



Project Report

**19th Session of the CLIVAR Scientific
Steering Group**

August 2012

January 2013

WCRP ref: 1/2013

ICPO report ref: 183

Contents

1	Action Items	5
2	Introduction	12
3	CLIVAR Strategy and Evolution	13
3.1	CLIVAR Status and Evolution.....	13
3.2	WCRP Context: JSC Presentation.....	13
3.3	CLIVAR Research Challenges and Capabilities	14
3.4	Future Panel Structure.....	16
3.5	Next Steps.....	17
4	Panel, Working Group, and ICPO Reports	18
4.1	Ocean Basin Panels.....	18
4.2	Global Panels.....	18
4.3	Regional/Monsoon Panels	18
4.4	International CLIVAR Project Office (ICPO) Update.....	19
5	Presentations from Other Programmes	20
5.1	GEWEX Developments and Possible Joint Activities.....	20
5.2	CliC/SPARC.....	20
5.3	US CLIVAR.....	21
6	Joint CLIVAR/IMBER Session	22
6.1	Decadal.....	22
6.2	Ecosystems and Climate.....	22
6.3	Next Steps.....	23
	Appendix 1: Agenda	24
	Appendix 2: Participants	28
	Appendix 3: Grand Challenges	29
	Appendix 4: Knowledge Exchange	31
	Appendix 5: Capacity Building	42
	Appendix 6: Acronyms	57

1 Action Items				
#	Action	Deadline	Responsible	ICPO Support
	SSG			
1	Respond to all Panel/WG requests for SSG input.	JSC-33	Hurrell, Visbeck, SSG	Beswick
2	Develop five proposed CLIVAR research challenges/themes: Tiger teams (5-8 people, tbd) for each research theme to develop ~2-3 page documents and have telcon panel/expert discussions by end of 2012.	End 2012	Tiger teams (tbd)	D/ICPO to oversee: Caltabiano (upwelling) Pirani (extremes, Decadal) Ereno (monsoons) Beswick (sea level)
3	Report to all Panels/WG JSC-33 outcomes relevant to future CLIVAR.	Early August 2012	Hurrell, Visbeck	Beswick
4	Develop ToR and proposed members for Task Force to develop standard definition of indices of major modes of variability and links to data sets; keep up-to-date and provide to broader community via web presence	SSG-20	Hurrell, Harrison, ICPO, JPS	D/ICPO
5	Task Team to work on a joint evolution of CLIVAR and IMBER science to better meet the Future Earth initiative and develop mechanisms for enhancing collaboration and exchange with IMBER, including recommended activities from SSG-19.	Report on progress to SSG-20	Drinkwater, Cai, Yu, Speer, IMBER	D/ICPO
6	Explore the scope of a joint CLIVAR summer school for postdocs annually. How can that be best organized? Ocean basin panel take lead in order to establish a four-year thematic cycle?	Report on progress to SSG-20	Gulev, Rintoul, Visbeck, ocean basin panels	Pirani

Task Force on Communicating CLIVAR Research Findings				
7	ToR and membership established at SSG-18. Work with panels/working groups to identify a few key topics and implement objectives articulated in ToR, working with ICPO. Report back by end of 2012.	End 2012	Communications task force	Beswick
All Panel Chairs				
8	Review the CLIVAR wide activities on outreach and capacity building and discuss options on how to strengthen that at their next panel meeting.	Report to SSG-20	Panel chairs	Beswick, Caltabiano, Ereno, Pirani
9	Report to tiger team on activities related to decadal variability and predictability.	End 2012	Panel chairs	Beswick, Caltabiano, Ereno, Pirani
Ocean Basin Panels				
10	Develop ToR and list of proposed members for Task Force on design of ocean climate indices	End 2012	Harrison, Haines, basin panels	Caltabiano
11	Develop ToR and list of potential members for Task Force to map out decadal variability and predictability activities across CLIVAR, linking with US CLIVAR decadal working group and WGCM/WGSIP DCP	End 2012	Goddard, Hurrell, basin panels	Pirani
12	Explore linkage to IOC regional panels on transfer of open ocean and climate knowledge to regional coastal zones and states and report back at next SSG.	SSG-20	Basin panels	Caltabiano

13	Report on joint activities with the ocean carbon uptake projects and explore how this connection can strategically be advanced in the future.	SSG-20	Basin panels	Caltabiano
14	Report on interaction with IFSOO through OOPC and other relevant bodies	SSG-20	Basin panels	Caltabiano
Monsoon Panels				
15	Continue close dialogue with GEWEX to ensure that the role of land vis-à-vis ocean processes in the context of S-I-S predictability of the monsoons can be jointly investigated.	SSG-20	Monsoon panels	Ereno
16	Discuss value/interest in validation of CORDEX data sets (as they become available) for relevant processes of variability and change that have been previously identified.	SSG-20	Monsoon panel chairs	Ereno
17	Report to SSG how GEWEX RHP (sp. regional hydrology projects) can help to strategically advance land impacts of climate variability and change.	SSG-20	Monsoon panels	Ereno
18	Take the lead in developing the I-S-I monsoon research theme for the future CLIVAR.	SSG-20	Monsoon panels	Ereno
19	Discuss with WMO (Rupa Kumar Kolli) re who are the appropriate groups (WWRP/WGNE, others) that provide guidance to the COFs. To what extent does it make sense for panel members to attend COFs, and present current research efforts relevant to the region? To the extent that COF process is not	End 2012	Goddard, Visbeck, monsoon panel chairs	Ereno

	seen as ideal (or scientifically rigorous), what pathways or mechanisms exist to provide input on best practices? Is there an interest of panel members to be part of collaboratively informing this process?			
Atlantic Implementation Panel				
20	Encourage to take the lead to develop a framework to internationalize oxygen minimum zone research jointly with PP and IOP.	SSG-20	AIP, PP, IOP	Caltabiano
Indian Ocean Panel				
21	Encourage interactions with WGSIP and WGOMD on possible new activities to improve ocean models and their role in seasonal and decadal predictability.	SSG-20	IOP	Caltabiano
Pacific Panel				
22	Consider how/if/when to expand activities of Pacific Panel (ENSO dynamics, equatorial/eastern boundary upwelling dynamics, decadal variability) including associated expansion of membership	SSG-20	PP	Caltabiano
23	Encourage interactions with WGSIP on possible new focus on improving ENSO prediction	SSG-20	PP, WGSIP	Caltabiano
Southern Ocean Panel				
24	Explore linkages with WGCM in the representation of upwelling south of the ACC in climate models.	SSG-20	SOP, WGCM	Beswick

CLIVAR/PAGES Working Group				
25	Keep ocean basin panels informed on Ocean2k activity.	Ongoing	CLIVAR/PAGES	Beswick
26	Discuss how to engage the other WCRP core project in future work.	End 2012	CLIVAR/PAGES	Beswick
WGOMD				
27	Develop short proposal on how ensure the flow of information from WGCM and WGSIP to CLIVAR panels and working groups.	End 2012	WGOMD	Pirani
28	Discuss jointly with GSOP how to strategically advance 'ocean downscaling' or regionalization of ocean system models.	SSG-20	WGOMD, GSOP	Pirani
29	Jointly explore why data assimilation and free-running forward models produce significantly 'different' ocean initial states. This is important for several reasons, including the use of these states to initialize decadal prediction simulations.	SSG-20	WGOMD, GSOP	Pirani
GSOP				
30	Report at next SSG on implementation of the IFSOO and the role CLIVAR should play.	SSG-20	GSOP	Caltabiano
VAMOS				
31	Continue to define future research foci but report on how to fit strategically into possible new	End 2012	VAMOS	Ereno

	organizational structure.			
32	Continue strategic debate about the future in the context of the new WCRP while maintaining ongoing activities.	End 2012	VAMOS	Ereno
33	Report on existing efforts on communication and outreach. Are there strategic elements that can increase the pull for CLIVAR science? Who are the right groups/agencies to interact with that can deal directly with users/applications. Q for JSC – who do they see as stakeholders? Are these strategic (financially)? Or, do they intend to engage directly with users, and this as seen as part of delivering GFCS. The latter is not appropriate for this body.	End 2012	VAMOS	Ereno
VACS				
34	Continue to work on new activities but report on what activities/science will be undertaken in the next 12 months (by 6 July 2012) and strategically the fit to possible new organizational structure.	End 2012	VACS	Pirani
35	Provide a list of ongoing 'international' activities within the scope of the proposed new VACS framework.	SSG-20	VACS	Pirani
AAMP				
36	Communicate to SSG plan to deal with expiring membership and strategically the fit to possible new organizational structure.	End 2012	AAMP	Ereno

37	Liaise with IOP and report on possible future joint ocean-atmosphere monsoon activities.	SSG-20	AAMP, IOP	Ereno
ICPO				
38	Establish monthly teleconferences between CLIVAR and GEWEX Project Offices to facilitate coordination and information exchange.	July 2012	Beswick, ICPO	Beswick
39	Establish monthly teleconference calls between ICPO, JPS, CLIVAR co-chairs.	July 2012	Beswick, ICPO	Beswick

2 Introduction

The 19th Session of the CLIVAR Scientific Steering Group (SSG-19) was held in La Paz, Mexico, between the 11th and 14th of June 2012. Dr Jim Hurrell and Professor Martin Visbeck, SSG co-chairs, led the meeting of 30 participants. The attendees are listed in Appendix 2 and consisted of SSG members, chairs or representatives of CLIVAR panels and working groups, representatives of the other core WCRP projects, and other invitees. See Appendix 1 for the agenda, and Appendix 4 for a list of acronyms.

One of the main objectives for the meeting was to discuss the evolution of CLIVAR, in the context of it as the “ocean-atmosphere” project within a restructured WCRP. The emerging proposed structure for CLIVAR, which highlights core capabilities and research foci, will be presented to the Joint Scientific Committee of WCRP at its meeting in Beijing, China in July 2012. Prior to SSG-19, CLIVAR’s panels and working groups provided information on their recent activities, progress and future plans. This input was crucial to the discussions at SSG-19 (see Appendix 4 for information on knowledge exchange activities and Appendix 5 for information on capacity building activities).

The SSG was updated on the activities of CLIVAR’s panels and working groups, as well as those of the International CLIVAR Project Office (ICPO). Participants were also interested to hear from potential hosts of the ICPO beyond 2014. The ICPO is currently hosted by the UK.

Another major component of SSG-19 was a joint session with IMBER (Integrated Marine Biogeochemistry and Ecosystem Research project of IGBP) on day three. Participants were presented with an overview of the IMBER and CLIVAR programmes, as well as scientific background on three key themes, from both perspectives, to inform the ensuing discussions. These activities culminated in an action to form a task team, with a mandate to formulate a strategic approach to future joint work.

The SSG extended their thanks to the local organizer, Carmen Coutoc of CIBNOR (Centro De Investigaciones Biológicas Del Noroeste), and to Luis Farfán of CICESE (El Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California), for their efforts in ensuring that the meeting was an extremely successful and sociable event.

