

Project Report

Report of 20th Session of the CLIVAR Scientific Steering Group – SSG-20

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

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1. Action Items

Action		Deadline	Responsible	ICPO Support
WCRP Projects and Activities				
1	Communicate with GEWEX regarding WCRP's Grand Challenges on Water Availability.	25 th May 2013	L. Goddard	C. Ereno
2	CLIVAR and CliC would work together to develop the relevant agenda items for the "Cryosphere in a Changing Climate Workshop" and inviting experts to give talks.	September 2013	S. Rintoul	J. Riley
3	Develop links between WCRP Cryosphere Grand Challenge and CLIVAR research community.	September 2013	S. Rintoul	J. Riley
4	Identify appropriate links for CLIVAR (and WCRP) to engage with OOPC	September 2013	GSOP co-chairs	N. Caltabiano
5	Request four basin panels to continue to articulate observing system requirements	July 2013	SSG, ICPO staff	N. Caltabiano
6	Recommend each CLIVAR ocean region panel nominate a liaison person to OOPC	July 2013	SSG, ICPO staff	N. Caltabiano
7	Implement a limited-lifetime Task Team on Sub-Surface Ocean Indices under GSOP in co-operation with WGOMD and ETCCDI	July 2013	E. Harrison	N. Caltabiano
8	Define mechanism(s), which can be adopted for efficient communication between CLIVAR and the WCRP global modelling working groups and WMAC	December 2013	G. Danabasoglu	A. Pirani
9	Develop a full consultation process for CLIVAR to contribute to the design of CMIP6.	July 2013	G. Danabasoglu	A. Pirani
10	Recommend a CLIVAR representative to co-lead Initiative 2 (Coupling clouds to circulations) of the WCRP Grand Challenge on Clouds	25 th May 2013	Co-chairs, G. Danabasoglu	A. Pirani
11	Produce a short document defining who the 'users' of CLIVAR science are and how CLIVAR can best interact with them	September 2013	L. Goddard	J. Riley
12	Develop links between CLIVAR, WCRP regional working group and Climate Services Partnership.	September 2013	L. Goddard	J. Riley
13	Develop links between CLIVAR and NACLIM. In particular the identified 'users' of the project output (currently strategic cities around Europe interested in climate variability impacts)	September 2013	L. Goddard	J. Riley
14	Develop call for papers for the WCRP Latin America-Caribbean Conference	September 2013	V. Detemmerman	C. Ereno
15	Increase social interaction with other Facebook and twitter social media communicators	December 2013	E. Hawkins	J. Riley

Action		Deadline	Responsible	ICPO Support
16	Develop terms of reference for using social media (particularly Twitter)	December 2013	E. Hawkins	J. Riley
17	Fully develop and make live new CLIVAR website, integrating new CLIVAR name and structure of working groups and panels into the web design. Jen and Tim to work on this with feedback from rest of ICPO, SSG chairs new communications group.	December 2013	L. Goddard Communications group	T. Waterfield
18	Explore new communication channels to interact, inform and engage with public and media.	December 2013	E. Hawkins	J. Riley
19	Investigate the linkages and partnerships that could be made with journalists, news agencies and blogs (e.g. ClimateWire, BBC, local institutional communications teams) – Catherine Beswick at NOCS could be used as a point of reference until migration of ICPO to new host.	December 2013	E. Hawkins	J. Riley
20	Develop the new CLIVAR logo – in conjunction with the new website. Investigate contracting out the logo design. (Lisa Goddard to make final, executive decision).	December 2013	L. Goddard Communications group	T. Waterfield
21	Assess the current website usage through Google analytics. Compare the use of the website pre and post web development.	December 2013	E. Hawkins	J. Riley
22	Investigate use of automated email system to inform SSG and panel members when a new report is published	December 2013	L. Goddard Communications group	T. Waterfield
CLIVAR Research Opportunities and WCRP Grand Challenges				
23	Produce Terms of Reference and draft template to further develop the research opportunities, which would include guidelines to develop new CLIVAR research activities	15 th June 2013	L. Goddard S. Rintoul	A. Pirani
24	ICPO to take lead on developing implementation strategy to provide a framework within CLIVAR that can support international coordinated activities.	November 2013	M. Visbeck, L. Goddard	A. Pirani
25	Establish the “ENSO in warmer world” and “Consistency between planetary heat balance and ocean heat storage” proposals as new Research Opportunities	December 2013	T. Lee, W. Cai GSOP co-chairs	N. Caltabiano
26	Research Opportunity on Monsoons to define focused activities and develop stronger links with WCRP GC on Monsoons	1 st September 2013	K. Sperber	C. Ereno
27	Change name of CLIVAR Research Opportunity on “Trends, nonlinearities and extreme events” to “Attribution and Prediction of Extreme Events”	ASAP	S. Gulev	A. Pirani
28	Work jointly with GEWEX to identify key science questions and topics where there is readiness in the attribution and prediction of extreme events community	January 2014	S. Gulev	A. Pirani

Action		Deadline	Responsible	ICPO Support
29	Upwelling Tiger Team to advocate for the need for improved high-resolution coastal wind observations and to make recommendations for observing system requirements	1 st September	K. Drinkwater	N. Caltabiano
30	CLIVAR Research Opportunity on Upwelling to promote link to IOC regions, with opportunity to establish contact local nations and links to local users of information	1 st September	K. Drinkwater	N. Caltabiano
31	Research Opportunity on Sea Level Rise to communicate with CliC and communities outside WCRP, and develop strong links to the WCRP Grand Challenge on Regional Sea Level	1 st September	D. Stammer	A. Pirani
32	Include some representation of the SeaFlux community in the “Heat balance and ocean heat storage” Research Opportunity	December 2013	T. Lee, W. Cai GSOP co-chairs	N. Caltabiano
33	Request proposers of the “ENSO in warmer world” Research Opportunity to define the areas where significant progress is prime	December 2013	T. Lee, W. Cai GSOP co-chairs	N. Caltabiano
Reports from CLIVAR working groups and panels				
34	Develop strategy towards one Monsoon Panel with the possibility of regionally focused working groups beneath that.	October 2013	M. Visbeck, K. Sperber	C. Ereno
35	Encourage adopting CMIP5/obs4MIP service of the ocean synthesis directory.	December 2013	G. Danabasoglu	A. Pirani
36	WGOMD and GSOP to extend collaborative intercomparison activities.	July 2014	GSOP Co-Chairs	N. Caltabiano
37	GSOP to provide OOPC active guidance in prioritization needs for the ocean observing system.	ASAP	GSOP Co-Chairs	N. Caltabiano
38	GSOP to co-ordinate with OOPC on implementation of FOO.	September 2013	GSOP Co-Chairs	N. Caltabiano
39	Provide input to OOPC on choice of EOv and ECVs, product requirements and proof of concept work.	September 2013	GSOP Co-Chairs	N. Caltabiano
40	Develop a joint WGOMD-WGNE approach to evaluate representation of fluxes at sub-mesoscale in ocean models.	September 2013	GSOP Co-Chairs	A. Pirani
41	Request panels to articulate what main science questions are likely to make rapid progress through coordination.	December 2013	SSG	ICPO Staff
42	Provide higher priority and visibility to national reports on website.	1 st June	S. Rintoul	J. Riley
Reports from national and international CLIVAR offices				
43	Integrate the ECS registered at the CLIVAR OSC into the ECS network.	December 2013	L. Goddard	J. Riley
44	Work on transitioning the network from top down to a bottom up structure. ICPO to develop a plan on how to give ECS the “lead” on the CLIVAR ECS network; ask Panels and WG to provide ideas.	December 2013	L. Goddard	J. Riley
45	Revise the current age range of CLIVAR ECS	December 2013	L. Goddard	J. Riley

46	Create opportunities at major meetings (AMS, Ocean Sciences) for Panel discussions involving experienced and Early Career scientists	December 2013	L. Goddard	J. Riley
47	Design better web space/pages for ECS including development of images used.	December 2013	L. Goddard	J. Riley T. Waterfield
48	Feedback to IAG the appreciation of US support and note the international effort resulting from it.	January 2014	M. Visbeck L. Goddard D. Stammer	R. Barry V. Detemmerman
49	Develop enhanced interaction between the IAG and CLIVAR leadership in the coming years.	January 2014	M. Visbeck L. Goddard D. Stammer	R. Barry V. Detemmerman
CLIVAR Organization post 2014				
50	Propose to the JSC the organization of a Pan-CLIVAR meeting in the Hague, 16-18 July 2014, in association with the GEWEX Science Conference	August 2013	M. Visbeck, V. Detemmerman	J. Riley
51	ICPO to work with Tiger Team leads to put out a targeted call for further input from the wider CLIVAR community to refine the research opportunities.	September 2013	M. Visbeck, L. Goddard, D. Stammer	ICPO Staff
52	ICPO to work with SSG to design an official proposal mechanism to enable members of the CLIVAR community to put their research ideas forward for review	September 2013	M. Visbeck, L. Goddard, D. Stammer	A. Pirani
53	Adopt/instate new JSC approach for membership of proposing potential candidates to SSG for an initial selection, ahead of contacting the candidates.	1 st September 2013	M. Visbeck, L. Goddard, D. Stammer	N. Caltabiano
54	Present the concept of a new CLIVAR climate dynamics panel at the JSC meeting, proposing CLIVAR championing of the panel development.	May 2013	L. Goddard M. Visbeck	A. Pirani J. Riley
55	Co-ordinate US CLIVAR science plan rollout with International CLIVAR roll out at the American Geophysical Union (AGU) and Ocean Sciences	November 2013	M. Visbeck, L. Goddard,	R. Barry M. Patterson
56	ICPO to work with SSG on drafting a short CLIVAR prospectus, detailing the science plan and implementation strategies.	October 2013	M. Visbeck L. Goddard	A. Pirani J. Riley
57	Draw up an editorial board from the existing CLIVAR SGS members to help with the final production of the prospectus and other relevant documents	February 2014	L. Goddard, E. Hawkins, W. Cai	J. Riley

2. Introduction to SSG-20

2.1. Local Arrangements

The 20th Session of the CLIVAR Scientific Steering Group (SSG-20) was held in Kiel, Germany, on 6-9 May 2013. Martin Visbeck and Lisa Goddard, SSG co-chairs, led the meeting of 43 participants. The attendees (listed in Appendix 2) comprised SSG members, chairs or representatives of CLIVAR panels and working groups, representatives of the other core WCRP projects, and other invitees.

Martin Visbeck welcomed the delegates to Kiel and gave a brief introduction to the GEOMAR Helmholtz Centre for Ocean Research and the Cluster of Excellence ‘The Future Ocean’, a joint project between Kiel University, GEOMAR, the Institute of the World Economy and the Muthesius School of Fine Arts.

Thanks were extended to the local organizers at GEOMAR for their efforts in ensuring that the meeting was a successful and sociable event, including the provision of live streaming of the meeting and providing absentees with the opportunity of participating, presenting and contributing to the discussions remotely.

2.2. Meeting Objectives and Overview of recent CLIVAR Developments

One of the main objectives of the SSG-20 was to discuss the evolution of CLIVAR in the context of its role as the “ocean-climate” project of the World Climate Research Program (WCRP).

Prior to the meeting CLIVAR panels and working groups provided written reports summarizing their achievements over the past year. These reports are available from: www.clivar.org/about/scientific-steering-group/activities/SSG20#4.

Martin Visbeck summarized the progress of CLIVAR since SSG-19 (La Paz, Mexico, June 2012). CLIVAR is in the process of formulating a new set of research opportunities that will contribute to the Grand Challenges of WCRP and the wider context of the oceans role in climate variability and change. The project will retain its global and balanced approach based on supporting the development of observations, models and theory and their joint exploitation for climate assessment and prediction. CLIVAR will intensify its partnerships with the marine biogeochemistry and eco-system community and continue to support education, capacity building and outreach.

The overall CLIVAR mission is to:

“Improve understanding and prediction of ocean-atmosphere interactions and their influence on climate variability and change, to the benefit of society and the environment.”

More specifically the overarching mission of the project is guided by its objectives to:

1. Understand the causes of climate variability on intra-seasonal to centennial time-scales through observations, analysis and modeling.
2. Improve predictions of climate variability and change associated with both internal and external processes.
3. Extend observational climate record through assembly of quality-controlled data sets.
4. Improve the atmosphere and ocean components of Earth-System Models.

In order to achieve these objectives CLIVAR has developed a set of core capabilities, facilitated by the skills and expertise of the scientists involved with the project. The core CLIVAR capabilities work to:

- Improving the atmosphere and ocean component of Earth System Models.
- Implementing innovative process and sustained ocean observations.
- Facilitating free and open access to climate and ocean data, synthesis and information.
- Supporting regional and global networks of climate and ocean scientist.
- Facilitating knowledge exchange and user feedback.
- Supporting education, capacity building and outreach.

These core and coordinated CLIVAR capabilities facilitate the overall progress in understanding anthropogenic climate change, intra-to-seasonal variability, predictability and prediction, and decadal variability, predictability and prediction.

3. Reports from WCRP Projects and Activities

3.1. Global Energy and Water Exchanges (GEWEX)

Kevin Trenberth, chair of GEWEX, gave an overview of the project, which is now renamed Global Energy and Water Exchanges (GEWEX) Project. It comprises the Global Data and Assessments Panel (GDAP), the Global Atmospheric Systems Study (GASS), and the Global Land–Atmosphere Systems Study (GLASS). GEWEX plans for 2013 and beyond have been detailed in reports published in November 2012 on [Science Questions](#) and [Imperatives](#). Two assessment reports were published in 2012 on [Radiative Flux](#) and [Satellite Global Cloud Data Sets](#).

