the climate prediction systems themselves and five papers each of which focused on a particular region: West Africa, Southern Africa, North America, South America and Europe. In addition to the two main sessions the workshop programme was significantly enhanced by a lively poster session and two guest lectures. Dr Tim Palmer (of ECMWF) discussed “Developments and future prospects in understanding predictability”. Dr Neil Ward (of IRI) discussed “Merging forecasts with applications”. Following the presentations, discussions were held to identify priorities for the future. These discussions involved breakout groups followed by a plenary session.

The proceedings of the workshop will be published as WCRP/CLIVAR workshop report series, a special issue of CLIVAR Exchanges (October) will be devoted to the Atlantic Predictability, with a short version of all the White Papers presented at the workshop.

The recommendations of the workshop are divided in two main parts:

- 1) Priorities for improved understanding of sources of predictability:
 - Capitalizing on advances in ENSO prediction
 - Tropical and South Atlantic: SACZ, SST and “Benguelas Ninos”
 - Extratropical North Atlantic: NAO, SST
 - Land surface processes: snow cover etc...
 - Aerosols: Saharan dust etc...
 - MOC
 - Changing external forcings
- 2) Priorities for the development of prediction systems
 - The observing network and estimation of ocean initial conditions
 - Model systematic errors and uncertainties
 - Extended hindcasts
 - Standard metrics for quantifying improvements in skill

The workshop identified two overarching challenges for Atlantic climate prediction over the next 5-10 years:

1) *To realise fully the potential of seasonal predictions for the tropical Atlantic region*

The potential skill and value of seasonal forecasts is highest in the tropical Atlantic. The challenge is to build a seasonal climate prediction system for the tropical Atlantic region that is comparable (in terms of data coverage, model fidelity, and –subject to physical limits– forecast skill) to that in the tropical Pacific.

This will entail:

- Significant enhancement of sustained observations in the tropical Atlantic region, in the ocean, at the land surface, and in the free troposphere
- Major efforts to reduce the systematic errors in simulation of tropical Atlantic climate in models used for seasonal prediction
- Research to better understand the fundamental ocean-atmosphere-land processes that control the climate of the tropical Atlantic region, its variability and predictability, including the statistics of sub-seasonal variability
- Improvement of data assimilation systems for the Atlantic Ocean (especially the treatment of salinity)
- Development of reliable methodologies for making seasonal forecasts relevant and useful to decision makers.

2) *To take the lead in the development of systems for decadal climate prediction*

The development of useful decadal climate predictions, incorporating both initial condition constraints and transient boundary forcings, is a “grand challenge” whose importance is increasingly recognised. Because of the key role played by the Atlantic Ocean in the global overturning circulation, the Atlantic

climate community is naturally placed to take a lead in this area. A number of specific challenges may be identified, for example:

- Development of an observational system for monitoring the MOC (already in progress)
- Understanding the limits of predictability in the MOC and the mechanisms that determine predictability
- Identifying which aspects of the oceanic initial conditions most constrain the future behaviour of the MOC
- Development of data assimilation methods for initialisation of decadal MOC forecasts
- Understanding how initial conditions and changing external forcings combine to determine climate evolution on decadal timescales, and (relatedly) development of suitable ensemble techniques for sampling forecast uncertainty
- Understanding and quantifying the regional climate impacts of MOC change and the predictability of these impacts.

11. Tropical Atlantic activities

Chidong Zhang reported on the US Atlantic Marine ITCZ (AMI) Climate Process Study (CPS). The overall goal of the AMI-CPS is to advance the understanding and simulation of AMI seasonal and interannual variability in order to improve prediction of tropical Atlantic climate variability and its societal impacts. The AMI process study has received strong support from the US CLIVAR SSC and it has been included in the NOAA OGP 2005 program announcement. A draft science plan was presented to the general research community at the recent AMS 26th Hurricane and Tropical Meteorology conference.

