

# WCRP REPORT

World Climate Research Programme



ICSU  
International Council for Science



## Project Report

**23<sup>rd</sup> Session of the CLIVAR Scientific Steering Group**

**Indian Institute of Tropical Meteorology; Pune, India  
27-30 November 2017**

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## **EXECUTIVE SUMMARY**

The 23<sup>rd</sup> Session of the CLIVAR Scientific Steering Group was held at the Indian Institute of Tropical Meteorology; Pune, India from 27<sup>th</sup> to 30<sup>th</sup> November 2017, and brought together the members of the Scientific Steering Group, co-chairs of the Panels and Research Foci, other WCRP core projects, and invited speakers to review progress, identify opportunities, develop strategies to achieve CLIVAR's objectives and finalize discussions on the new CLIVAR Science Plan. Over 35 participants gathered (in Pune or remotely) for three and a half days of plenary, breakout presentations and discussion.

Two public events were held as outreach activities: a one hour Public Lecture on modelling of the Indian monsoon; and a five hour Science Workshop with four lectures from CLIVAR members and six presentations from Indian scientists. The events were attended by over 40 researchers from several Indian institutions and the participants of the SSG meeting.

A representative of each Panel and Research Foci presented highlights of the activities implemented during 2017, plans for the next year and proposals for membership changes. The latest draft of the CLIVAR Science Plan was discussed as were plans for its finalization. Participants also heard about overall program direction, updated international program goals, and other agencies interests and opportunities. Further details on the meeting are available at the SSG meeting website (<http://www.clivar.org/events/23rd-session-clivar-scientific-steering-group>).

The Scientific Steering Group met on the last day of the meeting to discuss the outcomes, make recommendations, and decide on next steps. The following table summarizes the outcomes of the meeting (divided into Actions, Recommendations and Decisions).

**Outcomes: ACTIONS – RECOMMENDATIONS AND DECISIONS**

	<b>ACTION</b>	<b>Responsible</b>	<b>Due by</b>
<b>1</b>	<b>TPOS2020</b>		
1.a	To revise letter to send to TPOS2020 and circulate to SSG.	W. Cai, PRP	<b>5/01/2018</b>
1.b	To send letter to TPOS2020 with concerns about TAO decommission.	SSG	
1.c	To engage more with TPOS2020 leadership.	PRP, ENSO RF	
<b>2</b>	<b>Science Plan</b>		
2.a	Members of Science Plan sub-groups to provide final text for each sub-section.	ICPO	<b>18/12/2017</b>
2.b	Make sure S2S is emphasised in the CLIVAR SP.	SSG co-chairs	
<b>3</b>	<b>Summer School</b>		
	Circulate call for proposals to the ICTP summer school to all panels and RF.	ICPO	<b>18/12/2017</b>
<b>4</b>	<b>Annual Reports</b>		
	SSG to provide feedback for panels on their report.	SSG, ICPO	<b>5/01/2018</b>
<b>5</b>	<b>IORP</b>		
	IORP to contact Monsoons Panel about input to IndOOS review.	MP, IORP	<b>5/01/2018</b>
<b>6</b>	<b>GSOP</b>		
	SSG to make a recommendation about membership, including GSOP leadership. Mat Mazloef (Scripps), candidate from Carbon. Request for names will be sent out to all basin panels, OOPC, GCOS, GSOP ex-officio.	SSG co-chairs	<b>5/01/2018</b>
<b>7</b>	<b>EBUS</b>		
7.a	The lifetime of the RF remains limited to another two years. Any actual – adjusted - work program needs to reflect this lifetime.	EBUS co-chairs	<b>4/05/2018</b>
7.b	Within the next 5 months, the RF should submit to the SSG a revised proposal with specific deliverables to be achieved in the next 2 years (2018-19) following the draft submitted in November.	EBUS co-chairs	
7.c	The group needs also update its list of members taking into account their explicit expression of interest, and the direction that the group wants to take.	EBUS co-chairs	
7.d	EBUS co-chairs, should begin ASAP discussions with SCOR EBUE co-chairs about the organization of a Summer school jointly with ICTP.	EBUS co-chairs	
<b>8</b>	<b>ENSO RF</b>		

	Terminate ENSO RF during the ENSO Conference and hand over networking actions & summer school to Pacific R. Panel.	ENSO RF, PRP	<b>12/2018</b>
<b>9</b>	<b>Miscellaneous</b>		
9.a	Provide details about deoxygenation conference to ICPO, and ICPO to circulate to panel members. (CLIVAR to provide names for S. Arico).	S. Arico, ICPO	<b>5/01/2018</b>
9.b	ICPO to move ex-officio members in OMDP to “Emeritus”.	ICPO	<b>26/12/2017</b>
9.c	Request new ideas for Research Foci.	ICPO, SSG	<b>06/2018</b>

	<b>RECOMMENDATION</b>	<b>Responsible</b>
<b>1</b>	<b>NORP</b>	
1.a	The panel should look at expanding membership with inclusion of a representative from Russia for geographic balance as soon as possible.	Co-chairs
1.b	It would be useful to engage with ARP and PRP.	NORP, ARP, PRP
1.c	The panel should link up with GSOP on the issue of the Polar ORA-IP.	NORP, GSOP
<b>2</b>	<b>Monsoons Panel</b>	
	To make efforts to engage more with SPARC Monsoons activities.	MP
<b>3</b>	<b>PRP</b>	PRP
3.a	To explore the possibility of doing a review of observations for the other parts of the Pacific, as IORP is doing, with the objective of a contribution (abstract or white paper) for OceanObs'19.	Co-chairs
3.b	To identify a member from China for next year.	W. Cai
<b>4</b>	<b>ARP</b>	
	To further discuss/improve linkages with the US AMOC Science team.	ARP, SSG
<b>5</b>	<b>Concept Heat</b>	
	The RF should terminate at the end of 2018 and eventually evolve in a WCRP-wide activity. The co-chairs, in agreement with the CLIVAR and GEWEX leadership and with WCRP should discuss the RF future during 2018. The fall 2018 meeting should be the sunset of the RF, opening to the transformation to a WCRP-wide activity.	Concept Heat co- chairs
<b>6</b>	<b>SORP</b>	
	Suggest that SORP strengthens links with Climate Dynamics Panel—the non-steady state dynamics of the Southern Ocean are key questions of the coming decade – from synoptic to decadal scales.	SORP
<b>7</b>	<b>DCVP</b>	
	To avoid any conflict with other WCRP efforts on decadal predictions, DCVP should focus more clearly on predictability. Moreover, the RF should consider ending its activity in 2020 after which we can imagine that a decadal activity would continue at a more pan-WCRP level. Within CLIVAR the CDP panel will take over the “coordination” of decadal predictability after 2020. The transition should be coordinated by the RF and expertise needs to be reflected in the panel membership in preparation.	DCVP, CDP
<b>8</b>	<b>CDP</b>	
8.a	To develop better links to GC on clouds and circulation.	CDP
8.b	To engage with NORP especially in relation to storm track activities	CDP
<b>9</b>	<b>Miscellaneous</b>	
9.a	To engage more with OOPC by providing scientific input on observing requirements.	All panels
9.b	To make efforts to entrain young scientists as panel members.	All panels

