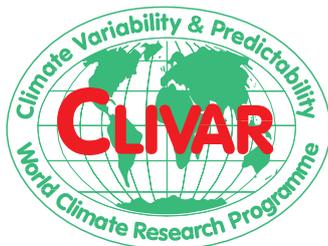


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LIST OF ACTIONS

ACTION 1: Contact GO-SHIP Science committee to express concern that if possible, GO-SHIP lines should return to full WOCE lines in the Atlantic region (M. Baringer, AIP co-chairs)

ACTION 2: Express to TACE SG concern about the lack of modelling activities in TACE (P. Chang, co-chairs)

ACTION 3: Provide to OOPC the requirements for instrumentation in the Intra-Americas Seas region in order to achieve IASCLIP science objectives (co-chairs)

ACTION 4: AIP members to attend the US AMOC, Subpolar Gyre (Woods Hole) and SAMOC workshops and draft an assessment report to be delivered to the SSG for discussion (M. Baringer, R. Curry, S. Cunningham)

ACTION 5: Contact Silvia Garzoli and Greg Johnson and discuss plans for workshop, already supported by OOPC (R. Curry, M. Baringer, P. Brandt)

ACTION 6: Suggest that CLIVAR SSG creates an Arctic Panel to coordinate diverse efforts to address modelling and observations issues in the Arctic (co-chairs)

ACTION 7. Propose joint VAMOS-AIP workshop on tropical biases (co-chairs)

ACTION 8: revisit metrics sent to WGOMD as part of REOS, and to GSOP as part of the ocean synthesis intercomparison project (A-M. Treguier to lead)

ACTION 9: Prepare a statement about the problem of lack of data management in CLIVAR and circulate to other basin panels for comment (A-M. Treguier, M. Baringer, Ruth Curry, co-chairs, ICPO)

ACTION 10: Find a replacement for Paulo Nobre, Chris Reason and Svein Oesterhus; extend the terms of Ruth Curry, Stuart Cunningham and Yochanan Kushnir for two more years (co-chairs and ICPO)

1. AIP overview and Terms of reference

The CLIVAR Atlantic Implementation Panel 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:

- a. To recommend and oversee the implementation of observations in the Atlantic Ocean sector and of research on Atlantic climate variability and predictability, in order to meet the objectives outlined in CLIVARs Science and Initial Implementation Plans, particularly with respect to the Principal Research Areas D1 (NAO), D2 (TAV), D3 (THC), and anthropogenic climate change.
- b. To collaborate with JSC/CLIVAR WGCM, WGOMD, and WGSIP in order to contribute to the design of appropriate numerical experiments and to jointly define and implement the requirements for data sets needed to validate and initialize models.
- c. To liaise with relevant CLIVARs panels, in particular the Southern Ocean, the VAMOS and the VACS panels to ensure that best use is made of resources from regional research programs.
- d. To liaise with GSOP, OOPC, PIRATA, ARGO, and the IOC-CO2 panel to ensure that CLIVAR benefits from and contributes to GEOSS.
- e. To liaise with relevant interdisciplinary SCOR-IGBP groups such as PAGES, GLOBEC, IMBER, and SOLAS and with regional Atlantic marine ecosystem research programs such as BCLME and GCLME to ensure that CLIVAR benefits from and provides input to these programs.
- f. To respond to needs from stakeholders and facilitate the transfer of knowledge from science to operations and applications with respect to Atlantic climate variability and predictability issues.
- g. To report to the CLIVAR SSG.

2. AIP-10 setting and charge to the meeting

Ruth Curry, AIP co-chair, welcomed all panel members and introduced new panel members present at the meeting. Apologies were sent by Doug Smith, Chris Reason, Svein Oesterhus and Mauricio Matta. She gave a brief introduction about the components of CLIVAR and the dimensions of its science, including CLIVAR's mission and primary science focus. She also charged the panel to identify key topics / processes that require focused study in the Atlantic climate system within next 5-10 years to further achieve WCRP/CLIVAR goals. A key point for the panel is also to identify the best direction and structure (who should lead, collaborations) for each of these.

The CLIVAR Scientific Steering Group (SSG) has proposed seven "Imperatives" that will guide the evolution of the CLIVAR science:

- I. Anthropogenic climate change
- II. Decadal variability, predictability and prediction
- III. Intraseasonal and seasonal predictability and prediction
- IV. Improved atmosphere and ocean components of Earth System Models
- V. Data synthesis, analysis, reanalysis and uncertainty
- VI. Ocean observing system
- VII. Capacity building

Using those Imperatives as guidelines and with an eye toward fostering links to the biogeochemical community (e.g. IGBP), the SSG, at their 16th Session, requested that AIP defines a roadmap for the future with an Atlantic perspective. What trajectories should be undertaken with respect to:

- Seasonal – Interannual Predictability and Forecasts (Tropical system (post-TACE), Atlantic influences on African Climate and monsoon systems, Interactions with the American monsoon systems); and
- Decadal Predictability and Forecasts (AMOC variability - dynamics and statistics, Atlantic – Arctic exchanges, and Atlantic exchanges with Southern Ocean - Drake Passage- and Indian Ocean - Agulhas Leakage)

The panel may also want to consider branching in new directions, e.g., actively advocating for deep ocean measurements, and the coastal response to Atlantic Ocean and climate changes.

