

CLIVAR Pacific Region Panel

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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 (e.g. Tropical Pacific Observing System, North Pacific Ocean Circulation Experiment) 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 influence of WBCs on the Pacific climate and their oceanic connection to the Indian Ocean through the Maritime Continent and (5) the predictability of Pacific climate. Given the breadth of topics in scope and the current members' expertise, the PRP is presently focusing most of its attention on four main activities: ENSO conceptual models, ENSO metrics, decadal variability in the tropical Pacific, Pacific observing systems, including TPOS2020 in its implementation phase, the North Pacific Circulation Experiment (NPOCE) and its integration with the Low Latitude Western Boundary Current System (LLWBCS). During 2020-2021, like in the previous year, most of the PRP activities and interactions have occurred virtually due to COVID-19. While progress has been made on the panel's main objectives, the lack of in-person interactions, and the cancellation of in-person events during 2021, have somewhat limited some of the expected achievements.

Achievements for 2020-2021

1. Conferences/Workshops/Meetings

ENSO School in Trieste. The PRP has re-initiated activities for the organization of the 3rd Summer School on "Theory, Mechanisms, and Hierarchical Modeling of Climate Dynamics: Tropical Ocean, ENSO, and their Teleconnections", originally scheduled to take place at the Abdus Salam International Center for Theoretical Physics (ICTP) in Trieste, Italy, from 3 to 14 August 2020.

Ocean Sciences sessions. PRP members have been actively involved in the organization of two sessions at the Ocean Sciences meeting scheduled for February 27-March 4, 2022:

- *El Niño in a Changing Climate.* Conveners: Jerome Vialard, Samantha Stevenson, Malte Stuecker, Andrew Wittenberg

- *Toward Predictive Understanding of Pacific Decadal Variability and its Global Implications*. Conveners (after merging with another similar session): Antonietta Capotondi, Cristian Proistosescu, Sara Sanchez, Malte Stuecker.
- *Marine Climate Extremes: Part 1 Mechanisms, Predictability and Coastal Impacts*. Conveners: Emanuele Di Lorenzo, Steven Bograd, Nadia Pinardi, Gerald Meehl, Antonietta Capotondi (invited to participate as CLIVAR representative)

PICES meetings. As co-Chair of the Joint PICES/CLIVAR working group on “Climate and Ecosystem predictability”, A. Capotondi has represented the PRP at the virtual working group meeting in the context of the PICES 2021 annual meeting. This was the last working group meeting prior to the sunsetting of the working group. A. Capotondi has also participated in the scoping meeting for a new PICES working group entitled “Climate extremes and coastal impacts in the Pacific”. The working group is of great relevance to CLIVAR and some of the WCRP Lighthouse Activities (LHAs), e.g., “My Climate Risk”, and “Explaining and Predicting Earth System Change”, and is intended to be joint with CLIVAR and other organizations.

CLIVAR-GOOS meeting. After A. Capotondi, I. Montes and S. Cravatte are now representing the PRP in the organization of the CLIVAR-GOOS Pan-Panel meeting planned initially in early May 2021 in Trieste, Italy. Monthly telecons have been organized in August, September, October. The meeting is currently planned in Trieste for August 2022, still with uncertainties in the possibility to organize an international in-person meeting, with participants expected from developing countries. The proposed format of the 3-day meeting includes a mix of plenary and breakout discussion sessions, during which the participants will:

- Present and discuss the current most important societal and scientific drivers of each of the regional basin-wide observing systems (*Global observation systems, with emphasis on the commonalities on the drivers and challenges identified by the regional reviews, as well as the urgent needs to expand observations to coastal areas; UN Ocean Decade coastal priorities*)
- Hear scientists from developing countries present the scientific and societal drivers for observing their coastal oceans and discuss how their needs may interface with the regional ocean observing systems and their products. (*flash talks, e.g. 5-10 mins each with focused outlines on their interests, needs, priorities and challenges, etc. Africa and South America will be the focal regions*)
- Discuss challenges, processes, and outcomes of reviewing and designing the regional observing systems for the next decade. For example, (i) the transition to more multidisciplinary observing systems (and panel membership), (ii) the need for regional-scale forecasting and expansion into the coastal zone, (iii) lobbying for resources, capacity-building, and developing partnerships, (iv) data archiving, assemblage, and sharing.
- Discuss how our efforts and priorities combine and how the panels can prepare together for the UN’s International Decade of Ocean Science for Sustainable Development, 2021-2030.

The list of invited speakers from developing countries is still under discussion.