Six new regional hydroclimate projects are proposed. A Pan-GASS workshop was held in September 2012 in Boulder.

Science questions of GEWEX are:

- How can we better understand precipitation variability and change?
- How do changes in the land surface and hydrology influence past and future changes in water availability and security?
- How does a warming world affect climate extremes?
- How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

Other topics of note:

- Global precipitation series exhibit a wide variation and models underestimate tropical precipitation. Tropical transients are too weak and precipitation intensity is too low.
- New satellite missions are planned for 2014 including the Global Precipitation Mission and SMAP for soil moisture and freeze/thaw.

After a short discussion, the CLIVAR SSG recognizes the need of strong interactions between CLIVAR and GEWEX for the development of WCRP GC. One of the GC that should have better interaction in their activities is the GC on Water Availability and both projects should ensure a dialogue is maintained.

ACTION 1 Communicate with GEWEX regarding WCRP’s Grand Challenges on Water Availability.

3.2. Climate and Cryosphere (CliC)

Jenny Baeseman, Director of the Climate and Cryosphere (CliC) Project Office, reported on her appointment and that of a new office assistant, a new five-year agreement with the Norwegian Polar Institute to host the project office, and a new Chair of CliC, Dr. Greg Flato. The web site has been re-developed but a major difficulty has been the lack of corporate memory.

New targeted activities include:

- West Antarctic glacier/ocean modeling.
- Understanding linkages between cryosphere elements.
- Coordination of cryosphere observations for model evaluation and prediction initialization.
- Arctic freshwater system synthesis.
- Arctic climate scenarios information archive and delivery.
- Permafrost retrospective simulation, merged with remote sensing.
- Ice sheet, sea ice and climate, and permafrost modeling.

The CliC Arctic sea ice working group held a Modeling and Observing Workshop in June in Tromso and has helped develop Ice Watch, a shipboard sea ice standardization tool and data network. A workshop on the Cryosphere in a Changing Climate will be held in October 2013 in Tromso, Norway, and there is opportunity for CLIVAR to provide input into scientific areas of “Predictions and projections of polar climate” and “Sea level rise amongst other themes”. CLIVAR input is sought on agenda items and speakers for this workshop.

ACTION 2 CLIVAR and CliC would work together to develop the relevant agenda items for the “Cryosphere in a Changing Climate Workshop” and inviting experts to give talks.

CliC is also leading the WCRP Cryosphere GC and CLIVAR should collaborate in developing their activities.

ACTION 3 Develop links between WCRP Cryosphere Grand Challenge and CLIVAR research community.

3.3. Stratospheric Processes and their role Climate (SPARC)

Elisa Manzini, leader of the SPARC Dynamics and Variability of the Stratosphere-Troposphere System (DynVar) activity, reported on SPARC and its contribution to the WCRP Grand Challenges – Regional Climate Information, Clouds, Circulation and Climate Sensitivity (lead), and Climate Extremes.

The scientific goals of SPARC are currently encapsulated within three main themes:

- Detection, attribution, and prediction of stratospheric change.
- Chemistry–climate interactions.
- Stratosphere–troposphere dynamical coupling.

To date some of the accomplishments of SPARC include:

- Stratospheric Sounding Unit (SSU) temperature trends.
- The analysis of the stratosphere in CMIP5. Atmosphere-ocean coupling is stronger in high top models.
- North Atlantic Oscillation (NAO) and trends in stratospheric winds.

Future work undertaken by SPARC will include an increased SPARC emphasis on stratosphere-troposphere coupling. Furthermore, there is a new Stratospheric Network for the Assessment of Predictability (SNAP), and a study of solar influences on climate.

3.4. Ocean Observation Panel for Climate (OOPC)

Katie Hill, reported on OOPC, the ocean component of Global Climate Observing System (GCOS), complementary to the Atmospheric Observations (AOPC) and Terrestrial Observations panels (TOPC) for climate. The former treats Ocean Essential Climate Variables (ECVs) and the latter Essential Ocean Variables (EOVs).

The Global Ocean Observing System (GOOS) Framework for Ocean Observations has been broadened to include biogeochemistry and biology, and expanded to the coasts. Recent changes focus on information delivery and societal applications. Key priorities for OOPC include:

- Taking a whole system approach to observing system assessment.
- Tropical Pacific Observing System ‘Vision’ Workshop.
- Scientific requirements and technology evolution.
- Deep Ocean Observing System (Physics, chemistry, biology).
- Boundary Currents - Approaches to observing.

- Reducing errors in air sea flux estimates.

In the future a GCOS Implementation Plan will be reviewed every 5 years and will feature a Review and Adequacy Report. A GOOS Decadal Work-Plan will also be developed and complemented by a GOOS OceanObs conference, the next being held in 2019.

One key issue to be resolved is identification of a primary contact for OOPC within WCRP, be it from CLIVAR or WDAC (WCRP Data Advisory Council). Historically, representatives of CLIVAR Basin Panels have been invited to OOPC meetings and OOPC chairs have been invited onto the WDAC. CLIVAR Basin panels are instrumental in providing observing system requirements and the SSG recommended that this should continue.

ACTION 4 Identify appropriate links for CLIVAR (and WCRP) to engage with OOPC

ACTION 5 Request four basin panels to continue to articulate observing system requirements

The question of what is happening on product assessment was raised. It was stated that there has been CLIVAR input on ECVs and on product requirements.

ACTION 6 Recommend each CLIVAR ocean region panel nominate a liaison person to OOPC.

3.5. Ocean Indices

There is a need to create a broader awareness of oceanic variability and its impact on society. The emphasis has been on ocean averages for the Intergovernmental Panel on Climate Change (IPCC), but regional signals are larger and merit study.

There is much low frequency, as well as interannual and multi-annual, variability in most climate index time series. Assuming useful ocean indices can be identified from ocean “products”, can we use operational ocean analyses to track these indices to societal advantage? Does the operational ocean community identify other subsurface indices of societal utility?

Some familiar climate modes appear likelier candidates for connection to oceanic variability than others, for example ENSO, Pacific Decadal Oscillation and Atlantic Meridional Oscillation exhibit strong anomalies and at least interannual time scales. A question that should be addressed include what are the modes of variability in subsurface variables such as upper ocean heat content, freshwater content, mass transport, steric sea level and current patterns?

Furthermore there are technical questions and issues that need addressing. These include;

- Are data sets complete enough and ‘clean’ enough?
- Instrument biases
- How will observing systems evolve?
- What climatology is to be used for observational anomaly studies?

To answer these questions and issues an initial suite of indices is needed – global, regional, region-linking and climate mode-linking. To collect these indices and direct the work a task team is recommended, comprised of members of GSOP, WGOMD and ET-OOFS/GOV. The aim of this team should be to develop an initial suite of indices in two years.

ACTION 7 Implement a limited-lifetime Task Team on Sub-Surface Ocean Indices under GSOP in co-operation with WGOMD and ETCCDI

3.6. Future Earth

Martin Visbeck presented a preliminary overview of how the new Future Earth Programme would operate. Future Earth has been developed because the challenges of global environmental change and sustainable development require new approaches, which are:

- More international, integrated and collaborative
- Co-designed with users and funders
- More responsive to society and the grand challenges of sustainability
- Build on the success of current international research programmes.

Work within Future Earth will be focused into 3 research themes:

1. Dynamic planet – which includes projecting environments, examining approaches and models, drivers, states, trends and thresholds, carrying out work in critical zones such as coasts, tropical forests, and Polar Regions.
2. Global development – which includes stewardship of resources, ecosystem services and grating / negotiating equitable access to food, water and healthy living environments.
3. Transformations towards sustainability – which includes examining transformation processes, innovation and ideas and global and regional governance.

To facilitate integration across the research themes, the science will be supported by a set of cross cutting capabilities (and potential partners), which include:

- Observing systems (GCOS, GEOSS etc.)
- Data systems (World Data Systems)
- Earth system modeling (Modeling Centers)
- Theory development (ISSC, Disciplinary unions)
- Synthesis and assessment (IPCC, IPBES etc.)
- Capacity development and education (START, UNESCO etc.)
- Communication
- Science-policy interface and interactions (UNEP etc.)

3.7. WCRP Update

3.7.1. Recent developments in WCRP

Antonio Busalacchi, chair of the Joint Scientific Committee (JSC), presented an update of the recent developments that have occurred in WCRP. He summarized the outcomes of the

WCRP Open Science Conference in Denver in October 2011 and noted the need for a symbiotic relationship between providers and users of climate information, producing actionable science that can be used to train the next generation of scientists and decision makers.

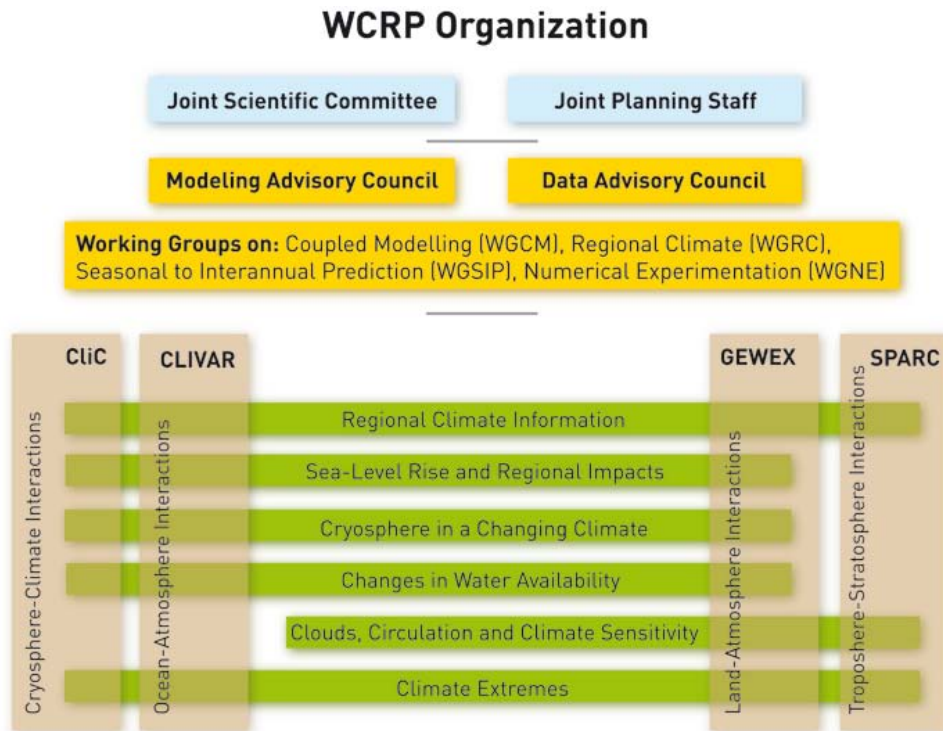


Figure 1 The WCRP organizational structure. The core projects, CLiC, CLIVAR, GEWEX and SPARC are highlighted in the brown boxes. The Grand Challenges are highlighted in Green. Where the core projects overlap with the Grand Challenge indicates the involvement of the project¹.

The structure of WCRP (Figure 1) particularly highlights the interactions of the core WCRP projects with the six WCRP Grand Challenges. The Grand Challenges (GC, described more fully in their corresponding white papers found at, www.wcrp-climate.org/index.php/grand-challenges) are designed to expedite progress in these topics through enhanced cross-programme coordination. Implementation strategies are being

¹ The Modelling Advisory Council coordinating high-level aspects of modeling across the WCRP, ensuring cooperation with main WCRP partners such as IGBP and WWRP.

The Data Advisory Council acts as a single entry point for all WCRP data, information and observation activities, coordinating their high-level aspects across the WCRP, ensuring cooperation with partners.

The WGCM coordinates WCRP modelling activities and organizes numerical experimentation for the IPCC assessments.

The WGRC prioritizes and coordinates regional climate research and serve as the conduit for two-way information exchange between the WCRP, other providers of climate services e.g. the Global Framework for Climate Services (GFCS).

The WGSIP develops a program of numerical experimentation for seasonal-to-interannual variability and predictability.

The WGNE fosters the development of atmospheric circulation models for use in weather, climate, water and environmental prediction on all time scales.

developed by community representatives and supported by the WCRP Projects (CLIVAR, GEWEX, CliC and SPARC). CLIVAR has the lead in Regional Climate Information, Regional Sea Level Variability, and Extreme Events Grand Challenges and contributes to several of the others.

The WGRC will not replace regional activities at Project level, but aims to facilitate cross-WCRP coordination and interface with the Global Framework for Climate Services (GFCS) and Future Earth, CORDEX (Co-ordinated Regional Climate Downscaling Experiment) and IPCC (Intergovernmental Panel on Climate Change) to improve predictions at regional scales.

Concerns were raised that this new organization of WCRP, through the Working Groups and Grand Challenges does not communicate science priorities of the core Projects, thus the science undertaken is not visible up front. However it was noted that the science achievements are addressed in the [WCRP accomplishments report](#).

3.7.2. WCRP Modelling Advisory council (WMAC)

The WMAC met in Beijing in July 2012 and developed their Terms of Reference. A second session is to be held in Brasilia in May 2013 to address gaps in WCRP, workshop on model tuning and summer schools on model development. An efficient communication between CLIVAR, WMAC and global modelling working groups is also essential.

ACTION 8 Define mechanism(s), which can be adopted for efficient communication between CLIVAR and the WCRP global modelling working groups and WMAC.

The 16th session of the WG on Coupled Modelling (WGCM) was held in September 2012 in Hamburg, Germany to look at what lessons we learnt from CMIP5 and discuss plans for CMIP6. It is important for CLIVAR to be involved since the beginning in those plans.

ACTION 9 Develop a full consultation process for CLIVAR to contribute to the design of CMIP6.

