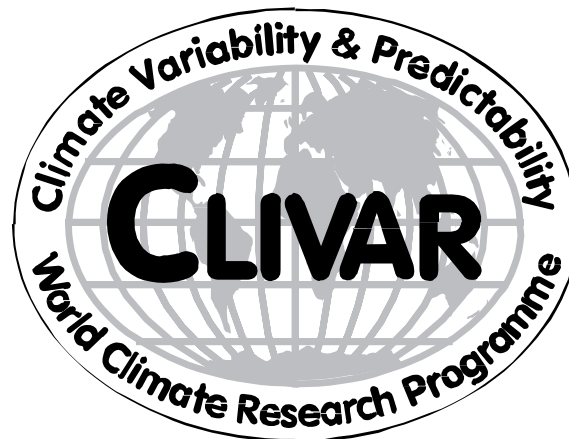


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Report of the 16th Meeting of the CLIVAR Scientific Steering Group (SSG-16)

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Summary of actions and recommendations

Cross WCRP items

1. Encourage cross WCRP activity in model validation and improvement; identify the process by which this is to be done (WGCM/WGNE lead).
2. Identify CLIVAR needs for coupled modelling, including clouds and radiation for feed into GEWEX
3. Clarify SPARC timescales for input to CHFP experimentation and ensure consistency with CHFP timescales (WGSIP chair/SPARC co-chairs)
4. Work to establish CliC CHFP involvement (WGSIP co-chair, CliC co-chairs), especially on sea ice.
5. Encourage peer review paper for general community on sea ice modelling (S. Griffies, CliC)
6. Explore ways to ensure CLIVAR requirements for Arctic science can be met (CLIVAR/CliC co-chairs)
7. Consider cross project activity on water vapour (GEWEX, CliC, SPARC, CLIVAR)
8. Recommendation: WCRP should, in place of a 2nd CLIVAR Science Conference, promote a pan WCRP Conference to celebrate the successes of the projects and broadcast the way forward for WCRP in the future, Action D/WCRP and WCRP Chairs and Directors.

Links with other programmes including national programmes

9. Seek mechanisms to strengthen US CLIVAR and International CLIVAR coordination (Action: David Legler, D/ICPO and the SSG co-chairs)
10. CLIVAR to explore ways to strengthen links with IGBP, including cross membership of panels, working groups and the SSG (co-chairs/ICPO to lead).
11. CLIVAR to strengthen advocacy for sustained ocean observing system

CLIVAR imperatives

12. Action subsequent to meeting: in order to provide D/WCRP with material for the WCRP implementation brochure that will be showcased at the upcoming WCC-3 (see below), each drafting team is requested to write a one paragraph description of the science under each heading (e.g., Decadal Variability, Predictability and Prediction) by 3 June. This should be a high level overview written for the non-expert. The first name under each imperative should take the lead.
13. Action subsequent to meeting: A 3-5 page description to be provided by 17 June of: (1) the science and the associated "grand challenges" of each imperative; (2) what is needed over the next 5 years to make significant progress toward and/or to achieve the goal(s) of meeting the challenges (e.g., strategic partnerships within WCRP, to IGBP or to other programs, workshops, cross-panel meetings, a task force, etc.) and (3) a rough time line of the activities.

Endorsed activities

14. Review and strengthen process by which CLIVAR- endorsed activities report outcomes to CLIVAR
15. Explore the set up of a data portal for CLIVAR-endorsed campaigns (ICPO)

Global modelling panels

16. Request Panels and Working Groups and other WCRP projects to distill information on experience with analyses of CMIP-3 output. Email to be circulated requesting this, with rationale (WGCM co-chairs, Anna Pirani)
17. Consider how to implement CPTs in an international context. Action: WGCM lead, with Jacob for WGNE and GEWEX.
18. Seek to build WGSIP links to other panels as for VAMOS (WGSIP co-chairs, panel chairs)

Global observations and synthesis

19. Basin panels are requested to provide feed in on science questions to be addressed using ocean synthesis products (GSOP co-chairs, ICPO, basin panels).
20. Work on interbasin issues encouraged either through GSOP or OceanObs'09 meeting of opportunity of basin panel chairs.
21. CLIVAR basin panel's requested to consider involvement in OceanObs'09 parallel community fora from perspective of physical oceanography (basin panel co-chairs, D Stammer).

Ocean basin panels

22. Identify WCRP representation to SCOR WG on Agulhas Working Group and pass to D/WCRP (Panels, D/ICPO)
23. Coordinate Atlantic tropical model bias work with VOCALS (Atlantic co-chairs in consultation with VOCALS)
24. AIP to take lead in facilitating a meeting between US AMOC and THOR when appropriate (AIP co-chairs)
25. Noting the large investments in western boundary current studies in the Pacific to which the PP can/is supplying needed coordination, consider inviting leaders of new initiatives in the Pacific to Pacific Panel (PP) membership, or at least involving them in PP meetings (PP co-chairs)
26. IOP are encouraged to entrain new members to explore science issues and build science case for continuing input of resources into IndOOS. Collaboration with AAMP is also encouraged. Consider back to back IOP and AAMP meeting in near future and potential further back to back meeting with VACS (IOP co-chairs, AAMP co-chairs, VACS co-chairs)
27. Check on CINDY/DYNAMO endorsement status (D/ICPO)

Africa/Monsoon Panels

28. CLIVAR to host MJO Task Force within AAMP, potentially linking across to VAMOS (VAMOS to consider). Action: SSG Exec in discussion with AAMP, VAMOS, D/WCRP and D Waliser; JPS to make connection with WWRP.
29. Identify AAMP and VACS involvement with CHFP (AAMP, VACS co-chairs)
30. Resolve issue of IASCLIP endorsement (VAMOS co-chairs, D/ICPO)
31. SSG encourages coordination between VAMOS and ETCCDI on extremes (ETCCDI/VAMOS chairs) and also encourages other panels to engage in extremes a in a similar fashion to VAMOS
32. VACS should seek cooperation with TFRCD/CORDEX within one year, leading to an eventual joint workshop. Action: VACS leadership with R Anyah
33. VACS to consider initiative to EU programme on an early warning and forecast system with prospect of WCRP/CLIVAR seed funding for planning meetings.

Report of CLIVAR SSG-16

1. Introduction

1.1 Background

The 16th session of the CLIVAR Scientific Steering Group (SSG-16) was held in the meeting rooms of the Royal Botanical Gardens, Consejo Superior de Investigacion Cientifica (CSIC), Madrid, Spain, from 19-22 May 2009. The SSG co-chairs (Jim Hurrell, Tim Palmer, and Martin Visbeck) led the meeting, which included 35 delegates comprised of other SSG members, chairs and members of CLIVAR panels and working groups, representatives from other core WCRP projects, and other invitees. The meeting had two primary foci: first, to build consensus on overall imperatives for CLIVAR science and its implementation over the coming 5 years, and second to assess the progress of panels and working groups in terms of advancing CLIVAR science. The SSG is grateful to Dr Roberta Boscolo¹ for acting as local organizer of the meeting. Through her efforts the meeting was an extremely successful and sociable event.

The agenda for the meeting is at Annex A and a list of participants at Annex B.