3 CLIVAR Strategy and Evolution

3.1 CLIVAR Status and Evolution

<http://www.clivar.org/sites/default/files/SSG19/ClivarIntroduction.pdf>

The new (post-2013) WCRP will be comprised of four core projects based on fundamental interactions of earth system: CLIVAR will be the ocean-atmosphere component, while GEWEX will be the land-atmosphere component. SPARC will enhance their remit to the stratosphere and troposphere. While CliC intersects with all three, the project will continue to deal predominantly with the cryosphere.

The impact of this WCRP evolution on CLIVAR was the major topic of discussion. Guiding questions included: (1) what research challenges and capabilities should be the focus of an ocean-atmosphere project? (2) Where do current CLIVAR activities broader than this remit fit into the restricted WCRP? And (3) should these changes mean that CLIVAR should change its name? The goal of SSG-19 was thus to begin to construct the new “CLIVAR”, including a discussion of the project’s organizational structure and how it might change, with an emphasis on the fact that current CLIVAR research priorities and capabilities must remain priorities somewhere within the restricted WCRP. The outcomes of the SSG-19 discussions were to be presented to the JSC in July 2012 for further debate, especially in the context of the evolution of the other core WCRP projects.

Two actions had already been taken with respect to the reorganization of CLIVAR; WGSIP and WGCM now report directly to the JSC, under the new WCRP modeling and data advisory councils. Whilst these groups are no longer housed within the CLIVAR structure, CLIVAR representation remains, and it will be important to establish an ongoing two-way dialogue between CLIVAR and WGSIP/WGCM.

With respect to VACS and VAMOS, they will continue to report to CLIVAR, but over the longer term will be redefined in consultation with stakeholders and researchers, to be more WCRP-wide. The extraordinary JSC session in October 2011 identified that AAMP should start reporting to both GEWEX and CLIVAR, and CLIVAR/PAGES also lends itself to a pan-WCRP activity.

Certain new activities could also fit within an ocean-atmosphere mandate, such as an Arctic Ocean implementation panel (in collaboration with CliC) and a task force on decadal predictability.

3.2 WCRP Context: JSC Presentation

The WCRP grand challenges are areas of science that are tractable for making significant progress in a reasonably short space of time (~5-year timescale), where focused effort is needed across the projects. The WCRP grand challenge topics had been agreed, but were to be further discussed and refined at the JSC meeting in July 2012. They are (at the time of writing, August 2012):

1. Actionable Regional Climate Information

2. Regional Sea Level Change
3. Cryosphere in a Changing Climate
4. Clouds and Climate Sensitivity
5. Changes in Water Availability
6. Prediction and Attribution of Extreme Events

Each WCRP grand challenge would be assigned a core project to take the lead on implementation, working in collaboration with other core projects. These decisions were also yet to be made at JSC-33. Core projects should also identify their own high priorities (e.g., along the lines of the existing CLIVAR research priorities, but in the context of a new “ocean-atmosphere” focus), recognizing many grand challenges inherently lie at the interfaces between the projects.

In terms of the WCRP grand challenges, it was thought that CLIVAR should have a particular stake in:

1. Provision of regional climate information, through CLIVAR’s I-S-I and decadal activities;
2. Sea level variability and change, owing to the wind forcing aspect of this problem and the impact of regional models of variability such as ENSO;
3. Changes in water availability through the monsoons work; and
4. Extremes, through involvement of ETCCDI.

Other highlights from JSC-32 and the extraordinary JSC relating to CLIVAR include the following:

- Stronger interface needed between CliC, CLIVAR and GEWEX (notably monsoons and drought), and between CLIVAR and SPARC.
- Strong collaboration needed between CliC and CLIVAR communities on the topic of sea level rise.
- The terms of reference for the modeling and data advisory councils have been agreed. A working group on regional activities has also been established, which will play a major role in activities under ‘climate services’ (the need for more ‘actionable’ science was one of the main outcomes of the WCRP Open Science Conference).

3.3 CLIVAR Research Challenges and Capabilities

<http://www.clivar.org/sites/default/files/SSG19/ClivarGrandChallenges.pdf>

http://www.clivar.org/sites/default/files/SSG19/CLIVAR_GC_MV3.pdf

The original objectives of CLIVAR were to (1) describe and understand the physical processes responsible for climate variability and predictability on seasonal, interannual, decadal, and centennial time-scales; and (2) detect the anthropogenic modification of the natural climate signal. These objectives were to place particular emphasis on WCRP’s ocean-climate theme. However, in order to adapt to society’s increasing demands for more understandable, accurate and timely climate information, CLIVAR and WCRP must evolve.

As a major step in this evolution, CLIVAR developed three ‘research challenges’ and four ‘imperatives’, to serve as the framework for CLIVAR and appropriate WCRP-wide activities going forward:

CLIVAR Research Challenges:

- Anthropogenic climate change;
- Decadal variability, predictability and prediction;
- Intraseasonal and seasonal predictability and prediction;

CLIVAR Imperatives

- Improved atmosphere and ocean component models of Earth System Models;
- Data synthesis, analysis, reanalysis and uncertainty;
- Ocean observing system; and
- Capacity building

Now, as WCRP takes a major step in its evolution, there are calls for CLIVAR to re-address the science topics that guide the activities of its panels and working groups. For CLIVAR’s own research challenges, increasingly funders will be looking for specific activities of limited lifetime; the panels could either generate activities or ensure that they are coordinated in conjunction with the international community. This structure would ensure linkages both within CLIVAR and with other groups (e.g. WCRP core projects, IMBER).

There also needs to be a conduit for stakeholder feedback. The knowledge transfer capability aims to achieve this. As well as workshops and capacity building, CLIVAR could develop international policy briefings – short plain language summaries on topical issues. This would help deliver up-to-date state of the science in plain language to society and governments.

Intra-sessional CLIVAR input into possible research and capability priorities for the new CLIVAR had been reviewed and compiled before SSG-19. Each topic was then discussed, debated and further refined. It was agreed that each would have a panel or working group associated with it, to think about the theme in an integrated way.

Research challenges:

1. Intraseasonal, seasonal and interannual variability and predictability of monsoon systems.
2. Decadal variability and predictability of ocean and climate variability.
3. Trends, nonlinearities and extreme events.
4. Marine biophysical interactions and dynamics of upwelling systems.
5. Dynamics of regional sea level variability.

Capabilities:

1. Improving ocean system models.
2. Improving ocean-observing systems.

3. Ocean data, synthesis and information systems.
4. Knowledge transfer and stakeholder feedback.
5. Education, capacity building and outreach.

Each of the research themes requires much more development. Under each of the themes will be more specific, targeted research questions. A communications and outreach element should also be added to each of these themes, as well as consideration of potential collaborators. It was decided that a high-level description of each research challenge should be developed before the JSC (e.g. context, key science questions), lead by volunteers on the basis of a developed template:

This is also not an exhaustive list; and if an activity does not fit within this structure, it does not mean it will not be covered. The proposal puts a framework in place to develop activities on key topics of interest to CLIVAR, to drive activities forward. It was also noted that it will be important to bring in experts from the community to the research theme meetings.

Participants were asked which of the grand challenges listed were most interesting and why. Participants then broke off into two groups, to refine the research themes into more precise science questions that would be exciting and garner support for funding. These first discussions are summarized in Appendix 3.

3.4 Future Panel Structure

Structurally, it was proposed that the new CLIVAR could be organized around research areas and capabilities, whereby cross panel membership (at the intersections of the matrix, see Figure 1) ensures cross-pollination. An initial proposal (to be further discussed before implementation in 2014) was that the 'panels' would meet in alternating years.

	I-S-I Monsoons	Decadal Variability	Sea Level Regional	Upwelling Ecology	Extremes Trends	...
Atlantic						
Pacific						
Indian						
Southern						
Model						
Data						
Transfer						
GEWEX						
SPARC						
CLIC						
WGSIP						
WGCM						
IMBER						

Figure 1: Proposed Structure, where CLIVAR “capability” panels are listed in red (along the left) and CLIVAR “research challenge” panels are listed along the top. The other boxes along the left represent other projects and panels that would also have representation on some of the research challenge panels.

3.5 Next Steps

It was emphasized during SSG-19 discussions that these are first steps toward defining the science priorities and implementation strategy of a new CLIVAR focused on ocean-atmosphere interactions. The JSC meeting should provide additional steer for how this structure could integrate with GEWEX, SPARC, CLIC and other WCRP working groups and panels. There will thus be an ongoing consultative process with the CLIVAR community over the next year, leading to SSG-20. That meeting itself will provide a significant opportunity to further refine the proposed structure and plan for the post-2013 CLIVAR. Issues clearly remain over how this will be implemented and how the structure will be supported.

4 Panel, Working Group, and ICPO Reports

Each of CLIVAR's panels and working groups delivered a presentation on highlights, near-term plans, focusing on the challenges; responses to issues raised at SSG-18 and discussion at SSG-19.

Presentations are available online, and some further points are outlined in the following sections:

<http://www.clivar.org/organization/ssg/activities/2402/presentations>

4.1 Ocean Basin Panels

The SSG encourages the Pacific panel's planned connectivity with WESTPAC. The SSG is also pleased to see more activity being undertaken by the Indian Ocean Panel looking at Indian Ocean Dipole research.

SOP is encouraged to provide a frame for international participation in SOBOM related activities. The SSG would encourage the panel to push this activity forward, regardless of whether the proposal is successful. The SSG would also encourage more collaboration between SOP and CliC on issues such as Antarctic peninsular loss of sea ice, and concurrent increases in sea ice observed elsewhere.

The SSG would like both SOP and the Pacific panel to be more explicit about what the groups' interests are on the decadal timescale.

The Southern Ocean upwelling system could be a focus of the CLIVAR grand challenge on upwelling.

4.2 Global Panels

ETCCDI could take a leading role in the proposed WCRP extremes grand challenge. ETCCDI was also encouraged to continue to raise the issue of data sharing with appropriate national and international agencies, and to involve VACS in ETCCDI's capacity building activities in Africa.

De facto WGOMD is CLIVAR's direct connection to WGSIP and WGCM. The SSG would encourage appropriate representation of WGSIP and WGCM members at CLIVAR meetings for issues not covered by WGOMD. It was also noted that ocean downscaling/high resolution modeling will be part of a future effort for WGOMD.

On ocean indices; there are already extensive lists on potential ocean indices, the next step is to refine these to a set of key ocean indices. There could be a workshop focused on developing a strategy in this area.

4.3 Regional/Monsoon Panels

There is a call for all WCRP monsoon activities to be managed jointly, rather than having activities dispersed between GEWEX and CLIVAR. In light of a potential joint monsoon activity, the next AAMP membership rotation will provide an opportunity to achieve a greater degree of cross membership. More coordination is also encouraged between AAMP and WWRP.

The JSC is also asking for a redesign process for VAMOS. The current portfolio of VAMOS activities will likely be managed differently, i.e. monsoon activities by the new monsoon group, ocean activities in the context of the ocean basin panels and regional climate and application research in the context of the new WCRP regional climate effort. It is important not to lose the process study element of this group, alongside many other successful activities. A lot of momentum would potentially be lost if the scope of the group was narrowed geographically.

The SSG would encourage VACS to progress from the strategic work to activities, and present and execute smaller scale projects with the limited resources available. Further collaboration between the basin panels and VACS is encouraged going forward.