2. Scientific results from activities

ENSO metrics. For three years the PRP has hosted the activities of the ENSO metrics group, building on the efforts of the former CLIVAR Research Focus on ENSO in a Changing Climate (2013-2018). This project has been coordinating a large international group of ENSO experts to develop and apply a community metrics and diagnostics package to automatically evaluate, compare, and explore the ENSO performance, teleconnections, and processes in climate simulations. To best support model developers and users, the package is written in Python, and designed to plug into widely-used community diagnostic tools (including ESMValTool, CliMAF, and the PCMDI Metrics Package). This project members, who met in 2020-2021 via teleconference, achieved several major milestones over the past year:

- 1) The open-source ENSO Metrics Package documentation and code (recently ported to Python 3) were **released to the public** via a GitHub [code repository](#) and [wiki](#), together with an [interactive metrics browser for the CMIP5 and CMIP6 models](#). Work also began to integrate the ENSO metrics package into the ESMValTool community diagnostic package.
- 2) The package was **documented** in the Bulletin of the American Meteorological Society ([Planton et al. 2021](#), coauthored by several PRP members, see publication list at the end of this report), and used to assess ENSO in the CMIP5 and CMIP6 models. The study found that the CMIP6 models significantly outperform those from CMIP5, with most CMIP6 models showing improved tropical Pacific seasonality and ENSO teleconnections. The paper is already a Web of Science Highly Cited Paper (top 1%), and the ENSO package has been highlighted in the August CLIVAR Bulletin and on [CLIVAR's website](#).
- 3) The package was used to explore the **robustness** of ENSO metrics, using CMIP6 and US CLIVAR large ensemble datasets to estimate the ensemble sizes needed to quantify and compare ENSO behavior among models, and between models and observations ([Lee et al. 2021](#)). Further work is exploring the extent to which required ensemble sizes can be designed by sampling existing long control simulations, and testing the sensitivity of the ENSO metrics to the time series length, radiative forcing (e.g., pre-industrial vs. historical), and the choice of observational reference datasets (Planton et al., in preparation). The package was also applied to diagnose the impacts of Andes topographic heights on ENSO ([Xu et al., AGU Fall Meeting 2020](#)), and evaluate ENSO in new models from the French National Centre for Meteorological Research (CNRM).
- 4) **New metrics** were added to the package, including background SST gradients, and process metrics for ENSO growth rate & frequency derived from ENSO conceptual models ([Jin et al. 2006](#); [Lu et al. 2018](#)). **New observational reference datasets** were also added to better span the observational uncertainty.

- 5) As a testbed for inclusion into the ENSO Metrics Package, new ENSO process metrics were developed and applied to the CMIP6 models by [Chen et al. \(2021\)](#), a study co-authored by F.-F. Jin (ENSO Conceptual Models working group member) and A. Wittenberg (PRP member and ENSO Conceptual Model working group member).
- 6) The PRP provided extensive input to the WCRP on how the PRP ENSO Metrics package can contribute to its Lighthouse Activities. For example, the package can support the WCRP Academy, e.g., by enabling student projects as part of PRP's planned ENSO Summer School.

ENSO Conceptual Model working group. The working group, led by Jerome Vialard, includes several current and past members of the PRP (Capotondi, Kug, Lengaigne, Luo, McGregor, McPhaden, Stevenson, Vialard, and Wittenberg), as well as several other ENSO experts (Soon-Il An, Dietmar Dommenget, Alexey Fedorov, Fei-Fei Jin, Malte Stuecker, Eli Tziperman, Chunzai Wang). It also includes some early career scientists (S. Gangiredla, Soong-Ki Kim, Shineng Hu, Xiang-Hui Fang). Since its inception in June 2020, the working group has met 10 times through teleconferences. In 2021, selected members continued to synthesize existing knowledge on several fundamental properties of ENSO and their representation in conceptual models:

- November 2020: Seasonal Synchronization/Multiplicative noise (Stuecker and Lengaigne)
- January 2021: Nonlinearity/Asymmetry (An and Kug)
- February 2021: Diversity/Conceptual models vs GCMs (Capotondi and Dommenget)
- April 2021: Predictability/Interactions with mean state (Vialard and Fedorov)
- June 2021: A review of ENSO low-order model (Jin)
- July 2021: The delayed, advective reflective & western Pacific oscillators (Wang)

These review presentations were followed by selected talks on recent relevant studies provided by Xui-Hui Fang, Soon-Ki Kim, Tao Geng, and Shayne McGregor. In 2022, the main objective of the working group will be to prepare a review paper on ENSO conceptual models, as described in the "Plans for 2022" section.

Tropical Pacific Decadal Variability paper. The review paper on Tropical Pacific Decadal Variability promoted by the PRP, and led by Scott Power was published in *Science* on October 1, 2021.