1.2 Opening of the meeting

The SSG and other attendees were pleased and honoured to have the meeting open with an address from the Spanish Secretary of State for Climate Change, Ms. Teresa Ribera, which stressed the importance of ongoing climate research and the IPCC process. Ms. Ribera was accompanied by the President of AEMet, Francisco Cadarso. Delegates were also welcomed with addresses from Dr Gonzalo Nieto, Director of the Royal Botanical Gardens and Dr Rafael Zardoya of the Museo Nacional de Ciencias Naturales. Tim Palmer provided the response and thanked the Spanish hosts for their good wishes on the success of the meeting and for the support received from CSIC.

2. WCRP strategy, outcomes of JSC-30 and other project/programme inputs

2.1 Outcomes of JSC-30 and WCRP strategy

To help set the context of the meeting, Dr. Ghassem Asrar, Director of WCRP, outlined current thinking on the future directions for WCRP. As part of the presentation, Valery Detemmerman presented the CLIVAR-relevant actions and outcomes of the 30th meeting of the Joint Scientific Committee (JSC) for WCRP (Maryland, USA, 6-9 April 2009). Dr Asrar emphasized that programme development within WCRP is taking place on two time horizons – to 2013 (“the intermediate term”) and beyond (“the longer term”). For the former, the WCRP Strategic Plan 2005-15 “Coordinated Observation and Prediction of the Earth System (COPES)” defines the pathway, with contributions to the WCRP cross cutting themes² fully integrated in the core projects’ work. Regarding the longer term, a new WCRP structure is required to achieve a more effective interface with the users of climate information products, building on the outcomes of World Climate Conference-3 (WCC-3) (Geneva, Switzerland, 31

¹ At the time of the meeting a member of the staff of the International CLIVAR Project Office (ICPO) working from the CSIC Instituto de Investigaciones Marinas, Vigo, Spain and now, since 1 June 2009, on the staff of the Joint Planning Staff for WCRP in Geneva.

² The WCRP cross cutting themes are: Anthropogenic Climate Change, Atmospheric Chemistry and Climate, Decadal Prediction, Seasonal Prediction, Monsoons, Climate Extremes, Sea Level Rise and the International Polar Year.

August – 4 August 2009) and to continue to promote and facilitate research at the frontiers of climate science.

In order to focus the way forward, at JSC-30 the core projects and other WCRP observational and modelling groups had highlighted their contributions to the COPES framework. Moreover, they presented preliminary science goals and implementation plans for the intermediate term. All of this information is being fed into an overall WCRP Implementation Plan and Accomplishments Document, to be distributed at key events such as WCC-3.

2.2 WCRP Core Project Inputs

Under this heading, presentations were made by representatives of the other three core projects of WCRP: the Global Energy and Water Experiment (GEWEX), Climate and Cryosphere (CliC) and Stratospheric Processes and Climate (SPARC). Each presentation highlighted future foci and synergies with CLIVAR. Particular cross-project items arising were as follows:

Encourage cross WCRP activity in model validation and improvement; identify the process by which this is to be done (WGCM/WGNE lead).

Identify CLIVAR needs for coupled modelling, including clouds and radiation for feed into GEWEX

Explore ways to ensure CLIVAR requirements for Arctic science can be met (CLIVAR/CliC co-chairs)

Encourage peer review paper for general community on sea ice modelling (S. Griffies, CliC)

Consider cross project activity on water vapour (GEWEX, CliC, SPARC, CLIVAR)

2.3 WCRP/WWRP Year of Tropical Convection

The status of the WCRP/ World Weather Research Programme (WWRP) “Year of Tropical Convection (YOTC)” was next outlined by Duane Waliser. An Implementation Plan for YOTC would be finalized in July 2009 at a planning workshop in Honolulu. Dr Waliser also presented a proposal for a Joint WCRP/WWRP Task Team on the Madden Julian Oscillation (MJO) as a follow-on from the previous US CLIVAR MJO Working Group (www.usclivar.org/mjo.php). From a CLIVAR perspective, the SSG agreed the MJO Task Team could be hosted within the Asian Australian Monsoon Panel (AAMP) and potentially the Variability of the American Monsoon (VAMOS) panel also.

CLIVAR to host MJO Task Force within AAMP, potentially linking across to VAMOS (VAMOS to consider). Action: SSG Exec in discussion with AAMP, VAMOS, D/WCRP and D Waliser; JPS to make connection with WWRP.

2.4 OOPC Report - development of the ocean observing system

The status of the ocean observing system was reviewed by Ed Harrison, Chair of the Ocean Observations Panel for Climate (OOPC). He noted that implementation of *in situ* instrumentation has slowed and it's not clear how long the system can be sustained via the science community. There are R&D, data sharing and data system challenges including those associated with extending the system to include biogeochemical and ecosystem variables. There has been good progress with ocean synthesis but demonstrating the

essential requirement for ocean observations for coupled climate predictions remains a challenge.

CLIVAR to strengthen advocacy for sustained ocean observing system

However, it is encouraging that the community response to the call for OceanObs09 Symposium (Venice, 21-25 September 2009) White Papers has been strong with over 100 proposals accepted and more than 70 received at the date of SSG-16.

2.5 World Climate Conference-3 (WCC-3)

Martin Visbeck briefed attendees on WCC-3 during the late morning session of day 2. Martin is a member of the WCC-3 International Organizing Committee and serves as Chair of its Programme Sub-Committee. The overarching theme of WCC-3 is "Climate prediction and information for decision-making focusing on scientific advances in seasonal to interannual timescales, taking into account multi-decadal prediction". WCC-3 will establish an international framework to guide the development of climate services which will link science-based climate predictions and information with climate-risk management and adaptation to climate variability and change throughout the world. The presentation led to some debate over whether the primary need was to better connect with users or to improve models and develop the science. Further information on WCC-3 is at www.wmo.int/wcc3/.

3. Contributions from national programmes and wider international activities

3.1 Contributions from national programmes

3.1.1 US CLIVAR The meeting heard three presentations on national CLIVAR efforts. On the first morning, David Legler, Director of the US CLIVAR Office, outlined US CLIVAR science initiatives, future strategy and links to international CLIVAR. He highlighted progress on the themes of drought research and decadal prediction (a third theme to be identified at the upcoming US CLIVAR Summit meeting) and with a number of other activities of US CLIVAR. These activities and associated WCRP cross-cuts (e.g. extremes and decadal prediction) have been very visible and active within the US. They have garnered enthusiasm & engagement amongst US agencies and US scientists, and new opportunities for CLIVAR abound. It was agreed that there is room for greater coordination between US and international CLIVAR, for instance through US CLIVAR activities on the Atlantic Meridional Overturning Circulation and prospects for evaluation of the next set of Coupled Model Intercomparison Project (CMIP5) runs.

Seek mechanisms to strengthen US CLIVAR and International CLIVAR coordination (Action: David Legler, D/ICPO and the SSG co-chairs)

3.1.2 CLIVAR-Spain Before lunch on the second day, the meeting attendees were pleased to have presentations on CLIVAR-relevant activities in Spain covering:

- Activities of AEMET relevant to CLIVAR, by Beatriz Navascués, AEMET, Madrid
- Climate Research in the Institute of Geosciences (IGEO), by Marisa Montoya & Ricardo García Herrera, Facultad de CC Físicas, Universidad Complutense, Madrid
- Activities of the Catalan Institut of Climate Sciences, by Xavier Rodó

Following these presentations, attendees visited and toured AEMet, the National Meteorological Agency. They were welcomed by and given an overview of AEMET by its President, Francisco Cadarso. Later that evening a number of meeting attendees were provided with a guided tour of the Royal Botanical Gardens led by its Director, Dr Nieto.

