

CLIVAR PACIFIC REGIONAL PANEL

Matthieu Lengaigne, lengaign@locean-ipsl.upmc.fr
Xiaopei Lin, linxiaop@ouc.edu.cn

Panel overview

The PRP general objectives cover a wide range of science issues. This includes efforts to develop a coordinated international strategy for a sustainable Pacific observing system (such as in support of the TPOS-2020 steering committee) and a better understanding of (1) the internal dynamics of the Pacific variability (including ENSO and Decadal Variability), (2) the impact of external forcing on the Pacific (including greenhouse gases, aerosols, volcanic eruptions and solar insolation), (3) how Pacific climate variability generates remote impacts through teleconnections and interacts with climate variations external to the Pacific, (4) the dynamics that control the multi-scale variability in Western Boundary Currents WBCs), the role of WBCs in Pacific climate and their oceanic connection to the Indian Ocean through the Maritime continent and (5) the predictability of Pacific climate. Due to time constraints of all panel members and the breadth of topics in scope, the PRP is currently focussing most of its attention on three main activities: pan-tropical climate interactions, decadal variability in the tropical Pacific and interaction with the TPOS-2020 Backbone Task Team (BBTT) to convey the PRP's concerns in setting priorities for the Pacific observing system.

Achievements for 2017-18

- **Conferences/Workshops/Meetings**

A large number of sessions in international conferences and workshops have been chaired and/or organized by PRP members as individuals (e.g. AGU Ocean Sciences, EGU, etc.). In the following, we only focus on the achievements involving the PRP members as a community:

- **Tropical climate interactions workshops:** ENSO affects climate in many regions both within the Pacific and well beyond. This interaction is not one way: the tropical Atlantic and Indian Oceans, for example, affect the Pacific on interannual to decadal timescales. In order to improve understanding of this interbasin influence two workshops were held. One was held in Xiamen China (21-23 January 2018) and another in Jeju, South Korea (22-25 August 2018). The first workshop was organised by W. Cai (SSG member and former PRP co-chair), while the second was organised by J.S. Kug (PRP member). Several other PRP members also attended the two workshops (M. Lengaigne, X. Lin, S. McGregor, M. McPhaden). These workshops led to the writing of a review paper (Cai et al. 2018) summarizing our knowledge and its gaps, of these tropical interbasins interactions. The main scientific outcomes of this paper will be summarized in the next section.

- **IVth international ENSO conference:** To address ENSO scientific challenges in the context of international climate research, assessments, and operational prediction efforts, CLIVAR PRP and ENSO RF along with CIIFEN co-organised the IV International Conference on El Niño Southern Oscillation: “ENSO in a Warmer Climate” held in Guayaquil (Ecuador) on the 16-18 October 2018 (3 PRP members were part of the organizing committee and gave keynote talks and most PRP members attended the conference). This allowed the international

community to review the progress on the science of ENSO with a focus on: i) examining the range of ENSO “flavors” (especially in regard to the longitudinal variations of warming); ii) assessing the existence of possible, and distinct precursors to the different flavors; and iii) examining how the different oceanic and atmospheric processes that drive ENSO, its flavors, teleconnections and impacts and predictability may vary in a warming world. This conference gathered 136 international scientists, including numerous early career scientists and students from South America.

- **Workshop on Decadal variability in the tropical Pacific:** The Interdecadal Pacific Oscillation is a major pacemaker of low-frequency climate variations worldwide and has been identified as the major cause of the recent slowdown, or “hiatus”, in global surface warming. While this phenomenon is partly driven by decadal ENSO modulations, the mechanisms underpinning Decadal Variability in the Tropical Pacific (DVTP) are not fully understood. To discuss and review our current understanding of the DVTP and its predictability, the PRP organised a workshop back-to-back with the annual IVth international ENSO conference in San Pedro de Manglaralto (Ecuador) on the 13 and 14 of October 2018. During this workshop our current knowledge of DVTP, its main characteristics, driving mechanisms (including its interactions with decadal ENSO variations but also the influence of interbasins connections and external forcing) as well as its predictability were discussed. This workshop gathered a total of approximately 25 climate scientists from CLIVAR PRP and ENSO Research Foci as well as other key scientists attending the ENSO conference. The effort is expected to be followed by a second workshop and result in a review article for submission to an international peer-reviewed journal (see below).