For AIP, the SSG-16 (May 2009) provided the following specific action items:

- a. Incorporate the Arctic community (through ASOF synthesis and AOMIP groups) to the greatest extent possible.
- b. Participate in the OceanObs'09 which will include discussions of each ocean basin's observing system requirements (now and future). AIP will provide one or more panellists to this Forum
- c. Decide on a date for the next panel meeting (first half of 2010). It should be attached to a workshop or other science meeting.
- d. Develop a plan to undertake a coordinated evaluation of synthesis and model products using observational metrics/indices

Items b. and c. above have already been acted upon. Items a. and d. will be discussed at the present meeting.

3. Atlantic observing system

3.1 OceanObs'09: Summary and key outcomes

Stuart Cunningham, Molly Baringer and Peter Brandt presented an overview of OceanObs'09 and their main recommendations impacting AIP. At the end of the OceanObs'09, a Conference Statement was produced (<http://www.oceanobs09.net/statement/index.php>) and defined that the core principles of participation in the sustained observing system include recognition that users require: (i) Rapid access to all relevant data, free of charge; (ii) An integrated system, making use of remotely sensed and in-situ observations is essential; (iii) Observations are openly shared in near-real-time when technically feasible; and, (iv) they are collected, analyzed, archived, and distributed to internationally agreed standards with agreed best practices.

Molly Baringer reviewed the Atlantic observing network. Some programmes have met the target requirements but have not met their scientific objectives. There is a clear need for refinement in terms of numbers (e.g. drifters) and technology (e.g. Argo). In the Atlantic sector, it is necessary to maintain the proposed GO-SHIP lines at minimum, but if possible, return to the full WOCE set. With regard to XBTs, the system is not yet fully implemented, and transects should be expanded to include the marginal seas. It is also necessary to improve calibration and deal with fall rate issues in order to make XBT data useful for climate research. An international panel for XBTs should be implemented in order to coordinate these issues.

ACTION 1: Contact GO-SHIP Science committee to express concern that if possible, GO-SHIP lines should return to full WOCE lines in the Atlantic region (M. Baringer, AIP co-chairs)

3.2 Tropical Atlantic observing network (P.Brandt, P.Nobre)

The main focus of TACE is to improve predictions and understanding of the eastern tropical Atlantic climate and the representation in models of key dynamical processes underlying its behaviour. TACE was envisioned as a program spanning a period of approximately 6 years

(2006-2011), but several projects that currently are contributing to TACE will extend beyond this timeframe. The results of TACE are expected to contribute to the final design of a sustained observing system for the tropical Atlantic.

Peter Brandt updated the AIP members on the progress of TACE observations. During the last years the establishment of the TACE observing system made substantial progress. While the PIRATA program represents the backbone of the observational network, several observational programs - partly initiated with the help of TACE – are currently active in the central and eastern tropical Atlantic (visit <http://tace.ifm-geomar.de/>).

TACE biggest contribution was its process studies to understand the variability in the tropical Atlantic, particularly interannual variability of the circulation, and SST variability. However, there are some questions that are part of its science objectives that have not been answered. Closing the mixed layer heat budget on seasonal-to-interannual time scales is still a problem. Most cruise data are available but difficult to use because of different formats used by different countries. Variability in some regions and seasons are not well captured by observations like e.g. the preconditioning phase in the equatorial upwelling region.

During the discussion, meeting participants discussed the hypotheses that are driving the design of experiments in the tropical Atlantic. It seems that the main questions are around SST biases, but mostly trying to identify the processes that can correct biases in atmospheric models. However, the TACE modelling working group is not functioning and there is no coordinated effort in this area. One particular issue that should be brought to the attention of TACE Steering Group is that high-resolution simulations should be applied to study processes like zonal jets and coastal upwelling for a better understanding of these processes in the climate system.

ACTION 2: Express to TACE SG concern about the lack of modelling activities in TACE (P. Chang, co-chairs)

Paulo Nobre reported on the status of PIRATA. There has been an increase in papers using PIRATA data that highlights the good availability of data although there is a problem of ship time for maintenance from Brazil. This is an issue that will be discussed at the next PIRATA SG meeting.