3.1.3 CLIVAR China An additional national presentation, given later in the meeting by Wenjie Dong, provided an overview of “CLIVAR China”. The mission and objectives of CLIVAR China are to understand the mechanisms of climate variability over China and Asia from seasonal to centennial time-scales through observation, analysis and modelling and to improve operational climate predictions at the Chinese Meteorological Agency. Current priorities are a project on ocean-atmosphere-land interaction over Asia and the Indian-Pacific Ocean (AIPO), the mechanisms of onset and cessation of the Asian Monsoon over China and climate extremes and hazards related in particular to drought, typhoons and flooding.

3.2 Wider international activities

3.2.1 MedCLIVAR Piero Lionello reported on progress with the European Science Foundation-supported MedCLIVAR activity, currently funded to 2011. MedCLIVAR’s scientific priorities are to describe past evolution of climate and assess current climate variability over the Mediterranean region, understand the mechanisms responsible for Mediterranean climate variability, and provide climate predictions in relation to future emission scenarios. Since its start in 2006, MedCLIVAR has held three strategic workshops and one school, has assigned 23 scientist exchange grants, and has sponsored or co-sponsored 5 scientific meetings. The activity includes scientific publications (including a book on Mediterranean Climate Variability) and the organization of EGU sessions and other scientific events.

4. ICPO Report

Howard Cattle updated the SSG on the structure, funding and activities of the ICPO. In particular he reminded the SSG that NERC support for the ICPO from 1 April 2010 is subject to the success of a new funding bid to them, currently being developed. A bid for a further 5 years’ of funding would be made though Dr Cattle himself planned to retire at the end of the present contract. The UCAR contract, providing support for the ICPO from NASA, NOAA and NSF through US CLIVAR, currently with the University of Southampton, is having to be renegotiated to be between UCAR and NERC as an internal NOCS requirement. In discussion of CLIVAR Exchanges, Dr Cattle noted that it was getting harder to get the historical number of contributions and that SSG suggestions on this were welcome.

5. Imperatives for CLIVAR research

5.1 Summary of CLIVAR contributions to the WCRP Strategic Framework document in context of JSC-30

As outlined by Jim Hurrell in his introduction to SSG-16, one key task for the meeting was to review the science goals and implementation plans for CLIVAR that he presented to at JSC-30, with the goal of refining and reaching consensus on the top priorities. The afternoon session, chaired by Martin Visbeck, therefore began with Jim Hurrell’s summary of the current list of CLIVAR imperatives contributing to the implementation of the COPES strategy over the next 5 years. These had emerged from a survey sent out to panels and working groups and had been submitted in the paper to JSC-30 entitled ‘CLIVAR contributions to the WCRP Strategic Framework document’ that can be downloaded from:

www.clivar.org/organization/ssg/ssg16/docs/WCRP_IP_v25Mar09.pdf

To facilitate the discussion, individuals amongst the attendees had been tasked in advance to present 2-3 slides on each imperative with the dimensions of CLIVAR addressed by the imperative identified on a matrix provided by Martin Visbeck.

5.2 Presentations on the near term imperatives and their relevance to CLIVAR science

Imperative 1: Realise the long-term climate change integrations under WGCM and contributions to their analysis and feed through to the impacts area. Introducer Sandrine Bony

Sandrine Bony outlined the current plans under WGCM for long term climate change integrations and the wide range of partnerships amongst the community that were involved. She stressed that CMIP5 analysis would continue well after the deadline of May 2011 for submissions to Working Group 1 of IPCC AR5. Challenges included the need for modeling groups to run experiments and archive outputs on time; for analysts to retrieve the data, analyze simulations and submit papers in just a few months for input to AR5 and for lead authors to synthesize information from an unprecedented range of inputs (in terms of experiments, models etc. There is a need to maximize the value and efficiency of CMIP5 analysis for advancing key science questions, serving the AR5 WG1 and impacts communities and improving climate models. Ideas for workshops and working groups need to be discussed. There needs to be a synthesis of information by analysts, working groups and regional panels (e.g. monsoons, polar regions), interactions between IPCC WG1 and WG2 and an attempt at a “seamless evaluation” of climate models.

In discussion it was agreed that this was a high profile item. Gasseem Asrar pointed out that as presented it is isolated from the planned decadal prediction runs of Imperative 3, which in practice it is not, both being under the WGCM CMIP5 umbrella. There is clearly a need for CLIVAR to identify just how it engages through workshops etc noting that the timelines are tight for those wanting to get their science into AR5. Stephen Griffies identified the process community as one that could be encouraged to engage.

Imperative 2: To explore regional aspects of ACC through CLIVAR regional studies, including use of regional models. Introducer Hugo Berbery

Hugo Berbery noted that an analysis of AR4 model performance has shown this to be uneven over the globe. There is notably poor performance over the Indian sub continent and the tropical Atlantic for example. Factors that might cause a region to be poorly (or adequately) represented include telecommunication mechanisms and regional climate processes and there is a need to understand in detail why this is the case through combining process studies and regional modeling. There needs to be a linkage between CLIVAR regional groups and the wider WCRP efforts on regional downscaling (the WCRP Task Force on Regional Climate Downscaling and the Coordinated Regional climate Downscaling Experiment (CORDEX)) to which links should be established within a year and common subjects of interest identified. It was noted that Africa provides the present focus for CORDEX. Interactions could be through workshops rather than working groups. In the context of VACS, it was agreed that:

VACS should seek cooperation with TFRCD/CORDEX within one year, leading to an eventual joint workshop. Action: VACS leadership with R Anyah

In discussion Toshio Tokioka noted that even at higher resolution, models don't simulate tropical rainfall well and he stressed the need for WGCM to work closely with e.g. YOTC, the Asian Monsoon Years (AMY) activity, AAMP and THORPEX. Tim Palmer emphasized the urgent need for work on model errors in the tropics; the focus on AR5 meant that this would likely not attract enough effort within the community. Ghassem Asrar pointed out that the decadal thrust and increased focus on regional climate downscaling are two ways in which WCRP is trying to identify the problems and guide model development in the future. Martin Visbeck noted both that Imperative 11 also seeks to address this issue and that IPCC AR5 will have greater focus on regional climate change which Imperative 3 seeks to address Peter van Oevelen stressed the considerable modelling effort in CEOP and GEWEX more widely and the potential for joint CLIVAR/GEWEX/CliC interaction in this area.

Overall it was agreed that this was an important area that CLIVAR should continue to strongly engage with.

Imperative 3: To realise the planned decadal timescale predictions, to contribute to their analysis and provide feed-in to the impacts area through regional climate modelling.

Introducer Tim Palmer

Discussion of this item, which involves nearly all aspects of CLIVAR was the subject of an evening discussion introduced by Tim Palmer. This is a central focus for CLIVAR.

Imperative 4: To understand the impacts of anthropogenic forcing on the dominant patterns of decadal variability and the interactions between the two. Introducer Helge Drange

Helge Drange summarized the issues associated with anthropogenic forcing due to greenhouse gases, ozone and aerosols. Aspects include the direct effect of these forcings, their amplified (non linear) response, uncertainties related to future forcing, the potential for regime shifts associated with tipping points and abrupt changes associated with a combination of anthropogenic and natural forcing and variability. Dr Drange suggested that, through a combination of observation, paleoclimate reconstructions, theory and modeling, CLIVAR should focus in particular on whether the interplay between anthropogenic forcing, natural forcing and extreme phases of the modes of variability may lead to rapid and/or irreversible changes, and the urgent need to identify the critical anthropogenic forcing which would lead to these.