Ad-hoc WGCM-WGNE Metrics Panel meetings were held to identify a limited, but diverse set of climate model performance metrics; the panel's wiki was made public in April 2012.

3.7.3. WCRP Grand Challenges on Clouds, Circulation & Climate Sensitivity

Bjorn Stevens, lead coordinator of the Clouds, circulation and Climate Sensitivity Grand Challenge gave a presentation on the work currently being undertaken and planned, which will contribute to the topic. This is the only GC which CLIVAR does not currently have some direct involvement. Limited understanding of clouds is the major source of uncertainty in Climate Sensitivity, but also contributes substantially to persistent biases in modeled circulation systems. The GC aims to address the following questions:

- How do clouds couple to circulations in the present climate?

- How will clouds and circulation respond to global warming or other forcings?
- How will they feed back on it through their influence on Earth's radiation budget?

To answer these questions, the GC is articulated around five complementary initiatives:

1. Climate and hydrological sensitivity.
2. Coupling clouds to circulations.
3. Changing patterns.
4. Leveraging the past record.
5. Towards more reliable models.

The community will be motivated to work on Grand Challenge initiatives, for example through high-profile papers through on-going projects (e.g. CFMIP/GASS, WGNE, SPARC, PMIP), workshops, summer schools and CMIP6 design.

ACTION 10 Recommend a CLIVAR representative to co-lead Initiative 2 (Coupling clouds to circulations) of the WCRP Grand Challenge on Clouds .

3.7.4. WCRP Capacity Development Strategy & CLIVAR

WCRP has two major thrusts in its strategy for education, training and capacity development. Firstly building capacity for research in developing regions and secondly empowering the next generation of climate scientists. The WCRP core projects are encouraged to support both aspects of scientific capacity building.

WCRP are hosting a series of conferences over the coming months (Africa Climate Conference 15-18 October 2013, CORDEX conference on regional climate 4-7 November 2013 and Climate and Society for Latin American and the Caribbean conference 17-21 March 2014) that will incorporate development aspects (e.g. funding for Early Career Scientist (ECS), prizes).

WCRP is working with ECS to help foster and develop their careers. In total WCRP sponsored 106 students and ECS in 2012. WCRP CORDEX training workshops have been held in 2012 and WCRP will be organizing summer schools in the future, the first in July 2014 on the Attribution and Prediction of Extreme Events. Following on from the CLIVAR initiative WCRP is planning to build a network of young scholars by creating an ECS network within each core project and within CORDEX. These ECS networks will be integrated with other WCRP activities. Efficient use will be made of social media to foster the ECS community and enhance the role of ECS networks in international research.

Questions were raised about what the role of WCRP was, in particular if the four core projects were to be the instigators of the ECS networks. There is a serious and tangible need for money to support such networks and more serious consideration of funding sources is needed. Therefore, WCRP/JPS could co-ordinate fundraising activities for the ECS networks across the four core projects. Furthermore, WCRP/JPS could provide a dedicated support position for web interface to co-ordinate such outreach activities across the core projects.

CLIVAR needs to identify the ‘users’ of CLIVAR science with the remit of focusing CLIVAR science into societally relevant and actionable research. Also, better links between CLIVAR, WCRP regional working group and Climate Services Partnership, as well as project such as NACLIM, should be developed.

ACTION 11 Produce a short document defining who the ‘users’ of CLIVAR science are and how CLIVAR can best interact with them.

ACTION 12 Develop links between CLIVAR, WCRP regional working group and Climate Services Partnership.

ACTION 13 Develop links between CLIVAR and NACLIM. In particular the identified ‘users’ of the project output (currently strategic cities around Europe interested in climate variability impacts)

3.7.5. Update on WCRP regional Conferences

3.7.5.1. Latin America & Caribbean Climate Conference 2014

The WCRP Conference for Latin America and the Caribbean (LA&C), which will develop, link and apply climate knowledge from scientists working across the region, will be held in Montevideo, Uruguay, 17-21 March 2014. At the last VAMOS panel meeting a steering committee was proposed to organize the conference. This committee will work together to set the agenda and design conference sessions and ensure a good mixture of social, physical and joint scientists are represented at the meeting. A kick off meeting for the SSC of the LA&C was held at the beginning of March 2013 in Buenos Aires, Argentina and identified five themes (water & energy, agriculture & ecosystems, human health, coastal zones and urban environments) as prioritized by GFCS. A final theme of climate prediction and predictability in LA&C will be used to summarize and wrap up the conference proceedings.

A web page has also been set up (www.cima.fcen.uba.ar/WCRP), which will host the logistical and conference organizational information. Registration fees will be charged to conference participants. Funding support will be requested from WCRP, The National Science Foundation (NSF), Inter-American Institute for Global Change Research (IAI), the United States Agency for International Development (USAID), the World Bank and CCCCC (Caribbean Community Climate Change Center).

A timeline of necessary activities has been developed which documents the key milestones to be met in order for the conference to be fully organized by March 2014. Decisions as to what keynote presentations are wanted and who will be invited to give them are the next steps that will be taken. It has also been decided that the keynote presentations, conference talks and discussions will be developed into short white papers which will include recommendations and future actions for climate science in LA&C. These papers will be reviewed in detail after the meeting.

The SSG thanked the organizers of the Conference for the hard work in the organization but urged them to quickly develop call for papers due to the short time until the conference.

ACTION 14 Develop call for papers for the WCRP Latin America-Caribbean Conference

3.7.5.2. African Climate Conference 2013

The African Climate Conference (ACC), organized jointly by WCRP, the University of Dar es Salaam, Tanzania, and the African Climate Policy Centre (ACPC) will be held in Arusha, Tanzania on 15-18 October 2013. The objective is to set the Africa wide agenda on climate research linked to existing continental policy processes, partners and institutions (regional, national and sub-national). Planning for the conference was initiated in January 2012 and progress is well underway with the conference organizational logistics. The conference fund raising committee is aggressively working to secure funding to meet the goal of having comprehensive representation from across Africa (universities, National Hydro-Met Services, Regional Climate Centres, NGOs, government entities, research agencies, etc.). Over 500 abstracts have been submitted to the conference organizers for review as oral or poster presentations with the majority requesting travel support.

In order to get policy and ministerial level support at the conference, thereby ensuring the conference has a high public profile across Africa, the president of Tanzania will open the meeting and there will be representation at ministerial level throughout to raise priorities within Africa for research. It is anticipated that social media will be used widely before and during the event to promote the conference and to make the meeting an interactive event.

3.7.6. WCRP communications strategy (from a CLIVAR perspective)

As a WCRP community, all core projects are moving towards a multi platform method of communication. In particular the WCRP communications team, across the four projects, have developed an RSS feed and a shared calendar, which helps all projects to look like a coherent community to the outside world.

Different audiences are targeted with different media types. Younger audiences will generally be reached through the use of social media.

ACTION 15 Increase social interaction with other Facebook and twitter social media communicators

Some CLIVAR members raised concern over the use of social media to communicate CLIVAR science and findings. Concerns were that the social media world may leave scientists open to criticism and attack from skeptics and posts may not represent the viewpoint of all community members. However, it was highlighted that social media, especially twitter, is just another vehicle for communication, not necessarily offering opinion but broadcasting scientific results, jobs and meetings to a wider community.

Nevertheless, terms of reference should be developed by the ICPO and SSG to clearly describe the use of social media by CLIVAR.

ACTION 16 Develop terms of reference for using social media (particularly Twitter)

The current website design is aimed at the already established CLIVAR community. CLIVAR is currently developing its website to make it more navigable for current users, more interactive and more inviting for new users and people just passing through the site. Consideration needs to be taken as to who the users of the website are and what other avenues of communication could be explored (e.g. the public, blogs and media). New parts of the website could be developed to include content for different audiences. It is unlikely that CLIVAR will be able to address all audiences to a high quality level. Instead, there should be some reflection of who the users of CLIVAR science are and target the website towards them.

ACTION 17 Fully develop and make live new CLIVAR website, integrating new CLIVAR name and structure of working groups and panels into the web design. Jen and Tim to work on this with feedback from rest of ICPO, SSG chairs new communications group.

ACTION 18 Explore new communication channels to interact, inform and engage with public and media.

ACTION 19 Investigate the linkages and partnerships that could be made with journalists, news agencies and blogs (e.g. ClimateWire, BBC, local institutional communications teams) – Catherine Beswick at NOCS could be used as a point of reference until migration of ICPO to new host.

Within the development of the new website a new CLIVAR logo should be included. The development of this logo should include a community consultation process with the ultimate decision on the design being made by the SSG.

ACTION 20 Develop the new CLIVAR logo – in conjunction with the new website. Investigate contracting out the logo design. (Lisa Goddard to make final, executive decision).

A useful analysis during the transition from the old to the new website would be to use Google analytics to determine how much traffic the new website will draw in comparison to the old one. It is hoped this development will be completed by the time the ICPO leaves Southampton. During the forthcoming months with the upcoming transition of the ICPO office, the hosting the website and paying for servers, publication of exchanges and access to Mail Chip also needs to be considered.

ACTION 21 Assess the current website usage through Google analytics. Compare the use of the website pre and post web development.

ACTION 22 Investigate use of automated email system to inform SSG and panel members when a new report is published

4. CLIVAR Research Opportunities and WCRP Grand Challenges

Martin Visbeck opened the discussion by highlighting that the concept of CLIVAR tiger teams should be developed into full Research Opportunities. To do this they will have to be advanced, which raised questions as to how best to carry this out and implement them in the context of the WCRP-Grand Challenges and whilst still mapping them onto CLIVAR priorities?

Members of each of the teams presented reports from the five existing tiger teams. Two further topics were presented to the CLIVAR SSG participants as potential new Research Opportunities. The Research Opportunities should be very focused, areas primed for significant progress in the next five years. It is necessary that a science case be made, with a review of what is known and what are the gaps. Also, it is important to identify who are the users for that information and if the right questions are being asked. Finally, the prospects for funding, and potential support from nations for workshops and activities should be identified?

Terms of Reference for the Research Opportunities need to be further developed.

ACTION 23 Produce Terms of Reference and draft template to further develop the research opportunities, which would include guidelines to develop new CLIVAR research activities

Research Opportunities are more strategic in building linkages between science, users and funding communities. The inclusion of new ideas in the CLIVAR structure would be done in an evolutionary manner, i.e., they could become new Research Opportunities or current panels can launch new initiatives. There is also scope for calls for proposals similarly to what is already done by US CLIVAR or SCOR. A period of consultation with users and funders would be a necessary step, which would allow the SSG to receive suggestion for governance options.

ACTION 24 ICPO to take lead on developing implementation strategy to provide a framework within CLIVAR that can support international coordinated activities.

The SSG also agreed to establish the two proposals as new CLIVAR Research Opportunities, in addition to the five original ones.

ACTION 25 Establish the “ENSO in warmer world” and “Consistency between planetary heat balance and ocean heat storage” proposals as new Research Opportunities

4.1. Intraseasonal, seasonal and interannual variability and predictability of monsoon systems

Andrew Turner presented a short report on the CLIVAR Research Opportunity on the “Intraseasonal, seasonal and interannual variability and predictability of monsoon systems”. Monsoon systems represent a major mode of climate variability on the planet and supply the majority of rainfall to vulnerable/developing nations. The overarching goal is to provide better predictions of intraseasonal-interannual monsoon variability at a regional and local level that is vitally important for food security, water supply, and the economy.

Key science questions involving processes, characterizing and observing, modelling and prediction of monsoons were highlighted. Links were drawn between this research opportunity and the following WCRP GC:

- Clouds, circulation and climate sensitivity
- Changes in water availability
- Regional Climate information

In order for this research opportunity to be fully implemented with the WCRP GC other WCRP programmes (e.g. GEWEX, GLASS and iLEAPS) should be embraced to exploit the collective knowledge of convective and land surface processes. Capacity within CLIVAR and WCRP could also be developed within this research opportunity by encouraging developing nations to engage in this research topic and encourage the participation of young scientists. For full details please refer to [Tiger Team report](#) and [presentation](#).

The SSG had a brief discussion on the presentation and the key topics that the Tiger Team has developed. The general consensus is that the CLIVAR Research Opportunity on Monsoons should address science topics that are focused and will not be addressed by any other group, while collaborating closely with the WCRP GC on Monsoons.

ACTION 26 Research Opportunity on Monsoons to define focused activities and develop stronger links with WCRP GC on Monsoons

4.2. Decadal variability and predictability of ocean and climate variability

Gokhan Danabasoglu presented a short report on the CLIVAR Research Opportunity on the “Decadal Variability in the Climate System and its Predictability”. Understanding decadal variability in the ocean climate system is important. It is over decadal timescales that society develops infrastructure and seeks to adapt to and mitigate to climatic variability. This research opportunity is global in nature, addressing the development of predictive understanding, monitoring, observations, modelling, and prediction. The overarching aim is to improve physical understanding of decadal variability and its predictability, including internal and forced variations (natural and anthropogenic forcing agents, including solar, volcanoes, GHG, aerosols).

The major themes that will be covered within this Research Opportunity were highlighted. Links were drawn between this research opportunity and the following WCRP GC:

- Regional Climate Information – which similarly to the CLIVAR research opportunity aims to separate the effects of anthropogenic forcings and the low frequency natural climate fluctuations.

In order to make progress over the next 3 – 5 years links need to be maintained between CLIVAR and GEWEX as well as identifying areas of science for focused research efforts to be conducted. The areas identified for rapid progress in this research opportunity include:

- The climate system historical forecast project (WGSIP).
- CMIP5 decadal prediction experiments.
- WGRC and CORDEX.
- New generation of models and co-ordinated model analysis.
- Better observations.
- Global framework for climate services.
- Enhanced interactions between stakeholders and climate scientists.