- **PRP panel meeting:** CLIVAR PRP held its 13th session in San Pedro de Manglaralto (Ecuador) on 15th October 2018, back-to-back with the IV international ENSO conference and workshop on DVTP. Ten out of 13 members attended the meeting. During this meeting, we discussed several important topics, including: i) the integration of the remaining ENSO RF activities into the PRP; ii) efforts to ensure TPOS2020 recognizes and accommodates the concerns of the CLIVAR PRP and ENSO RF in setting its priorities for the future observing system; iii) how to reactivate our activities related to the oceanic connection between the Pacific and the Indian Ocean; and iv) several new possible ENSO related activities (ENSO conceptual models and ENSO teleconnections and impacts on biogeochemistry and ecosystems). We also updated our terms of references for consideration to CLIVAR SSG (see Annex B). Some outcomes of these discussions are summarized in the last section of this report (Plan for 2018 and beyond). Half of this one-day meeting was a joint session with the ENSO RF.

- **Activities on the Pacific observing system**

- **TPOS2020 interactions:** One particular recommendation in the TPOS2020 design has raised very serious concerns in the international CLIVAR community: a reduced priority given to moorings in the broad trade wind regions away from the equator that implies a decommissioning of many mooring sites of the original array that have been producing unique data of great value for 25 years or more. There is a consensus among the PRP members and beyond, that this strategy will irrevocably break the continuity of unprecedented time series that have enabled fundamental advances in our ability to observe, understand, and predict ENSO and its impacts. We conveyed our concerns to TPOS2020 Back-Bone Task Team (BBTT) by sending

them an official letter co-signed by ENSO RF and CLIVAR SSG, that resulted in a joint PRP-BBTT teleconference and by contributing to the September 2018 TPOS2020 BBTT meeting in WHOI (via a collegial presentation presented by A. Wittenberg, one of the ENSO RF co-chair, also part of TPOS2020 BBTT). We believe that the ability to diagnose future ENSO variability in a changing climate in all its dynamical, spatial, and temporal complexity will be seriously compromised by any reduction in the existing array, for which very little scientific support is provided in the first TPOS2020 report. The position of the CLIVAR PRP and ENSO RF is that the first priority of TPOS2020 should be to maintain the existing tropical Pacific moored array as a component of the broader observing system, until there is clear and convincing evidence that off-equatorial moorings can be replaced without harming the continuity of the climate record. The need to minimize negative impacts and to allow sufficient overlap for cross-calibration of climate records based on changing data sources is clearly acknowledged in the first TPOS2020 report. Additionally, PRP members have been included in the TPOS2020 BBT and a Wind Task Team has been set-up to address these concerns. However, we feel as of now that TPOS2020 leaders did not accommodate the concerns of the International CLIVAR community in setting priorities for the observing system. Regarding the governance, we believe that the future success of the TPOS2020 process will heavily rely on a broad base support of the climate and ocean community (CLIVAR being a significant part of it) that can only be achieved by an inclusive, consensus building process. That is why we plan to propose an independent scientific oversight board of knowledgeable experts to be commissioned to review TPOS2020 plans in order to evaluate TPOS recommendations based on scientific priorities. Future actions planned for the year to come are summarized in the last section of this report (Plan for 2018 and beyond).