As noted by Detlef Stammer, this area is central to CLIVAR objectives and there would be a need to carry out experiments additional to those for AR5. Helge Drange felt that there is a huge potential for CLIVAR to promote activities to extract information from, and analyse, the CMIP5 runs and to do other (complementary) experiments. More widely he saw CLIVAR's role as promoting engagement between Working Groups to link observations and observation strategies, paleoclimatic records, model improvement (deficiencies, biases, drift) and extensive modelling assessments. He also advocated focus on a few processes/regions with the Atlantic-Arctic as one candidate. In terms of new approaches to observations, Sandrine Bony pointed to isotope records as being a good way to assess decadal variability in models from the perspective of changes in precipitation. The lead in WCRP in this area is with GEWEX and CLIVAR should seek to interact with this.

Imperative 5 To improve understanding of the role of the ocean in decadal variability through coordinated monitoring and modelling studies. Introducer Ruth Curry

Ruth Curry pointed out that decadal variability has clear societal impacts and that changes in external forcing (greenhouse gases, aerosols) will alter the statistics of regional patterns of variability. Observational challenges include provision of initial conditions for assimilation into models (new technologies) and measuring basin-scale mass transports and storage/transports of heat, freshwater and carbon (at least until models accurately reproduce these). There is also a need to develop partnerships with the assimilation community (evaluation of products) and with the carbon community (IOCCP, SIC). Modelling challenges encompass: identifying and correcting model biases (which themselves may differ on a regional basis), reproducing observed ocean transports (improved resolution, physical parameterizations), determining the mechanisms of decadal to multi-decadal variability and the separate influences of external forcings on internal variability. Near term there is a need to:

- Implement the observing system for the meridional overturning circulation (MOC) at various latitudes (N. Atlantic subpolar, S. Atlantic subtropics; continue RAPID, MOVE, Line W) and passages (Drake, Agulhas, Arctic-subArctic)
- Implement the deep ocean observing system funded at national and institutional levels, but internationally coordinated – workshops are needed to develop plans and proposals

- Address model biases and the consistency of simulated ocean transports through internationally coordinated multi-model experimentation and working groups to document various biases by analyzing large sets of models and synthesis products (perhaps on regional basis)

Longer term there is a need to converge to sustained ocean observing system for initialization and verification of models.

In discussion, Stephen Griffies questioned whether, if the models get perfect we can actually abandon the observational arrays. The premise is however that we will be able to monitor more cheaply and efficiently than through the use of large sustained arrays. Ben Kirtman asked whether we really know that there is more decadal predictability in the Atlantic than elsewhere and pleaded for attention to other basins also, especially the Pacific. In this context, Stephen Griffies advertised a workshop on “Decadal Variability, Predictability, and Prediction: Understanding the Role of the Ocean” to be held at NCAR in September 2010. The focus would be on the Atlantic but this could be broadened to the Pacific.

Overall the relevance and importance of this imperative was agreed.

Imperative 6: To realise the Climate System Historical Forecast Project (CHFP) as a WCRP-wide activity leading to improved seasonal predictions. Introducer Ben Kirtman
Ben Kirtman noted that the CHFP would:

- Provide baseline assessment of seasonal prediction capabilities using the best available models and data for initialization
- Provide experimental framework for focused research on how various components of the climate system interact and affect one another
- Provide a test bed for evaluating IPCC class models in seasonal prediction and weather prediction systems on the (sub-) seasonal timescale.

The current status of CHFP is that the baseline experiments are currently being completed ensuring data accessibility and encouraging diagnostic sub projects. There is collaboration with EU ENSEMBLES, APCC and CIMA in particular. Climate component interaction experiments are also being completed. These involve GEWEX-GLACE, for which the interactions are fully developed, developing interactions with SPARC, potentially but as yet undetermined interactions with CliC and the extension of weather models to (sub-) seasonal through THORPEX. In particular therefore there is a need to:

Clarify SPARC timescales for input to CHFP experimentation and ensure consistency with CHFP timescales (WGSIP chair/SPARC co-chairs)

Work to establish CliC CHFP involvement (WGSIP co-chair, CliC co-chairs), especially on sea ice

Beyond the baseline a need is foreseen (but not yet formulated) for focus on model improvements with the aid of process studies and for work on observing system assessment and design and the potential for seasonal prediction linking into IPCC AR5. Programmatic support is needed to help with funding for diagnostic sub-projects and follow-on experiments, for a planned workshop on CHFP at CIMA and WGSIP meeting, and eventually for a close-out workshop.

Discussion centred on the strategy to improve models and the need to bridge observations and modelling. Perhaps the best approach we have to address errors in simulations and develop new parametrizations that might help to overcome these is that of the US CLIVAR-

sponsored Climate Process Teams (CPTs) though there is not one modelling group that doesn't put effort into model improvement in one way or another.

Imperative 7: To facilitate completion of key CLIVAR-endorsed observational campaigns and the realization of their data legacy for improved understanding and prediction on seasonal and longer timescales. Introducer Yukio Masumoto

Yukio Masumoto emphasized the importance of the collaboration CLIVAR could bring to local and national efforts to carry out research on climate processes and the importance of ensuring adequate integration with modelling studies. In particular he raised the question of what is the best way forward to improve models and how best to implement new understanding and parameterizations? Ways forward for CLIVAR include:

- The coordination of related observational studies by panels and the SSG
- The establishment of a data portal for CLIVAR-endorsed observational campaigns
- Workshop(s) to enhance collaboration between observation and modelling activities.

In discussion the role of CPTs, the concept of which has been led by US CLIVAR, was emphasised with Dr Legler stressing the need to tightly integrate modellers and observationalists in process studies from the very beginning. There was the potential to extend the CPT concept to international CLIVAR which Dr Hurrell felt should be scoped. Dr Hendon noted that process studies often allow a capacity-building element to be developed as had happened under SPICE. From the perspective of CLIVAR-endorsed projects, there needs perhaps to be a formal process by which their outcomes are reported to CLIVAR. A tiger team from the modelling groups could be set up with a role to check on progress with existing process studies, data outputs etc.

Consider how to implement CPTs in an international context. Action: WGCM lead, with Jacob for WGNE and GEWEX.

Review and strengthen process by which CLIVAR- endorsed activities report outcomes to CLIVAR

Explore the set up of a data portal for CLIVAR-endorsed campaigns (ICPO)

Imperative 8: To improve the ability to predict modes of tropical variability for seasonal and decadal prediction. Introducer Wenju Cai

Wenju Cai's presentation focused on the links between ENSO and the annual cycle and other modes of variability – the MJO, the Atlantic zonal and meridional modes (through remote forcing), the Indian Ocean dipole and the Indian monsoon. He noted the need for better simulation of modes of variability and of ENSO itself in particular. This included the need for tropical cold bias removal, better representation of the annual cycle and of convection and global teleconnections and improved simulation of TIWs, WWBs and the ISO. He also drew attention to the need for new diagnostic tools (the BJ index in particular) to identify the main deficiencies of CGCMs in terms of ENSO performance. Better representation of ENSO, its irregularities and teleconnections is a pre-requisite to improve representation of Pacific decadal variability – a large part of the decadal signal in the Pacific is an "ENSO residual". Decadal predictions will be useless if the representation of ENSO and its teleconnections do not improve. Examination of how decadal signals project onto interannual scales may also be useful as would application of the BJ index framework to ENSEMBLES, CLIPAS and DEMETER data.