## **1. INTRODUCTORY SESSION**

### **1.1 Opening.**

The CLIVAR Scientific Steering Group (SSG) co-chairs, Annalisa Bracco and Detlef Stammer, welcomed all participants (Appendix A), presented the detailed agenda (Appendix B), and explained the meeting objectives:

- Discuss and vote on all SSG-related CLIVAR issues
- Report on developments over the last year
- Review progress within panels and Research Foci (RF)
- Review lifetime of RF
- Review membership proposals of panels and SSG
- Discuss CLIVAR finances and outreach
- Work on and finalize the CLIVAR SP
- Hear about WCRP developments

CLIVAR capabilities were highlighted, which are unique within WCRP. For instance, CLIVAR helped with the infrastructure, ocean and atmospheric modelling component of ESM, data synthesis, observing system, and capacity building.

SSG members need to discuss membership issues, since four members need to be replaced, as well as electing a new co-chair, for 2019.

Regarding the ICPO, it is important that SSG members and panel/RF co-chairs provide input on the efficiency of the office and how things could be improved.

The CLIVAR report for the WCRP-JSC in 2017 was well received. JSC did not give any specific CLIVAR action or follow-up.

The budget situation remains critical but has shown signs of improvement.

Regarding OceanObs'19: it was pointed out that CLIVAR has played a key role in the former OceanObs; S. Speich is co-chair of OceanObs'19, and CLIVAR needs to play a key role in this initiative.

### **1.2 WCRP Presentation (Guy Brasseur).**

WCRP is a successful programme, established around 40yrs ago. Looking towards the future, fundamental research remains important. Some issues to consider: predictability across scales, processes that determine the sensitivity of climate to external forcing, role of interactions and feedbacks, regional aspects and extremes.

WCRP is working on a 10-year new Strategic Plan, which will focus on fundamental scientific questions, whilst taking into account end-users/stakeholders requirements; and a 5-year Implementation Plan which will indicate how WCRP will work to solve these questions. Many consultations have been made, involving sponsors (ICSU, WMO, IOC), agencies (in different parts of the world), other programmes (like WWRP and Future Earth), Service Organizations (Climate and Met Services, IPCC), and other groups (e.g., YESS). Also, a SWOT exercise for WCRP has been initiated to identify strengths, weakness, opportunities, and threats.

The strategic plan will have three overarching questions (which are the result of many discussions between JSC members, with input from members of the core projects) on: process, sensitivity and predictability), a few scientific emphases, and some imperatives.

The Implementation Plan will include aspects of management, finance, and deliverables; it will focus on how to address the scientific questions posed as challenges in the strategic plan. An important input to the implementation plan will be the outcome of the co-sponsors' evaluation, which is being carried out by an external panel. The report of the evaluation will be distributed shortly and will make seven recommendations on science strategy, governance, operations, structure, financing, science to service, and partnerships.

The Science that CLIVAR is doing is considered central to the future of WCRP, thus the new CLIVAR SP is fundamental to the future of WCRP.

During discussion, participants mentioned the need for WCRP to push agencies and funders to highlight the need for adequate resources for both modelling and observations given the emphasis on global to regional scale. Also, the importance of making sure that societal impacts are taken into consideration and that they are the ones that should drive the science questions.

## **2. PANEL REPORTS**

### **2.1 NORP (John Fyfe)**

NORP is envisioned to be a forum for coordinating activities on the role of the Arctic Ocean and neighboring seas in the global coupled climate system, and facilitating progress in developing new tools and methods to observe and model the Arctic Ocean and neighboring seas. It was proposed in the fall of 2016 and endorsed in the spring of 2017 and membership was confirmed in June 2017. At the moment the panel is going forward with monthly telecons, and is planning to have a face-to-face meeting in Davos on June 2018.

Participants were impressed by the quantity and quality of the work done by the group in such a short time.

It was also noted that NORP and ARP should discuss soon themes that are of common interest such as the freshwater forcing of Arctic to Atlantic. It was noted that NORP has already connected with GSOP for the reanalysis study project, ORA-IP, but this communication should continue and be enhanced if possible.

Participants commended the fact that NORP has a IASC representative in the panel, like SORP has a representative in SCAR, since this would enhance coordinated activities

Participants consider that the high-low latitude connectivity is an important issue and thus suggest communicating with ongoing efforts like Horizon 2020.

IOC has expressed its interest in the Arctic and they initiated talks with CliC, thus NORP may consider contacting IOC at the Polar meeting.

### **2.2 SORP (Joellen Russel)**

SORP serves as a forum for the discussion and communication of scientific advances in the understanding of climate variability and change in the Southern Ocean. It advises

CLIVAR, CliC, and SCAR on progress, achievements, new opportunities and impediments in internationally-coordinated Southern Ocean research. The three main topics of SORP are: freshwater budget, heat balance and carbon budget. SORP has multiple sponsors, and membership will be an issue in 2018 due to many people rotating off.

Participants noted that SOMIP and other initiatives are looking at ice sheets, but there is a need for more activities, in particular observational activities that for this panel are carried out in coordination with SCAR.

Participants mentioned that a Southern Ocean center has been built recently by China and Australia with focus on the Antarctic Ice Sheet, and that ISMIP is the Ice Sheet MIP on the same topic, but profound challenges remain in the coupled model, thus in CMIP6. This is an issue that the panel should consider in the future.

In the past CliC was not much involved in SORP activities, it was commended that this has changed, and hope it will be maintained in the future.

Participants noted that questions to be addressed by the SORP include: heat balance, freshwater budget, and carbon budget (physical part); the panel should consider that carbon is also part of WCRP as a Grand Challenge and try to connect with it.

### **2.3 PRP (Mat Lengaigne)**

The PRP general objectives cover a vast range of topics, including the ENSO dynamics and teleconnections (in conjunction with the ENSO RF), decadal Pacific variability (in conjunction with the Climate Dynamics RF), ocean mass transports and properties, the regional impact of climate variability and change, western boundary current variability and the development of a sustainable tropical observing system (in conjunction with TPOS2020). Due to time constraints of all panel members and the too wide topics to be tackled, the PRP decided to focus its activity during the next couple of years on an emerging new challenge that has to be urgently addressed given its societal importance: the decadal variations in the tropical Pacific.