- **NPOCE update:** In 2017-2018, NPOCE conducted two cruises, the China-Philippine Joint Cruise in the Western Pacific Ocean and the China- Indonesia Joint Cruise in the Indonesia Through Flow (ITF) region. During these two cruises, NPOCE recovered 21 deep ocean subsurface moorings and deployed 30 subsurface moorings and 2 buoys in the western Pacific. 10 of the 30 subsurface moorings have real-time transmission function. Mooring measurements confirmed the existence of the countercurrent below the North Equatorial Current and revealed the significant intraseasonal variability of the undercurrents. Along with other progresses on extreme ENSO/IOD and ITF Salinity variability, NPOCE activities allowed to improve our understanding of the three-dimensional structure and multi-scale variability of the ocean circulation and warm pool in the western Pacific. NPOCE also organized the 3rd Open Science Symposium on Western Pacific Ocean Circulation and Climate in Qingdao China during May 08-10, 2018. After the symposium, the Scientific Steering Committee of NPOCE held its 2018 annual meeting in Qingdao on May 11, 2018.

- **Scientific results from activities**

All panel members contributed individually to a large number of papers relevant for the PRP activity. In the following discussion, however, we only summarize achievements arising from a PRP community effort, involving at least three PRP members. In this regard, two major themes (ENSO and tropical interbasins interactions) have been tackled during the past year:

- **Tropical interbasin interactions:** One major achievement arose from the PRP's contribution to a new review paper on pan-tropical climate interactions submitted for publication to *Science* (Cai et al. 2018) as a result of two workshops held on this topic this year (see above). PRP members were lead-authors of several sections of this very successful review, led by W. Cai,

a member of the CLIVAR SSG and a former co-chair of the CLIVAR PRP. This paper includes discussions on the Indo-Pacific interactions, the Atlantic and Indo-Pacific interactions, the apparent rise of the tropical Atlantic influence, the implications of pan-tropical interactions and the pathways forward. This paper especially emphasizes the role of multi-decadal Atlantic warming that began in the late 1990s and discusses how it may have influenced Indo-Pacific climate, the character of the ENSO cycle, and the hiatus in global surface warming.

- **ENSO complexity:** Another major collective achievement was its contribution to the production of a review paper on ENSO complexity in *Nature* led by Axel Timmermann. Reviews of this paper have been addressed in the course of the current year and the resulting paper was published in *Nature* (Timmerman et al. 2018).

- **Scientific capacity building and career support**

Some PRP panel members have been involved with capacity building activities at institutions in developing countries. For example, the “The International Workshop of the Indonesian Seas” was held in Mulawarman University, Borneo Indonesia in November 2017, with 35 early career scientists and students from regional universities participating with a workshop focused to better understand the circulation in the Indonesian seas through new science and technology. Partial financial support for the workshop and PRP member Sprintall was obtained from SCOR. One of the major achievements has been the PRP involvement in organising the IV International ENSO conference that allowed 45 early career scientists students from most south American countries to attend the workshop, with some support from WCRP, US CLIVAR, IOC, IRD and IAI to attend this workshop and discuss their work through poster presentations with worldwide senior climate scientists and oceanographers.

Plans for 2018 and beyond

As an outcome of the discussions PRP members had during the last PRP meeting in Ecuador, the panel proposes the following action items for the upcoming year:

1- CLIVAR recommendations on TPOS2020 design: Despite the sizeable efforts of TPOS2020 committee towards the design of a tropical Pacific Ocean observing system to meet the scientific challenges of the next few decades in many aspects, the proposed deprioritization of many off-equatorial mooring sites in the original TAO/TRITON array is of serious concern to the PRP. We are already near the deadline for the second TPOS report and we feel that the concerns raised in our letter (February 2018), during our joint teleconference (July 2018) and during the last TPOS2020 BBTT meeting (September 2018) have not been adequately accounted for by the TPOS BBTT. We would like to find a more productive and collaborative path than escalating the debate to an open letter in CLIVAR Exchanges or EOS, but we firmly believe that TPOS2020 should recognize and accommodate the concerns of the International CLIVAR community in setting priorities for the observing system. We therefore decided to: (1) postpone the submission of an open letter to CLIVAR Exchange or EOS; (2) contact TPOS-2020 sponsors (D. Legler from NOAA, A. Fischer from the IOC and M. Levy from the IRD) so that they are aware of the advice and needs of the broader CLIVAR community in setting priorities for the observing system and to also recommend that they establish an oversight committee of independent experts to assess the scientific merit of TPOS2020 plans; and (3) for the PRP to work collectively with the BB-TT to help set priorities for the TPOS, perhaps through joint meetings that would happen over the next few months prior to completion of the 2nd TPOS2020 report. If the TPOS2020 steering committee accommodates the main concern of the International CLIVAR community in setting priorities for the observing system (i.e. do not lower the priority of off-equatorial mooring sites without a clear demonstration that alternative technologies can successfully replace them and a clear management of a supposed transition, including a definition of an overlapping period, the criteria used to evaluate success or failure, and the definition of a committee that will arbitrate the decision) and if the sponsors of the TPOS2020 process respond positively to the second request, CLIVAR will enthusiastically support, endorse, and promote TPOS2020's efforts. Moving forward, we would like a response from both the TPOS BBTT and the TPOS sponsors by early December (well before drafting of the second report) as to whether these two requests will be honored. If not, then we will pursue alternative avenues to advertise our concerns about TPOS2020 priorities and process, beginning with an open letter in CLIVAR Exchanges and engagement with the WCRP.

2- Integration of low-latitude western boundary current and maritime continent observations into a unified multi-platform observing system: Numerous observations have been deployed over the past decade in the course of two projects endorsed by CLIVAR PRP, the North Pacific Ocean Circulation Experiment (NPOCE) and the Southwest Pacific Ocean and Climate Experiment (SPICE). Similarly, several years ago the activities of the former ITF Task Team around the oceanic connection between the Pacific and Indian Oceans through the Maritime continent were formerly integrated in the PRP scope. Because of other PRP foci and the lack of a formalised link with previous ITF TT members, the PRP did not manage to sufficiently develop activities around this central scientific theme. However, the maritime continent remains a PRP terms of reference (4), and is also the focus of new international interest through the Years of the Maritime Continent effort. We recommend integrating the observations, from fixed stations to mobile platforms, from the South Pacific to the North Pacific and from the

maritime continent, into a near real-time, fine-scale and multi-platform observing system for the low-latitude western Boundary currents in the Pacific. The set-up of a specific Task Team on this topic is currently considered by the PRP, which would include current members of the PRP (including J. Sprintall and X. Lin), potentially members of the former ITF TT as well as other members to be identified.

4- Integrating ENSO RF remaining activities into the PRP: To ensure the success of the integration of the action items to be completed in ENSO RF into the PRP, the PRP recommend (1) one of the ENSO RF co-chairs to join the PRP panel and (2) to set-up an ENSO metric Task Team that will gather some PRP members (S. Power, M. McPhaden, A. Wittenberg) and former members of the ENSO RF (E. Guilyardi, M. Collins ...) that will take care of pursuing the work started on that topic and ensure efficient and effective information sharing with PRP.

5- Initiating a new activity on ENSO conceptual models: This new activity has been proposed by J. Vialard and echoes the above will to integrate ENSO RF activities into PRP activities. Conceptual models of ENSO such as the recharged or delayed oscillators are very important in the way the community pictures the key mechanisms responsible for ENSO properties. The recharge oscillator is in many ways very successful in representing ENSO observed properties, or how they are represented in CMIP models. Yet, some physical interpretations of e.g. the lead relation between equatorial Pacific oceanic heat content and ENSO (which is at the heart of this conceptual model) have recently been challenged. This conceptual model furthermore cannot represent ENSO flavors or does not represent important nonlinearities such as the SST convective threshold, which are thought to play an important role in shaping up extreme El Niño events. The last published review on ENSO conceptual models by Wang and Picaut also dates from 2004. We hence propose to build a task team selected from PRP, ENSO RF members & invited experts to work on the following questions. What fundamental ENSO properties should a conceptual model represent? What key physical processes are needed to account for these properties? What are the strength and weaknesses of various existing conceptual models? What is the way forward to build improved conceptual models? A workshop on this theme could be organized back to back with the 2020 PRP meeting. The final outcome of this activity would be a review paper.