A further issue raised was that of tropical variability and greenhouse warming. The Atlantic panel could initiate activity on diagnosis of the effects of greenhouse warming on the Atlantic Niño and the meridional mode and AAMP/the Indian Ocean Panel could initiate activity to

diagnose effects of greenhouse warming on ENSO and the IOD. Due to the interactions of the IOD, ENSO and Atlantic variability, this could become a nice cross-basin panel activity

Imperative 9: To contribute to improved prediction of the global monsoon systems and African climate variability, including capacity building. Introducer Harry Hendon

Harry Hendon began by noting that ENSO (and perhaps the IOD) are predictable using models for 2-3 seasons but the Asian monsoon can't be predicted even at short lead time. Statistical schemes are no better. This is due to inadequate representation of physical processes in models (of convection, the land surface, ocean-atmosphere coupling) and inadequate resolution. Lack of appropriate initialization is another problem. However it may also be that the seasonal monsoon is inherently unpredictable or that there are sources of predictability not taken into account. The monsoons are dominated by Intraseasonal variability and there is enormous scope for practical application of skilful Intraseasonal forecasts. Indeed these may be of more utility than seasonal prediction because seasonal variability is low, ISV high, As yet our ability/techniques to predict monsoon ISV is unknown, but is promising. Scientific challenges include:

- Improving models, especially convection, the monsoon expression of MJO/ISV, land surface processes, the upper ocean mixed layer
- Coordinated assessment of representation of key monsoon components, especially MJO/ISV and its monsoon signature, diurnal cycle, land surface
- Determination of limits of predictability: ISV-IA-decadal
- Improved initialization (upper-deep ocean/land/ice)
- Intraseasonal initialization/ensemble generation
- Development and delivery of useful prediction products (capitalize on what's predictable)

A practical way forward would be to:

- Promote diagnostic sub-projects of CLIVAR-CHFP and GEWEX-GLACE2
 - Establish limits of seasonal monsoon predictability, impact of land surface initialization, benefit of higher resolution,, (would need funds for post-doc-PI to take the lead)
- Promote a WCRP-IMS project on "Reproduction and prediction of the monsoon ISO"
 - Support a monsoon ISV prediction experiment (Bin Wang/Duane Waliser)
 - Support the proposed MJO Task Force
 - Facilitate coordination of the ISV prediction/simulation projects for AMY07-12, YOTC, VAMOS, AMMA,....
- Hold a monsoon ISV prediction/simulation Workshop in 2010

In closing Dr Hendon also noted that monsoon regions encompass many countries with limited resources for operational prediction and research. Capacity building is critical therefore.

Imperative 10: To organise focussed WCRP activity on climate extremes (with GEWEX). Introducers David Legler/Petervan Oevelen/Francis Zwiers

David Legler introduced this item noting that there is much demand for information on climate extremes. Extremes research is aimed at observation, detection and attribution of extremes and, through modelling, seeking to establish their predictability and to make attempts at their experimental prediction. Climate variability affects extremes and there may be some predictability (on seasonal timescales or longer) for some types of extremes (e.g. drought). In addition, global warming is leading to changes in extremes having impacts in the ocean as well as on land such as coral bleaching and retreat of sea ice.

Currently, CLIVAR and GEWEX are implementing a drought prediction initiative in the extremes area through a joint Drought Implementation Group. There is however scope for an increased level of planning/consideration of extremes across the regional Panels, the modelling groups, and ETCCDI (the focus of which is on developing indices of extremes and capacity building workshops). Sharper focus on extremes is highly recommended. From a drought perspective a possible way forward is as follows:

Timeline

- 2009: Build an inventory of drought-related research activities, entrain regional expertise into DIG, develop draft publication outline (assessment of drought prediction-ability)
- 2010: Develop draft drought publication. Plan international drought (prediction-themed) workshop; complete/round out the drought publication

Program needs (national/regional)

- Evaluate regional drought predictability (use existing and new modelling experiments)
- Other drought research

Needs from CLIVAR

- Continued staff support (ICPO)
- Financial support for DIG to meet formally to plan the publication and workshop
- Support from WCRP/CLIVAR for an international workshop (2010/early 2011)

In discussion it was noted that VAMOS had already developed a plan for extremes that could be a model for development of activities in this area by other panels. Overall there was support for further developing the extremes effort overall but a recognition that the issue of drought is broader than that of extremes per se.

Imperative 11: Realize scientifically robust coupled model simulations and improve the ocean components within them. Introducer Stephen Griffies

Stephen Griffies emphasised three key study areas where ocean climate models are essential:

- AMOC and Arctic: variability, predictability, stability (including ice)
- Sea level rise: thermal expansion; ocean/ice-shelf interactions
- Southern Ocean: dynamical and biogeochemical (esp. carbon cycle) response to increasing westerlies.

These present challenges in terms of the representation of physical processes in ocean models:

- **AMOC and Arctic**
 - mesoscale and submesoscale eddies: parameterized and/or resolved
 - boundary currents and gyres: transport and eddy generation
 - water mass formation, including overflows and deep convection
 - poleward heat to the Arctic and its impact on sea ice
- **Sea level rise**
 - steric effects: water mass properties and non-Boussinesq kinematics
 - ice-shelf/ocean interactions: dynamic solid boundaries and flow under shelves
- **Southern ocean**
 - effects from mesoscale eddies (e.g., saturation): not presently robust across models
 - shelf interactions for downslope flows (ventilation) often missing or poorly represented
 - topographic interactions steer mean flows and generate eddies

In addition, drift and biases greatly handicap simulations, requiring improved processes, better numerics, and improved component models (ocean, atmosphere, land, sea and land ice). These issues will continue to limit our ability to address the key questions above, and others such as ocean acidification.

Partnerships to evolve understanding and improve models are needed between:

- Process modelers and theorists: fundamentals and parameterizations
- Climate modelers: processes and sensitivities in larger context, and motivate areas for measurements
- Observationalists: guidance and feedback from measurements

The timeline to do this and the identified needs from programmes and CLIVAR were then as follows:

- **Timeline:** ~10 years to garner robust understanding and quantification of uncertainties, which in particular should provide better idea of what models must either resolve or can parameterize.
 - enhanced studies of processes
 - experiences with refined ocean and coupled models
 - continued measurements and comparison to simulations
- **Needs from programs and CLIVAR**
 - Climate Process Teams: proven venue to help improve climate models
 - Workshops (a few suggestions)
 - Role of ocean in decadal variability and predictability of AMOC
 - Physics of sea level: observed and projected patterns and magnitudes
 - Physics and biogeochemistry in a changing Southern Ocean
 - WGOMD specific activities
 - Sponsor/organize above workshops
 - Coordinated Ocean-ice Reference Experiments
 - Collaboration with WGCM to coordinate CMIP5 analyses with ocean focus

The SSG noted that the focus here was on the ocean and that WGCM, GEWEX and WGNE were providing complementary effort on the atmospheric side. Prof Mechoso noted that the Ocean CPT under US CLIVAR had been very successful, not least because it was well focused.