Gokhan emphasized that CLIVAR can manage these activities by organizing community wide workshops/conferences for each ResOp. Form structured groups to co-ordinate these activities and do the work. It is essential that CLIVAR plays a major advocate role on behalf of the participating scientists in securing funding. For full details please refer to [Tiger Team report](#) and [presentation](#).

4.2.1. Polar predictability

Ed Hawkins presented on two Polar Climate Predictability activities, which are being organized in the international community and link with the CLIVAR Decadal variability and predictability of ocean and climate variability Research Opportunity. For full details please refer to the [presentation](#).

- The World Weather Research Programme (WWRP) Polar Prediction Project - focused on hourly to seasonal timescales.
- The WCRP Polar Climate Predictability Initiative (PCPI) – focused on longer timescales.

The aim of these projects are to:

1. Improve knowledge and understanding of past polar climate variations (100+ years).
2. Assess reanalyses in polar regions.
3. Improve understanding of polar climate predictability on seasonal to decadal timescales.
4. Assess performance of CMIP5 models in polar regions.
5. Model error in polar regions.
6. Improve understanding of how jets and non-zonal circulation couple to the rest of the system in the Southern Hemisphere.

Initiative 3 is of direct relevance to the seasonal and decadal timescale areas of focus within CLIVAR. It will consist of perfect model predictability studies to understand

processes giving rise to predictability in model simulations and with the aim of informing operational centres of levels of predictability and prediction system design.

4.3. Trends, nonlinearities and extreme events

Xuebin Zhang presented the Research Opportunity focusing on Trends, nonlinearities and extreme events. There are many types of weather and climate extremes with different time and space scales: droughts, major floods, heat waves, ice storms, and marine storms. Drought drivers are affected by changes in global circulation patterns and land surface conditions.

The overarching aim of this Research Opportunity is to better understand of the causes and mechanisms of variability and change in extremes, and improve the prediction of changes in extremes. Key questions, science challenges and implementation of these questions were discussed during the presentation. From a climate service perspective the key question is, what are the frequency and magnitudes of various extremes in the near term and in the future?

This Research Opportunity links in general terms to all the WCRP GC, but draws particular parallels with the GC on Prediction and Attribution of Extreme Events. It was suggested CLIVAR use the same title as the WCRP Grand Challenges “Prediction and attribution of extreme events”. An increased emphasis on representing ‘phenomena’ is needed, not just processes e.g. representation of tropical storms, blocking. The Research Opportunity should focus on key science questions, identifying topics where there is readiness in the community to make rapid progress.

ACTION 27 Change name of CLIVAR Research Opportunity on “Trends, nonlinearities and extreme events” to “Attribution and Prediction of Extreme Events”

There are also links between this Research Opportunity and the GEWEX, SPARC and CliC science focuses.

ACTION 28 Work jointly with GEWEX to identify key science questions and topics where there is readiness in the attribution and prediction of extreme events community.

For full details on this Research Opportunity please refer to the [Tiger Team Report](#) and the [presentation](#).

4.4. Marine biophysical interactions and dynamics of upwelling systems

Ken Drinkwater presented the Research Opportunity on Marine biophysical interactions and dynamics of upwelling systems. Upwelling systems are important because they are areas of high biological production, where biological systems feedback onto ocean climate. Upwelling regions are generally poorly represented in GCMs contributing to systematic model biases.

The initial focus of this Research Opportunity will be on biophysical processes and identify gaps in knowledge, with a short summary document to be developed on the major issues at international and national levels, and how CLIVAR/IMBER collaboration could complement existing activities. Some activities are already being implemented, with the CLIVAR/IOC-GOOS Indian Ocean Panel and the Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) regional programme of Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) forming an Eastern Indian Ocean Upwelling Research Initiative.

Knowledge exchange within this Research Opportunity will be primarily through workshops, articles in Exchanges, IMBER updates and other relevant newsletters, and also via the publication of review papers. Capacity building will principally be through travel support for early career scientists and graduate students.

The Research Opportunity can contribute to the WCRP Regional Climate Information in particular in terms of improved regional predictability. The SSG hopes that this community will advocate the need for improved high-resolution coastal wind observations as well as recommendations on observing system requirements more broadly. The North Pacific Marine Science Organization (PICES) is a potential partner for physical-biophysical interactions. Links to IOC regions would enhance links to local/national government funding entities (e.g. for funding, using permits, links to users etc.).

ACTION 29 Upwelling Tiger Team to advocate for the need for improved high-resolution coastal wind observations and to make recommendations for observing system requirements

ACTION 30 CLIVAR Research Opportunity on Upwelling to promote link to IOC regions, with opportunity to establish contact local nations and links to local users of information

For full details on this Research Opportunity please refer to the [Tiger Team Report](#) and the [presentation](#).

4.5. Dynamics of regional sea level variability

Claus Boening presented the Research Opportunity on Regional Sea Level Rise. Regional sea level rise is a climate parameter with immediate societal relevance. It is affected by all climate components and its changes are an integral measure of climate change. However it also has strong drivers not related to climate, which are not covered by WCRP. The causes during the last 20 years are ocean warming, glacier and ice sheets melting, with a strong spatial and temporal variability. Reconstructions suggest non-stationarity of spatial trend patterns and a linkage to natural climate modes (ENSO, PDO, NAO), and for many regions natural variability exceeds anthropogenic trend.

The presentation covered new research areas and the challenges in the future projection of sea level. Ocean-coastal and human interaction need to account for coastal effects in future projections as well as non-climate related anthropogenic effects, e.g. shelf dynamics, impacts of storm surges and waves, and inclusion of sediment and ground mining.

For more information please refer to the [tiger team report](#) and [presentation](#).

ACTION 31 Research Opportunity on Sea Level Rise to communicate with CliC and communities outside WCRP, and develop strong links to the WCRP Grand Challenge on Regional Sea Level**4.6. Consistency between planetary heat balance and ocean heat storage**

This new Research Opportunity was presented by Karina von Shuckmann. Improving the accuracy of our estimates of Earth's climate state and variability is critical for advancing our understanding and prediction of the evolution of our climate. Determining exact values for energy flows in the Earth system is an area of ongoing climate research. There are independent measurement approaches based on remote sensing and in situ measurements and each approach has problems. While deriving budgets of the Earth's Climate, errors involved in deriving the single components can accumulate and have major impacts on the accuracy of climate indicators, leading to large imbalances in estimates of global Earth's climate budgets. There is merit in pursuing all methods, but reconciling the different approaches remains a challenge. The main objective is to analyze the consistency between planetary heat balance and ocean heat storage estimates, data sets and information products based on different parts of the global observing systems (remote sensing and in situ) and ocean reanalysis.

For more information on this proposed Research Opportunity please refer to the [report](#) and the [presentation](#).

A CLIVAR/ESA scientific consultation workshop on “Earth Observation Measurement Constraints on Ocean Heat Budget” is to be held in July 2013. This workshop will provide an opportunity to the scientific community to further shape the ESA activity by gathering the scientific requirements in terms of Earth Observation (EO) data and products to support the new CLIVAR research opportunity. It will be important to involve the GEWEX activity “SeaFlux” in this workshop.

ACTION 32 Include some representation of the SeaFlux community in the “Heat balance and ocean heat storage” Research Opportunity**4.7. ENSO in a warmer world**

Tony Lee presented this new Research Opportunity on ENSO in a warmer world. There has been an extensive literature on ENSO diversity, its mechanisms, teleconnections and impact and many studies of ENSO in CMIP5 models and how ENSO may change in a warming world. However, there has been a lack of progress in prediction. Two CLIVAR-sponsored workshops, held in 2010 in Paris, France, and in 2013 in Hobart, Australia, reviewed “new strategies for evaluating ENSO processes in climate models”. A main recommendation was made as a result of these workshops to continue to “bring together the different communities of experts to collectively make significant progress in the representation of ENSO in CGCMs (Coupled Global Climate Models) and in the use of CGCMs in addressing open questions in ENSO science.”

A future outlook presented after a US CLIVAR ENSO workshop in 2013 suggested that ENSO is very likely to remain the dominant mode of interannual variability with global influences. There is no conclusive evidence that ENSO has changed in the 20th century. There is low confidence in how the ENSO properties will change in the future, and even if ENSO does not change, there is medium confidence that the ENSO teleconnection in the North Pacific and North America will shift eastward.

This Research Opportunity will bring experts together towards three main goals:

1. To better understand processes that control ENSO characteristics in nature and in the models,
2. To propose a standard ENSO evaluation protocol for CGCMs
3. To understand how ENSO characteristics might be modified in the next decades, namely under the influence of anthropogenic climate change.

For full details on this Research Opportunity please refer to the [report](#) and [presentation](#).

The original proposal for this new initiative was to set it up as a CLIVAR Task Team. However, the SSG feels that ENSO should feature as a Research Opportunity, perhaps broadening their activities to include multi-decadal variability. This would show that ENSO is of core interest for CLIVAR. It is important for this activity to identify what are the recent advancements that show potential for new knowledge. ENSO diversity is certainly one, with implications to predictability and biogeochemistry. CMIP5 results also open a new frontier for the community to understand about ENSO. The ENSO and climate communities need to engage with WGCM since there are already plans for the design of CMIP6 and recommendations on what is needed are welcome.

ACTION 33 Request proposers of the “ENSO in warmer world” Research Opportunity to define the areas where significant progress is prime.

5. Reports from CLIVAR panels and working groups

5.1. Asia- Australia Monsoon Panel

Ken Sperber, co-chair of the Asia-Australia Monsoon Panel (AAMP) presented the panel’s report to the SSG. AAMP has made significant contributions to CLIVAR activities:

- Publication of a systematic evaluation of Asian summer monsoon (ASM) in CMIP5 and CMIP3 climate models;
- Sponsored the monsoon Intraseasonal Variability Hindcast Experiment (ISVHE) and contributed to the development and continuing analysis of the numerical hindcast and forecast experiments
- Supports and contributes to the development of metrics and diagnostics of the MJO and monsoon intraseasonal variability (especially targeting the northward and eastward ISO propagation during the boreal summer monsoon) through interactions with the WGNE MJO Task Force and the development of diabatic heating experiments with YOTC

Panel members have taken the lead in developing the CLIVAR Research Opportunity white paper for “Intraseasonal, seasonal and interannual variability and predictability of monsoon systems”, and have also been involved in developing white papers for the “Decadal variability in the climate system and its predictability” and the “Marine biophysical interactions and dynamics of upwelling systems” CLIVAR Research Opportunities.

AAMP has been involved in several activities with WCRP and its partners. In conjunction with GEWEX, the panel has developed a proposal for a Pan-WCRP Monsoon Advisory Panel. Discussions with IMBER have defined some topics of common interest, such as the definition of the controls of interannual and long-term (including anthropogenic climate change) upwelling, and its impact on ecosystems, use of biogeochemistry and fishery proxies to improve the description of decadal ocean variability, and biophysical feedbacks that affect ocean properties. Closer interaction with the Monsoon Asia Integrated Regional Study (MAIRS) is also been established for investigations of the physical climate system and their impact on sustainability.

In the interest of investigating intraseasonal predictability and prediction, AAMP is collaborating with the WGNE MJO Task Force, YOTC, the WCRP/WWRP Subseasonal to Seasonal Prediction Project, CINDY/DYNAMO representatives, and CLIVAR IOP. Contributions have been made in the development of metrics for assessing MJO skill in models, the development of process-oriented MJO diagnostics, and improving the method of making forecasts of boreal summer intraseasonal variability, among other activities.

Some of the new science directions that the panel will be taking are:

- Jointly with IOP, improve understanding of the role of the Indian Ocean in modulating and limiting predictability of the Asian-Australian monsoon on subseasonal to interdecadal time scales
- Understanding the role of the global oceans for driving monsoon interdecadal variability, especially related to ENSO and its teleconnection to the monsoon, and climate regime changes
- Improved understanding of the role of land surface processes in modulating and providing predictability of the Asian-Australian monsoon on subseasonal to interannual time scales
- Improved understanding, model treatment, and evaluation of the role of aerosols for monsoon variability and change
- Improved understanding of natural variability and anthropogenic forcing in modulating the interdecadal changes of Asian-Australian monsoon
- Development and application of standard diagnostics and metrics for evaluation/validation to CMIP5 and CMIP3 numerical experiments for the East Asian summer monsoon
- Promote a better understanding to the role that land surface processes play in monsoon variability and predictability.

5.2. VAMOS

The report to the SSG was given by Hugo Berbery, co-chair of the Variability of the American Monsoon Systems (VAMOS) Panel. Some of the key science findings that the panel has been involved on: the IntraAmericas Study of Climate Processes (IASCLIP) activities have improved the understanding of the linkages between Intra-America seas warm pool extent and circulation features in the Caribbean and North America that lead to drought persistence, and also developed an improved climatological understanding of the linkage between vertical wind-shear and precipitation anomalies in the Caribbean region. There has been a better climatological characterization of the linkage between MJO-related intraseasonal modes and variability in American monsoon precipitation, with ongoing analyses of the cross-hemisphere flow characteristics and precipitation anomalies in the Americas. In addition to that, the VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS) project has a dedicated EGU journal issue with 60 papers to date.

VAMOS had been involved in developing the CLIVAR Research Opportunities white papers on ‘Intraseasonal, seasonal and interannual variability and predictability of monsoon systems’ and ‘Decadal variability in the climate system and its predictability’. Panel members have also been involved in the planning of the WCRP Conference for Latin America and the Caribbean, as well as providing feedback to the proposal for a Pan-WCRP Monsoon Advisory Panel. VAMOS has also developed or supported a few capacity building activities as part of the CLIVAR VAMOS Workshop on Modelling and Predicting Climate in the Americas, and IASCLIP project. The panel also plans to hold two VAMOS/CORDEX training workshops focused on presentation of regional climate model results and climate modelling capacity building in the corresponding regions.