Highlights activities during 2017 include: the ENSO complexity workshop in Busan, an ENSO review paper on ENSO complexity, and participation of 2 panel members on the TPOS2020 Western Pacific Task Team. PRP will participate on the organization of the ENSO Conference in Ecuador, and it is planning a 2018 Summer school on ENSO, in Italy.

Regarding the issue of the suggested decommissioning of some tropical buoys in TPOS2020 first report, there were a lot of concerns from the ENSO community in the Busan meetings this October. Maybe there is a science justification for removing those buoys in the western side, so it may not only about cost saving. Participants suggested the need to be more explicit about the scientific endeavors that will be directly affected by the decommissioning and responding to the arguments made in favor of it more directly. It was noted that there has been criticism by some program managers about the lack of intellectual/scientific interaction between PRP and TPOS. The suggestion was made to write a letter to the TPOS2020 steering group that would highlight these concerns in a constructive manner.

Participants also suggested that PRP works towards a review on Pacific observations beyond TPOS2020 like IORP is doing for IndoOOS, addressing the observational needs

for open science questions in the region. This would represent a useful contribution to OceanObs'19.

PRP needs to bring to the forefront the broad issues that are being investigated. Decadal variability studies should include the whole basin, while most activities appear to be focused in the tropics.

Participants noted that 2K-community involvement is important and could be further improved. WCRP and PAGES collaboration would benefit from these interactions.

#### **2.4 ARP (Sabrina Speich)**

Main activities and highlights of the panel during 2017 include: development of a pan-Atlantic Ocean Observing System, active participation in AtlantOS, strong contribution to the realization of the Bélem Statement; continuous development of the AMOC observing system (OSNAP, Rapid-Mocha, SAMOC); organization by ARP of the Tropical Atlantic Observing Review; community work on Ocean Eddies and Air-Sea interactions (in conjunction with OMDP and US CLIVAR); community work on air-sea HiRes CMIP coupled models analyses; community work on the ocean air-sea exchanges and dynamics and their impact on global and regional variability and energy transfers (in collaboration with OOPC and CONCEPT-HEAT); ARP with OMDP will jointly develop a proposal on 'Validating and Comparing CORE-II Hindcast Experiments in the Tropical Atlantic'.

Participants suggested enhancing the coordination between USCLIVAR AMOC team and ARP, understanding that progress has been made already. And that it would be important to further foster the involvement of ARP in AtlantOS in the future.

#### **2.5 IORP (Weiqing Han)**

The IndOOS (Indian Ocean Observing System) was started in 2006, IORP took the IIOE-2 (2015-2020) as an opportunity to promote both IndOOS and RAMA array. As a main activity, the panel is doing a review on the IndOOS; there are also plans to prepare two review papers (one on Indo-Pacific interactions, and another on monsoons-Indian Ocean interactions). The focus of the panel has been on this review, regarding the modelling, more could be done in the future.

On the issue of the ITF (Indonesian Throughflow), participants noted that when the CLIVAR ITF task team had ended and the SSG asked PRP and IORP to entrain that expertise and continue the ITF study. There will be a chapter on the ITF in the IndOOS review, and the former leader of ITF TT, Janet Sprintall joined PRP as member. The time seems mature to re-engage more actively on this problem, with a joint coordination (IORP and PRP).

It was also suggested that the panel links with the 4<sup>th</sup> Symposium on oceans (co-organized by IOC-PICES-ICES-FAO).

It was noted that there has been limited involvement with the modeling community, to address questions such as how CMIP models perform in the region. This is understandable given the IndOOS review underway, but more attention should be paid to the modeling work done in the region in the near future.

## **2.6 GSOP (Andrea Storto)**

GSOP successfully organized the “COST/CLIVAR Workshop on ocean reanalyses and inter-comparisons”, in Toulouse, France, in June 2017. This workshop has started a new phase of ORA-IP. A meeting report has been made available. Selected recommendations of the workshop include: i) the need of process- and region- oriented inter-comparisons with the participation not only of the reanalysis producer community, but involving experts from e.g. the observational community; ii) the request of inter-comparing also assimilation-free simulations, in order to liaise with the OMD Panel and fill the gap between protocol-free reanalyses (ORA-IP) and CORE-like OMIP simulations.

At the start of the 2017, GSOP lost its two co-chairs. Tony Lee rotated off, and Matt Palmer stepped down, but remains as a member until the end of his term (Dec 2017). At the last SSG meeting, it was felt that the whole membership of GSOP needed to be reviewed, given that the panel has developed a much stronger emphasis on ocean synthesis than on overall ocean observations. Lisan Yu and Andrea Storto are acting as leaders of the panel for the moment until a decision is made by the SSG.

The SSG realized that the GSOP TOR are still up-to-date and worth pursuing. The GSOP team should foster assimilation efforts, but should not lose track of data issues.

The SSG realize that presently the GSOP membership needs a considerable attention. This includes the leadership, which needs to be renewed as a first step. Jointly the new leadership needs to consider together with the SSG how GSOP can revive and refocus its work.

The ORA-IP effort has been very positive, benefitting from the interactions with GODAE on the methods, and these interactions, and ORA-IP, should continue.

However, the SSG noted that inter-comparisons are useful but do not improve in a direct way data synthesis product. It also appears that GODAE and GSOP are working towards very similar objectives. So GSOP should start serious work on improving existing reanalyses and possibly come to a ranking of which ones are more useful than others for CLIVAR and WCRP efforts.

GSOP needs to focus more on observations (not only reanalysis and synthesis products) and revive respective activities that existed in the past. This includes recommendations for improvements of the observing system that OOPC can take on and turn into action.

More definitive action of improving surface fluxes, jointly or in collaboration with SEAFLUX effort.

Participants recommend active contribution to and participation in OceanObs'19.

## **2.7 Monsoons Panel (Andy Turner)**

It is very important to emphasize that this a joint panel with GEWEX. Regarding membership, the panel has representation from the panel WGs. Also, the science done by the panel represents science interests from both CLIVAR and GEWEX

The panel has several Working Groups, which are tasked to link with regional activities: Africa WG (good contribution to the review papers for the IWM6); Asia-Australia

(monitoring of monsoon low pressure systems, direct involvements with local Met services); and the Americas (S2S is very important, with good skill for prediction).

S2S is a cross-cutting activity for the whole panel because of the importance to the regions. It is important that it is considered in the CLIVAR MP as it is considered the most relevant scale for societal impact.

MP is contributing to GMMIP. It has already identified a strong model dependence in response of the Asian monsoons to the Tibetan Plateau.

The panel is collaborating with IORP on the IndOOS review, also working in the endorsement/implementation of YMC. Many training activities are planned, with some proposed events probably connected to ICTP.