PIRATA has been successful in terms of international science collaboration, with opportunities to strength links with the biogeochemistry community. There is a question if PIRATA data are being used into model assimilation. It is understood that ECMWF uses the data as a way to test assimilation. Also ocean data initialization in the Atlantic is not a solved problem.

PIRATA/TACE is important for CLIVAR as part of its legacy but it is necessary to show for funding agencies that the acquired dataset is important.

AIP needs to emphasize that we need the data to understand the basics and why models get it wrong in the Atlantic.

3.3 IASCLIP and Atlantic Warm Pool (D.Enfield)

David Enfield presented to AIP members the activities of a new, international programme called Intra-Americas Study of Climate Processes (IASCLIP). This programme has been organized under CLIVAR's American monsoons panel (VAMOS), and has been endorsed by the CLIVAR SSG. IASCLIP was set up to better understand the Atlantic's role in Western Hemisphere climate, and to assess and improve climate model performance. The Atlantic Warm Pool (AWP) is the centrepiece of IASCLIP. The size of the warm pool has large interannual variability and it is associated with extreme events in populated area of the United States, as well as frequency of hurricanes.

IASCLIP has several projects and many of them are model based particularly because there is great need to assess multiple GCMs and how well they reproduce observed features. However, how can model simulations of the AWP be diagnosed if there are virtually no subsurface observations in the warm pool region? Surprisingly, there is a large deficiency of measurements in the region to constrain upper ocean temperature and air sea fluxes. Observations in that region were fewer in 1999-2005 than 1970s. This represents a serious gap in the Atlantic observing system, which may contribute to the Atlantic model bias problem. Two possible ways of dealing with this situation is by adding subsurface thermistors to existing weather buoys, as well as installing systems to measure surface fluxes in small islands in the region. Argo could be used in the Intra-Americas Seas (IAS) with a shallower parking depth and Iridium transmission. Gliders are another platform that can be further used in the region.

There are several advantages for these monitoring efforts: it can be real-time for climate monitoring and hurricane forecasting, it will strengthen ties to operational services in the region that will be required for any special field programs in the future (IASCLIP Alliance), it will motivate regional institutions to exploit new data sources and become active participants in IASCLIP research and could be fine-tuned as needed to satisfy changing needs of research community. The primary aim is that it should evolve into a sustainable climate observing system for the region.

ACTION 3: Provide to OOPC the requirements for instrumentation in the Intra-Americas Seas region in order to achieve IASCLIP science objectives (co-chairs)

3.4 Status of AMMA (L.Terray)

AMMA is a program on West African monsoon, its variability and Society-Environment-Resources-Climate interactions with the following objectives:

- To improve our understanding of the African monsoon & its influence on the physical, chemical and biological environment regionally and globally.
- To provide the underpinning science :
 - that relates its variability to issues of health, water resources, food security and demography for West African nations
 - defining and implementing relevant monitoring and prediction strategies.
- To ensure that the multidisciplinary research carried out in AMMA is effectively integrated with prediction and decision making activity.

Laurent Terray gave an overview of the main achievements of AMMA Phase 1, which was process studies oriented and focused on short timescales and land interactions. Monsoon onset still needs to be better understood, and unfortunately models do not provide great results. AMMA has promoted sustained observation of meteorological networks, the same not happening with ocean observations, and this will probably continue at the next phase. AMMA is developing links with human dimensions, moving from process-oriented studies to more applied area.

3.5 AMOC programs: UK RAPID-WATCH, EU-THOR, US-AMOC

3.5.1 UK RAPID-WATCH

Stuart Cunningham presented an overview of the UK RAPID-WATCH: Monitoring the Meridional Overturning Circulation project, which is funded by the UK's Natural Environment Research Council until 2014. RAPID-WATCH aims are:

- I. To deliver a robust and scientifically credible assessment of the risk to the climate of UK

and Europe arising from a rapid change in the Atlantic meridional overturning circulation (MOC).

- II. To assess the need for a long-term observing system that could detect major MOC changes, narrow uncertainty in projections of future change, and possibly be the start of an 'early warning' prediction system.

It is expected that the project delivers a decade-long time series of calibrated and quality-controlled measurements of the Atlantic MOC from the RAPID-WATCH arrays and these observations will be used with data from other sources to determine and interpret recent changes in the Atlantic MOC, assess the risk of rapid climate change, investigate the potential for predictions of the MOC and its impacts on climate.

The RAPID and USAMOC International Meeting on the Atlantic Meridional Overturning Circulation (AMOC) will take place in Bristol, UK, 12-15 July, 2011.