Imperative 12: To develop ocean and coupled synthesis/reanalysis systems providing input to present and future decadal prediction efforts. Introducer Detlef Stammer

As Detlef Stammer noted, major uncertainties in predictions (seasonal-interannual and decadal to century) originate from uncertainties in initial conditions and from errors in coupled models. Ocean syntheses are now being used to initialize coupled models. However, mismatches in model physics lead to initialization shocks and errors in coupled models lead to fast degradation. To overcome those, the assimilation needs to be performed in the framework of the coupled model employed to obtain proper initial conditions. At the same time a coupled assimilation system will potentially allow reductions in model errors through parameter optimization. Some proto-type coupled assimilation systems do exist (e.g. GFDL, K7). However, much needs to be done to understand and improve the first encouraging results. Thus new coupled assimilation systems need to be developed to produce initial conditions and improve model parameters. Efforts in this area are underway as part of EU THOR and various national efforts. Within CLIVAR coordination of such efforts requires close collaboration between GSOP, WGCM, WGOMD and WGSIP and more widely with WOAP, the atmospheric reanalysis communities and others. The

activity needs the application of skilful people over the next 5+ years. A CLIVAR workshop on initialization and coupled assimilation in 2011 could be timely.

Imperative 13: With OOPC and others, to facilitate continued development of the global ocean observing system, building on the outcomes of OceanObs'09. Introducers Detlef Stammer/Ed Harrison

Ed Harrison introduced this “imperative” by stressing that we continue to learn the implications of ocean undersampling, the changing historical observing system and metadata limitations and that a sustained ocean observing system with global coverage is critical for ocean state assessment, climate research and climate forecasting. Indeed even the agreed initial system, fully implemented won't meet all CLIVAR needs. In particular he asked, in terms of science imperatives, if we can we set priority goals and whether we can estimate adequacy for e.g. sub-Argo, carbon inventory change, overturning circulations, the Southern Ocean, the marginal ice zones and boundary currents? Further, what can we say about needs for forecasting and evaluation of climate projections?

From the perspective of ocean observing system implementation, shortage of funding is primary limiting factor for the present plan. Thus we need improved advocacy by assessment, research and forecast communities and this is a clear role for CLIVAR. We also need the next-generation of the GCOS Implementation Plan, enhanced OS coordination, more effective JCOMM and data management systems, better routine information and delivery and perhaps more survey capability. Research priorities likely will the set in-situ observing system evolution but how long can we expect research agencies to fund the on-going parts of the system? Will the research community want to continue to do the needed work and share the observations? We clearly need a strategy to sustain and evolve the system over multiple decades. What form do we think best for next phase(s)?

In terms of timeline and resources, the satellite situation is promising for the present ocean sensor suite but next-generation costs may be another matter. The initial in-situ system is feasible, but needs another ~USD50mil/yr. There may also be some sensor manufacturer issues. An enhanced system to cover all feasible physical variables over accessible ocean needs at least another USD50mil/yr and a decade of development. The cost of adding biogeochemical and ecosystem and living marine resources into an integrated system has not been scoped. It is not feasible at present, but initial steps can be taken for ~USD20mil/yr. In addition we need more ‘ocean and climate’ information from the observing system but at what cost in people, years and budget?

Imperative 14: To develop and strengthen the interactions and activities between CLIVAR's ocean activities and programmes focussed on ocean biology, biogeochemistry and ecology. Introducer Jim Hurrell

Dr Hurrell began by emphasising the fact that climate variability and change in the world oceans alter the structure and functioning of marine ecosystems, which in turn affects availability of ecological resources and benefits, changes the magnitude of some feedbacks between ecosystems and the climate system, and economic systems that depend on ecosystems. He further noted that Richardson and Poloczanska (2008) state that “less than 11% of published papers in each of the fields of ecology, conservation biology, and biodiversity research deal with marine systems” in part because of relatively low levels of funding and a lower capacity to observe marine ecosystems and also because multiple stressors stymie attempts to isolate a climate change signal.

The grand challenge problem is to understand and be able to project the potential effects of global climate variability and change on marine ecosystems, the goods and services marine ecosystems provide, the drivers and consequences of human responses to marine ecosystem variability and change, and marine ecosystem links to the climate system. As an example, in the regions of the world's most productive coastal upwelling habitats, some

evidence suggests that equatorward winds are strengthening, increasing the supply of nutrients to near-surface photosynthesizing organisms. Conversely, heating of the surface ocean through global warming should increase the density difference between surface and deeper waters, making vertical transport of nutrients more difficult. The question is which of these two competing mechanisms will dominate?

Partnerships and needs in this area include:

- Develop and strengthen existing links with IGBP (IMBER/GLOBEC), carbon (IOCCP,GO_SHIP), fisheries (ICES&PICES), and other regional efforts (e.g., SIBER – Sustained Indian Ocean Biogeochemical and Ecological Research Project)
- IMBER membership on CLIVAR panels, and vice versa
- Joint targeted workshops
- Develop ocean carbon observations and synthesis activities
- Development of Earth System Models that address physical, biogeochemical and marine ecosystem components and their interactions.

CLIVAR to explore ways to strengthen links with IGPB, including cross membership of panels, working groups and the SSG (co-chairs/ICPO to lead).

Imperative 15: To develop the interaction with users of CLIVAR science and delivery of CLIVAR outputs to operations. Introducer Lisa Goddard

Lisa Goddard's presentation began by questioning:

- **Who are the users?** (potentially e.g. educators, climate scientists outside (and inside) CLIVAR, sectoral scientists, operational forecasters, the adaptation community, decision & policy makers). Addressing user "needs" involves having a conversation about their "problem" NOT their demands.
- **What are the outputs?** (could be e.g. CMIP archive and other MIPs that have made enormous contribution to IPCC; research (peer reviewed papers, methodologies, educational materials). Outputs will be used if they address a need, if they are easily available and if they are understandable.
- **What aspect of "operations"?** CLIVAR is likely to deliver implicitly not explicitly to these.

In terms of implementation of this imperative, this is in many ways already underway. Some additional ideas to enhance what is already going on include:

- Programs like CPAPP (of US CLIVAR)
- IASCLIP Alliance (part of new programme within VAMOS)
- Portal/clearing house for data (observations, model, forecasts), also highlighting & archiving CLIVAR research/accomplishments/contributions.

Resources needed to enhance this aspect of CLIVAR include:

- A Communications Officer for CLIVAR
- Enhanced computing (Server, data storage??, programmer)
- Provision of web (& meeting?) support for coordination of regional "alliances" within CLIVAR programmes
- Add-on funding to support IPCC work, and other community service and outreach activities of high impact
- International CPAPP program (~\$110k USD/yr/post-doc)

5.3 Building consensus on the near term imperatives

These presentations led to considerable discussion that continued into the “round table” session of the next morning. The outcome was the following structure, key topics and actions:

Imperative I - Anthropogenic climate change

Topics: *Natural variability versus forced change; climate sensitivity and feedbacks; regional phenomena; Extremes.*

Actions: *Complete CMIP5 – see the WGCM report, this issue*

Imperative II – Decadal variability, predictability and prediction

Topics: *Determine predictability; mechanisms of variability; role of the oceans including the impact of ocean variations on land, temperature, precipitation, etc; adequacy of the observing system; initialization; prediction uncertainty; drought;*

Actions: *Build links pan-WCRP; complete CMIP; complete the Climate System Historical Forecast Project (CHFP) - see the WGSIP report, this volume – complete the Coordinated Ocean and sea ice Reference Experiments (COREs) – see WGOMD report, this volume)*