Participants commented that the panel is working well, the SSG was pleased with the evolution of the panel that took place. Specifically, the creation of regional working group was a great step forward and the panel seems to be up and running; and suggested that MP may need to identify/prioritize some joint activities with SPARC and consider preparing a review paper on the variability at seasonal to subseasonal timescales (S2S) in the monsoon systems, so that this S2S regional projects can feed into the wider S2S research.

### **2.8 OMDP (Gokhan Danabasoglu)**

There have been two major accomplishments in 2017: completion of the original CORE-II efforts and completion of the ocean model protocols for CMIP6 Ocean Model Inter-comparison Project (OMIP). An update on the new JRA55-do forcing product was also provided.

There are several cross-cutting engagements: OMDP members have significant ongoing involvements and collaborations with CLIVAR Regional Panels; DCVP RF; EBUS RF; WGCM; WGSIP; DCP; Metrics Panel; WCRP Grand Challenges on Regional Sea-Level Change and Near-Term Climate Prediction. The panel promotes the use of ocean model output from the OMIP and CMIP6 simulations. A new OMDP focus is evaluation of high-resolution (order 0.1°) ocean models via an inter-comparison project to assess fidelity of simulations (making use of JRA-55). A permanent OMDP task is to improve the representation of physics (e.g., via sub-grid scale parameterizations) to address model biases which are quite persistent in some cases. An emerging challenge is readiness for exa-scale computing.

Other reanalysis data have also been considered as the forcing in the new ocean-sea-ice MIP but the reason that JRA-55 dataset has been chosen was because it will be updated, it is supported by JMA, and it has fine resolution in space and time.

Participants commented that the panel should look for further interaction with IOC. IOC interests are especially strong in terms of time-series analysis, and OMIP offers a real opportunity for groups to inter-compare time series in simulations and observations.

Participants noted that the panel should be taking into consideration investigating the modulation of mesoscale circulations, in particular in relation to wind stress changes.

### **2.9 CDP (Shoshiro Minobe)**

The main objective of this panel is to advance our basic understanding of atmosphere-ocean climate dynamics using observations and models and to determine the role of climate dynamics in shaping climate variability and change on seasonal to centennial time scales. During 2017 there have been two main activities: the CLIVAR-PRIMAVERA collaboration; and a perspective paper (Collins, Minobe et al.), currently under minor revision in *Nature, Climate Change*.

The group has several plans for the future: next panel meeting will be in early in 2019, we will seek a venue and plan a joint workshop; a meeting on storm tracks in August 2018 (Stockholm); proposal for an Aspen workshop in 2018 on ‘Constraining Regional Climate Change’; a new working group of North Pacific Marine Science Organization (PICES) with three CLIVAR scientists; and preparation of the Japan CLIVAR committee for the next 3 years (by S. Minobe).

Participants noted that CDP was supposed to be a WCRP panel but ended up in CLIVAR, and that it is important that the panel interacts and coordinates with other groups of WCRP dealing with similar topics (such as SPARC).

It was also noted that the panel has made efforts to entraining young scientists as members, this is something that other panels should follow.

It is anticipated that CDP will take over the coordination of decadal predictability activities at the sunset of the DCVP RF, which is scheduled for 2020. Future membership changes should prepare the panel to it.

### **3. RESEARCH FOCI/GRAND CHALLENGE REPORTS**

#### **3.1 Concept-Heat RF (Karina von Schukmann)**

CONCEPT-HEAT has the main objective to build up a cross-disciplinary synergistic community for climate research aiming to work on two different issues: i) quantify Earth’s energy imbalance, the ocean heat budget, and atmosphere-ocean turbulent and radiative heat fluxes; and ii) analyze the consistency between the satellite-based planetary heat balance and ocean heat storage estimates, and compare these results to outputs from climate models to obtain validation requirements.

Plans for the future include: a CLIVAR/GEWEX workshop in 2018 (Toulouse, France); GEWEX (GDAP)/CLIVAR(C-H) in-depth assessment of the Earth Energy Imbalance; regional budget constraint activity; scientific paper on energy storage; continue interaction with ongoing initiatives (e.g. OOPC, University of Reading); continue interaction with CLIVAR GSOP and DCVP.

Participants suggested that the panel discuss what the RF should be doing, and if the meeting in 2018 should be the sunset, or a possible transformation to a WCRP-wide activity.

It was also commented that a larger activity may consider both energy and carbon budgets together, since the processes (on the physical part) are similar, even if the fluxes differ.

### **3.2 DCVP RF (Gokhan Danabasoglu)**

DCVP's primary objective is to advance the study of DCV, its characteristics, mechanisms, and predictability by focusing on key challenges, potentially predictable phenomena with significant impact on near-term climate evolution and potential for rapid progress. Some highlights during 2017 include the publication of a joint issue of CLIVAR Exchanges/PAGES Magazine on Decadal Climate Variability; publication of an *In Box* article summarizing the state of DCVP; also group members continued contributing to the activities of DCP and the WCRP Grand-Challenge on Near Term Climate Prediction (GC-NTCP).

There is some duplication of groups with similar topics within WCRP, such as DCP and GC-NTCP. WMAC and likely the WCRP review panel will give as recommendation to combine all decadal climate variability activities into one (particularly so for DCP and DCVP).

Participants noted that the contribution of DCVP is about predictability given that DCP is more focused on prediction, who is running the MIP. DCVP should consider ending in 2020, and they should focus on the predictability. DCP needs to be told that they would take over the "coordination" of decadal predictability, thus an adequate transition is needed and the required expertise needs to be reflected in the future membership.

### **3.3 ENSO RF (Wenju Cai)**

The group has four goals: i) improve understanding of the processes in nature and in models that control ENSO's behavior; ii) synthesize existing ENSO evaluation methods in CGCMs, promote best practices, and propose a standard ENSO evaluation protocol; iii) identify new observations needed to better constrain ENSO processes; and iv) understand how ENSO may change in the coming decades.

For 2018 the group plans to release a first « CLIVAR ENSO metrics 2018 » version used by two software packages; write a BAMS/NGEO paper in order to evaluate ENSO for CMIP6 (vs. previous CMIP); and to discuss emergent constraints for future projections.

The SSG acknowledges that the ENSO RF has already achieved most of its goals and deliverables and recommends that the RF completes its activity and presents its final findings and products at the ENSO conference, handing over follow-up networking actions to the Pacific Panel.

### **3.4 EBUS RF (A. Bracco)**

The group had leadership issues with E. Curchitser rotating off as co-chair. Additionally, the proposal submitted to and approved by SCOR for a working group on similar issues in the summer of 2017 presented substantial overlaps that the RF was asked to address. The RF members presented a plan recommending that they maintain the large scale modelling component, with a redefinition of objectives and a limitation of activities related to the biological part. The RF will continue focusing on eastern upwelling systems in the Atlantic and Pacific basins. The SSG and participants to the Pune' meeting agreed that a judicious restructuring to avoid/limit overlap was advisable. The RF should collaborate with the SCOR group (which will lead a number of investigations focused on

EBUS ecosystems), while retaining a more focus on physical mechanisms and model development (bias problem).