VACS members are proposing that the panel be renamed the Africa Climate Panel, and have more interaction with GEWEX.

4.4 International CLIVAR Project Office (ICPO) Update

http://www.clivar.org/sites/default/files/SSG19/ICPO_SSG19.pdf

Participants heard about the ongoing activities of the ICPO, in support of CLIVAR panels and working groups, and communications. One area which requires focus going forward is communications with GEWEX, and between the ICPO, SSG co-chairs, and panel/working group co-chairs.

The ICPO is currently hosted by the UK, and funded by both the UK's Natural Environment Research Council and the US CLIVAR Interagency Group (comprising NASA, NOAA, and NSF). Other countries have been invited to submit expressions of interest for hosting the ICPO beyond 2014. Participants of SSG-19 heard a concrete proposal from India (IITM, Pune), and expressions of interest from both Russia and Brazil.

5 Presentations from Other Programmes

5.1 GEWEX Developments and Possible Joint Activities

<http://www.clivar.org/sites/default/files/SSG19/Gewex.pdf>

GEWEX is undergoing a similar period of evolution, and in consultation with the wider community are exploring a name change, and are proposing five new grand science questions:

1. How can we better understand and predict precipitation variability and changes?
2. How do changes in the land surface and hydrology influence past and future changes in water availability and security?
3. How does a warming world affect climate extremes, and especially droughts, floods and heat waves, and how do land area processes, in particular, contribute?
4. How well are the models able to handle extremes and how can we improve their capability?
5. How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

There are several areas of existing (e.g. Seaflux, drought activity) and potential (e.g. extremes, Africa activity) interaction between GEWEX and CLIVAR, however in terms of management, it needs to be clear which project office is to take the lead.

5.2 CliC/SPARC

http://www.clivar.org/sites/default/files/SSG19/CliC_SPARC.pdf

A new scope for SPARC was developed at the SSG meeting in February 2012:

- The troposphere and its dynamics, probably also some interest in the mesosphere.
- From stratosphere climate-chemistry models to full ESMs and account of solar factors.
- Use CCMVal experience in model validation in other domains, model grading.

There are several issues of joint interest between SPARC and CLIVAR, including seasonal, decadal, WCRP polar climate predictability initiative, WCRP DynVar, and Indian I-SPARC.

CliC plans to strengthen its modeling activities, because there are clear needs to prioritise sea-ice and snow. This is to be achieved through attention to corresponding expertise in new SSG (instead of a single modelling group, several groups are now considered).

The Arctic, Southern Ocean and Antarctic are areas of joint interest to both CliC and CLIVAR. The Southern Ocean implementation panel is joint between CLIVAR

and CliC. In addition the new WCRP polar climate predictability initiative will provide another framework for interactions. The possibility of a joint Arctic Climate Panel remains. Sea level variability and change (SLVC) is also an overlapping theme, which, in WCRP, is currently being dealt with by the WCRP/IOC SLVC Task Group. However there is need to strengthen and possibly refocus the group.

5.3 US CLIVAR

<http://www.clivar.org/sites/default/files/SSG19/US%20CLIVAR.pdf>

US CLIVAR is currently refining its science goals through a science planning process for the 15-year period post-2014. Comments are invited on the US CLIVAR science plan, currently in preparation. The existing science goals are as follows:

1. Identifying and understanding the major patterns of climate variability on seasonal, decadal and longer time scales and evaluating their predictability;
2. Evaluating and improving the models used for prediction and projection to project climate change due to human activity, including anthropogenically induced changes in atmospheric composition;
3. Expanding our capacity in short term (seasonal-to-interannual) climate prediction and searching for ways to provide information on decadal variability;
4. Better documenting rapid climate changes and the mechanisms for these events, and evaluating the potential for abrupt climate changes in the future; and
5. Detecting and describing high impact climate variability and change.

US CLIVAR meetings are devoted to science themes: tropical predictability; decadal variability and predictability; climate of polar regions; climate extremes and climate; and carbon cycle. These themes are driven forward by science teams and limited lifetime working groups (currently ten, with five new groups implemented this year). This structure has been developed in close consultation with the US CLIVAR community, and reportedly makes for an effective process.

Climate Process Teams were discussed as a possible mode of operation for International CLIVAR. However, they require funding and are possibly easier to coordinate on a national scale. Longer lifetime groups (e.g. 3-5 years) would be more workable for CLIVAR/WCRP than the two-year timeframe adopted by US CLIVAR.

US CLIVAR has strong ties with International CLIVAR through process studies, and with the modeling and prediction groups. Working groups have representation from GEWEX and International CLIVAR to encourage cross-pollination. International CLIVAR should consider the processes needed to ensure science for the user and communication to the user.

The US CLIVAR presentation was very well received and the active engagement of US CLIVAR members in international CLIVAR projects and activities is strongly encouraged to ensure co-alignment where it makes sense.

6 Joint CLIVAR/IMBER Session

An overview of IMBER (Hoffman) and CLIVAR (Hurrell) were provided, alongside an introduction to the joint session (Drinkwater).

[\(<http://www.clivar.org/sites/default/files/SSG19/Hoffman.pdf>\)](http://www.clivar.org/sites/default/files/SSG19/Hoffman.pdf)

[\(<http://www.clivar.org/sites/default/files/SSG19/Hurrell.pdf>\)](http://www.clivar.org/sites/default/files/SSG19/Hurrell.pdf)

[\(<http://www.clivar.org/sites/default/files/SSG19/Drinkwater.pdf>\)](http://www.clivar.org/sites/default/files/SSG19/Drinkwater.pdf)

Subsequently, seven complementary presentations were delivered to participants, on climate science and biogeochemistry, ecosystems, and human dimensions:

Linking Biogeochemistry and Food Webs to Climate Change, M. Roman

<http://www.clivar.org/sites/default/files/SSG19/Roman.pdf>

The Role of Biology in Climate Models, S. Rintoul

<http://www.clivar.org/sites/default/files/SSG19/Rintoul.pdf>

Decadal climate prediction and the role of ocean biology in the Indian Ocean (Hood)

<http://www.clivar.org/sites/default/files/SSG19/Hood.pdf>

Decadal climate prediction: where are we? (Danabasoglu)

<http://www.clivar.org/sites/default/files/SSG19/Gokhan.pdf>

Responses to future climate change: from biogeochemistry to humans, Gattuso, Gattuso

<http://www.clivar.org/sites/default/files/SSG19/Gattuso.pdf>

IMBER Human Dimension Working Group, Bundy

<http://www.clivar.org/sites/default/files/SSG19/Bundy.pdf>

Status of Climate Change Modeling at Global to Regional Scales, Kumar

<http://www.clivar.org/sites/default/files/SSG19/Kumar.pdf>

Participants then split into groups, to discuss key topics of interest to both CLIVAR and IMBER. These are listed below.

6.1 Decadal

The following topics would be of interest to both CLIVAR and IMBER, in relation to research on decadal climate variability.

1. How to use physical interpretation to identify and attribute trends in decadal data.
2. Impact of biogeochemistry on physics versus impact of physics on biogeochemistry on decadal timescales.

6.2 Ecosystems and Climate

The following topics would be of interest to both CLIVAR and IMBER, in relation to research on ecosystems and climate.

1. Eastern boundary currents and upwelling.

There is strong interest from both communities on this issue, but there are lots of activities already happening. The need for a due diligence exercise was identified, in order to get a clearer view of what has been done and where the gaps are.

2. Links with oxygen minimum zones (OMZs).

CLIVAR's interests lie in ventilation, IMBER's with consumption. IMBER has two workshops coming up on OMZs.

3. Precipitation and run-off was also discussed.

These issues are further out of the purview of CLIVAR, but within the remit of GEWEX. However this issue could impact ocean stratification, and in turn impact biology. CLIVAR could make better use of ocean surface salinity.

6.3 Next Steps

Both IMBER and CLIVAR are undergoing restructuring, therefore creating an ideal opportunity to form stronger collaborations between the two programmes.

An appropriate way forward would be to support and foster a workshop and due diligence exercise, which would consider links at the international level as well as national level, investigating what activities are already underway, and how a CLIVAR/IMBER collaboration could complement or add value to existing activities, or begin to fill any gaps.

A task team will be formed to come up with some approaches looking at the longer term and to help push along some of the recommendations made today. The task team will consist of K. Drinkwater, and one individual from CLIVAR, and one from IMBER.

The two groups were also tasked with developing short summary documents.

Appendix 1: Agenda

MONDAY 11 JUNE: START OF DAY ONE

8:30-9:30	CLIVAR SSG Exec Meeting	
9:30	1. INTRODUCTION TO SSG-19	
	1.1. Introductions, local arrangements	15 min
	1.2. CLIVAR status, evolution and meeting objectives (Hurrell and Visbeck)	30 min
	2. WCRP FUTURE	
	2.1. Outcome of JSC-33, including future structure of WCRP, and recent developments in CliC, SPARC (Hurrell/Visbeck)	45 min
11:00	Coffee break	
11:30	2.2. GEWEX developments and possible joint activities (Trenberth)	20 min
	2.3. Discussion	10 min
12:00	3. REPORTS FROM OTHER PROGRAMMES (max. 10 min each)	
	3.1. US-CLIVAR update	10 min
12:30	Lunch	
13:30	4. CLIVAR FUTURE	
	4.1. CLIVAR grand challenges – summary of input from panels (Visbeck, Hurrell, Beswick)	30 min
	4.2. CLIVAR grand challenges discussion - plenary	60 min
	4.3. WCRP grand challenges, IGBP, Future Earth, GFCS interactions	30 min
15:30	Coffee break	
16:00	4.4. JSC presentation/discussion with D. Griggs via internet	30 min
16:30	4.5. Break out groups - Discussion of (WCRP and CLIVAR) grand challenges and CLIVAR strategy post 2013	60 min
17:30	4.6. Report to plenary from break out groups	30 min

18:00 END OF DAY ONE

18:30 *CLIVAR reception, Hotel Marina*

TUESDAY 12 JUNE: START OF DAY TWO

**09:00 5. CLIVAR PANELS AND WORKING GROUPS CHAIRS
PRESENTATION SUMMARY OF KEY PROGRESS /
ACHIEVEMENTS**

1-2 highlights and the near-term plans, focusing on the challenges; responses to issues raised at SSG-18 and discussion at SSG-19. The outcome of this session should be constructive actionable input to the panel chairs for their work.