Some of the new science directions that the panel will be taking are:

- Better understanding of how do cross-hemispheric teleconnections and circulation structures modulate onset and demise of the American monsoon systems;
- Identifying the underlying causes for the persistent sea surface temperature bias structures in coupled ocean-atmosphere models in the tropical Atlantic and how do those biases relate to the seasonal cycles of convection in the Americas;
- Showing the impacts of intraseasonal global modes on the seasonal evolution of the American Monsoon.

5.3. Madden Julian Oscillation (MJO) Task Force

Ken Sperber also presented a short report on the MJO Task Force. The MJO is the dominant form of intraseasonal variability in the Tropic impacting a wide range of weather and climate phenomena: monsoon onset and breaks, ENSO and Indian Ocean Dipole interactions, tropical cyclones, and mid-latitude weather. It is poorly represented in climate models.

The MJO Task Force has five subprojects:

1. Process-oriented diagnostics and metrics for MJO simulation.
2. Boreal summer monsoon ISV monitoring and forecast metrics, and hindcast experiments.
3. Simplified metrics and CMIP5 analysis.
4. Vertical structure and diabatic processes of the MJO.
5. MJO air-sea interaction, including diagnostics and metrics.

As part of their future plans, the Task Force will contribute to WCRP Grand Challenges, providing information on skillful climate information on regional scales and clouds and climate sensitivity. They also plan on developing subprojects on diagnostics and metrics, vertical structure and diabatic heating, and air-sea interaction require most attention, as well as organizing several workshop on some of the topics above.

5.4. Future of the Monsoon Panels

Ken Sperber introduced to participants of the meeting a proposal for the restructuring of monsoons research under CLIVAR. The main goal for a new structure is to have improved coordination in WCRP for monsoon research, a global forum for coordination of monsoon activities, and a mechanism to bring local/national activities to WCRP.

Three possibilities should be considered:

1. Business as usual, with monsoon research in WCRP promoted geographically under CLIVAR AAMP, VAMOS, CLIVAR-GEWEX ACP, and under GEWEX GLASS and GHP RHPs and relying on these panels to be pro-active for developing coordination, including with WGSIP and WGCM.
2. Create a new Pan-WCRP Monsoon Advisory Panel (PMAP), while retaining the local panels in CLIVAR and GEWEX, where one of the main advantages. Two co-chairs would lead the PMAP, one each from CLIVAR and GEWEX. Other members should at least include: a co-chair from each of AAMP, ACP, and VAMOS and from each of GEWEX GASS and GHP/GLASS, in addition two representatives from WGSIP and WGCM. Consultation with panels lead to recommendation of high level PMAP, which would have the same level as WCRP Modelling and Observation Councils, while retaining regional panels as working groups. The coordination of monsoon activities in the regional panels would be done by PMAP. These would also be critical in supporting Regional Climate Outlook Fora (RCOF) improvements. This option would act to minimize overlap in the research efforts between the different panels whilst increasing the global coordination and maintaining the originality and connections at regional level.
3. Re-constitute the regional monsoon panels as the CLIVAR-GEWEX Monsoon Panel, subsuming all of the current monsoon activity in AAMP, ACP, and VAMOS, and then relying on task-teams to tackle regionally specific issues. This would maintain a regional structure, where activities like process studies and integrated work on observation-model-analysis are supported. This option results in a possibly detrimental loss of the regional identity and connections of the old monsoon panels.

Input should be sought on how the different monsoon communities would be best served, supporting the energy and ideas of scientists involved in monsoon research. Martin Visbeck proposed that within 6 years the future monsoon panel should be structured akin to option 3 listed above. However in order to transition to this structure the panels should adopt option 2 as a temporary measure to ensure panel identity and contact with national and international stakeholders and connections are maintained. The concerns raised over this transitional pathway are that there will be political issues with regards to data sharing and co-operation etc. between the regional groups international representatives.

Furthermore, VAMOS was resistant to the idea of a global panel because it felt that it would be Asian-monsoon centric.

ACTION 34 Develop strategy towards one Monsoons Panel with the possibility of regionally focused working groups beneath that.

5.5. Global Synthesis and Observations Panel (GSOP)

Tony Lee presented the activities and accomplishments of the GSOP panel. One of the main contributions from GSOP to CLIVAR science is to evaluate the current generation of ocean synthesis/reanalysis products and to promote their application to study ocean circulation and its relation to climate. The evaluation has led to improved understanding about the consistency and fidelity of many aspects of ocean synthesis products (e.g., heat content, meridional overturning and related heat transport, major ocean current transports, etc.). Several papers have been published related to the evaluation and a program of further activity is underway. GSOP has now started a new initiative which aims to spin up a community effort on exploitation of ocean reanalyses, evaluation, and multi-ensemble products for ocean monitoring. Initial results have been analysed and discussed at the CLIVAR GSOP WHOI Workshop on Ocean Syntheses and Surface Flux Evaluation. A strong suggestion from the SSG was to adopt the obs4MIP framework to service the data available from the ocean synthesis directory

ACTION 35 Encourage adopting CMIP5/obs4MIP service of the ocean synthesis directory.

Another key activity being developed by GSOP concerns ocean-atmosphere surface fluxes, linking CLIVAR and GEWEX interests, and forming a useful basis for synthesis intercomparisons while engaging with a new community. The CLIVAR GSOP WHOI Workshop on Ocean Syntheses and Surface Flux Evaluation has prepared a series of recommendations that aim to improve the measurement and understanding of ocean-atmosphere surface fluxes.

GSOP has been tasked to lead the discussion on ocean climate indices. One key issue from the perspective of the global ocean observing community is the need to create a broader awareness of oceanic variability and its impact on society. There has been much emphasis on ‘world ocean’ averages for IPCC, but regional signals are larger and merit further study.

There is an important need to improve the international coordination of quality-control process and management of the historical subsurface ocean datasets in order to allow climate applications such as ocean synthesis to make informed choices in how to make more effective use of these data. The CLIVAR-GSOP Coordinated Quality-Control of Global Subsurface Ocean Climate Observations Workshop, which will be hosted by CSIRO in Hobart, in June 2013 is working towards this goal.

GSOP began working with the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER), through a collaboration with the Marine Ecosystem Task Team of the Global Ocean Data Assimilation Experiment (GODAE) OceanView program. The role of GSOP on this panel is to ensure that ocean synthesis products meet the needs of

biogeochemistry modeling. GSOP has also begun communicating with the CliC community on Arctic synthesis products. There is, however, scope for further activities to be developed with WGOMD, particularly regarding the ocean synthesis intercomparison initiative.

ACTION 36 WGOMD and GSOP to extend collaborative intercomparison activities.

As a longer term vision, the panel should be playing stronger role in global and regional heat/freshwater budget analysis, coupled synthesis, and analysis for biogeochemical applications. The Integrated Framework for Sustained Ocean Observing (IFSOO) should be followed by GSOP as discussed in previous SSG meetings, including discussion of EOV and ECVs. Discussions on the observing system redesign and evaluation, particularly potential OSSE for TAO are part of the panel's agenda. The panel should actively engage with OOPC's discussion on the needs for the ocean observing system.

ACTION 37 GSOP to provide OOPC active guidance in prioritization needs for the ocean observing system.

ACTION 38 GSOP to co-ordinate with OOPC on implementation of FOO.

ACTION 39 Provide input to OOPC on choice of EOV and ECVs, product requirements and proof of concept work.

5.6. Working Group on Ocean Model Development (WGOMD)

Gokhan Danabasoglu, co-chair of WGOMD, presented the WG (Working Group) report to the meeting participants. Coordinated Ocean-ice Reference Experiments (COREs) were proposed by WGOMD as a venue for comparing global ocean-sea-ice models run under a common prescribed atmospheric state, with boundary fluxes computed via the same bulk formulae.

The second phase of COREs, CORE-II, uses inter-annually varying atmospheric forcing over the 60-year period from 1948 to 2007. In the oceanographic community, the CORE-II simulations are usually referred to as hindcast experiments. These hindcasts provide a framework to evaluate ocean and sea-ice model performance and study mechanisms of time-dependent ocean phenomena and their variability from seasonal to decadal time scales for the recent past. CORE-II hindcast experiments can directly contribute to:

- Evaluation, understanding, and improvement of the ocean components of earth system models
- Investigation of mechanisms for seasonal, inter-annual, and decadal variability
- Attribution of ocean-climate events to trends and forced and natural variability
- Evaluation of robustness of mechanisms across models;
- Bridge observations and modeling, by complementing ocean reanalysis from data assimilation approaches.

Finally, the CORE-II hindcast simulations can provide consistent ocean and sea-ice initial conditions for decadal prediction experiments. Eighteen modeling groups are contributing to this CORE-II effort. The [CORE-II website](http://www.clivar.org/wgomd/core/core-2) (www.clivar.org/wgomd/core/core-2) has been developed to serve the community with information on how to participate in analysis of these CORE-II experiments. A special issue of Ocean Modelling will be produced in late 2014, and the CORE-II website is being advertised as part of the special issue announcement.

Two additional planned studies will focus on the South Atlantic states and representation of ocean circulation in temperature and salinity space, respectively. Other coordinated analysis efforts are encouraged from the CLIVAR community, particularly with a focus on the Pacific and Indian Ocean basins. The data (and potentially plotting / diagnostics tools) are freely available. NCAR has agreed to host and curate the dataset on its ESGF node and is currently testing the service with the NCAR datasets. Information will be available soon on how to access the centralized dataset via the CORE-II website. In the meantime, interested groups can contact the individual modeling groups to obtain the data.

WGOMD is contributing to several of the CLIVAR Research Opportunities and future plans include further contribution in addressing model biases and improved model physics, while also considering biogeochemistry and ecosystems, and high resolution modeling and regional/coastal modeling. Further studies on the role of ocean in decadal variability are also planned, as well support to operational oceanography and data assimilation activities. A direct joint effort with CliC would be studies on sea level and interactions with ice sheets.

One of WGOMD's concerns is over the proposed new CLIVAR structure. WGOMD feels strongly that it is essential for it to meet every 12-14 months, and this could be made difficult with the current structure, potentially making it difficult for successful efforts, like CORE, to happen. One suggestion is to make a distinction between panels and working groups in the new CLIVAR structure, reflecting a more advisory role for the panels.

One of points of discussion was regarding the issue of increasing ocean model resolution, while forcing functions remain at a resolution of half-degree, which has a direct impact on representation of fluxes at mesoscale. A joint WGOMD-WGNE approach is recommended to evaluate that.

ACTION 40 Develop a joint WGOMD-WGNE approach to evaluate representation of fluxes at sub-mesoscale in ocean models.

5.7. CLIVAR/CliC/SCAR Southern Ocean Panel

Hartmut Hellmer, a member of the CLIVAR/CliC/SCAR Southern Ocean Panel (SOP) reported on the panel's activities. The panel is further developing its Vision Document, which will contain some of the key science questions that will be addressed:

- **Sea-level rise:** What are the main contributions to sea-level rise? What are the relative contributions of, for example, steric changes in the ocean versus addition of mass to the ocean from land-ice sources?
- **Ocean modelling:** Which of the identified processes contributing to sea-level rise are well represented by current ocean models? What is the relative importance of steric contributions to sea-level rise compared to the mass induced contributions from ice-sheet melting? How well are ocean and coupled climate models able to predict changes in ocean warming at the ice-sheet margins? What role might sea-ice or polynyas play in moderating or amplifying ocean changes at the ice-sheet margins? How can the use of observations enlighten our understanding of ocean and sea-ice processes adjacent to Greenland and Antarctica? How can we reduce long-term drift in ocean climate models?
- **Ocean/ice-shelf interactions:** What is the state-of-science in both the observation and modelling of sub-ice shelf processes? How might these processes change in a changing climate? What are the relative roles of basal melt, basal accretion, and calving, in determining the current and future evolution of ice-shelves? How might changes in mean or extreme winds affect ice-shelves? What role might be played by sea-ice in buffering ice-shelves from tides and surface waves? What are the effects of increased ice-shelf meltwater injection on local ocean/sea-ice interactions?
- **Ice-sheet observation and modeling:** How well do we understand the current mass balance, including its spatial variability, of the Antarctic and Greenland ice-sheets? What is the state-of-science in ice-sheet modeling? What are the relative roles of ice dynamics and of surface mass balance in determining current and future changes?
- **Ice-sheet/ice-shelf interactions:** How will possible increased melting or break-up of ice-shelves affect ice-sheets? What is the role of ice-shelves on adjoining ice stream dynamics? How well are dynamical ice-sheet models able to simulate ice flow? Are these models capable of predicting the response to changes in the system?

The panel plans to have, following the successful joint workshop on Sea level rise, ocean/ice shelf interactions and ice sheets, a close engagement with WGOMD on Southern Ocean modeling activities, and evaluation of CMIP5 model projections. The panel is also preparing a review paper on the Twentieth century Southern Ocean climate change.

Regarding the observing system in the Southern Ocean, the panel has been an integral part of the Southern Ocean Observing System (SOOS) programme, supporting the design and implementation of an observing system for physical, biogeochemical and ecological processes, which is a formidable challenge, and requires multiple nation and agency involvement. Process studies such as SOP has also constantly evaluated the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES) project. Carbon uptake, CO₂ gas fluxes and support to ecosystem monitoring are also on the panel's agenda, as well as expansion of ocean coverage under sea-ice zone, and studies of atmospheric boundary layer and Southern Ocean clouds.