3.5.2 US AMOC Progress

Molly Baringer reported on the progress of the US AMOC activities. Task teams have been identified in addition to recommended activities and some early tangible results have already been achieved. Continued partnership with international collaborators is essential to the community-wide goals of AMOC monitoring and prediction. However, particular need for collaboration is for transatlantic measurements; the monitoring of subpolar North Atlantic and subtropical South Atlantic are key priorities.

The US AMOC Science Team organized their first annual meeting in May 2009 (<http://www.atlanticmoc.org/AMOC2009.php>). Two main issues were discussed at the meeting, the optimal observing system design for the AMOC and if there is an identifiable and measurable AMOC fingerprint that can be used to constrain the requirements for an AMOC observing system. The discussion of those two items provided comments for a Community White Paper (Cunningham et al.) submitted to OceanObs 2009 Conference on the observing system recommendations.

The 2nd AMOC Open Science Meeting is being organized and will happen in June 7-9 2010 in Miami (<http://www.atlanticmoc.org/AMOC2010.php>). The meeting will consist of invited and contributed talks, poster presentations and group discussion. In addition to AMOC Science Team members, scientists who can contribute to subjects that are closely related to the aforementioned topics and federal agency officials who are involved or interested in the AMOC program are encouraged to attend. This meeting will aim at identifying:

- The use of existing observations to characterize the variability and structure of the AMOC
- The impact of existing measurements on constraining AMOC state estimations and an evaluation of the need and strategy for enhancing the current AMOC observing system.
- An examination of the role of AMOC variability on the climate system (e.g., how the AMOC affects SST).
- The predictability of AMOC.

3.5.3 Thermohaline Overturning at Risk? (THOR)

THOR (<http://www.eu-thor.eu/>) is an EU large-scale integrating project with more than 20 European institutions involved. THOR had its kick-off meeting in March 2009 in addition to several workshops organized by its "Core Themes", which are: (i) MOC Variability, (ii) Model

Uncertainty, (iii) Observations of the North Atlantic MOC, (iv) Predictability of MOC, and (v) Technological Advancements.

Several achievements have been accomplished including experimental multi-model set up ready and results (CMIP5) are expected to be delivered in July 2010. All THOR current meters moorings for the Atlantic inflow through the Denmark Strait (two Aanderaa RCM instrumented moorings) and over the Iceland-Faroe Ridge (two ADCPs in trawl-protected frames, and two deep traditional ADCP instrumented moorings) are in place. Also, most of the ADCP moorings for the Faroe-Shetland inflow are deployed. Two ADCP moorings to monitor the deep overflow were deployed in the Denmark Strait during the “Merian” cruises, and two ADCP moorings are deployed in the Faroe Bank Chanel.

After these presentations, panel members discussed the role that AIP can play in networking these projects. AMOC observations are not a system but a collection of projects. UK RAPID-WATCH is the best developed of these individual components. Plans for an integrated system should include similar trans-basin arrays in the subpolar North Atlantic and in the South Atlantic in order to assess meridional connectivity and variability of MOC. Expectation is that a full meridional monitoring will be important to constrain and validate decadal variability in models.

The main concern is that to have an integrated system, arrays have to be synchronous. The RAPID array may be decommissioned by the time other elements are in place. Therefore, it is important to sustain it beyond 2014 or redeploy it in order to mesh with the full system. Upcoming meetings for Subpolar Gyre component and South Atlantic (SAMOC, Brazil), in addition to the US AMOC Science meeting (Miami, USA) will help define requirements and formalize international collaborations.

ACTION 4: AIP members to attend the US AMOC, Subpolar Gyre and SAMOC workshops and draft an assessment report to be delivered to the SSG for discussion (M. Baringer, R. Curry, S. Cunningham)

3.6 Deep ocean observational network

Panel members discussed deep ocean observations and scientific requirements based on the OceanObs’09 Community White Paper by Garzoli et al. The rationale for the need of a deep ocean observational network is that half of the ocean volume is below 2000 m depth and the deep ocean currents control climate changes on long term time scales (decadal to millennia). The status of the global heat content remains uncertain due to the paucity of measurements. Argo network revolutionised the observation network in the upper ocean so most of the global ocean heat content estimates are limited to the upper km of the ocean. There are indications of increased freshwater input at the high latitudes of the oceans and the deep ocean accounts for more than half of the total (natural) oceanic carbon inventory.

Possibly new technologies will need to mature in order to make such observational network a reality. Assimilation community needs to have measurements of the deep ocean, so there is need to articulate and coordinate such observations. Deep ocean has never been properly discussed in AIP, always relied on hydrography but because it has been scaled back in comparison to the WOCE era, there is need to complement.

Task force is established to push a workshop on deep ocean observations (Silvia Garzoli and Greg Johnson have OOPC’s support to organize a workshop).

