

CLIVAR Report

1. Highlights for JSC

- After consultation with scientists and stakeholders throughout the climate community, CLIVAR released its second-generation Science and Implementation Plan which builds on the important legacy of CLIVAR emerging since its inception in 1992 and redirects the CLIVAR goals and priorities for the coming decade http://www.clivar.org/sites/default/files/documents/CLIVAR%20Science%20Plan_Final.pdf
- CLIVAR has traditionally played an important role in defining the ocean observing system requirements, and contributed to review these needs in various basins during the past year:
 - **IndOOS Decadal Review:** The final actionable recommendations from the IndOOS Decadal Review were presented to Indian Ocean stakeholders during IORP-15. Strategy for implementing IndOOS has been emphasised, task groups for advocating IndOOS in international programmes/projects and a broader climate and ocean science community have been formed. <http://www.clivar.org/indoos-review-2006-2016>
 - **TAOS Review:** The second TAOS Review workshop was organised in collaboration with PIRATA-23, in on 24-26 October 2018. The draft TAOS review report is being finalised. <http://www.clivar.org/events/pirata-23-and-2nd-taos-review-workshop>
 - **OceanObs'19:** Several community White Papers have been led or participated in by CLIVAR panels and Research Foci. A breakout session entitled "Ocean observations for climate reconstructions" has been proposed by GSOP.
 - **TPOS2020:** Both PRP and GSOP provided feedback to the 2nd TPOS2020 report, highlighting the need to continue the current configuration of tropical mooring arrays that have been producing unique and valuable data for 25 years, until there is clear and convincing evidence that other technologies can replace them.
- CLIVAR (through the Pacific Region Panel and the ENSO Research Foci) and the Centro Internacional para la Investigación del Fenómeno de El Niño (CIIFEN), organised the IV International Conference on El Niño Southern Oscillation: ENSO in a warmer Climate, 16-18 October 2018 in Guayaquil, Ecuador, with 136 participants from 20 countries. The purpose was to bring together experts to analyze and discuss the dynamics of El Niño-La Niña, as well as its implications to society. <http://www.clivar.org/events/iv-international-conference-el-ni%C3%B1o-southern-oscillation-enso-warmer-climate>. ENSO RF successfully completed its mission after the conference, and integrated its remaining activities into PRP.
- SORP continuously keeps in touch with, collects and appraises activities of several countries in the Southern Ocean via the national representatives. Reports from 11 countries in 2017 have been released in the CLIVAR website. Until now we have received reports from 9 countries for 2018, which are also available online. <http://www.clivar.org/clivar-panels/southern/national-representatives>.

- The Earth's energy imbalance is a topic developed by the CLIVAR Research Foci "Consistency between planetary energy balance and ocean heat storage" (CONCEPT-HEAT) that has grown in scope to embrace the relevant activities of the WCRP Core Project, in particular GEWEX. As a closing activity of this RF, a WCRP workshop on "The Earth's Energy Imbalance and its implications", was organized, 13 – 16 November 2018, Toulouse, France. <http://www.clivar.org/events/2018-wcrp-workshop-earth%E2%80%99s-energy-imbalance-and-its-implications-eei>
- As the scientific organizing committee, co-chairs and members from OMDP led a workshop on the Sources and Sinks of Ocean Mesoscale Eddy Energy which took place on 12-14 March, 2019. The workshop gathered the most forefront work on the mesoscale study, stimulated related discussion and prospective papers on this topic. <http://www.clivar.org/news/workshop-sources-and-sinks-ocean-mesoscale-eddy-energy-took-place-florida-state-university>
- With the emphasis on interdisciplinary cooperation, CLIVAR has strengthened its link with biology and biogeochemistry communities. PRP planned its next meeting in conjunction with 2019 PICES annual meeting. Also, co-chairs of PRP and EBUS RF are taking the lead in PICES WG-40 (Climate and Ecosystem Predictability). A workshop entitled '[Towards an integrated approach to understanding ecosystem predictability in the North Pacific](#)', will be organised on 20-21 July 2019 in Qingdao, China, which has been endorsed by CLIVAR.
- With the recognition of a strong need for Coastal Climate Services, a workshop on "sea level science for services" will be organised by WCRP GC and CLIVAR RF on Regional Sea Level and Coastal Impacts from 12-13 November 2019, at Orléans, France, to explore what science can provide in relationship to coastal zone management and on the importance of land subsidence on a global scale. <http://www.clivar.org/events/workshop-wcrp-grand-challenge-and-climate-services>
- The First CLIVAR-FIO summer school on "*Past, Present and Future Sea Level Changes*" was held at Qingdao, China from June 25 to June 30, 2018. 38 trainees from 25 countries attended the course, which covered a wide range of physical processes contributing to global and regional sea level change: from observations to modelling of the main physical processes of global and regional sea level rise and variability. <http://www.clivar.org/events/clivar-fio-joint-summer-school-2018>
- The ICTP-CLIVAR Summer School on "*Oceanic Eastern Boundary Upwelling Systems*" will be organised on 15-21 Jul 2019 at Trieste, Italy. This school will focus on coupled ocean-atmosphere dynamics in upwelling systems, their biogeochemical and ecological processes, and their sensitivity to climate variability and change. Afternoons will be devoted to practical sessions involving the use of circulation models, analyses of relevant data sets, and discussion of current research. <http://indico.ictp.it/event/8702/>
- The Advanced School and Workshop on American Monsoons: progress and Future plans, will be held in Sao Paulo, Brazil, 19-24 August. 2019. The two events are fostered by the

Working Group on American Monsoons, one of the regional monsoons working groups established under the coordination of the CLIVAR/GEWEX Monsoons Panel.