Center for Southern Ocean Biogeochemical Observations and Modeling (C-SOBOM) is a new initiative with funding proposal been submitted to US NSF. There will be links to several CLIVAR panels and groups, not only in science but also with education diversity and outreach activities. Activities will include undergraduate education and outreach, graduate and postdoctoral training as well as independent non-profit journalism to promote the understanding of climate science.

5.8. CLIVAR/IOC-GOOS Indian Ocean Panel

Tony Lee, a member of the CLIVAR/IOC-GOOS Indian Ocean (IOP), gave a presentation on the panel's activities in the last year. IOP is promoting the implementation of the Indian Ocean Observing System (IndOOS), especially its critical component called the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA). This will continue to dramatically change the data-poor condition for the Indian Ocean and will without question improve the understanding of the monsoon climate system. It will also improve the generally relatively poor model simulation and prediction skills in the monsoon region. The RAMA array is at present 67% complete, with 31 of the designed 46 sites occupied with equipment and/or through ship time contributions from the US, Japan, India, China, Indonesia and France, as well as from regional programs such as ASCLME.

IOP is contributing to several of CLIVAR Research Opportunities. IOP is working closely with AAMP to realize the maximum scientific contribution from observation to prediction. IOP is working on a review paper on the decadal variability in the Indian Ocean, which will also discuss the further research priorities along this direction. In relation to extreme events, the panel has analysed the influences of ENSO and the monsoon seasonal cycle on tropical cyclone activity in the Bay of Bengal (BoB), with some studies helping with prediction of super cyclones in the region. In-situ and satellite data available from the Indian Ocean are being used to understand the intraseasonal and interannual variability. Time series measurements of temperature recorded from RAMA moorings in the BoB and Equatorial Indian Ocean, along with satellite measurements, are utilized to describe the intraseasonal variability of the thermocline in the BoB.

One of the IOP's unique characteristics in the climate space is its scientific collaboration with Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) in the context of characterizing marine biophysical interactions and dynamics of upwelling systems. Key issues underpinning this collaboration include

1. Defining and understanding biogeochemical variability,
2. Developing models of ocean-atmosphere-biosphere interactions
3. Assessing the impacts of climate change on ocean primary productivity and air-sea CO₂ exchange.

Efforts are underway to integrate physical and bio-geochemical scientific research in the IOP/SIBER collaborative context, including the incorporation of selected biogeochemical measurements, such as through the addition of CO₂, pH, Fluorescence, Particle Backscatter, and O₂ sensors to RAMA flux reference sites. This objective has already seen the addition of fluorescence and pCO₂ sensors to two of the equatorial and eastern equatorial Indian Ocean RAMA sites, respectively.

To further develop and enhance this integrating objective between IOP and SIBER, a new activity is in development: “Eastern Indian Ocean Upwelling Research Initiative – dynamics and ecosystem”. The primary objectives of this initiative, which will be initially addressed by a series of workshops, are to

- Discuss scientific issues and topics, including observational and modeling strategies, which should be covered by the Eastern Indian Ocean Upwelling Research Initiative,
- Discuss observational requirements for this initiative: Whether the existing observations are sufficient, if not what are the new observations required to meet the above scientific issues,
- Make a position paper for the Eastern Indian Ocean Upwelling Research Initiative and
- Work out the implementation plan. IOP and SIBER are also jointly engaging in the emerging 50th Anniversary initiative for the International Indian Ocean Expedition (IIOE-2).

IOP engaged in many capacity building activities through the tangible engagement of its members, experts, involved agencies and its regional programs. A good example is the panel’s involvement with In-Region Western Indian Ocean Capacity Building Workshop of the WMO/IOC Data Buoy Cooperation Panel (DBCP) and Partners.

5.8 CLIVAR Indonesia Throughflow – Task Team

Tony Lee also presented a short report on the activities of the *Indonesia Throughflow – Task Team (ITF-TT)*. The main objectives of the ITF-TT is to understand connectivity between ITF and Indian Ocean Dipole (IOD), ENSO and monsoon systems, while coordinating different inflow and outflow observation components. The Task Team is preparing a review paper of the current understanding of the structure, variability and dynamics of the circulation within the Indonesian archipelago, and also a capacity building workshop is planned in Bandung, Java in early 2014, which will provide a capacity building component to train regional scientists with interests in the ITF and its role in the climate.

5.9 Pacific Panel

Alexandre Ganauch presented the activities of the Pacific Panel. The Panel is actively overseeing activities studying western boundary currents: NPOCE, GAIA, INSTANT-II, OKMC, SPICE and PACCS. The panel is also spearheading new activities to improve our understanding of the South Pacific Convergence Zone (SPCZ). Research conducted by projects in the Pacific’s western boundary currents region will provide the necessary understanding to support climate studies and impacts in the region. As an example, changes in the Northwestern Pacific (NWP) water properties and ocean circulation can influence the heat and freshwater budget and hence the atmospheric deep convection and the changes in air-sea interactions over the Indo-Pacific warm pool, thereby playing a role

in modulating ENSO cycles and the East Asian Monsoon variations, as well as in the development and evolution of the NWP cyclones.

The Panel has been in discussion with NOAA, on issues of declining report from the US-sponsored TAO array, and on the future of TAO array. The underlying question is "how best to develop a more sustainable and helpful ocean observing system to the tropical Pacific" given the scientific and societal needs, new knowledge, and new technology. Pacific Panel members will actively take part on the workshop that NOAA and JAMSTEC are organising. The panel should emphasize, when assessing the tropical array, that high skill in ENSO/tropical prediction is a great service for society.

Panel members organised "The third CLIVAR workshop on the Evaluation of ENSO Processes in the Climate Models" which was held 21-23 January 2013 in CMAR's Hobart site. The workshop reviewed the latest El Niño-Southern Oscillation paradigms, past, present and future ENSO simulation, and the importance of ocean observations in improving ENSO in climate models. One of the outcomes is to further calibrate the IPCC Fifth Assessment statement on how ENSO may change in a warming climate.

The panel has also actively contributed to two of CLIVAR's Research Opportunities: Regional sea-level rise and extreme events, both with large impacts for countries in the Pacific basin, mainly Small Islands States. Long-term sea level changes are driven by a combination of anthropogenically forced climate change and natural climate variability. A clear understanding of the natural sea level variability at decadal to multidecadal timescales is crucial to confidently attribute the long-term sea level changes found in observations. Recent regional long-term sea-level variations in Indo-Pacific are largely wind-driven. Wind-induced sea-level changes may delay sea-level rise in some regions in the Southwestern Pacific by up to several decades. Some models do not capture well the magnitude of recent sea level trends although the pattern of those trends is well captured.

Rising mean sea level projects onto changes in extreme events. In addition to an increase in sea level extremes, more extreme events are expected as a response of the South Pacific Convergence Zone to greenhouse warming, including droughts and tropical cyclones in regions not accustomed to such events. Further, accelerated warming along western boundary currents may lead to change in cyclone tracks and frequency. Panel members interacted with South Pacific Regional Environment Programme on using climate information in the organisation's climate change action and adaptation plan.

5.10 Atlantic Panel

Peter Brandt presented the report of the Atlantic Panel. With the end of the CLIVAR TACE program and in cooperation with VOCALS, the Atlantic Panel is assisting the development of a new direction of tropical Atlantic research directed towards a better understanding of the role of the eastern tropical upwelling systems in tropical Atlantic variability (TAV). This includes the improvement of the long-term observing system (southeast extension of PIRATA), new process studies (heat and freshwater budget studies in eastern boundary upwelling), as well as the bias reduction of coupled model. The goals are to:

- Improve the prediction of TAV

- Identify possible oceanic contribution to the eastern Atlantic SST bias in coupled models,
- Better understand future projection of the impact of TAV on marine ecosystem and fisheries in eastern boundary upwelling systems (in cooperation with SOLAS/IMBER).

The Atlantic Panel will continue to oversee the AMOC observing system in the subpolar, subtropical North Atlantic, as well as tropical and South Atlantic; support the continuation of TACE, through the EU-PREFACE proposed international project with many African partners and strong capacity building aspects, in order to enhance predictability and understanding of tropical Atlantic variability and climate change.

Future directions for the panel include: with Pacific and Indian Ocean Panels, the development of a framework on ocean deoxygenation and oxygen minimum zones; contribution to WCRP Grand Challenges and CLIVAR Research Opportunities on decadal variability; develop activities, jointly with US CLIVAR ETOS Working Group on the eastern tropical Atlantic bias problem, and lead a CLIVAR/IMBER/SOLAS cooperation in the tropical Atlantic, focusing on eastern boundary upwelling systems including ecosystem management, fisheries, and socio-economic impacts. The panel is also supporting further developments in capacity building with African participation in tropical Atlantic research, with focus on coasts and upwelling.

One issue that has been suggested to the Atlantic Panel is increase engagement with WGOMD, particularly on aspects of eastern tropical Atlantic bias and analysis of the Atlantic variability from the CORE2 model experiments.

ACTION 41 Request panels to articulate what main science questions are likely to make rapid progress through coordination.

5.11 CLIVAR/CCI/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI)

The CLIVAR/CCI/JCOMM Expert Team (ET) on Climate Change Detection and Indices (ETCCDI) report was presented by their co-chair, Xuebin Zhang, ETCCDI's activities are central to the Grand Challenges on the science underpinning the prediction and attribution of extreme events and provision of skillful future climate information on regional scales. Several ETCCDI members are involved in the development of WCRP Grand Challenges and CLIVAR Research Opportunities on climate extreme documents and implementation plan. One of the main activities of the ET is maintaining a sustained programme of regional workshops that drive capacity development in less developed regions where both data availability is scarce and/or data accessibility is difficult, helping regional climate service. The results from the workshops are published in the peer-reviewed literature and will continue to be an important contribution to the IPCC assessments. The ET continues to develop this successful workshop formula, looking at ways to increase regional collaboration and participation in international activities of scientists involved in its capacity development activities. In addition to the workshops, software for indices calculation and data homogenization and indices data derived from observations and

model simulations are freely available and are becoming important resources for research on climate extremes.

The ET has been working with the support of the ClimDEX Project to produce global gridded indices of temperature and precipitation extremes. This activity has produced several global datasets of these indices including HadEX2 (an updated HadEX indices product). They also plan to update indices for observations and CMIP5 output.

The key science questions that the ET is planning to address in the next few years are related to the detection of anthropogenic influence on regional extremes and attribution of extreme climate events, as well as looking into mechanisms by which modes of ocean-atmosphere variability affect weather and climate extremes, and how these modes of variability may change under global warming and possible impacts on future weather and climate extremes.

Some of the challenges that the group will face are linking WCRP science on extremes to CCI adaptation and climate service needs, and keep their work plan focused, while enhancing traditional indices work as demands grow, considering new areas and developing marine indices, such as sea level rise, wind and waves.

5.12 CLIVAR/PAGES

J. Jungclaus presented this report. At the outset of this session it was firmly established that the group should be referred to as CLIVAR/PAGES rather than any other derivative and that the PAGES community were happy to take the backseat in the name. By making this decision hopefully a more consistent terminology will now be adopted when referring to this working group.

The group has not formally met since 2011 despite a PAGES OSC in February 2013 in Goa, India. The Goa meeting was a success on many levels despite the CLIVAR/PAGES community not meeting up. An ECS OSC meeting was held in the two days preceding the main OSC. This event was well received by the ECS community in attendance and overall it was taken very seriously as it was clear that this was a dedicated ECS event. The next time the group plans to meet will be in autumn 2013 when the transition of the group membership and co-chairs will be discussed.

Whilst it was clear to the CLIVAR SSG community that much work had been undertaken and completed by the Ocean 2K initiative it was unclear what this group has done which wouldn't have otherwise happened within the PAGES community. It was stressed that this group really drives the connection between the paleo-record and modern day to future prediction of climate variability and provides access to data from timeframes that would otherwise not be accessible. Such data can help to provide mechanistic explanations for current observations in climate variability. It was suggested that perhaps the way forward for this group would be to integrate relevant experts from the paleo community into the CLIVAR panels and working groups, which would otherwise be missing an opportunity to have access to such data. Furthermore, such a move would hopefully enhance cross-fertilization of paleo and modern communities of researchers. However, the opposite

could also be useful, integrating CLIVAR scientists into the PAGES working groups. Consequently the way forward is not clear-cut.

6. Reports from national and international CLIVAR offices

6.1. ICPO Report & Discussion of Issues arising from written national reports

CLIVAR's organizational structure is in the processing being reviewed, noting changes from 2012 to 2013. The future plans for the ICPO, from April 2014 onwards, were presented in basic terms to the wider community. An overview was also provided of how the ICPO has been communicating CLIVAR science, issues and the overall organization to the wider community through Exchanges publications, panel meetings and workshops

It was noted that seven countries have also provided written national reports of activities related to CLIVAR. It is important to give those reports increased visibility in order to better engage the scientific community of those and other countries. Once uploaded on the CLIVAR website, the location of these reports will be advertised to the wider CLIVAR scientific community, via the bulletin, social media and news articles on the website.

ACTION 42 Provide higher priority and visibility to national reports on website.

6.1.1. Report on ECS outreach, EGU Town Hall, input on new name

CLIVAR has taken steps to start an Early Career Scientist (ECS) network. It was noted that CLIVAR already has some contact with the ECS community through the Open Science conference, held in 2011 and that these contacts should be utilized in the new ECS network.

ACTION 43 Integrate the ECS registered at the CLIVAR OSC into the ECS network.

Currently the principal aim of the network is to act as a resource for ECS to connect with one another and to find useful resources hosted on the ECS pages of the CLIVAR website. The network is still in the very early stages of development. Unlike APECS, which is a grass-roots organization the CLIVAR network is currently top down. It is hoped that with time and further development this will be reversed in order to create a more sustainable bottom up structure to the network. In order to do this it was suggested a core group of people should be identified who would work with the project office at the outset to develop terms of reference and establish how the ECS and wider CLIVAR communities will interact.