Main research activities planned: assessment of JRA-55, coordinated with OMDP; development of metrics and diagnostics, evaluation of air sea interactions within four eastern boundary upwelling systems. The group is planning a joint meeting with SCOR WG at the IOC/ICES/PICES conference in June 2018 to discuss progress, and will submit a proposal to hold a summer school in 2019. The RF is also coordinating sessions at the Ocean Sciences meeting in Portland.

In terms of membership, following the decision of some panel members to step down, it is proposed that the group moves to a 3-co-chair system (A. Lazar, T. Toniazzo and R. Rykaczewski) and looks strategically for new members to cover missing expertises.

One issue that has delayed the progress of the EBUS RF research is linked to the postponement of the release of the latest high resolution OMIP simulation results from NCAR forced by JRA-55. In this regard, the SSG suggests that the group begins its work using other simulations that are available from other groups.

Concern was expressed about the timescale of the RF (2 years) considering the range of planned activities. The EBUS Science plan should be adjusted, with a proposal for activities that realistically reflect the 2-year timespan. The group should modify and resubmit their ToRs by May. The SSG will review their activities in one year. A communication line should be established between the EBUS and EBUE SCOR WG co-chairs for the organization of Summer school jointly with ICTP in 2019. Given the interest of IOC on this RF, it is advised to keep IOC informed of all activities and of the joint school between the EBUS RF and the SCOR EBUE WG.

### **3.5 Sea Level GC (D. Stammer)**

During a 10-year period (Jan 2015 - Dec 2024), the Sea Level GC will address the following imperatives, which will be approached in five parallel, but interconnected, working groups:

- An integrated approach to historic sea level estimates (paleo time scale)
- Quantifying the contribution of land ice to near-future sea level rise
- Contemporary regional sea level variability and change
- Predictability of regional sea level
- Sea level science for coastal zone management.

Several experiments are in progress and several meetings are in preparation. Among them: CMIP6-FAFMIP and CMIP6-ISMAS6.

A meeting on coastal sea level change at the ISSI in Bern is being planned. Also a summer school on “Regional Sea Level and Coastal Impacts” will take place in June, 2018 in Qingdao, China in cooperation with FIO. A preliminary list of lecturers have been called for and identified. Several publications will result as outcome of the sea level conference and the workshop on high-end sea level rise.

The outreach activity in the SL conference proved to be a successful exercise to interact with the public and a good example for WCRP to consider in future events.

Participants noted that there is an idea of a joint design of SL research via establishing an office in IOC or OOPC, since it involves many communities, this discussion should be

brought to the IOC assembly/council. Also, the panel needs to point out the importance and great difference of regional SL over global SL. The group should also involve the PAGES group working on sea level (PALSEA2).

#### **4. CLIVAR SCIENCE PLAN**

The CLIVAR Science Plan was presented and the following comments were made by participants:

- Cryosphere should be an important issue on the SP, there was a comment from CliC that cryosphere is not mentioned enough, thus the SP should include it and outline the topics that are of interest to CLIVAR, and link up to CliC's SP.
- Paleo also should be highlighted more and plugged in some sections.
- People agreed that it was necessary to have a glossary list to summarize the definition of all terms to be used in the SP.
- Considering this was a SP instead of a review, there is no need to have extensive references.
- The questions for RFs should be narrowed down, and their achievements included.
- Timeline: two weeks for everyone to finish the revised version in Chapter 2.
- Chapter 1 should be completed at the end of the process.
- Introduction of part 2: should bring ocean to the front of the questions, with an introduction for those questions before part 2.1.
- Question 1: should be on climate sensitivity but need to make sure that "transient" is mentioned. Remove climate regulation, and explain that in the text. The new part of question one is the interconnectivity, teleconnections, extremes and predictions at regional scale and high-res aspects, budgets (energy, water, carbon).
- Question 2: should not mention only ocean but ocean-atmosphere processes; or better still, use the word feedback.
- Questions can be general, not necessarily all about new topics, because we do not know the answer for all yet. The new issues/questions would be described in the text.
- What is the audience? Primarily it would be researchers but also programme managers; therefore the wording to be used needs to be considered.
- In terms of predictability, scale is important to be linked, seamless.
- IPCC relevant science needs to be considered.
- Connecting to regions and fundamental information to services (indicators, etc.).
- There should be a difference between outputs (deliverables) and outcomes.
- Research Foci: expand the first part, describing the role and importance, with the short description of the current ones with accomplishments, as examples.
- Chapter 4: change to "Enabling Capabilities".
- Chapter 5: move to chapter 1.
- Section 2.1 – needs to perhaps include more on decadal variability (2.2.1) (2.3 will focus on predictability).
- Diurnal cycle – coupling atmosphere-ocean, to go to 2.2.
- Include a section specifically on EBUS since RF Foci have limited life time and that it links to other subprojects (SOLAS/IMBER/BCP).
- Expand on issues connected with O2/OMZ where it is relevant.

#### **5. ICPO REPORT**

### **ICPO (J. Santos)**

In terms of the ICPO in Qingdao, there has been a transition period after V. Detemmerman left. Also changes at the ICMPO, with all Scientific Staff leaving, M. Ali has been appointed as Director of the office with some other IITM staff temporary assigned. Further changes at the ICPO, N. Caltabiano is leaving. There are plans to have an international Intern appointed for help at the ICPO.

New Coordination of groups at ICGPO:

Jing Li: ARP, EBUS, IORP, ENSO, GSOP, PRP

Lei Han: OMDP, SORP, NORP, DCVP, SL, CDP, Concept Heat

Developed a funding information database available on the CLIVAR webpage intended for PIs, the office is looking for funding for activities such as the Summer Schools and the ENSO Conference.

ICPO had discussions with FIO about organizing a bi-annual summer school. Likewise for the development of a summer school with ICTP.

The office have started to coordinate regular telecons with other IPOs and JPS.

J. Santos's commitment is until early 2019, several factors need to be taken into account. The financial support from FIO/SOA for the Qingdao office is secured for 2018, WCRP needs to renew the agreement with FIO at the end of 2019.

### **Summer schools (A. Bracco)**

Two possible activities have been discussed:

- i) FIO (agreement with WCRP, joint activity with ODC. \$30K provided by FIO (per activity). 50 participants, back to back with the ODC Summer Course.
- ii) ICTP (agreement with WCRP) to start in 2019. Organize jointly with a panel meeting. Topic and location to be decided. ICTP: \$30K (per activity), not dependent on where the meeting is. Some uncertainty if this level of funding can be maintained. For each course it is expected that WCRP would provide a matching fund of 5K Euros.