5.1. Ocean basin activities

5.1.1.	Atlantic (Brandt)	20 min
5.1.2.	Pacific (Cai)	20 min
5.1.3.	Indian Ocean (Yu)	20 min
5.1.4.	Southern Ocean (Talley)	20 min
5.1.5.	Discussion	30 min

10:30 *Coffee break*

11:00 5.2. Global activities

5.2.1.	GSOP (Haines)	20 min
5.2.2.	WGOMD (Danabasoglu)	20 min
5.2.3.	WGSIP/Decadal (Kumar)	20 min
5.2.4.	Discussion	30 min

12:30 *Lunch*

13:30	5.2.5	ETCCDI (Zhang, Harrison)	20 min
	5.2.5.	WCRP/CLIVAR/PAGES panel (Masson Delmotte/skype)	
	5.2.6.	Discussion	30 min

15:00 *Coffee break*

15:30 5.3. Regional activities

5.3.1.	VACS (Lamb)	20 min
5.3.2.	AAMP (Sperber)	20 min
5.3.3.	VAMOS (Gochis)	20 min
5.4.	Discussion on future panel structure (Visbeck/Hurrell)	60 min

17:30 END OF DAY TWO

18:00 *Joint CLIVAR/IMBER reception, Hotel Marina*

WEDNESDAY 13 JUNE: START OF DAY THREE

09:00 6. JOINT IMBER/CLIVAR SESSION

- | | | |
|------|---|--------|
| 6.1. | Introduction (Hofmann, Visbeck/Hurrell, Drinkwater) | 30 min |
| 6.2. | Linking biogeochemistry and food webs to climate (Roman) | 20 min |
| 6.3. | The role of biology in climate models (Rintoul) | 20 min |
| 6.4. | Decadal climate prediction and the role of ocean biology (Hood) | 20 min |

10:30 *Coffee break*

- | | | | |
|-------|------|--|--------|
| 11:00 | 6.5. | Decadal climate prediction: where are we? (Danabasoglu) | 20 min |
| | 6.6. | Responses to future climate change: from biogeochemistry to humans (Gattuso/Bundy) | 20 min |
| | 6.7. | Status of climate change modeling at global to regional scales (Kumar) | 20 min |
| | 6.8. | Discussion | 30 min |

12:30 *Lunch*

- | | | | |
|-------|-------|--|---------|
| 13:30 | 6.9. | Break-up into working groups to discuss potential collaboration (2.5 hr including coffee break at 15:30) | 150 min |
| | 6.10. | Plenary reconvenes for reports by breakout groups | 60 min |

17:00 Joint session ends

THURSDAY 14 JUNE: START OF DAY FOUR

09:00 7. REFINE GRAND CHALLENGES 60 min

10:00 8. ACTION ITEMS FROM SSG-19 60 min

11:00	<i>Coffee break</i>	
11:30	9. ADDITIONAL ITEMS	
	9.1. ICPO report and future of the ICPO	50 min
	9.2. Date and place of next meeting (Visbeck/Hurrell)	10 min
12:30	END OF SSG-19	
13:30	SSG Executive session	60 min

Appendix 2: Participants

Name	Email	Panel/Affiliation
SSG MEMBERS		
Ken Drinkwater	ken.drinkwater@imr.no	CLIVAR SSG
Lisa Goddard	goddard@iri.columbia.edu	CLIVAR SSG
Sergey Gulev	gul@sail.msk.ru	CLIVAR SSG
Jim Hurrell	jhurrell@ucar.edu	CLIVAR SSG (Co-chair)
Steve Rintoul	Steve.Rintoul@csiro.au	CLIVAR SSG
Siegfried Schubert	Siegfried.D.Schubert@nasa.gov	CLIVAR SSG
Martin Visbeck	mvisbeck@geomar.de	CLIVAR SSG (Co-chair)
Dongxiao Wang	dxwang@scsio.ac.cn	CLIVAR SSG
STAFF		
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Carlos Ereno	carlos_erenoyahoo.com	ICPO
PANEL CO-CHAIRS		
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Wenju Cai	Wenju.Cai@csiro.au	Pacific Panel
Gokhan Danabasoglu	gokhan@ucar.edu	WGOMD
Dave Gochis	gochis@ucar.edu	VAMOS Panel
Keith Haines	k.haines@reading.ac.uk	GSOP
Ken Sperber	sperber1@llnl.gov	AAMP
Weidong Yu	wdyu@fio.org.cn	Indian Ocean Panel
Xuebin Zhang	Xuebin.Zhang@ec.gc.ca	ETCCDI
INVITEES		
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Jeniffer Mays	jmays@usclivar.org	US CLIVAR Project Office
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Lynne Talley	ltalley@ucsd.edu	Rep. Southern Ocean Panel
Jim Todd	james.todd@noaa.gov	NOAA CPO
Kevin Trenberth	trenbert@ucar.edu,	GEWEX Chair

Appendix 3: Grand Challenges

Summaries from break-out group discussions on day one.

Decadal Variability

- Question: What are the physical mechanisms responsible for low frequency variability and can they be exploited for decadal climate prediction?
- Context: Time-scale on which societal decisions are made
Need to understand natural variability to interpret change
- Key science challenges:
 - 1 Better initialisation techniques
 - 2 How much of decadal 'SST' is predictable? Given SST, how much of decadal climate signal is predictable?
 - 3 Mechanisms of decadal variability:
 - 4 Contribution of horizontal advection?
 - 5 Can ocean state estimates be used to diagnose physics?

Regional sea-level rise

- Question: How will the regional distribution of sea level change on interannual to centennial time-scales?
- Context: Strong societal pull for knowledge of sea-level at regional scale
Regionally-dependent variability may dominate trend for decades
- Key science challenges:
 - 1 Contribution of wind-driven circulation change
 - 2 Ocean – ice sheet interaction in Southern Ocean
 - 3 How to represent gravitational attraction in climate models?

Upwelling

- Question: What are the key physical processes responsible for upwelling and how can their representation in climate models be improved?
- Context: Present models have large biases in upwelling zones; reasons not understood; impacts on climate simulation are large (e.g. ITCZ)
- Key science challenges:
 - 1 What is cause of tropical bias in climate models? How can we remove it? Does nesting/increased resolution help?
 - 2 What observations are required to make progress?
 - 3 How will upwelling regions change in future, including changes relevant to biology and biogeochemistry?

Ventilation

- Question: How will ventilation of the ocean change and what impacts will ventilation changes have on climate, biogeochemical cycles and biological productivity?
- Context: Ventilation is key process for ocean storage of heat, moisture, carbon and oxygen; and for establishing mean state & propagation of anomalies
- Key science challenges:
 - 1 Oxygen changes in future (oxygen minimum zones)?
 - 2 How sensitive are shallow and deep overturning cells to climate variability and change?
 - 3 How do changes in stratification affect ventilation?

Weather and Climate Extremes in a Changing Climate

- What are the key modes of ocean/atmosphere variability that impact weather and climate extremes and how are they expected to change in the future?
- What are the physical mechanisms by which SST anomalies (including trends) lead to changes in high impact (societally relevant) weather and climate extremes?
- The development of new observationally-based approaches to inform model development that improves the ability of models to simulate the ocean/atmosphere variability most relevant to extremes?
- What are the observational needs to better quantify past and current weather and climate extremes?

Predicting Monsoon Variability on ISI and Longer Time Scales

- At what time scales and in what regions do the oceans play a key role in monsoon variability and predictability (e.g., the role of the Indian Ocean in modulating predictability of the AAM on decadal time scales)
- What are the relative contributions of the ocean and land surface processes in driving monsoon variability (e.g., west African monsoon)?
- What are the key model deficiencies limiting the veracity of models in simulating the monsoons and their variability (e.g., deficiencies in ENSO, MJO, treatment of aerosols, convection, diurnal cycle, resolution, etc.)?
- What are the observation needs for predicting and improving the characterization of monsoon variability on ISI to decadal time scales (e.g., RAMA array, long term precipitation data)

Appendix 4: Knowledge Exchange

Knowledge transfer is predominantly in the form of the following:

- Workshops
- Workshop reports
- Exchanges and other newsletters
- Webpages (e.g. ETCCDI indices and software, VACS climate atlas, REOS, CORE, easyINIT synthesis information repository, IndOOS data portal)
- Review papers, white papers, guideline documents
- IPCC authorships
- Listserves
- Peer reviewed papers
- AAMP have developed diagnostics for operational centres and climate model diagnosticians
- The Southern Ocean panel has a consortium of national representatives on the Southern Ocean.

The target audience is primarily the scientific community, but also funders, decision makers and the public to a lesser extent.

Successes, such as the global synthesis evaluation effort championed by GSOP and IOP activities under IndOOS, are improving technical knowledge and capabilities, and research activities in countries such as Indonesia. However, it is noted that with respect to IndOOS, to better use the data in national and regional application is still challenging. There is a need to educate the importance of IndOOS data and utilize datasets efficiently to understand different Indian Ocean Processes.

Several challenges were highlighted:

- Some of the capacity building and knowledge transfer activities are based on rather short-term projects and/or in-house funding. Mechanisms to secure long-term commitments from both sides, i.e. knowledge providers and receivers, should be established.
- Additional support/skills needed to further develop software, websites.
- A lack of new generation of expertise / expertise in developing countries is a problem.
- Using appropriate languages suitable for different target audiences.
- There is a need to establish better linkages to the user community to inform the users of the capabilities and limitations of the ongoing experimental forecasting.

There was a suggestion that programmes endorsed by CLIVAR should be asked to report on their activities regarding knowledge transfer.

Southern Ocean Panel (SOP)

1) Date form completed:

23rd April 2012

2) Working group/panel responding:

Southern Ocean Panel

3) Responder and position (e.g., co-chair):

Catherine Beswick, Staff Scientist, with input from panel co-chairs (Kevin Speer and Matthew England)

4) Which knowledge transfer methods have been used?

- Workshops
e.g. planning workshop for SOOS
- Contribution to newsletters
e.g. Exchanges 58 (thematic issue on CLIVAR's ocean basin panels), Exchanges 35 (Southern Hemisphere Climate Variability)
- Panel webpages on the CLIVAR website
Posting information on panel activities and other resources
- Email
Generally utilising CLIVAR mailing lists
- Consortium of national representatives on the Southern Ocean
The following countries have national representatives: Argentina, Australia, Belgium, Brazil, Chile, China, Finland, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Russia, South Africa, Spain, UK, USA
At present more knowledge transfer from SOP to the national reps. To facilitate a more two-way interaction, short reports are being requested from national reps to feed into SOP-8, to get an overview of activities in the region
- Documents
e.g. community paper on Southern Ocean Observing System: Rationale and strategy for sustained observations of the Southern Ocean. This was released for broad community input
e.g. Southern Ocean Vision Document. This is an evolving document, to highlight to funders etc. what the key science questions in Southern Ocean science over the next few years
e.g. provided input to the group preparing the ACCE document (J Turner at BAS)
e.g. contribution to US Clivar documents

5) Who has been targeted to receive the new information?

- Public
- Funders
- Other science programmes
- Consortium of national representatives on the Southern Ocean

6) What have been the greatest successes?

SOOS, CASO, DIMES

7) What have been the greatest challenges?

Icebreaker access for science, measurements in the ice zone, basic meteorology data and fluxes.

8) What are the plans to make CLIVAR science more 'actionable'?

Scientific exchange and coordination centered around observations and programmes like SOOS, and the development of key process modeling for climate studies. A new Antarctic Reanalysis to contribute to SOOS.

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?

Expert Team on Climate Change Detection and Indices (ETCCDI)

1) Date form completed

May 9, 2012

2) Working group/panel responding

ETCCDI

3) Responder and position (e.g., co-chair)

A. Pirani

4) Which knowledge transfer methods have been used?