One of the rationales for the AMI-CPS is the need for in situ observations: there have been no in situ tropospheric observation in the tropical Atlantic since GATE (1974). A well designed network of in situ observations will:

- Advance understanding of the mechanisms governing the variability and predictability of AMI
- Quantify errors in model simulations and data reanalysis products
- Assist model improvement and development
- Improve climate prediction in the TA region

Experience and knowledge gained from the EPIC2001 field experiment provide guidance to AMI process studies; AMI process studies can further test and confirm results from EPIC2001, for example:

- Convective forcing (Raymond et al. 2003)
- Cloud structure (Peterson et al. 2003)
- Shallow meridional circulation (Zhang et al. 2004)
- Momentum balance in the boundary layer (McGauley et al. 2004)

Observing the unique features of AMI will provide new knowledge on climate processes related to the ITCZ not available from any previous process study, like:

- Interaction between external and internal influence on the ITCZ
- Effects on African dust and dry-air outbreaks on convection and precipitation in the ITCZ
- Interaction among the ITCZ, equatorial SST and the West African Monsoon

The first objective of AMI-CPS is to improve our understanding of processes key to predictability of AMI on seasonal to interannual timescales. The four key scientific issues are:

- Convection-circulation interaction
- Effects of African dust, aerosol and dry air on convection and precipitation in the ITCZ
- ITCZ-upper ocean-monsoon interaction
- Mechanisms of remote influences

The second objective of AMI-CPS is to provide quantitative information and knowledge that contribute to the long-term efforts of model development and improvement. AMI-CPS aims at collecting unprecedented in situ observations needed to quantify errors and uncertainties in model products (numerical simulations and data assimilation) and to expose deficiencies in models responsible for their errors and uncertainties.

The AMI field campaign (fig. 3) and enhanced monitoring activities have been and will continue to be a joint venture with AMMA. It will serve as the commencement of the Tropical Atlantic Climate Experiment (TACE) - see Section 12 below - and provide real time observation for THORPEX. AMI-CPT will work together with the U.S. Climate Feedback Teams (CPTs) and will seek links to future VAMOS studies.

In spring 2005 the AMI-CPS science plan will be presented at the funding agencies and subsequently the implementation plan and the proposals will be submitted. The first field campaign is scheduled for 2007 in the eastern equatorial Atlantic.

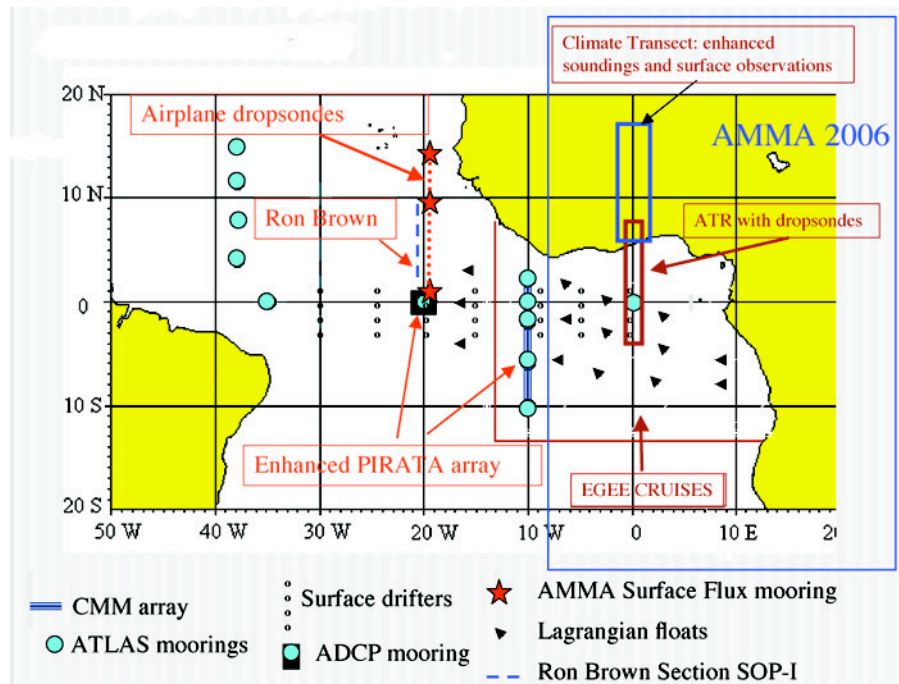


Figure 3. Example of a springtime AMI field campaign (the EPIC2001 model)