Participants noted that it is important to decide on expectations for lecturers, perhaps the preparation of notes from tutors so that the student can review them, some work given for the tutor, with follow up. We should aspire for lecturers to stay for the whole time, help mentoring, not only give a 1-day lecture and go home. Also, there are WMAC Summer schools, which are focused on model development, need to keep track on their activities, and if CLIVAR has any ideas for topics, these could be run by WMAC.

### **ENSO Conference (J. Santos)**

The ENSO Conference has been proposed by the ICPO as a means for enhancing the visibility of CLIVAR in Latin America, by looking for regional partners (in this case The International Research Center on ENSO, CIIFEN) to organize events; this approach was one of the recommendations made by the JSC-WCRP during its meeting in Paris. So far the Office has been able to mobilized funds for around US\$40K from different donors for the event.

ICPO will be in charge of the logistical aspects of the organization of the conference, in cooperation with the local partners CIIFEN and Escuela Superior Politecnica del Litoral (ESPOL). PRP and ENSO RF will take the lead on the scientific coordination of the meeting, to assure this, 5 members of PRP and 5 members of ENSO RF are part of the Scientific Organizing Committee of the Conference.

## **6. INTERACTION WITH OTHER PROJECTS**

### **6.1 WCRP (M. Sparrow)**

WCRP sponsors: ICSU merger with ISSC, not yet clear how this may directly impact WCRP. WMO is preparing a new Strategic Plan (2020-2023), putting science and research as high priority; and a 5-year IP, both to be finalized by the end of 2018.

A new Director of the Research Department is currently being recruited by the WMO, and it is planned that this person will have overall responsibility for WCRP, WWRP, and GAW, though it is likely that a Chief will be appointed to WCRP (as WWRP and GAW) to directly manage the programme.

Regarding budget issues, there was a successful 2017 application to WMO for some additional funds for targeted WCRP activities; at the moment WCRP is still waiting for the 2018 budget from WMO. The IOC contribution for next year is not yet known. There are some new national contributions, but many countries still have not yet paid their 2017 contributions.

For the core projects: at the moment we can confirm 40K for each project. The budget will be re-looked at once the WMO contribution is known.

### **6.2 US CLIVAR (S. Legg)**

In early 2017, the US CLIVAR SSC reviewed progress of the national effort in addressing its goals and research challenges outlined in its 2013 Science Plan. While good progress has been made over the past four years, the SSC identified gaps in quantifying observation and model uncertainties and the bridging with operations, linking to users. These gaps were addressed at the 2017 US CLIVAR Summit, held in Baltimore in August. The Summit brought together the members of the SSC and its three implementation panels, agency managers, and invited speakers to review progress, address gaps, identify opportunities, and develop a set of actions that the US panels will implement in the year ahead. Key action items include: organizing regional multidisciplinary networks to study sea level change on the US East Coast and ecological forecasts along the US West Coast (aligning with the EBUS foci); reviewing the US GO-SHIP Program (in collaboration with the Ocean Carbon Biogeochemistry Program); organizing a small meeting on observational uncertainty metrics; providing feedback on process studies and updating best practices for process study data management and sharing; publishing a Variations edition on challenges in quantifying forecast uncertainty; and developing journal articles on communication of climate model outputs for applications across specific sectors.

US CLIVAR does not intend to reproduce the efforts of CLIVAR internationally, but rather hosts and organizes activities in the US that advance CLIVAR, where it intersects with the interests of the US funding agencies. The US CLIVAR working groups –

currently on (i) Arctic-midlatitude interactions and (ii) the expanding tropical belt – include international members, and also US CLIVAR workshops are open to the international community. Furthermore, US CLIVAR continues to support travel for US members of CLIVAR panels and research foci teams to attend their quasi-annual meetings, helping to further strengthen the communication between the US and international science planning and implementation.

### **6.3 IOC (S. Arico)**

There are several groups of CLIVAR that are relevant with IOC groups, such as the IOC ecological study group with OMDP, NORP, SORP, and EBUS. Salvatore called for concrete actions after the SL conference in New York. For the upcoming CLIVAR ENSO conference, IOC would sponsor 2 ECS to attend, but the IOC interest goes beyond this small financial support, so there is a need to engage further. The summer school to be take place in FIO next June was collaborated between CLIVAR and IOC ODC. IOC also informed about the deoxygenation conference in June 4-8, 2018 in Washington DC (ECCWO), and wished CLIVAR people presenting there. He would share the conference info with CLIVAR.

There is possibility of collaboration between OMDP and IOC on the topic of biogeochemical time series; discussions are also possible with NORP and SORP, this panels could link well with IOC.

There is possibility of working with CLIVAR modelling groups on including the biological components into the climate models.

IOC has also interest in any CLIVAR activities related to ocean carbon.

IOC Summer school (2019) in deoxygenation, should be some link/presentation for CLIVAR on the physical aspects of deoxygenation.

4<sup>th</sup> IOC/PICES/ICES Symposium on Oceans (DC, USA). IOC would like more engagement from CLIVAR, there are several parallel workshops that are being planned.

IOC is involved in the World Ocean Assessment, in WOA-2, and is pushing for the process to be more like IPCC, IOC is part of the technical secretariat for WOA-2.

### **6.4 SPARC (G. Beig)**

SPARC is currently implementing its reanalysis intercomparison project, S-RIP. SPARC will hold its General Assembly in October 10-15, 2018 in Kyoto, Japan.

There are several links to CLIVAR: ACAM (Monsoons): emission and air quality, aerosols, cloud, impact on chemistry; SNAP (predictability), DynVar, QBOi, S-RIP (reanalysis intercomparison project), ATC. The work of CLIVAR and SPARC on Monsoons is complementary, and there are opportunities for possible interaction in the future.

SPARC has links with IGAC and GAW, and these needs to be refined. Some activities are on hold waiting for the WCRP review.

### **6.5 GEWEX (G. Stephens)**

There is GEWEX involvement in the Water for food baskets, Extremes GCs (and some on the climate sensitivity). GEWEX looks at coupled processes. Water is the key driver, at local scales, by driven by global scale processes.

GEWEX science framed in 4 science questions, and plays a unique role in WCRP on Earth Observations, and data assessments. GEWEX meetings planned for 2018: SSG in January, PanGASS in February, and GEWEX OCS in May.

### **6.6 CliC (L. Hislop)**

CliC had a busy 2017, including a series of workshops, covering all major components of the CliC Action Plan. The year began with the CliC sponsored International Symposium on the Cryosphere in a Changing Climate in Wellington, New Zealand. CliC contributed to the event as a member of the science and organizing committees and hosted two workshops and the annual CliC SSG meeting.