Imperative III – Intraseasonal and seasonal predictability and prediction

Topics: *Monsoons, El Nino-Southern Oscillation, tropical Atlantic variability, MJO/Intraseasonal variability; prediction uncertainty.*

Actions: *Build links pan-WCRP; complete CHFP.*

Imperative IV – Improved atmosphere and ocean component models of Earth System Models

Topics: *Analysis and evaluation; climate process teams (process studies).*

Actions: *Build links pan-WCRP, IGBP; complete COREs*

Imperative V – Data synthesis, analysis, reanalysis and uncertainty

Topics: *Ocean; coupled data assimilation systems*

Actions: *Build links with IGBP – carbon, biogeochemistry, ecosystems*

Imperative VI – Ocean observing system

Topics: *Advocacy for sustained observations; development, implementation and system design.*

Actions: *Build links with IGBP – carbon, biogeochemistry, ecosystems.*

Imperative VII – Capacity building

Topics/Actions: *Topical workshops, summer schools, expert training.*

In order to develop the process further, tiger teams were established to develop short (5 page or less) summaries of the key science questions, implementation plans and the associated timelines for each of the seven imperatives. These summaries would provide input to the WCRP Implementation Plan and also guide CLIVAR activities over the next several years.

Action subsequent to meeting: in order to provide D/WCRP with material for the WCRP implementation brochure that will be showcased at the upcoming WCC-3 (see below), each drafting team is requested to write a one paragraph description of the science under each heading (e.g., Decadal Variability, Predictability and Prediction) by 3 June. This should be a high level overview written for the non-expert. The first name under each imperative should take the lead.

Action subsequent to meeting: A 3-5 page description to be provided by 17 June of: (1) the science and the associated "grand challenges" of each imperative; (2) what is needed over the next 5 years to make significant progress toward and/or to achieve the goal(s) of meeting the challenges (e.g., strategic partnerships within WCRP, to IGBP or to other programs, workshops, cross-panel meetings, a task force, etc.); and (3) a rough time line of the activities.

5.4 A proposed pan-WCRP Science Conference

The SSG also debated whether a second, international CLIVAR science conference should be promoted, or whether it would be more in line with current developments in WCRP planning to hold a pan-WCRP conference, with perhaps special sessions on CLIVAR and other WCRP projects. On balance there was more support for holding a pan-WCRP science conference, perhaps in early 2011. This idea is being developed further.

Recommendation: WCRP should, in place of a 2nd CLIVAR Science Conference, promote a pan WCRP Conference to celebrate the successes of the projects and broadcast the way forward for WCRP in the future, Action D/WCRP and WCRP Chairs and Directors.

6. Reports from CLIVAR Panels and Working Groups

The third day of the meeting was primarily taken up with presentations on, and discussion of, key progress and issues for the SSG and mechanisms for coordination across the programme. The discussions were stimulated by short presentations from the CLIVAR panels and working groups and informed by the summary reports of progress provided as written documents prior to the meeting. Revised versions of these documents were published in CLIVAR *Exchanges* No. 49/50 available via:

http://eprints.soton.ac.uk/67029/1/Exch_49.pdf

A detailed account of these presentations is not included here therefore. A number of recommendations and actions emerged as a result of the panel and working group reports as follows::

6.1 Global modelling panels

Request Panels and Working Groups and other WCRP projects to distill information on experience with analyses of CMIP-3 output. Email to be circulated requesting this, with rational (WGCM co-chairs, Anna Pirani)

Seek to build WGSIP links to other panels as for VAMOS (WGSIP co-chairs, panel chairs)

6.2 Global synthesis and observations

Basin panels are requested to provide feed in on science questions to be addressed using ocean synthesis products (GSOP co-chairs, ICPO, basin panels).

Work on interbasin issues encouraged either through GSOP or OceanObs'09 meeting of opportunity of basin panel chairs.

CLIVAR basin panel's requested to consider involvement in OceanObs'09 parallel community fora from perspective of physical oceanography (basin panel co-chairs, D Stammer)

6.3 Ocean basin panels

Identify WCRP representation to SCOR WG on Agulhas Working Group and pass to D/WCRP (Panels, D/ICPO)

Coordinate Atlantic tropical model bias work with VOCALS (Atlantic co-chairs in consultation with VOCALS)

AIP to take lead in facilitating a meeting between US AMOC and THOR when appropriate (AIP co-chairs)

Noting the large investments in western boundary current studies in the Pacific to which the PP can/is supplying needed coordination, consider inviting leaders of new initiatives in the Pacific to Pacific Panel (PP) membership, or at least involving them in PP meetings (PP co-chairs)

IOP are encouraged to entrain new members to explore science issues and build science case for continuing input of resources into IndOOS. Collaboration with AAMP is also encouraged. Consider back to back IOP and AAMP meeting in near future and potential further back to back meeting with VACS (IOP co-chairs, AAMP co-chairs, VACS co-chairs)

Check on CINDY/DYNAMO endorsement status (D/ICPO)

6.4 Africa/Monsoon Panels

Identify AAMP and VACS involvement with CHFP (AAMP, VACS co-chairs)

Resolve issue of IASCLIP endorsement (VAMOS co-chairs, D/ICPO)

SSG encourages coordination between VAMOS and ETCCDI on extremes (ETCCDI/VAMOS chairs) and also encourages other panels to engage in extremes a in a similar fashion to VAMOS

VACS to consider initiative to EU programme on an early warning and forecast system with prospect of WCRP/CLIVAR seed funding for planning meetings.

7. Wrapping up

The final morning of the meeting largely centered on future strategy and agreement on scientific and implementation priorities over the next few years. All recommendations and actions coming out of the meeting were also reviewed. The overall impression was that CLIVAR remains a very active and successful programme with lots of national, regional and global activities that will remain at the heart of WCRP for the foreseeable future. Thus, the JSC vision of a smooth transition into a new structure post-2013 was welcomed by the SSG and its panels and working groups. It was agreed to take membership issues arising during the meeting off line.

The next SSG will be held at NCAR, Boulder, Colorado during the week of 17-21 May 2009.

The full set of meeting papers is at www.clivar.org/organization/ssg/ssg16/ssg16.php
Presentations are at www.clivar.org/organization/ssg/ssg16/SSG16-presentations.php

Annex A

CLIVAR SSG-16

Royal Botanical Gardens, Madrid, Spain

19-22 May 2009

AGENDA (v 14 May 2009)

[MONDAY 18 MAY, 2000 CLIVAR SSG Exec discussion over working dinner]

TUESDAY 19 MAY, start 0900

CHAIR OF MORNING SESSION: TIM PALMER

1. Introduction (0900-1000)

1.1 Welcome by:

- Francisco Cadarso, President, AEMet on behalf of State Secretary of Climate Change D^a Teresa Ribera and AEMet
- Dr. Gonzalo Nieto, Director of the Real Jardin Botanico
- Dr Rafael Zardoya, Museo Nacional de Ciencias Naturales
- CLIVAR SSG co-chairs

1.2 Introductions (all), local arrangements (Howard Cattle, Roberta Boscolo)

1.3 Introduction to SSG-16 (Jim Hurrell, 10 mins + 5 mins discussion)

2. Outcomes of JSC-30 and sponsor and other project/programme inputs (1000-1310)

2.1 Outcomes of JSC-30 (G Asrar, 20 mins + 10 mins discussion)

2.2a GEWEX and CliC (Project chairs/representatives) (10 mins + 5 mins discussion each)

Tea/coffee (1100-1130)