Integration of low-latitude western boundary current and maritime continent observations into a unified multi-platform observing system. During 2020-2021, the COVID-19 pandemic caused a lot of inconvenience to scientific research. Nevertheless, with joint efforts, the NPOCE made substantial progress in continued monitoring of the Low-Latitude Western Pacific Ocean (WPO) and the Indonesian Throughflow (ITF) by successfully organizing and conducting two cruises in the western Pacific Ocean and the Indonesia Seas. The Institute of Oceanology, Chinese Academy of Sciences (IOCAS) conducted a non-stop 62-day cruise in the WPO on board of R/V 'Kexue' in fall 2020,

which is the longest scientific expedition since the beginning of the NPOCE. With the help of the Research Center of Oceanography, Indonesian Institute of Sciences (PPO-LIPI), the IOCAS-LIPI Indonesian sea joint cruise was successfully conducted in spring 2021. About 41 papers associated with the WPO circulation and climate variability were published over the past year.

TPOS2020 Updates:

Updates on TPOS2020 project:

- The Third and Final Report of TPOS 2020 has been fully endorsed by the Steering Committee as the conclusion of the TPOS 2020 Project, and has been released in August 2021 (<https://tpos2020.org/project-reports/final-report/>)
This report builds upon the First and Second Reports (released in 2016 and 2019, respectively). The TPOS2020 Final Report ([Kessler et al. 2021](#)) provides the foundation for the future evolution of the arrays: describing remaining unresolved issues and a governance structure that will provide the necessary scientific advice and coordination among the implementing agencies.
- A new website is now available, with many information on the data that constitute the TPOS, on related pilot and process studies, and on outreach.
<https://tropicalpacific.org/>
- Past TPOS2020, the project is transitioning. As recommended in the final report, two groups (the ICG, Implementation Coordination Group, and the SAC, Steering Advisory Committee) have been created; co-chairs have been invited and should be soon official. These groups will now be populated, with an open procedure of applications through GOOS and CLIVAR that should soon start. The ICG will be responsible for tropical moored array (TMA) planning and coordination, data management, profiling floats coordination, and interfacing with international higher-level bodies. The SAC will be a “scientific advisory committee”, tasked to provide ongoing scientific oversight, ensure a scientific and technological watch to evolve the TPOS, considering new technology and pilot study results, and to refine the design if needed, as the TPOS must stay open to evolution.

Updates on TPOS state:

- Concerning the TPOS state and the implementation of the new array: the Covid-19 crisis had several important negative impacts on TPOS implementation. China SIO deployed 4 moorings in the western area (<https://tropicalpacific.org/projects/china-experimental-observing-project-in-the-western-tropical-pacific/>), but could not do the intercomparison studies that were planned and strongly recommended to ensure the data quality. Observational programs on the LLWBCs have been stopped, interrupting long-timeseries. All TRITON moorings have been withdrawn. There are currently no moorings transmitting data west of 165°E, which is very worrying.
- China deployed 28 Argo floats (among which 8 BGC floats).
- NOAA investment in TAO and Argo floats is strong. TPOS2020 recommended changes should be soon implemented. Sensors are purchased, and initial deployments are scheduled for Summer 2022.
- NOAA is stepping up its TPOS Argo work, including both core Argo and BGC

- The SEPICAF project (led by Boris Dewitte <https://www.ocean-ops.org/reportcard2021/>) has already released several Argo floats (9 along the coast of Peru, and 5 offshore of Chile). The floats off Peru are being used for local monitoring of El Niño (<http://met.igp.gob.pe/variabclim/argo2.html>)

Ocean Isotopes.

The PRP remains committed to supporting efforts to create and maintain long-term records of water isotopes in the Pacific. The US CLIVAR working group on Observations and Modeling of Water Isotopes in the Climate System has now sunset, but PRP member Stevenson continues to maintain contact with former working group members and to participate in the ongoing writing of the working group review paper on water isotopes in the climate system. Stevenson is working on developing connections between PRP and other user groups interested in facilitating 'follow-up' activities in the areas of water isotope-enabled climate model intercomparison and the collection and compilation of long-term measurements of sea and rainwater isotopes. Potential groups include GO-SHIP, UNOLS ship of opportunity cruises, and climate modeling centers active in isotope-enabled model development, in addition to former US CLIVAR working group members.