ACTION 44 Work on transitioning the network from top down to a bottom up structure. ICPO to develop a plan on how to give ECS the "lead" on the CLIVAR ECS network; ask Panels and WG to provide ideas.

Currently CLIVAR ECS are defined as being within five years of graduation for their most recent degree. However, it was suggested that this was too restrictive especially as it is becoming harder to find permanent positions. It was suggested that no age range should be applied, if you feel like an ECS then you are.

ACTION 45 Revise the current age range of CLIVAR ECS

Concern was raised over whether the CLIVAR organization as a whole was too large for effective engagement with ECS. Perhaps the best way of breaking the CLIVAR structure down into a more manageable size is to get the panels and working groups to better interact with the ECS. This is the approach that US CLIVAR has taken to better interact with ECS. Furthermore there needs to be something concrete that ECS will see of benefit to them in the network to encourage their engagement.

ACTION 46 Create opportunities at major meetings (AMS, Ocean Sciences) for Panel discussions involving experienced and Early Career scientists.

It was suggested that to make the ECS network look like a fun and dynamic group, images of people in the field and interacting with other ECS should be used. This will help to make it feel more like an interactive community. It was recommended to refer to the images used on the APECS website.

ACTION 47 Design better web space/pages for ECS including development of images used.

The remaining discussion during this session focused firstly on the input from the ECS network on the new CLIVAR name and on CLIVAR's presence at EGU 2013. The SSG participants gratefully acknowledged the ECS feedback on the CLIVAR name, although a point of caution was noted that the ECS community should not be repeatedly asked for their opinions on the 'new CLIVAR' as this may be disengaging.

6.1.2. Discussion of CLIVAR Strategy to address societally-relevant research opportunities/challenges and knowledge exchange

The societal relevance of the proposed research topics was mentioned in many of the tiger team reports. As a group of scientists there is a personal interest in the field. However, when undertaking science the funders and users of the science also need to be kept in mind. Consequently identifying the users of CLIVAR science is an important process to undertake because it will help to target the communities' research efforts. It is important to realize that CLIVAR is one part of a very large and integrated network of scientists, organizations, governments and individuals who will benefit from scientific research on different levels.

It is unlikely that the CLIVAR community will ever directly interact with the end users (e.g. farmers who are affected by climate change). Instead the users of CLIVAR science are the 'middle men', typically meteorological and climate services, and the climate research community. It would be useful for the CLIVAR community to specifically identify who the current users of the CLIVAR science are. With this identification the community would be

able to determine if there is sufficient interaction with the users and links with meteorological services. Thought should also be applied to how CLIVAR can better interact and interface with existing connections with meteorological services.

WCRP has implemented the Global Framework on Climate Services (GFCS). Other programmes have grown and developed from the GFCS, such as the U.S. Climate Services Partnership. The Climate Services Partnership provides a network of people who undertake climate services as part of their jobs. Such a group is perhaps something that could be implemented at WCRP level to promote and enhance climate services across the core projects, identifying specific user needs. However, in regions such as Africa where there are few facilities and infrastructure in place, the local scientific community would struggle to fit into this sort of a framework. Currently users in Africa see CLIVAR itself as the main mechanism to bring in capacity and strengthen meteorological services. Consequently a careful balance would need to be struck when further developing a working group to implement climate services and user needs at either CLIVAR or WCRP level.

6.2. U.S. CLIVAR Report

A new science plan has been developed to organize climate research in the US aiming to:

- Improve understanding and prediction of global climate variability and change,
- Reinvigorate the US science community interest in and engagement of U.S. CLIVAR,
- Bolster funding commitments by US agencies to achieve their mission objectives.

It will be open for public review in June and will be finalized and released in December 2013.

Fundamental science questions are:

- How predictable is the climate on different time and space scales?
- What climate processes are critical for improving simulation of climate variability in climate models?
- What changes in climate variability will determine the regionalization of climate change?
- What are the connections and feedbacks between climate variability and other components of the climate system?

The goals are to:

- Understand the role of the oceans in climate variability on different time scales.
- Understand the processes that contribute to climate change and variability in the past, present, and future.
- Better quantify uncertainties in the simulations and projections of climate variability and change.
- Improve the development and evaluation of climate simulations, and collaborate with the research community.

The research challenges are:

- Decadal variability and predictability.
- Climate extremes.
- Polar climate.

- Climate and carbon/ biogeochemistry.

The benefits of enhanced international co-operation:

- Entraining broad expertise.
- Responding to multiple interests at planning stage.
- Leveraging through multi-lateral co-sponsorship planning stage, and the leveraging through multi-lateral co-sponsorship.

ACTION 48 Feedback to IAG the appreciation of US support and note the international effort resulting from it.

ACTION 49 Develop enhanced interaction between the IAG and CLIVAR leadership in the coming years.

7. CLIVAR Organization post 2014

To reflect the renewed emphasis on the role of the oceans in climate, the SSG discussed some potential shifts in responsibilities of the existing panels. The remit of CLIVAR should remain; think globally but act locally and is consequently reflected in the new organizational structure (Figure 2). In order to ensure continuity of important ongoing activities, the transition to the new structure would be gradual, with some changes being implemented immediately and others taking several years to take effect.

The SSG agreed that the new structure would be further discussed at the pan-CLIVAR meeting in July of next year, giving the panels time to develop new terms of reference and membership proposals. The pan-CLIVAR meeting would also present an opportunity to discuss the proposed changes with the panel members and with representatives from other projects and in particular GEWEX.

ACTION 50 Propose to the JSC the organization of a Pan-CLIVAR meeting in the Hague, 16-18 July 2014, in association with the GEWEX Science Conference

The most important change to the overall CLIVAR structure would be the creation of “Research Opportunities”. The SSG had been very impressed by the presentations by the Tiger Teams that had been formed at the last SSG meeting, and by the two new proposals brought forward at this meeting. They saw the “Research Opportunity” as a means for the Project to remain flexible and respond to new developments in the field while the panels maintained a focus on the core activities critical to advancing CLIVAR and WCRP goals with respect to the oceans’ role in climate. The Research Opportunities also represented a pathway for CLIVAR contributions to the WCRP Grand Science Challenges and are expected to combine expertise across CLIVAR panels, experts from other ECRP projects or the wider Global Environmental Change community (IGBP, Diversitas and IHDP soon under Future Earth).

The essence of all the panels and working groups will remain in the new CLIVAR structure as they provide continuity and long-term foci for ocean and atmosphere climate research.

However, the terminology used in the naming of the panels and working groups is being streamlined. All panels and working groups will be simply known as panels, which have a clearly regional focus, in the case of the ocean basins. The word implementation will also be dropped from the CLIVAR vocabulary. The panels effectively set the scientific agenda within the CLIVAR community. However, it must be noted that setting the agenda is not implementing the science. The implementation is actually done at institutional level rather than the CLIVAR community level.

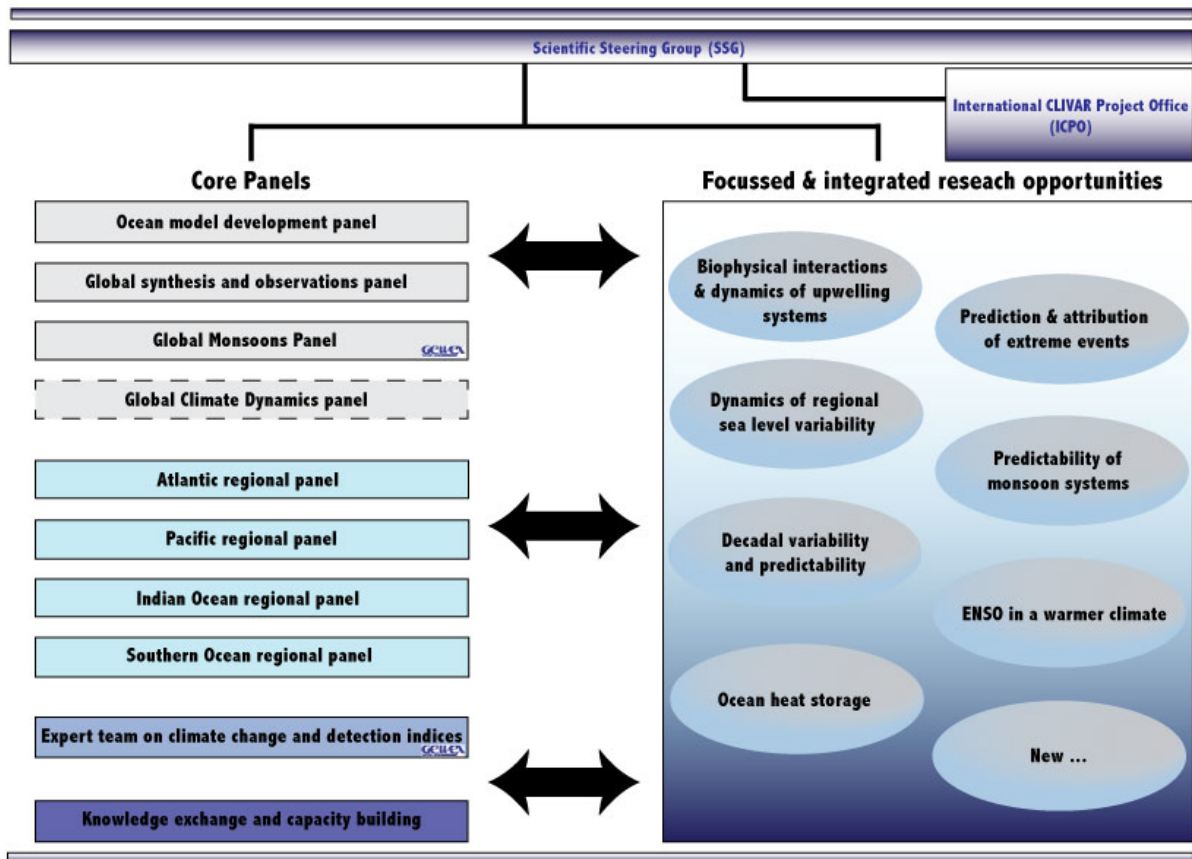


Figure 2 The new organizational structure of CLIVAR reflecting the changes to the core panels and development of new CLIVAR research opportunities.

7.1 The way forward

7.1.1 Research Opportunities

To reflect the new remit of CLIVAR research it was decided that the words describing CLIVAR (Climate Variability and Predictability) would be adjusted. It was decided that CLIVAR would henceforth be known as:

CLIVAR (CLIMATE & OCEAN: variability, predictability and change).

Currently the tiger teams are developing prospectuses highlighting the gaps in the scientific understanding of each of the research opportunities. However, these prospectuses are not focused enough to be answered over a five-year period. Further

refinement of the research opportunities are needed to provide a focused science remit, which will be able to produce an achievable outcome in five years.

ACTION 51 ICPO to work with Tiger Team leads to put out a targeted call for further input from the wider CLIVAR community to refine the research opportunities.

In order for these pop up task teams to be a success there needs to be a formal mechanism in place whereby members of the CLIVAR panels can propose a new research opportunity for review by the SSG. The research opportunities should be bottom up proposals from the CLIVAR community. This will hopefully ensure that the research opportunities are non prescriptive and reflect the current interests and directions of the current CLIVAR research community.

ACTION 52 ICPO to work with SSG to design an official proposal mechanism to enable members of the CLIVAR community to put their research ideas forward for review.

7.1.2 Panel memberships and operating terms of reference

The JSC has implemented a new procedure whereby each of the WCRP projects proposes names for their SSG members to the Vice-Chair of the JSC before contacting each candidate. A similar procedure should be implemented for CLIVAR panels, where proposed names should be approved by the CLIVAR SSG before candidates are contacted. Panel positions should be advertised through the CLIVAR Bulletin and CLIVAR Exchanges, promoting opportunities to engage in CLIVAR panels and inviting nominations (including self-nominations). This procedure was endorsed by the SSG.

ACTION 53 Adopt/instate new JSC approach for membership of proposing potential candidates to SSG for an initial selection, ahead of contacting the candidates.

7.1.3 Global monsoon panel

The Monsoon panel will continue with a global coverage and regional focus. However, it currently remains unclear how this panel interacts with both the CLIVAR monsoon tiger team and GEWEX community. The existing working groups will continue under the name of the Global Monsoon Panel but will keep their original identity. Over the course of the next five years they will gradually merge into the single CLIVAR/GEWEX Global Monsoon Panel after regional partners have been informed of changes. The development of the CLIVAR GEWEX interaction on monsoons should be made a priority over the coming months with significant work and interactions being set up before the pan GEWEX-CLIVAR meeting. This will enable more mature discussions to be undertaken about the tasks to tackle as a joint community during the pan GEWEX-CLIVAR meeting.

7.1.4 Atmospheric Dynamics Panel

It was proposed that a new CLIVAR panel should be developed within the new CLIVAR structure. The purpose of this panel is to bridge the CLIVAR and GEWEX communities addressing large-scale atmospheric dynamics research, especially focusing on understanding of the fundamentals of atmospheric dynamics and the contribution it makes to climate predictability. Such a panel is likely to have inputs from the GEWEX and SPARC communities and will contribute to the WCRP GC on Regional Climate Information. This concept will be presented to the JSC at the forthcoming JSC34 meeting.

ACTION 54 Present the concept of a new CLIVAR climate dynamics panel at the JSC meeting, proposing CLIVAR championing of the panel development.