ETCCDI indices and software

Issues being addressed by ETCCDI include the practical aspects of developing guidance and materials for National Meteorological and Hydro Services (NMHSs) are toolkits including software, documentation, and other material to guide the calculation and use of climate change detection indices and climate data homogenization, improvement of global coverage and assessment of indices. The ET is also concerned with improving indices and analysis tools.

The main purpose of the ETCCDI indices and software website is to provide:

- ET approved definitions and guidance on the calculations of climate change indices, along with standard software packages
- Practical guidance on the homogenization of climate data
- Materials for use in ETCCDI training workshops
- Access to online resources of climate indices
- A place for the submission of new or updated indices data

The software packages for data homogenization (RHtestsV3) and indices calculation (RClimDex) are based on a very powerful and freely available statistical package R that runs under both Microsoft Windows and Unix/Linux.

Review papers and guidelines

- a. Guidelines on Analysis of extremes in a changing climate in support of informed decisions for adaptation.

A. M.G. Klein Tank, F. W. Zwiers and X. Zhang, 2009, Climate Data and Monitoring WCDMP-No. 72, WMO-TD No. 1500, 56pp.

- b. Indices for monitoring changes in extremes based on daily temperature and precipitation data
Zhang Xuebin, Alexander Lisa, Hegerl Gabriele C., Jones Philip, Tank Albert Klein, Peterson Thomas C., Trewin Blair, Zwiers Francis W., 2011, *WIREs Clim Change*, 2: 851-870. doi: 10.1002/wcc.147
- c. Detection and attribution of climate change: a regional perspective
Stott, P.A., N. P. Gillett, G. C. Hegerl, D. J. Karoly, D. A. Stone, X. Zhang, and F. Zwiers, 2010, *Wiley Interdisciplinary Reviews: Climate Change*, 1(2), 192-211.

ETCCDI Moodle Course on extremes and indices

Material that is used for teaching purposes during the ETCCDI regional workshops is being adapted for a general online, freely available course.

5) Who has been targeted to receive the new information?

NMHS staff and young scientists

6) What have been the greatest successes?

Mobilising ETCCDI and its community at large to continually refine and come to consensus on a core set of extremes indices, developing and maintaining software that is freely available for all, producing recommendations and review papers to guide and explain climate extremes analysis, monitoring and detection and attribution studies.

7) What have been the greatest challenges?

More could be done for outreach and website, though this depends on additional support and other skills since most ET members are scientists.

8) What are the plans to make CLIVAR science more ‘actionable’?

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?

Variability of the African Climate System (VACS)

1) Date form completed

May 9, 2012

2) Working group/panel responding

VACS

3) Responder and position (e.g., co-chair)

A. Pirani

4) Which knowledge transfer methods have been used?

Development of the VACS Climate Atlas

A climate atlas with a focus on the observed and modelled climate of Africa. The Atlas currently has five parts, with a sixth part (FAQs on African Climate) in draft form. Parts I and II are on the observed climatology over Africa and surrounding tropics. Variables include minimum temperature, maximum temperature, diurnal temperature range, water vapour and cloud cover. Part III deals with mineral aerosols from satellite observations. Part IV features components of the ERA40 Reanalysis Project and Part V the WCRP CMIP3 multi-model climate change data archive. VACS aims to expand the Atlas to include CMIP5 and CORDEX data.

CLIVAR Exchanges Special Issue – August 2012

This Exchanges issue will feature short articles that give an overview of many key programmes that are on going on African climate research. The issue will be a very useful one-stop piece where the community can find out about these major initiatives.

WCRP Africa Newsletter

VACS is initiating a (quarterly) newsletter to communicate new research from emerging scientists in Africa, to share funding and training opportunities and events, and to distribute programmatic news. The first issue will be timed to come out with the VACS Exchanges special issue. The aim is to make the newsletter informal enough for scientists to submit short notes, whether they have results or not, to inform and so strengthen the network across African research groups. The newsletter will be an important mechanism to encourage people to circulate news on their hard work, since publishing an article in the international peer-reviewed literature can be problematic.

5) Who has been targeted to receive the new information?

The network of African climate scientists as well as scientists outside Africa interested in African climate. The WCRP newsletter will not only serve to strengthen the network of scientists within Africa, but also familiarise scientists working outside Africa with who is who within the local research groups, both of which will help to create points of contact for new collaborations. Climate impacts and adaptation specialists working on African issues will also be interested to receive the new information.

6) What have been the greatest successes?

7) What have been the greatest challenges?

8) What are the plans to make CLIVAR science more ‘actionable’?

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?

Working Group on Ocean Model Development

1) Date form completed

May 9, 2012

2) Working group/panel responding

WGOMD

3) Responder and position (e.g., co-chair)

A. Pirani

4) Which knowledge transfer methods have been used?

- Workshops
- Resource websites (REOS, CORE)
- CORE model intercomparison framework
- Review papers, recommendations and guidelines documents

Griffies, S. M. and G. Danabasoglu, 2011: Physical Ocean Fields in CMIP5. *CLIVAR Exchanges – WCRP Coupled Model Intercomparison Project – Phase 5*, No. 56, Vol. 16, 32-34.

Griffies, S. M., *et al.*, 2010: Problems and Prospects in Large-Scale Ocean Circulation Models, Proceedings of the OceanObs'09 Conference: Sustained Ocean Observations and Information for Society, Venice, Italy, 21-25 September 2009, Volume 2, Eds. J. Hall and D.E. Harrison and D. Stammer, ESA Publication WPP-306.

Griffies, S. M., *et al.*, 2009a: Coordinated Ocean-ice Reference Experiments (COREs). *Ocean Modelling*, **26**, 1–46.

Griffies, S. M., *et al.*, 2009b: Sampling Physical Ocean Fields in WCRP CMIP5 Simulations. ICPO Publication Series 137, WCRP Informal Report No. 3/2009

- CLIVAR Exchanges Special Issues

Furthering the Science of Ocean Climate Modelling - CLIVAR Exchanges Special Issue, No. 44, Vol 13, 40pp, 2008.

Ocean Model Development and Assessment - CLIVAR Exchanges Special Issue, No. 42, Vol. 12, 28pp, 2007.

5) Who has been targeted to receive the new information?

The climate modelling community

6) What have been the greatest successes?

Working with the strong ocean modelling community to produce consensus documents and pedagogical knowledge transfer material. The CORE I reference paper (Griffies *et al.*, 2009a) so far has a citation index of 71.

The CORE-II experimental framework has successfully attracted a lot of interest, with 20 modelling groups participating in the simulations, currently with 5 major publications in preparation.

7) What have been the greatest challenges?

The biggest challenge for WGOMD is a lack of new ocean model developers. The new generation of scientists are mostly model users rather than developers, in other words 'black box' modellers that not have a good understanding of what ocean models can actually do. A particular challenge is to find ocean modellers from developing countries.

8) What are the plans to make CLIVAR science more 'actionable'?

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?

Atlantic Implementation Panel (AIP)

1) Date form completed

2) Working group/panel responding

Atlantic Panel

3) Responder and position (e.g., panel co-chair)

L. Terray, P. Brandt (panel co-chairs)

4) Which knowledge transfer methods have been used?

Workshop reports

5) Who has been targeted to provide the knowledge to?

Wider scientific community with interests in the Atlantic Ocean

6) What have been the greatest successes?

Although these are not driven by the panel, some successful activities in the Atlantic region are the French activities (IRD) to establish Master courses in Physical Oceanography at the University in Cotonou, Benin or to improve the teaching in physical climate sciences at the Dakar University. There were also several French and German research cruises with participants from African countries or even explicitly dedicated for capacity building and knowledge transfer (three German Maris S. Merian cruises in 2011 in South West Africa). A particularly successful program was the AMMA program (funding from different nations and the EU) aimed at improving the understanding of the African Monsoon as well as weather and climate prediction in Sub-Sahara Africa. A large part of the funding was dedicated to enhance the science infrastructure in Sub-Sahara Africa.

7) What have been the greatest challenges?

8) What are the plans to make CLIVAR science more 'actionable'?

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming

Briefing of different activities (projects and programs) at the panel meetings should always include aspects of knowledge transfer

Programs endorsed by CLIVAR, should be asked to report on their activities regarding knowledge transfer

Global Synthesis and Observations Panel

1) Date form completed

2) Working group/panel responding

GSOP

3) Responder and position (e.g., panel co-chair)

Keith Haines and Tony Lee (panel co-chairs)

4) Which knowledge transfer methods have been used?

CLIVAR website (including meeting reports and whitepapers), particularly with the development of the Ocean Synthesis Directory and Air-sea flux Directory

Scientific publications resulted from CLIVAR/GSOP coordinated activities such as the global synthesis evaluation/intercomparison effort.

easyINIT synthesis information repository.

Recent strong engagement with GODAE-Oceanview leading to joint meetings (held and planned) and discussions on engagement and outreach.

5) Who has been targeted to provide the knowledge to?

Wider scientific community with interests in Ocean Synthesis and Air-sea fluxes

6) What have been the greatest successes?

As a result of the global synthesis evaluation effort championed by GSOP, a number of peer-reviewed publications have been published that help the synthesis community to gain a better understanding of the quality and consistency of synthesis products.

The global synthesis evaluation also leads to a renewed effort to consolidate and sustain the evaluation, as well as to an effort of near real-time ocean monitoring (e.g., of upper ocean heat content) using ensemble synthesis products.

GSOP workshop on synthesis and air sea fluxes

- 7) What have been the greatest challenges?**
- 8) What are the plans to make CLIVAR science more 'actionable'?**
- 9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming**

Explicit discussions at next panel meeting

Indian Ocean Panel

- 1) Date form completed**

15 May, 2012

- 2) Working group/panel responding**

Indian Ocean Panel

- 3) Responder and position (e.g., panel co-chair)**

Weidong Yu, M. Ravichandran (panel co-chairs)

- 4) Which knowledge transfer methods have been used?**

CLIVAR website

IndOOS Data portal (http://www.incois.gov.in/Incois/iogoos/home_indoos.jsp), particularly the RAMA data link at <http://www.pmel.noaa.gov/tao/rama/>

Ocean buoy technology transfer from JAMSTEC/Japan to BPPT/Indonesia

Training and Knowledge transfer from PMEL/NOAA, USA to NIOT/INCOIS, India for buoy technology, especially moorings and deployment techniques

NDBC/NOAA provided training on Quality control procedure for in-situ data (IndOOS) to NIOT/MoES, India

JAMSTEC transfers, under SATREPS project of JICA/JST, mooring buoy technology and related knowledge to BPPT, Indonesia, and knowledge on regional climate prediction to ACCESS and universities in South Africa.

- 5) Who has been targeted to provide the knowledge to?**

Wider community utilising data and information from IndOOS, including young researchers and students.

Regional countries with better capacity in observing technology so as to ensure the sustainability of IndOOS

- 6) What have been the greatest successes?**

Data, information and knowledge from IOP are well known to the region and being applied into the local and regional purpose with various successes. IOP activity is one of the success stories of IOGOOS Pilot projects.

Local countries, like Indonesia, are quickly improving their technical capability in ocean observing.

Research activities in regional countries have been improving.

7) What have been the greatest challenges?