6- Participation in the writing of an upcoming AGU Monograph entitled “El Nino Southern Oscillation in a Changing Climate”: This book, edited by A. Santoso (former PRP member), W. Cai (SSG member and former PRP co-chair) and M. McPhaden (PRP ex-officio), will provide a review on ENSO and the effect and interplay of climate change on its dynamics, prediction, and impacts. The book will contain 20 chapters and will be co-authored by numerous authors, including many PRP members. A two-day working-group meeting of authors involved in the ENSO monograph will be held at the Centre for Southern Hemisphere Oceans Research (CSHOR, Hobart Tasmania) to advance the draft. It will be preceded by a three-day workshop that will gather ENSO experts and students in order to re-assess the state of ENSO science.

7- Organising a second workshop on Decadal Variability in the Tropical Pacific: Following the successful first workshop held on that topic in Ecuador last month, the PRP will organize a second workshop the first week of April 2019 in Paris with the same participants and one or two others. The goal of this workshop will be to finalize the writing of a high-impact paper reviewing our current knowledge of Decadal Variability in the Tropical Pacific as well as providing recommendations on how to improve our understanding of the Pacific decadal variability, its predictability, and associated challenges.

8- Co-organizing a workshop on “Atmospheric convection and air-sea interactions in the Tropical Oceans” to be held in Boulder (Colorado, USA) on 7-9 May 2019. It will be co-organized between US and international CLIVAR (including PRP, IORP and ARP). A. Capotondi (PRP member, next co-chair) joined the organizing committee and J. Vialard (PRP member) and J. Sprintall (PRP member) will most likely attend this event. This workshop will review the progress in that field over the past 30 years and identify key scientific problems that could benefit from coordinated modelling and observational process studies involving the tropical convection and air-sea interaction communities. This topic is particularly important for CLIVAR PRP as the non-linear response of tropical convection to SST is not well understood and very important to make progress in our understanding of ENSO, intraseasonal variability and interbasin interactions.

9- Organizing an ENSO summer school: The PRP is currently involved in the organisation of a summer school on ENSO. This school should gather ~20 students and last for 10-14 days. It was initially planned for 2019 but the different options considered did not work out. It will now be held at the ICTP (Trieste, Italy) or in the Galapagos Islands (Ecuador) at some stage in 2020. It will require funding sponsors such as US CLIVAR, International CLIVAR, IRD and ICTP in 2020. Further support is welcome.

10- Reviewing the term of references: The PRP worked on a revised version of the PRP TORs to be considered by CLIVAR SSG (See Annex B).

Budget and other needs for 2018

1- PRP Workshop on “Decadal Variability of the Tropical Pacific”: The PRP requests 3,5k\$ support from CLIVAR to support the travel expenses from participants that cannot use their own funds (2 people).

2- Workshop on “Atmospheric convection and air-sea interactions in the Tropical Oceans”: The PRP, IORP and ARP jointly request a 10k\$ support from international CLIVAR to support the travel expenses from students/early career scientists outside the US.

3- Next PRP meeting (end 2019): The PRP requested a 4k\$ funding to support the travel of two PRP members that cannot use their own funds).