Tropical Pacific Decadal Variability Working Group. Tropical Pacific Decadal Variability (TPDV, defined here as the naturally-occurring variations at timescales from 8 to 40 years) is a key component of modes of Pacific decadal variability, like the Pacific Decadal Oscillation in the Northern Hemisphere, and the Interdecadal Pacific Oscillation basin-wide. TPDV appears to play an important role in the global climate, and also confounds the detection of the climate change signal in the tropical Pacific. The recent [PRP Science paper](#) on this topic has highlighted how oceanic processes may produce decadal variations and contribute some degree of predictability. The TPDV working group aims at reviewing and elucidating the nature of the ocean-atmosphere feedbacks driving Pacific decadal variability. The working group includes several panel members (S. Cravatte, Y. Imada, K. Karnauskas, Y. Kosaka, J.-J. Luo, S. McGregor, M. McPhaden, S. Stevenson, A. Taschetto, F. Wang, X. Zhang, A. Capotondi), several experts from the broader scientific community (K. Cobb, R. Farneti, N. Holbrook, F. Kucharski, M. Mayer, B. Qiu, A. Santoso, J. Sprintall, M. Stuecker, C. Ummenhofer), and seven early career scientists (Giorgio Graffino, Ryan Holmes, Shijian Hu, Nicola Maher, Sara Sanchez, Arnold Sullivan, Mathias Zeller). The working group has been meeting monthly since May 2021 to review the current state of knowledge on oceanic and atmospheric processes forcing Pacific decadal Variability based on observations, modelling studies, and paleo-climate archives. The Working Group proposed a session on “Pacific Decadal Variability” at the upcoming Ocean Sciences meeting (February 27-March 4, 2022), which was subsequently merged with another session on a similar topic. Only Working Group members Capotondi and Sanchez have remained in the conveners’ list after merging.

3. Scientific Capacity Building and Career Support

- During 2021, A. Capotondi and S. Stevenson have served as mentors for the US program “Mentoring Physical Oceanography Women to Increase Retention” (MPOWIR). This program involves one conference call per month to support young

women at the Ph.D. and Post-Graduate level in successfully navigating the field of Physical Oceanography and finding appropriate and fulfilling roles.

- A. Wittenberg served as a summer mentor as part of Princeton University's CIMES diversity undergraduate research program
- The ENSO conceptual model and the Tropical Pacific Decadal Variability working groups include several early career scientists and provide them with opportunities to participate in discussions and activities that can support their scientific and professional development.

4. Knowledge exchange

- The joint PICES/CLIVAR working group has allowed very valuable interactions between the two communities. The new working group on ocean extremes can be expected to provide continuing interactions and collaborations.
- The PRP reviewed the science plans of the WCRP LHAs in September 2021, and provided extensive input to the LHAs on areas of potential interactions. In particular, the activities of the Tropical Pacific Decadal Variability working group can project strongly on the goals of the LHA on "Explaining and Predicting Earth System Change" (EPESC), while the PRP involvement with ocean extremes and their coastal impacts, in conjunction with PICES, has a strong overlap with some of the foci of "My climate Risk". To establish a dialogue with EPESC, Capotondi presented an overview of the TPDV working group entitled "A CLIVAR Pacific Region Panel Working Group on Tropical Pacific Decadal Variability: Goals and Possible Synergies" at the EPESC virtual workshop on "Attribution of multi-annual to decadal changes in the climate system".

Plans for 2022 and beyond

NPOCE. Given the traveling limitation under the influence of COVID-19, the NPOCE will hold series of webinars to strengthen the scientific communications and promote cooperation among NPOCE SSC members and early-career scientists every 3-month. Two field programs, the Equatorial Line Observations (ELO) and the Measuring and Modeling the Indonesian Throughflow International Experiment (MINTIE) funded by NSF in the Indonesian seas are expected to proceed in early 2022 and 2023. NPOCE will continue the effort to address its collective research needs on field experiments and data sharing in the WPO and its ambient oceans/seas. Due to the COVID-19, the 4th OSS (Open Science Symposium on Western Pacific Ocean Circulation and Climate) is planned to be held in a synchronized virtual and face-to-face format in 2022 in Xiamen, China.

TPOS2020. The PRP will maintain a close interaction with TPOS2020 in its implementation plan through member S. Cravatte, and provide input as needed.

CLIVAR-GOOS workshop. The PRP will continue its involvement in shaping the format and outcomes of the workshop through the participation of S. Cravatte and I. Montes in the steering committee.