2.2b SPARC inputs (Project chair/representative) (10 mins + 5 mins discussion)

2.3 Other sponsor issues, to cover WMO/WCP, ICSU, IOC, WCC-3, WWRP, THORPEX, WGNE (V Detemmerman, 20 mins + 10 mins discussion)

2.4 WCRP/WWRP Year of Tropical Convection update and MJO Task Force (10 mins + 5 mins discussion)

2.5 OOPC Report (E Harrison, 15 mins + 5 mins discussion)

3. Contributions from national programmes

3.1 US CLIVAR science initiatives, future strategy and links to international CLIVAR (D Legler, 10 mins + 10 mins discussion)

4. ICPO Report (1310-1330)

- 4.1 ICPO report (H Cattle) (10 mins)
- 4.2 Discussion of ICPO Report, including ICPO future (10mins – return to this under “strategy if needed)

LUNCH (1330-1430)

CHAIR OF AFTERNOON SESSION & EVENING DISCUSSION: MARTIN VISBECK

5. Strategy 1430-1900

- 5.1 Summary of CLIVAR contributions to the WCRP Strategic Framework document in context of JSC-30 – (1) Near term imperatives (Jim Hurrell)
- 5.2 Short presentations (2-3 slides each) on the near term imperatives and their relevance to CLIVAR science in the longer term (identified individuals)

Tea/coffee (1630-1700)

- 5.3 Building consensus on the near term imperatives
- 5.4 Summary of CLIVAR contributions to the WCRP Strategic Framework document in context of JSC-30 – (2) Long term frontiers (Jim Hurrell)

Discussion of long term frontiers

EVENING DISCUSSION (2000 - 2200)

Restaurant LA TAPERIA, Paseo del Prado 22 (we all chip in)

Topic: “Prospects for Decadal Climate Prediction”, introduced by Tim Palmer

2200 END OF DAY 1

WEDNESDAY 20 MAY, start 0930

CHAIR OF WEDNESDAY SESSION: JIM HURRELL

5. Strategy continued (0930-1230)

- 5.5 CLIVAR role in WCRP cross cuts
- 5.6 Mid term future of WCRP from a CLIVAR perspective

Base around:

- Outcomes of JSC-30
- CLIVAR inputs to WCRP IP
- Discussion around Imperatives to 2013 and Frontiers of climate science
- How we deliver the CLIVAR contributions to the WCRP IP
- Implications for SSG business

Tea/coffee (1100-1130)

5.7 CLIVAR Science Conference 2011 or 12

6. Summary of key progress and issues from chairs of CLIVAR Panels and Working Groups (25 mins each – 10 mins presentation, 15 mins questions/discussion)

We are looking for 1-2 highlights, and the near term plans focussing on the challenges. The goal is to provide constructive actionable input to the panel chairs for their work.

6.3a Ocean basin panels: Southern Ocean (1230-1255)

3. Contributions from national programmes continued (1255-1355)

3.2 Developments in CLIVAR-relevant science in Spain (15 mins + 5 mins discussion each)

- *The activities of AEMET relevant to CLIVAR by Beatriz Navascués, AEMET, Madrid*
- *Climate Research in the Institute of Geosciences (IGEO) by Marisa Montoya & Ricardo García Herrera, Facultad de CC Físicas, Universidad Complutense, Madrid*
- *The Catalan Institut of Climate Sciences by Xavier Rodó*

LUNCH 1400

3. Contributions from national programmes continued (1500-1540)

3.3 CLIVAR China (W Dong)

Others (tbc) (10 min each including discussion; max 40 min overall)

Socio-cultural activities (1545-1900)

- Tour of National Meteorological Agency followed by short reception (bus pick up from Royal Botanical Gardens at 1545, return by 1745)
- 1800 Guided Visit to the Royal Botanical Gardens

END OF DAY 2

THURSDAY 21 MAY, start 0930

CHAIR OF MORNING SESSION: TIM PALMER

6. Summary of key progress and issues from chairs of CLIVAR Panels and Working Groups (25 mins each – 10 mins presentation, 15 mins questions/discussion)

We are looking for 1-2 highlights, and the near term plans focussing on the challenges. The goal is to provide constructive actionable input to the panel chairs for their work.

6.1a Global Modelling Panels: WGCM, WGSIP, WGOMD,

6.1b Discussion on coordination across modelling panels in context of strategy (20 mins)

Tea/coffee (1105-1135)

6.2a Global Synthesis and Observations (GSOP activities)

- 6.2b Discussion on role of GSOP in context of needs for global observations, reanalysis and links to modelling activities in context of strategy (15 mins)
- 6.2c Climate change detection (ETCCDI activities) and paleoclimate (CLIVAR/PAGES)
- 6.2d Discussion on ETCCDI and CLIVAR PAGES activities in context of strategy (10 mins each)

LUNCH (1325-1430)

CHAIR OF AFTERNOON SESSION: MARTIN VISBECK

- 6.3a Ocean basin panels: Atlantic, Pacific, Indian
- 6.3b Discussion on coordination across basin panels in context of strategy (20 mins)

1630-1700 Tea/coffee

- 6.4a Africa/Monsoon Panels: AAMP, VAMOS, VACS
- 6.4b Discussion on coordination across monsoon panels in the context of strategy and the WCRP monsoon cross cut (20 mins)
- 6.5 ESF MedCLIVAR (P Lionello, 10 mins + 5 mins discussion)
- 6.6 Discussion on overall coordination across the programme as a whole in context of strategy (30 mins)

1910 END OF DAY 3

EVENING – NO HOST SSG-16 DINNER at Restaurant TERRA MUNDI, Calle Lope de Vega 32

FRIDAY 22 MAY

SSG Exec (0830-0930)

Plenary session (0930-1330)

- 7. Summing up session on strategy**
- 8. Review of action items; revisit of issues as needed**

1100-1130 Tea/coffee

- 8. Review of action items; revisit of issues as needed (continued)**
- 9. SSG and Panel/Working Group membership issues**
- 10. Date and place of next meeting**
- 11. Close**

1330 END OF SSG-16

Annex B CLIVAR SSG-16 list of attendees

First name	Surname	Capacity in which attending	Affiliation	email
Richard	Anyah	VACS Rep.	Natural Resource and Environment, University of Connecticut, USA	richard.anyah@unconn.edu
Ghassem	Asrar	D/WCRP	Joint Planning Staff, WCRP, Geneva	GAsrar@wmo.int
Hugo	Berbery	VAMOS co-chair	Dept. of Meteorology, University of Maryland, USA	berbery@atmos.umd.edu
Sandrine	Bony	WGCM co-chair	Laboratoire de Meteorologie, Universite M et P Curie, France	bony@lmd.jussieu.fr
Roberta	Boscolo	ICPO, local organizer	ICPO	rbos@iim.csic.es
Nico	Caltabiano	Invited scientist	INPE	caetano@noc.soton.ac.uk
Howard	Cattle	D/ICPO	ICPO	hyc@noc.soton.ac.uk
Ruth	Curry	Atlantic Panel co-chair	Dept. Geology and Geophysics, Woods Hole Oceanographic Institution, USA	rcurry@whoi.edu
Valery	Detemmerman	JPS for WCRP	Joint Planning Staff, WCRP, Geneva	VDetemmerman@wmo.int
Wenjie	Dong	SSG member	National Climate Centre, China Meteorological Administration, China	dongwj@bnu.edu.cn
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