ACTION 5: Contact Silvia Garzoli and Greg Johnson and discuss plans for workshop, already supported by OOPC (R. Curry, M. Baringer, P. Brandt)

3.7 Agulhas leakage and SCOR Agulhas Current WG (L. Beal)

Lisa Beal gave an overview about the Agulhas leakage and the Agulhas Current time-series. Paleo-climate data indicate that the variability in the Agulhas System is on a par with Heinrich (land-ice release) Events, in terms of its effect on global climate. Satellite and model studies suggest that the Agulhas leakage represents a positive feedback on global warming (through enhancement of AMOC), in contrast to northern ice sheet melt which represents a negative feedback. There is a need for continued observations of Agulhas variability to better understand and verify these studies.

The goal of the Agulhas Current time-series is to build a multi-decadal time-series of Agulhas Current transport. Phase 1 will constitute deployment of a mooring array across the Agulhas along an altimeter ground track (off East London, SA) to obtain an accurate 3-year long time series of transport from in situ measurements. In Phase 2 there will be a “calibration” of the along-track altimeter data with the measured transports to produce a proxy time series of Agulhas Current transport from 1992 and into the future, for as long as altimeter missions continue to cover this track.

Lisa Beal also reported on the SCOR Working Group 136 on the Climatic Importance of the Greater Agulhas System. The group had their first meeting at Ocean Sciences in Portland, 22-26 February 2010. The objectives of this working group, which has a large capacity building component, are:

- Facilitate collaboration between existing and planned (observational and modelling) studies in the greater Agulhas Current system, such that we minimize the gaps in the research, maximize the scientific outcome, and encourage estimates on the robustness of key findings (e.g. multiple model ensembles).
- Write a review paper (for publication in a peer-reviewed journal) that highlights the importance of the greater Agulhas system in terms of regional and global climate, reviewing the current levels of both understanding and uncertainty as to how changes in the system come about, how they effect climate, and vice versa.
- Identify key components of the circulation that deserve further study through physical/paleo observations and/or models, some of which may act as indices/proxies (through sustained observation) that can help describe the state of the Agulhas system on decadal to climate time scales. Report these findings to regional and international strategic planning committees, such as CLIVAR, GOOS, GEOSS, GO-SHIP etc. Encourage involvement of East African countries in sustained observations (in partnership with ASCLME).
- Write a proposal for, and organize, a Chapman Conference on the “Climatic Importance of the Greater Agulhas System”, to be held in 2012, with the full participation of the African science community.

3.8 Connections with Atlantic hurricane activity (S. Camargo)

Suzana Camargo gave a presentation about the issues related to Atlantic tropical cyclone (TC) activity. It is clear that TC activity is modulated by different climate modes, e.g. ENSO, Atlantic Meridional Mode (AMM), North Atlantic Oscillation (NAO), Madden - Julian Oscillation (MJO). Atlantic TC forecasting ability at many time scales depends on the quality of the SST forecasts. The role of local vs. remotely forced sea surface temperature variability in TC projections needs to be better understood and better and more observations of heat content in the Inter-Americas Seas are required. On weather time-scales the knowledge of ocean structure is necessary for better intensity forecasts

4. Atlantic-Arctic connections

The lack of an Arctic component in CLIVAR represents a serious disadvantage towards a complete understanding of the climate system. The time has come to plan and start activities in the Arctic that will contribute to the future prediction of its climate at seasonal, yearly and decadal times scales.

Marika Holland gave a presentation on this issue and noted that the following advances will be necessary to enable Arctic climate prediction:

- continued development of the integrated Arctic Ocean Climate System (IAOOS),
- quantitative hindcast of the past changes in the Arctic, which will likely require an Arctic System Reanalysis as its initial step,
- ocean data synthesis in the Arctic and sub-Arctic,
- a review of the polar climate system predictability and
- continued improvement of the representation of Arctic processes in coupled models.

The Arctic science would certainly benefit from a coordination of the modelling and observational efforts in the region, and CLIVAR is well positioned to play a role in coordinating these, together with other groups/projects like CliC, AOMIP and SEARCH.

AIP suggests the creation of an Arctic regional panel tasked with:

- Integrating present efforts that have interest in the Arctic science
- Focus on ocean-atmosphere phenomena, exchanges with Pacific and Atlantic basins, model development (particularly with regard to sea-ice), and model-data integration.
- Promote a synthesis of existing data sets, e.g. APY and ASOF data
- Interact strongly with other CLIVAR panels (AIP, PP, WGSIP and WGOMD)

ACTION 6: Suggest that CLIVAR SSG creates an Arctic Panel to coordinate diverse efforts to address modelling and observations issues in the Arctic (co-chairs)

5. Tropical Atlantic model biases

5.1 Toulouse meeting (Feb 2009) on tropical Atlantic (L. Terray)

Laurent Terray reported on the outcomes of the 2nd International Tropical Atlantic Meeting TACE/PIRATA/AMMA, which occurred in February 2009 in Toulouse. A full report can be found at http://www.clivar.org/organization/atlantic/TACE/TA_meeting_report_feb2009.pdf.