Articles published in 2017/18 as part of panel activities (PRP members in bold)

[1] Timmermann A., S.I. An, **J.-S. Kug**, F.-F. Jin, W. Cai, **A. Capotondi**, **K. Cobb**, **M. Lengaigne**, M. Stuecker, K. Stein, A. Wittenberg, T. Bayr, J. Boucharel, H.-C. Chen, Y. Chikamoto, B. Dewitte, D. Dommenges, E. Guilyardi, Y.-G. Ham, M. Hayashi, S. Ineson, D. Kang, W. Kim, J.-Y. Lee, T. Li, J.-J. Luo, **S. McGregor**, **M. McPhaden**, Y. Planton, **S. Power**, H. Rashid, H. Ren, **A. Santoso**, K. Takahashi, A. Todd, G. Wang, G. Wang, S.-W. Yeh, J. Yoon, **K.-S. Yun**, **X. Zhang**, 2017: ENSO complexity, *Nature*, 559(7715), 535.

[2] Cai W., L. Wu, **M. Lengaigne**, T. Li, **S. McGregor**, **J.S. Kug**, J.Y. Yu, M.F. Stuecker, **A. Santoso**, X. Li, Y.G. Ham, Y. Chikamoto, B. Ng, **M.J. McPhaden**, Y. Du, D. Dommenges, F. Jia, J.B. Kajtar, N. Keenlyside, **X. Lin**, et al.: Pan-tropical inter-basin climate interactions, submitted to Science,

Annex A

Proforma for CLIVAR Panel requests for SSG approval for meetings

1. **Panel or Working Group:** PRP, ARP, IORP
2. **Title of meeting or workshop:** “Atmospheric Convection and Air-sea Interactions over the Tropical Ocean”
3. **Proposed venue:** Boulder, Colorado, USA
4. **Proposed dates:** 7-9 May 2019
5. **Proposed attendees, including likely number:** ~80
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** The proposed workshop is aligned with CLIVAR’s goal of fostering understanding and prediction of climate variability and change on intra-seasonal-to-centennial timescales, through observations and modeling with emphasis on the role of the ocean and its interaction with other elements of the Earth system, and to serve the climate community and society through the coordination and facilitation of research on outstanding climate questions as is stated in its Science plan. Specifically it, the workshop will contribute to meeting the objectives of the Process Studies and Model Improvement (PSMI) Panel “to reduce uncertainties in the general circulation models used for climate variability, prediction, and climate change projections through an improved understanding and representation of the physical processes governing climate and its variation.” One of the goals of the workshop is to highlight advances in our understanding of the connections and feedbacks between the atmosphere and tropical oceans. Over the last 20 years, CLIVAR has been instrumental to these advances both in the expansion of ocean observing systems as well as improvement of representation of processes in climate models. The second goal of the workshop is to identify and document gaps in our understanding of coupling of precipitation and SSTs over tropical oceans. A unique feature of this workshop is that it will bring together the atmospheric convection and the air-sea interaction communities thereby complementing CLIVAR’s goal of “Multidirectional knowledge exchange between different climate science communities”. Furthermore, by engaging the sub-seasonal to decadal predictability and operational prediction communities, the workshop will help identify atmospheric convection and air-sea interaction processes that influence predictability and have the potential to advance prediction. In order to suggest observational and modeling strategies needed to address these issues, the workshop agenda will include discussions of long term observing systems, field campaigns, modeling, and data analysis tools. Another important contribution of the workshop to CLIVAR’s goals is that it will enable early and midcareer investigators to present their work while learning about CLIVAR and broader community activities, introduce them to important areas of research as they chart their career paths. Those early and mid-career scientists could then be involved in CLIVAR working groups, panels and process study teams.
7. **Specific objectives and key agenda items:**
Tuesday Plenary
- AM1 Plenary: Historical perspectives (progress over last 30 years)

- AM2 Plenary: Outstanding issues in tropical precipitation, SSTs, ocean heat content, and ocean surface winds.

- PM1 Posters

- PM2 Breakouts “Outstanding issues” (two breakouts)

Wednesday:

- AM1 Plenary: Broader scientific activities (TPOS2020, TAOS, IndOOS, ESAS2017, S2S, CMIP6)

- AM2 Plenary: Technological advancement (modeling, remote sensing and in situ observations, autonomous sensors, data processing, etc.)