The AMMA (African Monsoon Multidisciplinary Analyses) plans were presented by Alban Lazar. AMMA's main goals are:

- To provide an improved description and understanding of the West African Monsoon (WAM), water cycle, variability and associated scale interactions
- To improve our understanding of the atmospheric chemistry and aerosols over WA and its global impact
- To identify & implement an integrated observing strategy in WA, needed to support research and prediction (medium-range, seasonal and climate scale)
- To develop & test the long term monitoring of surface & atmosphere (combining satellite and surface networks)
- To implement a strategy to use weather and climate observations and modeling/assimilation outputs for applications (health, food security, water resources)
- To develop training/education activities for African countries

To achieve these aims AMMA proposes a multidisciplinary approach to the study of the WAM. AMMA will link observations, data analysis and modeling on a wide range of space and time scales. The project will address the following interacting science areas: Monsoon dynamics and scale interactions, continental water cycle, aerosols, atmospheric chemistry, food, water and health. The observation strategy will thus associate operational observations (great attention will be paid to collecting and archiving historical datasets in close collaboration with African countries) with long term observations concentrated in a sub-regional window and obtained from various ongoing research projects (CATCH, IMPETUS, INTEO, GLOWA-Volta, AERONET, IDAF). In addition, intensive multi-disciplinary observations will be performed during specific periods, focusing on the understanding of key processes. The utility of bringing in additional observations for the future will be tested using modeling and assimilation systems.

Recommendations for future optimal networks will result, an important demand of African services and regional agencies.

AMMA is planned to be a multi-year project and will involve 3 observing periods:

- The Long term Observing Period (LOP) is concerned with data of two types. First, there are a number of unarchived observations that have been obtained during the past 50 years that would benefit studies on interannual-to-decadal variability of the WAM. These include rainfall and data describing land cover changes. Secondly, supplementary long-term observations (2002-2010) will be promoted to document and analyze the strong interannual variability of the WAM.
- The Enhanced Observing Period (EOP) is designed to serve as a link between the LOP and the SOP. Its main objective is to document over a climatic transect the annual cycle of the surface conditions and of the atmospheric state variables at convective-to-synoptic spatial scales. The EOP will cover two rainy seasons & inter-seasons 2005-2006-2007
- The Special Observing Period (SOP) will focus on detailed observations of specific processes at various key stages of the rainy season during three periods in 2006: (i) monsoon onset (May-July), (ii) peak monsoon (July-August) and (iii) late monsoon (August-September)

AMMA is supported by France (12.5 MEuros) and the EU (12.7 MEuros). The international Scientific Plan is being finalized and the set-up of the international organization is planned for 2005. More information can be found at <http://medias.obs-mip.fr/amma/>

The annual Tropical Atlantic Workshop was held on 7-9 June 2004. About 25 specialists on tropical Atlantic circulation met at KNMI in de Bilt (The Netherlands) to discuss recent advances in observing and modelling the tropical Atlantic and to coordinate future plans. The program, a list of participants, and most presentations of the meeting at KNMI can be found online at: <http://www.knmi.nl/samenw/tameet/tameet.html>. These plans include the Tropical Atlantic Climate Experiment (TACE) that focuses on improving the understanding of SST-ITCZ interactions in the eastern Tropical Atlantic region, the African Multidisciplinary Monsoon Analysis (AMMA) that focuses on the African Monsoon and its offshore components, and the Atlantic Marine ITCZ (AMI) project. The discussion sessions were directed at formulating objectives for the CLIVAR – TACE initiative and coordinating these objectives with the other programs such as AMMA and AMI. There was consensus that the eastern tropical Atlantic is important for climate variability in the tropical Atlantic region. There is a clear connection between eastern tropical Atlantic SST and ITCZ position and strength, while the processes that regulate SST are not well understood. This absence of understanding argues for additional research effort in this region. The central goal of this research would be:

To improve the understanding of the interaction between the ITCZ and upwelling zones (Benguela region, Guinea dome, eastern cold tongue) and the implications for predictability.