7.1.5 Launch of the new CLIVAR

The launch of the new CLIVAR will be critical and is planned for the 2014 Ocean Sciences meeting, in Hawaii. Post this date further roll out could be co-ordinated with the release of the U.S. CLIVAR implementation plan. Such collaboration with U.S. CLIVAR would further engage users and funders in the new CLIVAR activities, and present to community as a cohesive whole. A session for stakeholders and funders could not be hosted at the pan GEWEX/CLIVAR meeting at The Hague in 2014. Care should be taken not to focus exclusively on rolling out the new CLIVAR to just the ocean science community. Engagement with the atmospheric community is also needed and perhaps could be best reached through AMS and EGU meetings where launch events could be organized.

ACTION 55 Co-ordinate US CLIVAR science plan rollout with International CLIVAR roll out at the American Geophysical Union (AGU) and Ocean Sciences

In order to be able to launch the new CLIVAR a short prospectus will be produced concisely detailing the CLIVAR science plan and implementation strategy .

ACTION 56 ICPO to work with SSG on drafting a short CLIVAR prospectus, detailing the science plan and implementation strategies.

In order to roll out the new CLIVAR in this short timeframe an editorial team will be put together from the existing SSG members to help develop and edit the documents produced.

ACTION 57 Draw up an editorial board from the existing CLIVAR SGS members to help with the final production of the prospectus and other relevant documents.

Appendix 1: Agenda

CLIVAR SSG-20
Kiel, 6-9 May 2013 (Mon-Thurs)

AGENDA (V.11)

Open Session: 09:00 Monday 6 May-15:00 Thursday 9 May
Executive Session (core SSG members): 15:00-17:00, Thursday 9 May

Summary of daily activities:

Day 1 – Intro, JSC/WCRP update including WCRP modeling & WDAC; Clouds GC; reports from WCRP Projects; OOPC; ocean indices; USCLIVAR; ICPO report & issues arising from national reports; ECS outreach; capacity development

Day 2 – Tiger Team reports – 1 hour: 15 min presentation of key science issues; 15 min implementation strategy, links to WCRP GCs and other Project Science Questions; 30 min disc;

Late afternoon/evening outing

Day 3 – CLIVAR Panel reports and discussion of future panel activities and working arrangements with other groups

Day 4 – Discussion of way forward (including panel functions/structure, co-design strategies, communication, “new” CLIVAR launch, name, logo, future panel structures & TOR), review of actions and recommendations, followed by:

- Executive Session – SSG core members

MONDAY 6 MAY: START OF DAY 1

Chair: Martin Visbeck

09:00	1. INTRODUCTION TO SSG-20	
	1.1. Local arrangements	15 min
	1.2. CLIVAR meeting objectives	30 min
	Presentation - M.Visbeck, L.Goddard	
	2. WCRP UPDATE	
	2.1. Recent developments in WCRP	45 min
	Presentation - A.Busalacchi	
10:30	Coffee break	
11:00	2.2 WCRP Grand Challenge on Clouds, Circulation and Climate Sensitivity	20 min
	Presentation - B. Stevens	

11:20	3. REPORTS FROM WCRP PROJECTS AND ACTIVITIES, including their input to WCRP GCs	
	3.1. GEWEX Presentation - K. Trenberth	40 min
	3.2. CliC Presentation - J. Baeseman	30 min
12:30	Lunch	
13:30	3.3. SPARC Presentation - E. Manzini	30 min
14:00	4. OOPC Presentation - K. Hill	20 min
	5. Ocean Indices Presentation - E. Harrison + T. Lee	20 min
	6. Discussion	20 min
15:00	Coffee break	
15:30	7. US CLIVAR report USA National Report Presentation - M. Patterson	30 min
16:00	8. ICPO report & discussion of issues arising from written national reports UK National Report Presentation - R. Barry	30 min
16:30	Chair: Lisa Goddard	
	9. Report on ECS outreach, EGU town Hall, input on new name, etc. ECS Outreach Report ECS Survey Report Presentation - J. Riley	30 min
	10. WCRP capacity development strategy and disc of CLIVAR involvement Presentation - R. Boscolo - via skype	30 min
	11. WCRP regions (L. America and Africa workshop) 11.1 Presentation - H. Berberry 11.2 Presentation - A. Pirani	30 min

18:00	Adjourn for day 1 – Ice breaker GEOMAR building	
	TUESDAY 7 MAY: START OF DAY 2 – Tiger Team Reports	
	Chair - Goddard	
09:00	12. Intro to CLIVAR role vis a vis WCRP Grand Challenges – Presentation - M. Visbeck	15 min
09:15	13. Intraseasonal, seasonal and interannual variability and predictability of monsoon systems Monsoons Report Presentation - A. Turner, lead	35 min
10:00	14. Decadal variability and predictability of ocean and climate variability Decadal Variability Report (14.1 Presentation - G. Danabasoglu) (14.2 Presentation - E. Hawkins)	35 min
10:25	Coffee break	
11:05	15. Trends, nonlinearities and extreme events Extremes Report (15.1 Presentation - X. Zhang, lead) (15.2 Presentation - S. Schubert)	35 min
11:40	16. Marine biophysical interactions and dynamics of upwelling systems Upwelling Report Presentation - K. Drinkwater, lead	35 min
12:15	17. Dynamics of regional sea level variability Sea Level Report Presentation - C. Boening	
12.55	Lunch	
14.00	18. Consistency between planetary heat balance and ocean heat storage Ocean Heat Storage Report Presentation - K. von Schuckman	20 min
14:20	19. ENSO in a warmer world ENSO Report Presentation - T. Lee	20 min
15:30	Depart for excursion/dinner Kiel Molfsee (tbc)	

Joint Panel Dinner

WEDNESDAY 8 MAY: START OF DAY 3

Chair: Steve Rintoul

- 09:00 20. CLIVAR PANELS AND WORKING GROUPS**
PRESENTATIONS -summary of key progress, issues for SSG and plans related to CLIVAR “research opportunities”
(30 min each for presentation and discussion)
- 20 Regional activities Chair: Lisa Goddard**
- 20.1 AAMP Report 30 min
 a. Presentation - AAMP (K. Sperber)
 b. Presentation - MJO TF (K. Sperber) 30 min
- 20.2 VAMOS Report
 Presentation - VAMOS (H. Berberry)
- 10:30 Coffee break**
- 11:00 21 Global activities Chair: Lisa Goddard**
- 21.1 Report GSOP 30 min
 Presentation - GSOP (T. Lee) 30 min
- 21.2 Report WGOMS
 Presentation - WGOMD (G. Danabasoglu)
- 12:00 22 Ocean basin activities Chair: Steve Rintoul**
- 22.1 Report SOP 30 min
 Presentation - Southern Ocean (H. Hellmer)
- 12:30 Lunch**
- 13:30 22.2 Report IOP 30 min**
 a. Presentation - Indian Ocean Panel (T. Lee)
 b. Presentation - Indonesian Throughflow WG (T. Lee) 30 min
 30 min
- 22.3 Report PP
 Presentation - Pacific (A. Ganachaud)
- 22.4 Report AIP
 Presentation - Atlantic (P. Brandt)
- 15:00 Coffee break**
- 15:30 23 Joint activities Chair: Martin Visbeck**

	23.1 Report ETCCDI	30 min
	Presentation - ETCCDI (X-B. Zhang)	
	23.2 Report CLIVAR/PAGES	30 min
	Presentation - CLIVAR PAGES (J. Jungclaus)	
16:30	24 Working arrangements with other WCRP programmes and WGs, GFCS and the Future Earth family (in particular, GEWEX, SPARC, CliC, WGCM, WGSIP, WMO CCI, OOPC, IMBER, PAGES) (M. Visbeck)	60 min
	24.1 Presentation – WMAC (H. Berberry)	
	24.2 Presentation - Future Earth (M. Visbeck)	
17:30	Adjourn day 3	
	THURSDAY 9 MAY: START OF DAY 4	
	<i>Chair: Lisa Goddard</i>	
09:00	25 Discussion on future panel functions/structure /implementation plans)	45 min
	Presentation - S. Rintoul	
09:45	26 Discussion of CLIVAR Strategy to address societally-relevant research opportunities/challenges and knowledge exchange (L. Goddard)	45 min
10:30	Coffee break	
	<i>Chair: Lisa Goddard</i>	
11:00	27 WCRP communications strategy	20 min
	Presentation - J. Riley	
11:20	28 Discussion of way forward (including new CLIVAR launch, name, logo, communications team activities)	40 min
	Presentation V. Detemmerman (Discussion leader)	
12:00	29 Panel member renewal/structure (general) and TORs	30 min
	Presentation – a. CLIVAR Structure M. Visbeck	
	Presentation – b. CLIVAR Structure2 M. Visbeck	
12:30	Lunch	
13:30	30 Review of actions and recommendations	30 min
	31 Place and date of next SSG meeting	15 min

	32 Closing remarks	15 min
14:30	Coffee break	
15:00	Executive session - SSG core members	120 min
17:00	End SSG 20	

Appendix 2: Participants

Name	Email	Panel/Affiliation
SSG MEMBERS		
Martin Visbeck	mvisbeck@geomar.de	CLIVAR SSG (Co-chair)
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PAGES/CLIVAR
GEOMAR

Appendix 3: Acronyms

AAMP	Asian-Australian Monsoon Panel
AMS	American Meteorological Society
AMV	Atlantic Multidecadal Variability
AOPC	Atmospheric Observation Panel for Climate
AP	Atlantic Panel
APECS	Association of Polar Early Career Scientists
CCCC	Caribbean Community Climate Change Centre
CCI	Commission for Climatology
CliC	Climate and Cryosphere
CLIVAR	Climate Variability and Predictability
CMIP	Coupled Model Intercomparison Project
CORDEX	Co-ordinated Regional Climate Downscaling Experiment
CORE	Coordinated Ocean Reference Experiment
CSOBOM	Centre for Southern Ocean Biogeochemical Observations and Modeling
DAC	Data Advisory Council
DBCP	Data Buoy Cooperation Panel
DIMES	Diapycnal and Isopycnal Mixing Experiment
DYNAMO	Dynamics of the Madden-Julian Oscillation
DYNVAR	Modelling Dynamics and Variability of Stratosphere-Troposphere System
ECS	Early Career Scientist
ECV	Essential Climate Variable
EGU	European Geosciences Union
ENSO	El Nino-Southern Oscillation
EO	Earth Observation
EOV	Essential Ocean Variables
ESA	European Space Agency
ESGF	Earth System Grid Federation
ETCCDI	Expert Team on Climate Change Detection and Indices
GASS	Global Atmospheric Systems Science
GC	Grand Challenge
GCM	Global Climate Model
GCOS	Global Climate Observing System
GDAP	GEWEX Data and Assessments Panel
GEWEX	Global Energy and Water Cycle Experiment
GFCs	Global Framework on Climate Services
GHP	GEWEX Hydrometeorology Panel
GLASS	Global Land Atmosphere Systems Study
GOOS	Global Ocean Observing System
GODAE	Global Ocean Data Assimilation Experiment
GSOP	Global Synthesis and Observations Panel
IAI	Inter American Institute
IASCLIP	Intra Americas Study of Climate Processes
ICPO	International CLIVAR Project Office
IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere-Biosphere Programme
IIOE	International Indian Ocean Expedition

IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IOC	Intergovernmental Oceanographic Commission
IOD	Indian Ocean Dipole
IOP	Indian Ocean Panel
IPCC	Intergovernmental Panel on Climate Change
ISVHE	Intraseasonal Variability Hindcast Experiment
JAMSTEC	Japanese Agency for Marine Earth Science and TEchnology
JPS	Joint Planning Staff
JSC	Joint Scientific Committee
MISO	Monsoon Intra Seasonal Oscillation
MJO	Madden-Julian Oscillation
NACLIM	North Atlantic Climate Variation Project
NAO	North Atlantic Oscillation
NCAR	National Centre for Atmospheric Research
NGO	Non Governmental Organisation
NOAA	National Oceanic and Atmosphere Administration
NOCS	National Oceanography Centre Southampton
NPOCE	Northwestern Pacific Ocean Circulation & Climate Experiment
NSF	National Science Foundation
NWP	North West Pacific
OOPC	Ocean Observation Panel for Climate
OSSE	Observation System Simulation Experiment
PAGES	Past Global Changes (an IGBP project)
PDO	Pacific Decadal Oscillation
PICES	North Pacific Marine Science Organisation
PIRATA	Prediction and Research Moored Array in the Atlantic
PMIP	Paleoclimate Modelling Intercomparison Project
PP	Pacific Panel
RAMA	Research Moored Array for African-Asian-Australian Monsoon Analysis & Prediction
SIBER	Sustained Indian Ocean Biogeochemical and Ecological Research
SCOR	Scientific Community on Ocean Research
SNAP	Scenarios Network for Alaska and Arctic Planning
SOLAS	Surface Ocean Lower Atmosphere Study
SOP	Southern Ocean Panel
SPARC	Stratospheric Processes and their role in Climate
SPCZ	South Pacific Convergence Zone
SPICE	Southwest Pacific Ocean Circulation and Climate Experiment
SSG	Scientific Steering Group
TACE	Tropical Atlantic Circulation Experiment
TAV	Tropical Atlantic Variability
TT	Tiger Team
TAO	Tropical Atmosphere Ocean Project
UNESCO	United Nations Scientific Educational and Cultural Organisation
VOCALS	VAMOS Ocean Cloud Atmosphere Land Study
VAMOS	Variability of the American Monsoon Systems
WCRP	World Climate Research Programme
WDAC	WCRP Data Advisory Council
WESTPAC	10C Sub-commission for the Western Pacific

WG	Working Group
WGCM	Working Group on Coupled Modeling
WGNE	Working Group on Experimental Experimentation
WGSIP	Working Group on Seasonal to Interannual Prediction
WGRC	Working Group on Regional Climate
WGOMD	Working Group on Ocean Model Development
WWRP	World Weather Research Programme
YOTC	Year of Tropical Convergence