To better use the IndOOS data in national and regional application is still challenging. We need to educate the importance of IndOOS data and utilize them efficiently to understand different Indian Ocean Processes.

Some of the capacity building and knowledge transfer activities are based on rather short-term projects and/or in-house funding. Mechanisms to secure long-term commitments from both sides, i.e. knowledge providers and receivers, should be established.

8) What are the plans to make CLIVAR science more 'actionable'?

IOP is discussing the best way to bridge the open ocean observation and the national/regional social applications. One potential solution is through the regional programs. How to coordinate better the regional program will be discussed in the 9th panel meeting.

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming

CLIVAR/PAGES Working Group

1) Date form completed:

23rd April 2012

2) Working group/panel responding:

CLIVAR/PAGES Working Group

3) Responder and position (e.g., co-chair):

Catherine Beswick, Staff Scientist

4) Which knowledge transfer methods have been used?

- Workshops
 - e.g. March workshop on Using Paleo-Climate Model/Data Comparisons to Constrain Future Projections*
- Contribution to newsletters
 - e.g. Exchanges 58 (thematic issue on CLIVAR's ocean basin panels)*
- Panel webpages on the CLIVAR website
 - Posting information on panel activities and other resources*
- Email
 - Generally utilising CLIVAR mailing lists*
 - Recently established open Clivar/Pages listserv to encourage discussion with the wider community*
- Documents
 - e.g. CLIVAR/PAGES Vision Document*

- 5) **Who has been targeted to receive the new information?**
 - Scientific community
- 6) **What have been the greatest successes?**
- 7) **What have been the greatest challenges?**
- 8) **What are the plans to make CLIVAR science more 'actionable'?**
- 9) **If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?**

Pacific Panel

- 1) **Date form completed**
22/May/2012
- 2) **Working group/panel responding**
Pacific Panel
- 3) **Responder and position (e.g., panel co-chair)**
Wenju Cai and Alex Ganachaud (panel co-chairs)
- 4) **Which knowledge transfer methods have been used?**
 - Panel meeting reports, review papers
 - Training sessions for scientists from developing countries including SPC
 - IPCC lead authorships
 - Workshops targeting a specific Pacific science area
- 5) **Who has been targeted to provide the knowledge to?**
 - a. Scientists from developing countries including SPC
 - b. General public
 - c. Policy makers
 - d. Resource managers
- 6) **What have been the greatest successes?**
 - Review papers in Nature Geoscience on ENSO and climate change
 - Oceanic hot spots and implication for marine ecosystems and biodiversity, and the need for long-term ocean observations – a Nature Climate Change paper
 - Nature paper on more extreme swings of the SPCZ and implications for SPC
 - Three CLA and lead authors from the panel members
- 7) **What have been the greatest challenges?**
Use appropriate languages to different audiences
- 8) **What are the plans to make CLIVAR science more 'actionable'?**

Several workshops/training sessions are planned

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming

Asian-Australian Monsoon Panel (AAMP)

1) Date form completed

May 17, 2012

2) Working group/panel responding

AAMP

3) Responder and position (e.g., co-chair)

Harry Hendon, Ken Sperber (AAMP co-chairs), Carlos Ereno (ICPO representative)

4) Which knowledge transfer methods have been used?

Through MJO working group/task force:

- implemented MJO diagnostics at operational centres
- developed boreal summer BSISO diagnostics for real time monitoring and assessment of predictions (hasn't happened yet, but close)
- developed diagnostics that can be applied to climate/forecast models to assess shortcomings of MJO/BSISO

5) Who has been targeted to receive the new information?

Operational centres, climate model diagnosticians

6) What have been the greatest successes?

Getting endorsement from WGNE for experimental MJO forecasting was an actionable item that prompted the NWP community to contribute their real-time forecasts to this ongoing project.

7) What have been the greatest challenges?

Many NWP centres have insufficient historical forecasts to do proper bias correction of experimental MJO forecasts.

8) What are the plans to make CLIVAR science more 'actionable'?

Need to establish better linkages to the user community to inform them of the capabilities and limitations of the ongoing experimental forecasting

9) If no transfer mechanisms are in place what actions can be taken to remedy this shortcoming?

Appendix 5: Capacity Building

Capacity building is predominantly in the form of providing travel support for early career researchers and scientists (and other groups such as government agencies, NGOs, private sector) from developing countries, to attend panel/wg meetings and workshops. ETCCDI also now plans for transferring workshop teaching material to an online Moodle course on data processing, quality control and indices calculations.

Dedicated CLIVAR workshops are also utilized as a forum for capacity building (e.g. VACS 2006 workshop aimed at training young scientists, NMHSs and the wider research community; Pacific Panel providing training and tools for South Pacific Countries; IASCLiP training for island nations), as well as co-sponsorship of summer schools and training for young scientists (e.g. ClimeCO summer school, CLARIS LPB, the Pacific Panel's ENSO Summer School).

However, respondents noted a lack of funding to hold dedicated capacity building workshops. One suggestion was to establish a network of funding partners to support sustained activities. Dealing with cultural differences can also be a challenge.

ETCCDI activities have highlighted a specific challenge: many nations do not as yet commit to the free and unrestricted international exchange of meteorological and related data and products. In some cases where the raw data is not permitted for exchange, nations will contribute post-processed indices data only, which is problematic in terms of transparency

It was suggested that programmes endorsed by CLIVAR should be asked to report on their activities regarding capacity building. AIP will develop a structure to collect information on capacity building activities and distribute them via the panel webpage.

Looking at other programmes, there have been some successful activities, such as AMMA, which aimed at improving the understanding of the African Monsoon as well as weather and climate prediction in sub-Saharan Africa.

It was noted that panel/working group members carry out capacity building activities, but not necessarily as part of CLIVAR activities. IndOOS is an example where CLIVAR members are actively involved in capacity building of Indian Ocean rim countries.

Southern Ocean Panel

1) Date form completed:

23rd April 2012

2) Working group/panel responding:

Southern Ocean Panel

3) Responder and position (e.g., co-chair):

Catherine Beswick, Staff Scientist, with input from panel co-chairs (Kevin Speer and Matthew England)

4) Who is the target group/s of working group/panel's capacity building efforts?

Early career researchers

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Invitations to panel meetings and workshops, to present and contribute to discussions (e.g. SOP7)

6) Past capacity building activities

As above

7) Present capacity building activities

As above

8) Planned future capacity building activities

Continue to engage younger scientists in Southern Ocean science, by participation at meetings

9) What have been the greatest successes?

10) What have been the greatest challenges?

Lack of funding to hold dedicated capacity building workshops/meetings

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming?

Better guarantee of funding for specific activities

Expert Team on Climate Change Detection and Indices

1) Date form completed

May 7, 2012

2) Working group/panel responding

ETCCDI

3) Responder and position (e.g., panel co-chair)

A. Pirani

4) Who is the target group/s of working group/panel's capacity building efforts?

National Hydrological and Meteorological Services (NHMS) staff and young scientists

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Regional workshops, that are modeled after the Asia-Pacific Network for Global Change Research (APN) Indices and Indicators Workshops, are important activities of the ETCCDI and its predecessors. The general goals of the workshops include:

- Derive indices from daily data, especially measures of changes in extremes
- Fill in blank data areas in "global" analysis of climate indices
- Increase confidence in local analyses by placing these analyses in a larger, regional context that includes results from neighboring stations and countries.

- Increase regional research synergies by sharing insights and improve analyses between neighboring countries
- Foster greater appreciation for data and data archeology
- Specific goals for each workshop include producing a peer-reviewed journal article on analysis of climate change for the giving region, and making available the data and indices in the analysis.

6) Past capacity building activities

Dec 2011	Gambia, Western Africa
Feb 2011	ICPAC, Kenya, Greater Horn of Africa
Jan 2011	CIIFEN, Ecuador, South America
Dec 2009	Indonesia, Indonesia
Oct 2009	Mauricien Met Service, Mauritius, Indian Ocean Nations
Mar 2009	Mexico, Central America
Feb 2008	Republic of Korea, Eastern Asia
Dec 2007	Vietnam, Southeast Asia
Apr 2007	Congo, Central Africa
Jan 2006	GCISC, Pakistan, South Asia
Feb 2005	IITM, India, Central & South Asia
Nov 2004	CRRH, Costa Rica, INSIVUMEH, Guatemala Central America
Oct 2004	Turkish State Meteorological Service, Turkey, Middle East
Aug 2004	Universidade Federal de Alagoas, Brazil, South America
June 2004	University of C.T, South Africa, Southern and Eastern Africa
Mar 2004	BMRC, Australia, S.E. Asia and S. Pacific
Dec 2002	BMRC, Australia, S.E. Asia and S. Pacific
Apr 2001	BMRC, Australia, S.E. Asia and S. Pacific
Feb 2001	Moroccan Meteorological Service, Morocco, North Africa
Jan 2001	University of West Indies, Jamaica, Caribbean
Dec 1999	BMRC, Australia, S.E. Asia and S. Pacific
Dec 1998	BMRC, Australia, S.E. Asia and S. Pacific

7) Present capacity building activities

Workshop: May 2012, Jamaica, Caribbean

8) Planned future capacity building activities

- Continued program of regional workshops
- Transferring workshop teaching material to an online Moodle course on data processing, quality control and indices calculations.

9) What have been the greatest successes?

Regional workshops are aimed at regions of the world where data availability is limited. The result has been an improved global view of temperature and precipitation changes and increased capacity in local specialists in data analysis for climate monitoring. Internationally exchanged indices reveal global changes in extremes while the continuing series of workshops is enhancing the capacity of countries to extract important climate change information from their long-term daily data. These workshops increase regional research synergies by sharing insights between neighboring countries, and foster greater appreciation for data rescue and data archeology.

Producing peer-reviewed publications from most training workshops, a global paper (Alexander, L. V., et al., 2006: Global observed changes in daily climate extremes of temperature and precipitation, JGR, 111, doi:10.1029/2005JD006290) and contributed significantly to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (AR4 IPCC). Publications since then will be contributing to AR5.

10) What have been the greatest challenges?

Many nations do not as yet commit to the free and unrestricted international exchange of meteorological and related data and products. In some cases where the raw data is not permitted for exchange, nations will contribute post-processed indices data only, which is problematic in terms of transparency.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

There is the possibility of linking an ETCCDI-style indices workshop component to other workshops planned for a particular region (if the audience is right)

Variability of the African Climate System (VACS)

1) Date form completed

May 9, 2012

2) Working group/panel responding

VACS

3) Responder and position (e.g., panel co-chair)

A. Pirani

4) Who is the target group/s of working group/panel's capacity building efforts?

Young scientists, National Meteorological and Hydrological Services staff, and the research community at large.

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Workshops and tutorials on using the IRI Climate Predictability Tool (CPT)

6) Past capacity building activities

VACS Southern and Eastern African Climate Predictability Workshop, Tanzania Meteorological Agency, Dar es Salaam, Tanzania, 10-13th July 2006

7) Present capacity building activities

8) Planned future capacity building activities

Activities that aim to 'train the trainers' are favoured to build up a sustained capacity development approach.

9) What have been the greatest successes?

10) What have been the greatest challenges?