The recommended oceanic observations focus on a line along 23°W, which is the same line along which atmospheric observations are proposed for the AMMA and AMI projects. Moorings along this line and in the upwelling regions in the Southern Hemisphere are proposed as well as glider sections with oxygen sensors. Also, enhanced deployment of Argo floats and surface drifters in the region is recommended. The plans will be coordinated with the cruises in the same region planned in the French EGEE project.

It was recommended that the main focus of ocean model improvement needs to be on diapycnal oceanic mixing and mixed layer physics. Atmospheric modellers need to focus on stratus clouds/radiation feedbacks and shallow and deep convection. Specific projects that were proposed include a systematic investigation of the impact of ocean model resolution and of the impact of ocean/atmosphere coupling on the simulation of sea surface temperature in the tropical Atlantic region. Also, studies on potential predictability with atmospheric models and studies on the effect of dust were recommended.

The workshop made clear that the emphasis of future work would be on the eastern tropical Atlantic. With a wealth of data available from the western tropical Atlantic it is now the appropriate time for synthesis activities on the western tropical Atlantic. R. Molinari (NOAA/AOML) will coordinate these activities.

ACTION ITEM 13 Encourage the writing of an article for the next CLIVAR Exchanges on the output of the last Tropical Atlantic Variability meeting held in De Bilt, NL, June 2004. (*W.Hazeleger*)

12. The Tropical Atlantic Climate Experiment (TACE)

TACE builds on a long history of planning efforts by the Atlantic research community to develop an enhanced observing program that would address important CLIVAR objectives in the tropical Atlantic. TACE will enhance the sustained networks in the tropical Atlantic such as PIRATA, XBT lines, Argo and the like. In general, the TACE plan will strengthen arguments for such a program of observations and complimentary analyses.

At the last panel meeting, Jim Hurrell together with Rowan Sutton and Ilana Wainer were charged with reviewing the initial plans for the TACE. The review team found some substantial gaps in the TACE white paper as it now stands and made a number of specific comments for consideration by the TACE group. They encouraged the engagement of a slightly more diverse group of authors with expertise in the areas of predictions and synthesis. The review team suggested that the CLIVAR Atlantic panel fully embrace this program and help in its more complete definition and most importantly execution. The reviewers were very encouraged by the truly multinational team of core investigators and understand the complexity of the issues with national funding constraints, mix of process and sustained efforts as well as the minimal guidance currently offered by the prediction outfits.

Bill Johns, representing the TACE group, thanked Jim Hurrell and the other reviewers for their constructive feedbacks on the TACE white paper and informed the participants that an executive summary is already available through the CLIVAR Atlantic web page (<http://www.clivar.org/science/atlantic.htm#NEWS>).

ACTION ITEM 14 Encourage the revision of the Executive Summary for TACE (*Sutton, Johns, Hazeleger and Bourles*)

Bill Johns also reported on the latest advances and definition of TACE objectives and plans. The TACE goal is:

- To advance understanding of coupled ocean-atmosphere processes in the tropical Atlantic on seasonal to interannual time scales in order to realize the potential predictability of regional and global climate.

A 5 year enhanced monitoring/process study is envisioned, ultimately leading to the specification of the sustained observations network in the tropical Atlantic needed to meet CLIVAR goals. The specific objectives are:

- Enhance existing observing system to provide the data needed for research and operations
- Improve coupled predictive systems and ocean synthesis
- Collaborate with prediction centres to ensure a rapid knowledge transfer from science to operations

The observational foci for TACE are the ocean processes relevant to the Tropical Atlantic predictability. The role of advection, upwelling and vertical mixing in the eastern central equatorial and off-equatorial eastern Atlantic is of prime importance to TACE, as these processes affect the main patterns of SST (fig. 4). The specific objectives are:

- Improve surface flux, SST/mixed layer and upper ocean heat content/stratification fields
- Improve empirical understanding of atmospheric structure and ITCZ response to SST forcing
- Determine the importance of surface and subsurface ocean advection and storage for SST variability
- Determine variability in eastern coastal upwelling and the role of off-equatorial undercurrents
- Determine the role of shallow overturning variability of the STCs in modulating upwelling and SST
- Understand the role of salinity in eastern boundary barrier layers