- PM1 Posters

- PM2 Breakouts “Future process studies” (two breakouts)

Thursday:

- AM1 Plenary: Integration: Breakout reports, discussion

- AM2 Plenary: Closing and report writing planning

8. **Anticipated outcomes (deliverables):** The workshop organizers and participants will prepare a report that documents:

- Progress over the last 30 years in the four themes individually and collectively

- Key scientific problems that could benefit from coordinated modeling and observational process studies involving the tropical convection and air-sea interaction communities

- Technological advancement in modeling and observational infrastructure that could be brought to address these scientific challenges

- Strategies for coordination with the broader scientific community

A BAMS article summarizing the outcome of the workshop will be prepared.

9. **Format:** The meeting will last two and half days. The format of the meeting will be a workshop with plenary, breakout and poster sessions. Plenary sessions will be held in the mornings, while breakout and poster sessions will be held in the afternoons. A workshop reception will be held on the first evening to encourage dialogue in an informal setting.

10. **Science Organizing Committee (if relevant)**

- Samson Hagos (Chair, Pacific Northwest National Laboratory, CLIVAR PSMI Panel)

- Greg Foltz (Co-Chair, NOAA Atlantic Oceanographic and Meteorological Laboratory, CLIVAR PSMI Panel)

- Hyodae Seo (Woods Hole Oceanographic Institution, CLIVAR PSMI Panel)

- Chidong Zhang (NOAA Pacific Meteorological and Environmental Laboratory)

- Sue Chen (Naval Research Laboratory, Monterey)

- Alain Protat (Australian Bureau of Meteorology)

- Elizabeth Thompson (Applied Physics Laboratory, Univ. of WA)

- Dongxiao Wang (South China Sea Institute, Chinese Academy of Science)

11. **Local Organizing Committee (if relevant)**

12. **Proposed funding sources and anticipated funding requested from WCRP:**

We request travel support for of eight international participants, including one organizer and seven ECS/students. Estimated cost : 10k\$

Other sources of funding include:

US CLIVAR: Request 29k\$ for meeting logistics and travel support for 8 invited participants and six of the eight organizers (two are federal employees), and 6 early career researchers.

NOAA CPO: Request \$3K to support the cost of travel to fund 2 NOAA scientists co-organizing this workshop

ONR: Request to support \$1.5K the cost of travel to fund a DoD scientists co-organizing this workshop

International CLIVAR: Requesting \$10K for travel support of international participants, including organizers, speakers, and ECS/students

Registration revenue: Estimated \$12.8K from participant registration fees

**Proforma for CLIVAR Panel requests
for SSG approval for meetings**

1. **Panel or Working Group:** Pacific Region Panel
2. **Title of meeting or workshop:** 2nd Workshop on Decadal Variability of the Tropical Pacific
3. **Proposed venue:** Paris, France
4. **Proposed dates:** 1-5 April 2019
5. **Proposed attendees, including likely number:** All participants of the first workshop held in Ecuador + a couple of additional invitees (~25 people)
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** relevance to CLIVAR science: this topic is very relevant to the tropical climate dynamics and predictability, a core science topic in the new CLIVAR science plan; relevance to WCRP Grand Challenge: very relevant to “Near-term Climate prediction” grand challenge; Cross-panel interactions: will involve collaboration with DCVP RF (2 members of this panel already involved in this activity)
7. **Specific objectives and key agenda items:** Finalize a high-impact review paper on the Decadal Variability of the Tropical Pacific
8. **Anticipated outcomes (deliverables):** Review paper
9. **Format:**
10. **Science Organizing Committee (if relevant):** M. Lengaigne (PRP co-chair), S. Power (PRP member), A. Copotondi (PRP member and next co-chair)
11. **Local Organizing Committee (if relevant):** J. Vialard (PRP member), E. Guilyardi (ENSO RF co-chair)
12. **Proposed funding sources and anticipated funding requested from WCRP:** Local support on project money of E. Guilyardi, M. Lengaigne et J. Vialard + 3,5k\$ (travel expenses for 2 PRP members)