Funding constraints are a significant challenge. Developing a network of funding partners to support sustained activities would be helpful.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

Working Group on Ocean Model Development (WGOMD)

1) Date form completed

May 9, 2012

2) Working group/panel responding

WGOMD

3) Responder and position (e.g., panel co-chair)

A. Pirani

4) Who is the target group/s of working group/panel's capacity building efforts?

Young scientists, climate model analysts and climate/ocean model development groups.

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Workshops are part of the WGOMD terms of reference to educate and communicate topical ocean science issues to the science community. Each workshop provided pedagogical lectures introducing state-of-the-science ideas and results; offered opportunities for discussions and candid debates; and facilitated networking and collaboration.

WGOMD maintains the CLIVAR Repository for Evaluating Ocean Simulations (REOS - <http://www.clivar.org/organization/wgomd/resources/clivar-repository-evaluating-ocean-simulations>). This website guides the community on how to best evaluate ocean models with directions to recommended data sets, information on metrics and a comprehensive reference list.

The Coordinated Ocean-ice Reference Experiment (CORE) is a framework that serves as a basis for a broad ocean model intercomparison activity. Ocean-ice model experiments are useful since they are less costly than fully coupled experiments, they can be used in hindcast mode to reproduce the history of ocean and ice variables and hence help in the interpretation of observations, they allow for the understanding of processes in the absence of biases introduced by the atmospheric model and hence potentially give superior representations (compared to the ocean component of a coupled model) of key physical, chemical and biological processes and so help in model development.

Experience has shown that groups that are developing new ocean models have benefited significantly by joining the CORE framework, repeating past multi-model analysis to validate their development progress.

6) Past capacity building activities

WGOMD has organized the following workshops:

“Workshop on Evaluating the ocean component of IPCC-class climate models”: June 2004, Princeton/GFDL USA. Roughly 120 scientists attended this 3-day workshop to discuss the status of ocean climate modeling, based largely on development of the AR4 coupled models. The workshop consisted of four sessions, each introduced by an overview lecture, followed by a selection of shorter specialized presentations. Presentations are available at:

<http://www.clivar.org/organization/wgomd/activities/gfdl04>.

“Southern Ocean Modeling Workshop”: November 2005, Hobart Australia. Roughly 100 scientists attended a 2-day workshop consisting of 10 lectures and discussion, each of 90 minutes duration. The lecturers provided insights regarding key elements of Southern Ocean physics, biogeochemistry, and modeling. Presentations are available at:

<http://www.clivar.org/organization/wgomd/activities/southern-ocean-modeling-workshop>.

“Numerical Methods in Ocean Models”: August 2007, Bergen Norway. Roughly 100 scientists attended this 2-day workshop consisting of seven sessions, each introduced by an overview lecture and then followed by a selection of specialized presentations. This workshop focused on uncovering the latest ideas in numerical and physical methods for simulating the ocean. Presentations are at:

<http://www.clivar.org/organization/wgomd/activities/nmw>.

“Ocean Mesoscale Eddies: Representations, Parameterizations, and Observations”. April 2009, UK Met Office Hadley Centre, Exeter, UK. Roughly 140 participants attended this 3-day workshop to discuss different views on the state-of-the-science in ocean mesoscale eddies as seen through observations, simulations, and theory. The workshop consisted of six speakers per day with 70 minutes each to delve in-depth into the chosen subject, and for questions and discussion. Additionally, there were more than 40 posters from students, post-docs, and senior scientists. The presentations and most of the posters are available at:

www.clivar.org/organization/wgomd/activities/meso.

“WGOMD-GSOP Workshop on Decadal Variability, Predictability, and Prediction: Understanding the Role of the Ocean”. September 2010, NCAR, Boulder, USA. Roughly 120 participants attended this 4-day workshop to discuss the current state of research into the ocean’s role in decadal timescale climate variability and predictability. Session Chairs led end of session discussions assessing community consensus and future coordinated directions. The workshop culminated in a final summary discussion on what could be achieved by a joint effort, whether the community could develop a common framework in decadal variability, predictability and prediction research. Most of the presentations are available at:

<http://www.clivar.org/organization/wgomd/activities/decadal>.

7) Present capacity building activities

8) Planned future capacity building activities

“WGOMD-SOP-CliC Workshop on Sea Level Rise, Ocean-Ice Sheet Interactions and Ice Sheets”: February 2013, CSIRO, Hobart, Australia

9) What have been the greatest successes?

Interest in the WGOMD workshops is high and attracts attendance both from the leaders of the field and young scientists. We have been successfully awarded funding that has enabled us to support many young scientists to participate, both as speakers and to present posters. 23 young scientists applied for funding support to attend the last meeting in 2010 and we were able to support 13.

10) What have been the greatest challenges?

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

Atlantic Panel

1) Date form completed

2) Working group/panel responding

Atlantic Panel

3) Responder and position (e.g., panel co-chair)

L. Terray, P. Brandt (panel co-chairs)

4) Who is the target group/s of working group/panel's capacity building efforts

Students and early career scientists from developing countries

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Co-sponsoring Summer Schools; workshops

6) Past capacity building activities

ClimECO summer school was convened with GLOBEC and focused on climate driving on marine ecosystem changes

Invitation, when financial support is available, for students and early career scientists from developing countries to attend workshops

7) Present capacity building activities

N/A

8) Planned future capacity building activities

N/A

9) What have been the greatest successes?

Although these are not driven by the panel, some successful activities in the Atlantic region are the French activities (IRD) to establish Master courses in Physical Oceanography at the University in Cotonou, Benin or to improve the teaching in physical climate sciences at the Dakar University. There were also several French and German research cruises with participants from African countries or even explicitly dedicated for capacity building and knowledge transfer (three German Maris S. Merian cruises in 2011 in South West Africa). A particularly successful program was the AMMA program (funding from different nations and the EU) aimed at improving the understanding of the African Monsoon as well as weather and climate prediction in Sub-Saharan Africa. A large part of the funding was dedicated to enhance the science infrastructure in Sub-Saharan Africa. Two of the AMMA conferences were held in Africa (Dakar, Senegal and Ouagadougou, Burkina Faso). In

most of the larger programs funded in Europe such capacity building activities are required.

10) What have been the greatest challenges?

Travel support is always an issue, if available scientists from different countries could be invited to attend panel meetings to report on dedicated (successful) activities

Even with successful activities as described above, it has been difficult to network them.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

Briefing of different activities (projects and programs) at the panel meetings should always include aspects of capacity building

Programs endorsed by CLIVAR, should be asked to report on their activities regarding capacity building

AIP will develop a structure to collect information on capacity building activities and distributed them via the panel webpage.

Global Synthesis and Observations Panel

1) Date form completed

2) Working group/panel responding

GSOP

3) Responder and position (e.g., panel co-chair)

Keith Haines and Tony Lee (panel co-chairs)

4) Who is the target group/s of working group/panel's capacity building efforts

Students and early career scientists, esp. from developing countries

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Workshop.

6) Past capacity building activities

CLIVAR/GSOP-GOCAE OceanView workshop on Observing System Evaluation, Santa Cruz, California, June 2011.

7) Present capacity building activities

N/A

8) Planned future capacity building activities

Panel will consider, based on funding available, inviting students and early career scientists from developing countries to attend the Ocean Synthesis and Air-Sea flux evaluation Workshop to be held at WHOI, in November 2012.

CLIVAR/GSOP will coordinate with GODAE OceanView to plan a workshop on Observing System Evaluation and Coupled Data Assimilation in April, 2013 that will provide a capacity building opportunity for students and early career scientists.

Panel will discuss ideas at next meeting, recognizing limitations of available resources.

9) What have been the greatest successes?

N/A

10) What have been the greatest challenges?

Resources needed to explicitly engage developing countries.

Global focus of the GSOP synthesis activity naturally reduces interest from groups who may have a strong regional interest.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

To be addressed at panel meeting. Perhaps engaging interest in best practice in regional observation exchanges and data management to improve products.

Indian Ocean Panel

1) Date form completed

May 15, 2012

2) Working group/panel responding

Indian Ocean Panel

3) Responder and position (e.g., panel co-chair)

Weidong Yu, M. Ravichandran (panel co-chairs)

4) Who is the target group/s of working group/panel's capacity building efforts

Scientific community, government agency, NGO, private sector, marine-related industry sector in the countries around Indian Ocean rim and outside countries with interests in the Indian Ocean.

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Workshops, training to young scientists/students for utilizing IndOOS data

6) Past capacity building activities

Due to limited resources, IOP did not directly involve in the capacity building activities till now. However, IOP get much involved in many capacity building activities through its members, experts, involved agencies and its regional programs. The experience has proved that these are efficient ways. IOP members are the resource personals for the IOGOOS conducted workshops and trainings.

IOP members/experts are very active in various capacity building activities, especially in the Indian Ocean rim region. For example, Dr. Sidney Thurston from NOAA as IOP expert leads the In-Region Western Indian Ocean Capacity Building Workshop of the WMO/IOC Data Buoy Cooperation Panel (DBCP) and Partners. This workshop was successfully held in Kenya in 2012, in Mauritius in 2011 and in South Africa in 2010. Some of the IOP members were actively participated in the above capacity building workshops as a resource personal. Such activities primarily aim to involve more African countries to participate in building IndOOS in terms of deployment of floats, drifters, etc., and also use the data from IndOOS array for their own area or requirements. IndOOS involved agencies have various bilateral capacity building program. For example, NOAA/US and MoES/India developed the arrangement on IndOOS collaboration and capacity building. NOAA train Indian researchers for using IndOOS data in Ocean model for generating ocean analysis

products, which are used for initial condition for coupled ocean-atmosphere model for prediction of seasonal forecast of Monsoon. JAMSTEC/Japan and BPPT/Indonesia, FIO/China and BRKP/Indonesia, also developed the similar arrangements. These mechanisms in fact have been supporting the implementation of IndOOS and will play the important role in the future sustaining IndOOS.

The regional programs affiliated with IndOOS also played important role in capacity building in the region. For example, Monsoon Onset Monitoring and its Social and Ecosystem Impact (MOMSEI), as one regional program of IndOOS, organized two summer schools in 2010 and 2011 to train the young scientists from the region to use the IndOOS data and monsoon knowledge in their own research. Another successful example is the Arabian Sea and Bay of Bengal regional observing system from India. User interaction workshops are organised every year by India by inviting university students / young researchers to know about the availability of ocean data in the Indian Ocean.

7) Present capacity building activities

All the activities mention in Item 6 are still on going.

8) Planned future capacity building activities

IOP will discuss its capacity building plan in its 9th panel meeting in 15-17 Oct. 2012 in South Africa. The discussion will result in the coordinated plan for capacity building conducted by IOP members and its regional programs.

9) What have been the greatest successes?

The capacity building increased the regional awareness of the scientific and social value of the IndOOS, which in turn helped the efficient implementation of IndOOS and its long-term sustaining. The IndOOS data access has significantly increased after these awareness programs.

Through the capacity building, the Indian Ocean rim countries are using the IndOOS data in their own researches and applications with various successes. This will realize the social value of our research.

10) What have been the greatest challenges?