A new initiative this year was the establishment of the Northern Oceans Regional Panel (NORP). This panel is jointly run with the WCRP CLIVAR project and will complement the work of the Southern Ocean Regional Panel (SORP). The overall focus will be on cryosphere, ocean, and atmosphere linkages in Arctic and sub-Arctic seas. The members will have their first workshop together with SORP at the POLAR2018 conference in Davos in June 2018.

The Grand Challenge “Melting Ice and Global Consequences” (GC) has been moving forward on its initial focus areas. CliC plays an important role in contributing to the GC’s goals by mobilizing the global cryosphere modelling community and supporting the sixth iteration of the WCRP Coupled Model Intercomparison Project (CMIP6).

Throughout the year, CliC actively contributed to a number of United Nations and WMO linked initiatives, programs, conferences and events, CliC regularly provides input to the Executive Council Panel of Experts on Polar and High Mountain Observations (ECPHORS), the Global Cryosphere Watch (GCW) and the Year of Polar Prediction (YOPP).

## **7. SSG CLOSED MEETING**

During this session, membership proposals and annual reports were discussed, in addition other comments were made:

- It was suggested inviting selected members from local and regional for the open sessions of SSG meeting to help train the young scientists in strategic science discussions. The panels would be encouraged to involve one young scientist in their memberships.
- Discussion on the mission of O-KAN (Knowledge Action Network) in a telecom (O-KAN development team, with members of the sponsors of the O-KAN). They are in the process of deciding what they will be doing. Ocean-KAN: It is challenging working with scientists from very different backgrounds, though also a strength of the group, should also be discussed within CLIVAR. Ideas for small projects are put to the O-KAN. Some funds available, perhaps from Belmont Forum, with calls.

- WCRP does not do much on plastic and radiation, plastic is big in FE.
- Meeting at ICDC with carbon groups (SOLAS, IMBER, IOCCP), Nick Grubber organized it. There is no much international coordination, with the collapse of WG, and CLIVAR should take the lead. Further meetings will be organized, they are preparing a document. IOCCP has a coordination mandate, they need a science partner

The co-chairs closed the meeting, thanking all SSG members for their participation, and the local hosts for all the logistics arrangements.

## APENDIX A. Participants

Group	Name	Organization
SSG	Krishna AchutaRao	Indian Institute of Technology
ICMPO	MM Ali	CLIVAR
Observer	Salvatore Arico	IOC
Observer	Gufran Beig	SPARC
ICMPO	Harish Borse	CLIVAR
SSG	Annalisa Bracco	Georgia Institute of Technology
SSG	Pascale Braconnot	CEA-CNRS
SSG	Wenju Cai	CSIRO
ICPO	Nico Caltabiano	CLIVAR
OMDP	Gokhan Danabasoglu	NCAR
SSG	Boris Dewitte	LEGOS
SSG	Stephen Griffies	NOAA Geophysical Fluid Dynamics Laboratory and Princeton University
ICPO	Lei Han	CLIVAR
IORP	Weiying Han	The University of Colorado
Observer	Lawrence Hislop	CLIC
Observer	R. Krishnan	IITM
ICMPO	Ashwini Kulkarni	CLIVAR
PRP	Matthieu Lengaigne	LOCEAN
ICMPO	Somnath Mahapatra	CLIVAR
CDP	Shoshiro Minobe	Hokkaido University
SSG	Pedro Monteiro	CSIR
Observer	Ravi Nanjundiah	IITM
SORP	Joellen Russell	University of Arizona
ICPO	Jose Santos	CLIVAR
WCRP Liason	Mike Sparrow	WCRP
ARP	Sabrina Speich	Brest & Laboratoire de Météorologie Dynamique
SSG	Detlef Stammer	CEN, Universität Hamburg
Monsoons	Andy Turner	U. Reading
Concept Heat	Karina Von Schuckmann	Mercator

### Remote Participants

<b>Group</b>	<b>Name</b>	<b>Organization</b>
Observer	Guy Brasseur	WCRP
NORP	John Fyfe	Canadian Centre for Climate Modelling and Analysis
Observer	Sonya Legg	US CLIVAR and Princeton University
Observer	Graeme Stephens	GEWEX
GSOP	Andrea Storto	Centro Euro-Mediterraneo sui Cambiamenti Climatici

## APENDIX B. Agenda

Monday 27/11			Session	Presenter / Discussion lead	Time
	<b>1</b>		<b>Opening</b>		
09:00		1.1	Welcome	IITM Director/ ICMPO	10
09:10		1.2	Welcome and meeting objectives	D. Stammer/A. Bracco	30
09:40		1.3	WCRP (Telecon, Hong Kong)	G. Brasseur	30
<b>10:10</b>			<b>Break</b>		<b>20</b>
	<b>2</b>		<b>Panel Reports</b>		
10:30		2.1	CLIVAR/CliC Northern Ocean Region Panel (Telecon, Canada)	J. Fyfe	25
10:55		2.2	CLIVAR/CliC/SCAR Southern Ocean Region Panel	J. Russell	25
11:20		2.3	Pacific Region Panel	M. Lengaigne	25
11:45		2.4	Atlantic Region Panel	S. Speich	25
12:10		2.5	CLIVAR/IOC-GOOS Indian Ocean Region Panel	W. Han	25
<b>12:35</b>			<b>Lunch</b>		<b>60</b>
13:35		2.6	Monsoons Panel	A. Turner	25
14:00		2.7	Global Synthesis and Observations Panel (Telecon, Italy)	A. Storto	25
14:25		2.8	Ocean Model Development Panel	G. Danabasoglu	25
14:50		2.9	Climate Dynamics Panel	S. Minobe	25
<b>15:15</b>			<b>Break</b>		<b>25</b>
	<b>3</b>		<b>Research Foci Reports</b>		
15:40		3.1	Consistency between planetary energy balance & ocean heat storage	K. Von Schuckman	25
16:05		3.2	Decadal Climate Variability and Predictability	G. Danabasoglu	25
16:30		3.3	ENSO in a changing climate	W. Cai	25
16:55		3.4	Eastern Boundary Upwelling Systems	A. Bracco	25
17:20		3.5	Regional Sea Level Change and Coastal Impacts Grand Challenge	D. Stammer	25
17:45		3.6	Discussion on budget/meetings	D. Stammer/ A. Bracco	15
18:00			Tea and Snacks		15
18:15			<b>Public Lecture:</b> Modelling the Indian monsoon and the INCOMPASS field campaign	A. Turner	60
19:15			Cultural Program		60
<b>20:15</b>			<b>Adjourn for day</b>		
Tuesday 28/11			Session	Presenter / Discussion lead	Time
<b>09:00</b>	<b>4</b>		<b>CLIVAR Science Plan</b>	D. Stammer/A. Bracco	
09:00		4.1	Science Plan – Chapter 2		90
<b>10:30</b>			<b>Break</b>		<b>30</b>
11:00		4.2	Science Plan – Chapter 2 (cont.)		90
<b>12:30</b>			<b>Lunch</b>		<b>60</b>
13:30		4.3	Science Plan writing up session		120
<b>15:30</b>			<b>Break</b>		<b>30</b>