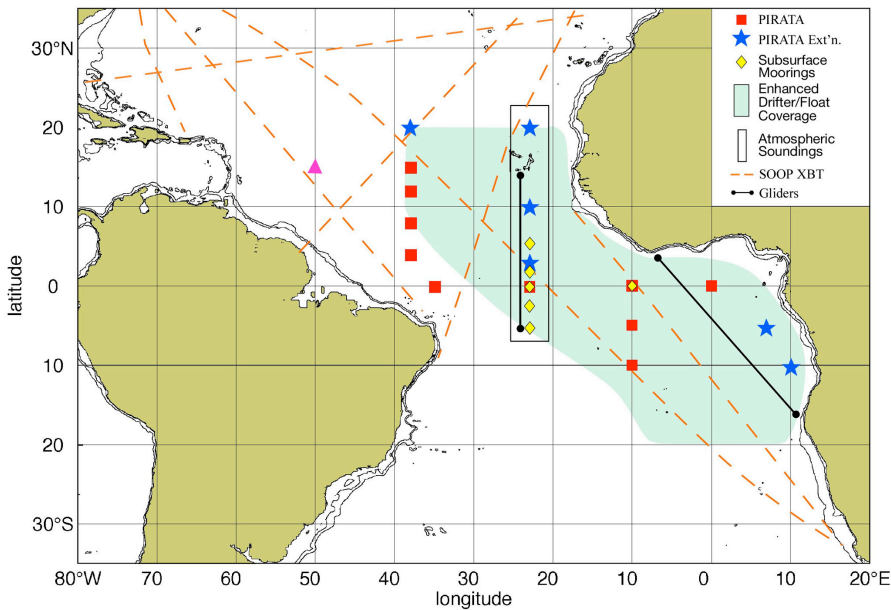


Figure 4. TACE Observational Strategy

For what concerns the coupled predictive systems and ocean synthesis the main goal is:

- To determine oceanic processes important in regulating SST in the tropical Atlantic and associated atmospheric responses (focus: validate and understand the mixed layer heat budget in upwelling regions and processes affecting subsurface heat content variability)

This will be achieved with:

- Systematic investigation on effects of resolution of ocean models on ocean dynamics and coupling.
- Testing of new parameterizations for mixing, convection, and BL processes (include results of process studies: PUMP, EPIC, etc.)
- Assimilating all the collected observations (*in-situ* data and fluxes) into ocean models forced with surface fluxes over the TACE observation period.
- Hindcast simulations with atmospheric models forced with observed SST variability.
- Collaborate with prediction centers to identify sources of model error that impact forecast skill

It is planned to have targeted workshops with teams of ocean, atmosphere, and coupled modelers (including representatives from operational centers) and observationalists.

An international coordination and implementation meeting is scheduled for early February 2005 and the plan for the beginning of TACE is 2006 (same as AMI and AMMA).

The TACE group was encouraged to produce a final version of the TACE white paper taking into account the reviewers' comments and the latest advances.

ACTION ITEM 15 Review the final version of the TACE White Paper (R.Sutton, J.Hurrell, I.Wainer and C.Zhang)

ACTION ITEM 16 Submit the final TACE White Paper to the SSG for endorsement (M.Visbeck and R.Boscolo)

13. The CLIVAR Self-Assessment

As part of the CLIVAR self-assessment the Atlantic panel had to provide some background information to the reviewer. Fritz Schott was the designated reviewer for CLIVAR DecCen, which includes the three principal research areas in the Atlantic sector. Fritz Schott made available his review just before the Atlantic panel meeting. In his opinion the Atlantic Basin Panel presents a good mix of atmospheric and oceanic experience, with observationalists and modellers represented in its membership so that from the DecCen perspective the Atlantic panel is doing exactly what needs to be done.