It is always the big challenges to identify the local and national requirements and to set up the useful linkage between the IOP research and national/regional requirements.

However, these challenges will be understood and well resolved by more communication with the local scientific communities, governments, NGOs, social sectors, especially through the capacity building activities.

Funding issue is another long existing concern to strengthen capacity building activities.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

CLIVAR/PAGES Working Group

1) Date form completed:

23rd April 2012

2) Working group/panel responding:

CLIVAR/PAGES Working Group

- 3) Responder and position (e.g., co-chair):**
Catherine Beswick, Staff Scientist
- 4) Who is the target group/s of working group/panel's capacity building efforts?**
Early career researchers
- 5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)**
Invitations to panel meetings and workshops, to present and contribute to discussions (e.g. March 2012 workshop)
- 6) Past capacity building activities**
As above
- 7) Present capacity building activities**
As above
- 8) Planned future capacity building activities**
Continue to engage younger scientists in CLIVAR/PAGES science, by participation at meetings
- 9) What have been the greatest successes?**
- 10) What have been the greatest challenges?**
Lack of funding to hold dedicated capacity building workshops/meetings
- 11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming?**
Better guarantee of funding for specific activities

Asian-Australian Monsoon Panel (AAMP)

- 1) Date form completed**
May 17, 2012
- 2) Working group/panel responding**
AAMP
- 3) Responder and position (e.g., panel co-chair)**
Harry Hendon, Ken Sperber (AAMP co-chairs), Carlos Ereno (ICPO representative)
- 4) Who is the target group/s of working group/panel's capacity building efforts?**
Support for young scientists
- 5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)**
MJO workshop
- 6) Past capacity building activities**
(1) Workshop on Modelling Monsoon Intraseasonal Variability, 15-17 June, 2010, Busan, Korea and

(2) participation in the Seventh Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII) 6-8 April 2011, Beijing, China, (research talks and participation in forecast forum)

7) Present capacity building activities

Iterating with RCOF Coordinator, and WGNE/WGSIP representative to develop an implementation plan to ensure that RCOF forecasting and verification procedures follow established norms developed by the NWP community

8) Planned future capacity building activities

- (1) September 2012 Decadal workshop sponsored by AAMP, and
- (2) Plan to participate in the organization of the International Workshop on Monsoons next year.

9) What have been the greatest successes?

WCRP/WGNE coordination on implementing experimental MJO forecasting

10) What have been the greatest challenges?

- (1) Achieving actionable predictions on subseasonal to decadal time scales,
- (2) Establishing links to user/application communities,
- (3) Developing the necessary tie-ins with GEWEX to explore the role of land surface processes in simulating/predicting monsoon variability,
- (4) Establish a closer working relationship with the WWRP Monsoon Panel

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming?

Variability of the American Monsoon (VAMOS) Panel

1) Date form completed

May 17, 2012

2) Working group/panel responding

VAMOS

3) Responder and position (e.g., panel co-chair)

Hugo Berbery, Dave Gochis (VAMOS co-chairs), Carlos Ereno (ICPO representative)

4) Who is the target group/s of working group/panel's capacity building efforts?

- a. Support for young scientists
- b. Consulting with island nations in the Intra-America Seas region as part of IASCLiP

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Modeling workshop, Petropolis, Brazil, 4-6 June, 2012

Support for student participation in CLARIS LPB meetings through CLARIS LPB

Training for young South American students and scientists in European institutes through CLARIS LPB

For IASCLiP, this work has involved visits from VAMOS panel member Arthur Douglas to numerous island nations helping them evaluate their regional synoptic observing networks. It has also involved consultations and networking regarding the establishment of regional GPS-precipitable water vapour networks in the Caribbean and in Mexico.

6) Past capacity building activities

Nov 2009: The international summer school on land-cover change and hydroclimate of the La Plata Basin. About 45 students from seven countries in South America participated in an intensive course on the role of land cover and ecosystems on the La Plata Basin regional hydroclimate. Iguassu, Brazil.

As part of CLARIS LPB Project - special calls with grants for:

- Young Scientists participation at project meeting
- Poster Prizes for young scientist posters: presented at project meetings based on scientific and multidisciplinary criteria
- Exchange grants for all scientists: based on scientific and multidisciplinary criteria
- Publication grants and in European Journals

IASCLiP:

2010 several VAMOS panel members participated in a GPS network workshop in Mexico helping to articulate the scientific justification for GPS networks and to prioritize research and operational goals related to the design and implementation of these networks.

2010 and 2011, Art Douglas has made several trips to Caribbean island nations to help identify critical priorities for improving surface, upper air and oceanographic observing platforms.

2009-present: IASCLiP has developed and provided, free of charge, an online forecast forum which synthesizes numerous seasonal forecast products for the Caribbean region.

7) Present capacity building activities

The VAMOS team is organizing and supporting the VAMOS modelling workshop which is aimed at attracting participation of early-career scientists into climate research and climate-services activities.

IASCLiP: Art Douglas is presently in the Dominican Republic consulting with their national weather service in the development of improved seasonal forecasts and improving observational infrastructure

VAMOS team members continue to collaborate with scientists and agency personnel throughout Mexico and the Caribbean to help establish GPS observing networks in the region. The involvement here is primarily through helping local scientists and agencies formulate their within-country proposals.

8) Planned future capacity building activities

Generally, VAMOS envisions coordinate its capacity building activities around the concept of 'climate services' which is growing rapidly throughout Latin America. Prioritization of key climate service activities and their connections to VAMOS science will be a focus topic of discussion at the VPM-15 meeting in Petropolis Brazil in June, 2012.

9) What have been the greatest successes?

LPB activity: The course taught in 2009:

- The school was attended by 45 graduate students and young scientists with different backgrounds from seven countries, including underrepresented ones.
- The *University of Buenos Aires* and the *Universidad Nac. Del Centro* has given credits to PhD students that attended the course.
- Both GEWEX/WCRP and CLIVAR/WCRP have developed respective sets of "Imperatives" (Priorities), and both refer to our Summer School as an example of Capacity Building.
- Through two field trips, one to the Itaipú central facilities and the other to visit nontraditional farms, the students were presented with new technologies, conservationist practices and alternative ways of producing energy.
- Thanks to a partnership with IAI, travel expenses of most students were covered by the Summer School, so that the student's selection (there were around 100 candidates) was primarily based on their scholarly merits.

For IASCLiP, several proposals have been developed regarding the deployment of GPS water vapour observing networks. The international project in the Caribbean called COCONET was funded in 2010-2011 and the network is being built. The status of the proposals for Mexico are still pending.

10) What have been the greatest challenges?

The fiscal situation in many American countries remains difficult, particularly for climate service oriented activities funded by the U.S.

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming?

Pacific Panel

1) Date form completed

21/May/2012

2) Working group/panel responding

Pacific Panel

3) Responder and position (e.g., panel co-chair)

Wenju Cai and Alex Ganachaud (panel co-chairs)

4) Who is the target group/s of working group/panel's capacity building efforts

Early career scientists and students

Pacific Island Countries

Developing countries

5) Which methodology of capacity building activities have been used (e.g., workshops, activities for Early Career Scientists, etc.)

Summer school

Building data portal and climate database

SPCZ workshop, and training

Coaching (one on one) of young scientists from the South Pacific Countries (SPC) for attendance to international conference (e.g., 30 to 10 ICSHMO)

6) Past capacity building activities

ENSO Summer School

7) Present capacity building activities

- a. The panel facilitates training of SPC scientists to explore the likelihood of future changes in temperature, rainfall, wind, sunshine, humidity and evaporation based on 20-year time periods around 2030, 2055 and 2090 under several greenhouse gas emissions scenarios.
- b. The panel is involving in building user-friendly tools that provide past and current climate information for the SPCs
- c. Panel scientists are working with SPC scientists, in writing joint paper (e.g., SPCZ under climate change, Nature paper).
- d. Workshop on the ITF and impact in Jakarta (March 2012) held as a training session for regional scientists, giving out certificates.

8) Planned future capacity building activities

Capacity building component to continue to train regional scientists with interests in the ITF and its role in the climate. This will more readily enable regional researchers and students to be directly engaged in the use of data and tools for monitoring the ITF and understanding its potential impacts on climate.

Continue to facilitate training sessions for SCP scientists, warm pool and impact on fisheries, ocean acidification, and coral bleaching.

Young scientist scholarship to attend major international workshop (e.g., Open Science Symposium for WBC workshop in Qingdao).

With IOC/WESTPAC, training sessions are planned for regional scientists on extreme sea level events.

9) What have been the greatest successes?

Scientists from SPC and other developing countries appreciate that there is a large body of empowering knowledge and resources they can tap into.

10) What have been the greatest challenges?

Dealing with culture differences

11) If no capacity building activities are planned by this working group/panel what actions can be taken to remedy this shortcoming

Appendix 6: Acronyms

AAM	Antarctic Annular Mode
AAMP	Asian-Australian Monsoon Panel
AIP	Atlantic Implementation Panel
AMOC	Atlantic Meridional Ocean Circulation
CCMVal	Chemistry-Climate Model Validation Activity
CIBNOR	Centro De Investigaciones Biológicas Del Noroeste
CICESE	El Centro de Investigación Científica y de Educación Superior de Ensenada
CliC	Climate and Cryosphere
CLIVAR	Climate Variability and Predictability
DynVar	Modeling the Dynamics and Variability of the Stratosphere-Troposphere System
ENSO	El Nino-Southern Oscillation
ESM	Earth System Model
ETCCDI	Expert Team on Climate Change Detection and Indices
GEWEX	Global Energy and Water Cycle Experiment
GFCS	Global Framework on Climate Services
GSOP	Global Synthesis and Observations Panel
ICPO	International CLIVAR Project Office
IGBP	International Geosphere-Biosphere Programme
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IITM	Indian Institute of Tropical Meteorology
IOC	Intergovernmental Oceanographic Commission
IOP	Indian Ocean Panel
ITCZ	Intertropical Convergence Zone
JPS	Joint Planning Staff
JSC	Joint Scientific Committee
MJO	Madden-Julian Oscillation
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NOAA CPC	NOAA Climate Prediction Center
NOAA CPO	NOAA Climate Program Office
NOAA NCEP	NOAA National Centers for Environmental Prediction

NSF	National Science Foundation
OMZ	Oxygen Minimum Zone
PAGES	Past Global Changes (an IGBP project)
RAMMA	Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction
SLVC	Sea Level Variability and Change
SOBOM	Southern Ocean Biogeochemical Observations and Modeling
SOP	Southern Ocean Panel
SPARC	Stratospheric Processes and their Role in Climate
SPICE	Southwest Pacific Ocean Circulation and Climate Experiment
SSG	Scientific Steering Group
SST	Sea surface temperature
TACE	Tropical Atlantic Climate Experiment
WGCM	Working Group on Coupled Modeling
WGSIP	Working Group on Seasonal to Interannual Prediction
VACS	Variability of the African Climate System
VAMOS	Variability of the American Monsoon Systems
WCRP	World Climate Research Programme
WESTPAC	IOC Sub-commission for the Western Pacific
WGOMD	Working Group on Ocean Model Development
WWRP	World Weather Research Programme