The main objectives of this meeting were defined as to:

- Improve our knowledge on the mechanisms of the climate variability and the seasonal climate prediction over the Tropical Atlantic and surrounding countries.
- Set up design experiments to test optimal design of observing systems to improve sea surface temperature predictions in the tropical Atlantic and demonstrate improved coupled prediction skill in the tropical Atlantic with enhanced observations.
- Set up coordinated forced and coupled model inter-comparison experiments to investigate the main processes involved in tropical Atlantic model biases at various time scales. Compare these runs with available observations with emphasis on the upper ocean in the eastern equatorial Atlantic.

The specific session on Atlantic biases showed that current coupled climate models show very poor performance in simulating tropical Atlantic, with biases in mean state and variability. Similar biases are present in both seasonal hindcasts and climate simulations. Some advances have recently been made in documenting the biases in the current generation of coupled models.

Common error patterns in surface winds and precipitation already exist in uncoupled atmospheric GCMs with “perfect” SSTs, but these biases are amplified in the coupled models (CMIP3 and seasonal forecasting). There is a need to better understand the seasonal evolution of the biases and the associated mechanisms. The workshop also showed that current models exhibits biases in other regions such as the Atlantic Warm Pool.

5.2 VOCALS perspective on model biases (P.Zuidema)

Paquita Zuidema presented some of the experience of the VOCALS project in dealing with model biases in the Southeastern Pacific. Coupled GCMs suffer from common difficulties in their depiction of both the eastern Pacific and Atlantic basins, such as: the so-called double ITCZ problem; excessively strong equatorial cold tongues; and eastern basin SSTs that are too warm. VOCALS has brought a southeastern Pacific (SEP)-specific address of these problems, and observations and high-resolution modeling are improving our understanding of the relevant processes. The VOCALS project is helping to improve our understanding of how future climate change may manifest itself in the southeast Pacific. Regional ocean circulation features are now better articulated, and well-characterized cloud and surface energy budgets reference datasets form an important legacy

5.3 Summary of discussion: addressing tropical model biases

Tropical model biases are still a problem not resolved, and a serious impediment to progress in seasonal-to-interannual prediction. It appears that not much progress has been made to address the bias issue in the tropical Atlantic sector, although some improvement has been made to reduce model biases in tropical Pacific sector. It is not likely that CMIP5 modelling will successfully resolve this issue.

Although problems of coupled GCMs in the southeast Atlantic (SEA) are similar to those in the SEP, there are important differences between the two regions. The Atlantic basin is far smaller than the Pacific basin, while the two stratocumulus decks in the SEA and SEP are of comparable size, so that the former covers a large fraction of its basin. The smaller Atlantic basin size encourages a tighter and more complex land-atmosphere-ocean interaction, with deep convection over the Amazon and the monsoonal convection over Africa affecting the large-scale circulation. On the southeast Atlantic’s boundary, the orography along west African coast does not extend as high as does the Andes, allowing atmospheric circulation patterns over Africa to exert a more obvious influence on the SEA free troposphere than for the southeast Pacific. One consequence is the outflow of biomass burning aerosol layers over the SEA stratocumulus deck, stimulating unique aerosol-cloud-climate interactions that are difficult to confidently constrain with only satellite observations.

The Southeast Atlantic contains the major planetary stratocumulus deck left unexamined. Its meteorology, oceanography, and relationship to surrounding land masses differs from the southeast Pacific. France, the United Kingdom, and Germany have actively researched along the western African seaboard (e.g., AMMA, SAFARI), while South African scientists have been active in Agulhas Current research. Although the VOCALS project is one model for focusing scientific and modelling questions for the southeast Atlantic, it is unclear if this is the appropriate model. More prior research appears to have occurred in the southeast Atlantic than in the southeast Pacific, and better tools (reanalyses, satellite datasets) are now available than existed at the inception of VOCALS. Both of these factors provide greater information on scientific and geographical focusing in the southeast Atlantic than available to VOCALS: the Gulf of Guinea, for example, has important monsoonal interactions with equatorial Africa, contains some of the warmest Atlantic waters, and as part of the southeast Atlantic is also subjected to high seasonal atmospheric aerosol loadings. The connection between the southeast and equatorial Atlantic needs elucidation.

Panel members, after discussion, decided that the best way forward would be to have a joint VAMOS-AIP workshop on tropical biases, also in association with VOCALS groups.