<http://www.clivar.org/events/advanced-school-and-workshop-american-monsoons-progress-and-future-plans>

- Being one of the outcomes of the CLIVAR ECS Symposium 2016, an article 'Reflections on the CLIVAR Early Career Scientists Symposium 2016' was published in October 2018, in *Climate and Atmospheric Science*, a Nature Partner Journal. In the paper, the authors emphasised the need for open science and reduced barriers to international collaboration, identified science priorities, and the need for improving and expanding global observations. <https://www.nature.com/articles/s41612-018-0015-y>

2. Primary science issues

- **Enabling regional to local predictions** in support of reliable climate information is key in the Post COP21 world of transient climate change. Improving seamless regional climate forecast capabilities emerges as a closely linked challenge for the international research community. Addressing this challenge requires a multiscale approach to climate predictions. Scientists from the CLIVAR community offer their vision for an approach that emphasizes enhanced scientific understanding of regional to local climate processes as the foundation for progress. <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EF000979>
- To understand the **Decadal Variability in the Tropical Pacific (TPDV)** has been identified by PRP and ENSO RF as one of their priorities. The [first TPDV workshop](#) was organised on 13-14 October 2018 at San Pedro de Manglaralto, Ecuador, in conjunction with the ENSO2018 Conference. A group of Chapter Lead Authors will [gather again in Paris, France, from 1 to 5 April 2019](#), to overview the up-to-date progress and draft sessions, and finalise the paper.
- EBUS RF is working on a '**perspective style**' paper to document the current questions in EBUS and to identify key areas of uncertainty that require collective capacity to highlight, which include: 1) to understand the wind/atmospheric structure; 2) to resolve the relative roles of large-scale/synoptic scale processes and local processes in controlling physical and biological properties of EBUS; and 3) to understand how the characteristics of variability in EBUS oceanic properties potentially alter the ecosystem sensitivity to climate change.
- El Niño-Southern Oscillation (ENSO) remains the focus of PRP and ENSO. One of key findings that documented that the eastern Pacific El Niño will intensify under a scenario of high emission of carbon dioxide, has been published in [Nature](#).
- By recognising that the ocean-atmosphere interactions in the tropics have a profound influence on the climate system, scientists from PRP and ENSO RF contributed in publishing a review paper in [Science](#), that provides a timely and comprehensive view on the nature of pan-tropical climate connections, discusses potential implications for seasonal to multi-year

climate predictability and greenhouse warming projections, and identifies clear pathways toward further understanding and model improvement.

- The OMDP panel published a review paper '**Challenges and Prospects in Ocean Circulation Models**'. The paper reviewed the evolution of ocean circulation model in the past 10 years, summarized the new developments in ocean modelling since a similar OMDP review from 2010, and indicated the challenges and prospects at the forefront of present work in ocean modelling. <http://www.clivar.org/news/progress-challenges-and-prospects-ocean-circulation-models>
- '**Challenges and opportunities for improved understanding of regional climate dynamics**', which was written by the members from the CDP panel was published in [Nature Climate Change](#). The paper highlights the challenges and opportunities in understanding the dynamical processes in the atmosphere and ocean, which may provide an inspiration for the researchers involving the climate dynamic field.

3. Issues and challenges

- As several regional panels within CLIVAR are taking the initiative in shaping the global/regional ocean observing systems, it would be good for those panels to meet together and share their experience in different basins.
- Though great effort has been made by CLIVAR panels in providing the scientific and technical guidance to global/regional observing systems, it is also important to advocate the key messages to decision makers, who possess the resources to invest in the infrastructures of observing systems.
- CLIVAR has some panels jointly organized with other core projects (CLIVAR/GEWEX Monsoons Panel, CLIVAR/IOC GOOS Indian Ocean Region Panel, CLIVAR/CliC Northern Ocean Region Panel and CLIVAR/CliC/SCAR Southern Ocean Region Panel). Some of these activities have worked well in partnership, but we recognize that in some cases communication among partners needs to strengthen for a more effective collaboration.
- Taking into account the evolving societal needs for seeking solutions to climate change, to resilience to disasters, and to sustainable development for the planet, CLIVAR recognises the importance to link CLIVAR science with regional climate services. In particular during the critical period in formulating the Implementation strategy for UN Decade of Ocean Science for Sustainable Development (2021-2030), it would be important for CLIVAR to strengthen its cooperation with IOC-UNESCO and other key regional and national partners to support the adaptation strategies and science-informed policy responses to global changes.
- CLIVAR initiated short-term Research Foci (RFs) on topics identified by the community as important and likely to achieve major breakthroughs within 3-5-years through international/interdisciplinary cooperation. Two of these activities closed at the end of 2018 (CONCEPT-HEAT will probably evolve into a pan-WCRP activity and ENSO which was absorbed by PRP). A third one (DCVP) will become part of the CDP at the end of 2019. A new call is anticipated, but again the funding availability remains an issue.