16:00		4.4	Science Plan - Implementation		90
<b>17:30</b>			<b>Adjourn for the day</b>		
19:30			Dinner by Director, IITM		
<b>Wed. 29/11</b>			<b>Session</b>	<b>Presenter / Discussion lead</b>	<b>Time</b>
	<b>5</b>		<b>ICPO/WCRP report</b>		
09:00		5.1	ICPO report	J. Santos	20
		5.2	WCRP report	M. Sparrow	10
	<b>6</b>		<b>CLIVAR activities</b>		
09:30		6.1	CLIVAR Summer Schools	D. Stammer/A. Bracco	40
10:10		6.2	ENSO Conference	J. Santos	20
<b>10:30</b>			<b>Break</b>		<b>20</b>
	<b>7</b>		<b>Interactions with Other Projects</b>		
10:50		7.1	US CLIVAR (Telecon, USA)	S. Legg	20
11:10		7.2	IOC	S. Arico	20
11:30		7.3	SPARC	G. Beig	20
11:50		7.4	CLIC	L. Hislop	20
12:10		7.5	GEWEX (Telecon, London)	G. Stephens	20
<b>12:30</b>			<b>Lunch</b>		<b>60</b>
13:30			<b>Science Workshop</b>	IITM/SSG	
			"The future of climate and ocean science in the WCRP/CLIVAR framework of international collaboration"	A. Bracco	30
			"Elements of sea level in a changing climate"	S. Griffies	30
			"Past monsoons: what do they tell about our future?"	P. Braconnot	30
			"Enhanced Decadal Warming of the Southeast Indian Ocean during the Recent Global Surface Warming Slowdown"	W. Han	30
<b>15:30</b>			<b>Break</b>		<b>30</b>
16:00			<b>Science Workshop continues</b>	IITM/SSG	
			Climate studies at IITM	Ravi S Nanjundiah, IITM	20
			IITM ESM for studying long term climate variability and change with special focus on Asian monsoon.	R Krishnan: Exec. Dir CCCR, IITM	20
			Biogeochemistry of the Indian Ocean and Climate Change	Sunil Singh: Dir. NIO	20
			Monsoon prediction for sustained food-grain production	Sulochna Gadgil, IISc	20
			Rain and river water in the Bay of Bengal	D. Sengupta, IISc,	20
			Indian earth observation data for CLIVAR	Vinay Dadhwal, IIST	20
<b>18:00</b>			<b>Adjourn for day</b>		
<b>Thursday 30/11</b>			<b>Session</b>	<b>Presenter / Discussion lead</b>	<b>Time</b>
			<i>In camera</i> – SSG and ICPO only		
09:00	<b>8</b>		<b>Review of 2017 Meeting proposals and budget</b>	ICPO staff/SSG	45
09:45	<b>9</b>		<b>Membership issues</b>	SSG	45
		9.1	Life cycle of RF		
		9.2	Discussion on every panel		
<b>10:30</b>			<b>Break</b>	<b>IITM</b>	
11:00	<b>10</b>		<b>Preparations for next JSC</b>	D. Stammer/A. Bracco	60
12:00	<b>11</b>		<b>Any Other Business/Next SSG</b>	D. Stammer/A. Bracco	30
<b>12:30</b>			<b>End of meeting</b>	IITM	

## APENDIX C. Acronyms

AMOC	Atlantic Meridional Overturning Circulation
ARP	Atlantic Region Panel
AtlantOS	Integrated Atlantic Ocean Observing System
CDP	Climate Dynamics Panel
CliC	WCRP Climate and Cryosphere Core Project
CLIVAR	WCRP's Climate and Ocean Variability, Predictability and Change Core Project
CMIP	Coupled Model Intercomparison Project
CMIP6	6th Phase of CMIP
CORE-II	Coordinated Ocean-ice Reference Experiments – Phase II
DCPP	Decadal Climate Prediction Project
DCVP	Decadal Climate Variability and Predictability
EBUS	Eastern Boundary Upwelling Systems
ENSO	El Niño Southern Oscillation
ESM	Earth System Model
FIO	First Institute of Oceanography
GC	Grand Challenge
GEWEX	WCRP's Global Energy and Water Exchanges Core Project
GMMIP	Global Monsoons Model Intercomparison Project
GODAE	Global Ocean Data Assimilation Experiment
GSOP	Global Synthesis and Observations Panel
IGAC	International Global Atmospheric Chemistry
ICPO	International CLIVAR Project Office
ICSU	International Council for Science
ICTP	International Centre for Theoretical Physics
IIOE-2	Second International Indian Ocean Expedition
IITM	Indian Institute of Tropical Meteorology
IndOOS	Indian Ocean Observing System
IOC	Intergovernmental Oceanographic Commission of UNESCO
IORP	Indian Ocean Region Panel
IPCC	Intergovernmental Panel on Climate Change
ISSI	International Space Science Institute
ITF	Indonesian Throughflow
JMA	Japanese Meteorological Agency
JPS	Joint Planning Staff
JRA-55	Japanese 55-year Reanalysis
KAN	Knowledge-Action Networks
NORP	Northern Ocean Region Panel
OMDP	Ocean Model Development Panel
OMIP	Ocean Model Intercomparison Project
OOPC	Ocean Observations Panel for Climate
ORA-IP	Ocean ReAnalysis Intercomparison Project
OSNAP	Overturning in the Subpolar North Atlantic Program
PAGES	Past Global Changes
PRP	Pacific Region Panel
RAMA	Research Moored Analysis for African-Asian-Australian Monsoon
RF	Research Foci
S2S	Sub-seasonal to Seasonal
SCAR	Scientific Committee on Antarctic Research
SOA	Chinese State Oceanic Administration
SCOR	Scientific Committee on Oceanic Research
SOMIP	Southern Ocean Modeling Intercomparison Project

SORP	Southern Ocean Region Panel
SP	Science Plan
SPARC	Stratosphere-troposphere Processes And their Role in Climate
SSG	Scientific Steering Committee
TAO	Tropical Atmosphere Ocean
TPOS 2020	Tropical Pacific Observing System
WCRP	World Climate Research Programme
WWRP	World Weather Research Program
WMAC	WCRP Modelling Advisory Council
WMO	World Meteorological Organization
YESS	Young Earth System Scientist