ACTION 7. Propose joint VAMOS-AIP workshop on tropical biases (co-chairs)

6. Reports

6.1. WGSIP activities in the Atlantic (B.Kirtman)

WGSIP aims focus on a programme of numerical experimentation for seasonal-to-interannual variability and predictability, paying special attention to assessing and improving predictions. Further research aims are to develop appropriate data assimilation, model initialization and forecasting procedures for seasonal-to-interannual predictions, and to consider such factors as observing system evaluation, use of ensemble and probabilistic methods and statistical and empirical enhancements, and measures of forecast skill.

Ben Kirtman, co-chair of WGSIP, showed that one of the main activities developed by WGSIP in the last year was the continuation of the WCRP Climate-system Historical Forecast Project (CHFP), as part of the WCRP Seasonal Prediction Cross Cutting Topic. CHFP is a multi-model and multi-institutional experimental framework for sub-seasonal to decadal complete physical climate system prediction, and it is designed to provide:

- Baseline assessment of seasonal prediction capabilities using the best available models and data for initialization.
- Experimental framework for focused research on how various components of the climate system interact and affect one another.
- Test bed for evaluating IPCC class models in seasonal prediction.

CHFP data will be available from June 2010 and will be available through Distributed Data Centers (CIMA-Argentina, ENSEMBLES-UK, APEC-Korea). Links are being strengthened with CliC, via the Sea-Ice Predictability Experiments, to explore seasonal predictability associated with snow and sea ice; with SPARC, via the Stratosphere-resolving HFP experiment (StratHFP), where high and low resolution models will be used to quantify improvements in actual predictability by initializing and resolving the stratosphere in seasonal forecast systems; and, GEWEX, via Global Land-Atmosphere Coupling Experiment (GLACE-2), to determine prediction skill associated with accurate initialization of land surface states.

Another main activity was the coordination of WCRP CMIP5 Near Term Experiments, which is a coordinated experiment to study multi-decadal prediction and near-term climate change. A CMIP5 WGCM-WGSIP group is in place to oversee this framework.

Future activities of WGSIP include an effort to increase visibility, participation and analysis of CHFP, as well as increase regional capacity building through training on the use of CHFP data for applications. A “IAI Training Institute on the Use of Seasonal Predictions for Applications in Latin America” is being organised by WGSIP and will happen in 02 – 13 August, 2010 in Buenos Aires, Argentina.

6.2 Miami Workshop on “Predicting the climate of the coming decades” (B. Kirtman)

Ben Kirtman also reported on the outcomes of the workshop at the Rosenstiel School of Marine and Atmospheric Science of the University of Miami on January 11-14, 2010. The goal of the workshop was to bring together academics and practitioners who have shared interests in

predicting the climate of the coming decades. This included researchers who were involved in developing climate prediction systems, studying decision making processes, developing applications of climate information, regional resource managers, and representatives from the insurance industry. This cross disciplinary approach to climate prediction and use is becoming increasingly important as the nations of the world develop new or enhance existing national climate services. Presentations covered three general topics: (1) status of decadal climate prediction efforts, (2) assessing user needs of decadal timescale climate information and (3) constraints on decision making.

One of the issues of interest to AIP is that, in the Atlantic, the source of predictability is thought to come from the Atlantic Meridional Overturning Circulation (AMOC). In some of the models, this produces patterns of the surface temperature of the North Atlantic basin, which may affect hurricanes, rainfall over North America and temperatures over much of Europe. In fact it has been shown during the workshop that experimental decadal prediction being made today indicate modest skill.

6.3 Considerations about high resolution models in the Atlantic (Anne Marie Treguier)

Anne Marie Treguier presented a few considerations about the use of high resolution models. As these models are very costly to run, it is difficult to have data to validate them. Advance planning is necessary because the model needs to be run for the region where data is going to be collected. For model validation, eddy kinetic energy derived from observations was used to validate models until five years ago. These days the root mean square of sea level anomaly is used for that purpose.

Unfortunately there is no wish list from modellers about what data they need to validate models. Observations are driven by scientific questions and the real need for the modeller is easy availability of data. AIP metrics prepared for the CLIVAR Repository for Evaluating Ocean Simulations (REOS) was an ad hoc exercise, without consultation with modellers. It seems necessary to revisit it and take it to WGOMD. This can be a good opportunity to bring together observationalists and modellers to draw up a list of metrics.

ACTION 8: revisit metrics sent to WGOMD as part of REOS, and to GSOP as part of the ocean synthesis intercomparison project (A-M. Treguier to lead)

7. Management and accessibility of observational data

During the panel meeting, one issue that clearly emerged as a challenge for CLIVAR was data management. Panel members discussed that CLIVAR, as a project, has failed to get its participants involved into producing a data management plan and products that would benefit the earth science community. The key issue around addressing scientific questions of predictability and prediction on, for instance, decadal timescales relies on good quality controlled and available data sets. Accessibility to the high quality observational data sets is an issue: data can be found in different formats and grids, incomplete metadata, etc. are all problems.