So far the Atlantic database has not permitted conclusive observational evidence on the ocean's role in decadal Atlantic climate variability, most importantly in the case of the MOC. It is suggested that the basin panels should obtain guidance from a set of model sensitivity studies from the respective CLIVAR model panels for designing a sustained observational network. Special concern was expressed for the PIRATA array and its extensions. Presently, extensions of PIRATA in the western and eastern tropical South Atlantic are being proposed (both well justified by White Papers) while at the same time PIRATA partners of the "backbone array" threaten to withdraw support. Hence, a discussion on the TA sustained moored station requirements is urgently needed. The review document will be presented and discussed at the SSG meeting scheduled after the CLIVAR Conference.

ACTION ITEM 17 Report on the SSG deliberations about the assessment of the Atlantic Panel and future directions of CLIVAR (*M.Visbeck*)

14. Panel Membership and other issues

It was suggested that the terms of membership of several members of the panel be extended as follows: M. Visbeck (2 years), J. Hurrell (2 years), R. Sutton (4 years) and A. Piola (4 years) and propose a replacement for P. Koltermann (finished).

Also it was proposed that W. Hazeleger to become co-chair, for the next two years serving together with M. Visbeck.

ACTION ITEM 18 Submit list of new members to the panel for input and submit final list to SSG (*M.Visbeck and R.Boscolo*)

ACTION ITEM 19 Encourage the panel members to propose topical workshops (*all*)

ACTION ITEM 20 Suggest modification to the current panel Terms of Reference to Boscolo (*all*)

ACTION ITEM 21 Explore the possibility of holding the next panel meeting in conjunction with an international science meeting preferably on ACC (*M.Visbeck and R.Boscolo*)

ACTION ITEM 22 Invite Geir Ottersen (GLOBEC rep.) to our next meeting (*R.Boscolo*)

APPENDIX A: List of Attendees

Panel Members

Hazeleger Wilco	KNMI, de Bilt, NL	hazelege@knmi.nl
Hurrell Jim	NCAR, Boulder, USA	jhurrell@ucar.edu
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Guests and Observers

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Robinson Walt	Uni. Illinois USA	robinson@atmos.uiuc.edu
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ICPO

Boscolo Roberta	IIM-CSIC, Vigo Spain	rbos@iim.csic.es
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APPENDIX B: Agenda

8:30 Continental Breakfast

9:00 Introduction to the Meeting

- Welcome (M. Visbeck)
- Meeting arrangements (R. Boscolo)
- Atlantic Review Paper on Journal of Climate (M. Visbeck)
- Review of Agenda (M. Visbeck)
- Review of Action Items from last meeting (M. Visbeck)
- Update on CLIVAR/ICPO activities (R. Boscolo)
- Brief update on WGOMD (D. Wright)

10:30 Coffee Break

11:00 High-Latitude Session

- Brief update on RAPID (D. Marshall)
- CLiC intersections with CLIVAR (C. Mauritzen)
- Brief update on ASOF (B. Dickson)
- Brief update on Subpolar activities (T. Haine)
- ICES Working Group on Oceanic Hydrography (S. Bacon)

11:45 Meetings Reports

- Brief summary of CLIVAR/PAGES workshop (N. Koc)
- Brief update on THC workshop (M. Visbeck)
- Brief update on OOPC (D. Marshall)
- Brief update on upcoming reanalysis workshop (D. Stammer)
- Brief summary of CLIVAR Ocean Data Management Workshop (D. Stammer)
- Brief update CLIVAR GSO Panel (D. Stammer)

12:30 Lunch

13:30 South Atlantic Session

- SACOS Report feedback (D. Wright)
- SACOS next steps (A. Piola)
- GOOD HOPE review (D. Marshall)

14:30 Atlantic Predictability workshop (R. Sutton)

15:00 Coffee Break

15:30 Tropical Atlantic Session

- Brief update on AMMA (A. Lazar)
- Brief update on AMI (C. Zhang)
- Brief update on the TAV Workshop (W. Hazeleger)
- TACE document feedback (J. Hurrell)
- TACE next step (B. Johns)

17:30 Panel Session

- Panel membership
- Panel assessment and feedback
- Terms of reference to be updated?
- New Workshops
- Next panel meeting

18:30 Adjourn

19:30 Panel Dinner

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