**Proforma for CLIVAR Panel requests
for SSG approval for meetings**

1. **Panel or Working Group:** Pacific Region Panel
2. **Title of meeting or workshop:** 15th session of the PRP meeting
3. **Proposed venue:** Victoria, Canada
4. **Proposed dates:** 28-29 October 2019
5. **Proposed attendees, including likely number:** PRP members + 5 invitees (~20 people)
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** Opportunity to hold our meeting back to back with the annual 2019 PICES meeting to foster our collaboration with this community
7. **Specific objectives and key agenda items:** Tropical-extratropical teleconnections, Climate impact on biogeochemistry ecosystems
8. **Anticipated outcomes (deliverables):**
9. **Format:**
10. **Science Organizing Committee (if relevant)**
11. **Local Organizing Committee (if relevant)**
12. **Proposed funding sources and anticipated funding requested from WCRP:**
4k\$ (travel expenses for 2 PRP members)

Annex B:

Terms of Reference for Pacific Region Panel (revised)

1. To oversee and facilitate the implementation of CLIVAR vision in the Pacific sector in order to meet the objectives outlined in the Science Plan and Implementation Strategy, in collaboration with other relevant panels, research foci groups and task teams. This includes efforts to develop a coordinated international strategy for a sustainable Pacific observing system (such as in support of the TPOS-2020 steering committee) and a better understanding of the

- Internal dynamics (including scale-interactions, non-linearities, inter-basins and tropical-extratropical interactions) of the Pacific variability, including the El Niño Southern Oscillation (ENSO) and Pacific Decadal Variability
- Impact of external forcing on the Pacific (including greenhouse gases, aerosols, volcanic eruptions and solar insolation) and their attribution
- Global climatic teleconnections and impacts of the Pacific climate variability (including regional/coastal sea level, ecosystems and extreme events), and their interaction and modulation by sources external to the Pacific.
- Dynamics that control the multi-scale variability in the Western Boundary Currents, their relationships to the Pacific climate and their oceanic connection to the Indian Ocean through the Maritime continent
- Predictability of the Pacific climate and its global impacts at intraseasonal to multi-decadal timescales (including ENSO and the Pacific Decadal variability)

2. To promote the synergistic use of theory, numerical modelling and the analysis of available observational datasets to address the above scientific questions, including observations over the instrumental period (satellites, reanalyses, gridded reconstructions) as well as paleo-climate proxies when appropriate

3. To coordinate the related activities of the Pacific nations, facilitating cooperative efforts and coordinating work within the boundaries of the various nations as well as outside those boundaries. To provide a forum for exchange and discussion of national plans in the Pacific and to facilitate observational and modelling efforts and data sharing

4. To identify persistent model errors and interact with the Global Synthesis and Observations Panel (GSOP), the Ocean Model Development Panel (OMDP) and the World Climate Research Program (WCRP) to contribute to model improvement (e.g. equatorial Pacific cold tongue, South Pacific Convergence Zone and ENSO biases)

5. To liaise with the Ocean Observation Panel for Climate (OOPC), Global Ocean Observing Systems (GOOS) and Global Observation Panel for Climate (GCOS), with the Joint Commission for Oceanography and Marine Meteorology (JCOMM), and other relevant groups to ensure that CLIVAR benefits from and contributes to observations in GOOS and GCOS

5. To liaise with the North Pacific Marine Science Organisation (PICES), the International Geosphere-Biosphere Program (IGBP), the International Marine Biosphere Research (IMBeR) program and the Future Earth research initiative to understand the influence of Pacific climate variability and change on regional marine ecosystems and assess its associated societal impacts.

6. To advise the CLIVAR SSG of progress and obstacles toward successful implementation of CLIVAR in the Pacific