CLIVAR's omission in dealing with data management resulted in the present fragmented accessibility of CLIVAR datasets. One of the problems is that a label of "CLIVAR program" datasets is that the number of datasets labelled as "CLIVAR" varies widely from person-to-person, and country-to-country, and in many cases the labelling of datasets as CLIVAR has not proven to increase the flow of data. Furthermore, other groups have already developed very good strategies and standards that can be followed (e.g. Argo, OceanSITES)

Panel members concluded that there is a need to critically emphasize data management to the CLIVAR mission and the need for a serious proactive stance as part of transition to next phase of CLIVAR.

ACTION 9: Prepare a statement about the problem of lack of data management in CLIVAR and circulate to other basin panels for comment (A-M. Treguier, M. Baringer, Ruth Curry, co-chairs, ICPO)

8. Other AIP business

Some members have completed their terms: Paulo Nobre, Chris Reason, Stuart Cunningham, Svein Oesterhus, Ruth Curry and Yochanan Kushnir. The panel has agreed to extend the terms of Ruth Curry, Stuart Cunningham and Yochanan Kushnir.

ACTION 10: Find a replacement for Paulo Nobre, Chris Reason and Svein Oesterhus; extend the terms of Ruth Curry, Stuart Cunningham and Yochanan Kushnir for two more years (co-chairs and ICPO)

Appendix A - Agenda

CLIVAR Atlantic Implementation Panel – 10th meeting Feb 28 – Mar 2 Miami, FL, USA

Final Agenda

Sunday, Feb 28th 2010

- 09:00 Welcome and charge to the meeting (L.Terray, R. Curry)
- 09:10 Report on SSG-16 (R. Curry)
- 09:25 Events, action items since AIP-9 (N. Caltabiano)
- 09:40 Review of AIP Terms of Reference (L.Terray, R. Curry)

- 10:00 Coffee Break

- 10:30 OceanObs'09 (P. Brandt, S. Cunningham, M. Baringer)
Summary and key outcomes.
The way forward

- 12:00 Lunch

- Session: The Atlantic observational network (R. Curry)

- 13:00 TACE - summary of present status (P. Brandt)
- 13:15 PIRATA - summary of present status (P. Nobre)

- 13:30 IASCLIP and Atlantic warm pool (David Enfield)
- 13:50 Connections to Atlantic hurricane activity (S. Camargo, Y. Kushnir)
- 14:10 Discussion

- 14:30 Links with AMMA (L. Terray)
- 14:50 Discussion

- 15:15 Coffee

- 15:45 EU-THOR (P. Brandt)
- 16:00 UK-RAPID (S. Cunningham)
- 16:15 US-AMOC (M. Baringer)

- 16:30 AIP website – focus on process studies (N. Caltabiano)
- 16:45 Present Atlantic field programs (R. Curry)
- 17:10 Discussion: How well are CLIVAR data policies being followed?

Monday, Mar 1st 2010

09:00 Atlantic – Arctic connections (M. Holland)
09:30 Discussion: How should Arctic be represented in CLIVAR?

10:00 Coffee Break

10:30 Agulhas leakage and SCOR - Agulhas Current WG (L. Beal)
10:45 Discussion

Session: The state of Atlantic Climate Modeling

11:00 Report on the Toulouse "Tropical Atlantic" meeting on model biases issue (L. Terray)
11:20 High-resolution models and model biases (A-M. Treguier)
11:35 VOCALS experience with tropical biases issues (P. Zuidema)
11:50 Discussion on Tropical biases issues (Y. Kushnir , P. Chang)

12:30 Lunch

13:30 Seasonal – interannual prediction activities over the Atlantic (B. Kirtman)
13:50 Report on the Miami “Predicting The Climate Of The Coming Decades” workshop (B. Kirtman)
14:10 Discussion

14:30 Report on the Utrecht Decadal prediction workshop (L. Terray)
15:00 Discussion

15:45 Coffee

16:15 GSOP call for ocean basin case studies using ocean reanalysis products (R. Curry)

Tuesday, Mar 2nd 2010

09:00 Deep observational network (Silvia Garzoli)
09:30 Discussion: Is there a role for AIP to move it forward?

10:00 Coffee

10:30 Workshop and/or coordinated actions proposals
11:00 Membership issues
11:30 Next meeting

Appendix B - Attendees

Molly Baringer	NOAA/AOML/PHOD, USA	Molly.Baringer@noaa.gov
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