ENSO Conceptual Model working group. The WG was supposed to meet in person along with the PRP after the Ocean Sciences meeting in Hawaii. This, and other plans to meet physically in 2022 are currently very uncertain due to the pandemics. The WG will still contribute to the Ocean Sciences meeting with an online ENSO session which has a focus on conceptual models (convenors: Stevenson, Stuecker, Wittenberg & Vialard), and a “tutorial” (speakers: Jin and Wang) on the same topic. The ENSO conceptual model working group will however continue its activities through e-mail and teleconferences, as done over the last year. The first objective for 2022 is to start working on a review paper. The previous extensive review chapter on ENSO theory, in the “El Niño Southern Oscillation in a Changing Climate” book did focus on presenting the existing recharge oscillator model, with only a short section on the “way forward”. That will be the main goal of our WG review paper, with the specific intent of providing a generalization of the Recharge Oscillator model that can account for ENSO diversity. The WG coordinator (J. Vialard) will synthesize material covered during the teleconferences in 2021 during the first 2022 meeting, and will start a discussion on material to be included in the review and contributing authors.

ENSO metrics. Work on ENSO metrics will continue during this coming year, and will benefit from the interactions with the ENSO Conceptual Models Working Group, particularly with regard to process diagnostics. Work will further proceed to incorporate the ENSO metrics package into community tools like the PCMDI Metrics Package (PMP) and the Earth System Model Evaluation Tool (ESMValTool), to support model development and analysis internationally. We may also leverage ES-Doc (which aims to systematically document models, e.g., their "Comparator") to enable grouping models by resolution, lineage, and parameterization schemes. The metrics will be applied to a broader set of CMIP5 and CMIP6 simulations, to investigate impacts of climate change on ENSO, and to identify emergent constraints toward reducing projection uncertainties and clarifying future ENSO risks. The ENSO Metrics package will also be used to support student projects as part of the ENSO Summer School. As it continues to mature, the ENSO Metrics project could benefit from any available CLIVAR resources — especially in the form of postdoctoral support — to accelerate community uptake via research and development, documentation, tutorial-building, training, and website curation.

Tropical Pacific Decadal Variability (TPDV) Working Group. The Working Group is planning to complete the TPDV review in Spring 2022, and summarize the main results in a review paper. Meanwhile, key aspects of oceanic and coupled variability are being identified as targets for joint Working Group efforts to assess the representation of these processes in CMIP6 simulations, both coupled and ocean-only (OMIP). We expect the next 1-2 years to be devoted to these collaborative activities.

PICES Working Group on “Climate extremes and coastal impacts in the Pacific”. The PRP will continue working closely with PICES and the appropriate LHAs in the development of this Working Group.

ENSO School in Trieste. If approved and funded, the PRP will pursue the organization of the school. The present plans are targeted to an in-person event that will occur over a

two-week period at the end of July, 2022. However, if this format is not possible for safety reasons, a virtual format will be considered. The Abdus Salam International Center for Theoretical Physics (ICTP) in Trieste should be able to provide support for the virtual format.

Articles published in 2020/21 as part of panel activities

Power, S., M. Lengaigne, A. Capotondi, M. Khodri, J. Vialard, B. Jebri, E. Guilyardi, S. McGregor, J.-S. Kug, M. Newman, M. J. McPhaden, G. Meehl, D. Smith, J. Cole, J. Emile-Geay, D. Vimont, A. T. Wittenberg, M. Collins, G.-I. Kim, W. Cai, Y. Okumura, C. Chung, K. M. Cobb, F. Delage, Y. Planon, A. Levine, F. Zhu, J. Sprintall, E. Di Lorenzo, X. Zhang, J.-J. Luo, X. Lin, M. Balmaseda, G. Wang, B. J. Henley, 2021: Decadal climate variability in the tropical Pacific: Characteristics, causes, predictability and prospects, *Science*, **374**, [DOI: 10.1126/science.aay9165](https://doi.org/10.1126/science.aay9165)

Cai, W., **A. Santoso, M. Collins, B. Dewitte, C. Karamperidou, J.-S. Kug, M. Lengaigne, M. J. McPhaden, M. F. Stuecker, A. S. Taschetto, A. Timmermann, L. Wu, S.-W. Yeh, G. Wang, B. Ng, F. Jia, Y. Yang, J. Ying, X.-T. Zheng, T. Bayr, J. R. Brown, A. Capotondi, K. M. Cobb, B. Gan, T. Geng, Y.-G. Ham, F.-F. Jin, H.-S. Jo, X. Li, X. Lin, S. McGregor, J.-H. Park, K. Stein, K. Yang, L. Zhang, W. Zhong, 2021:** Changing El Niño Southern Oscillation in a changing climate. *Nature Reviews Earth & Environment*, **2**, 628-644, <https://doi.org/10.1038/s43017-021-00199-z>

Planon, Y. Y., E. Guilyardi, **A. T. Wittenberg, J. Lee, P. J. Gleckler, T. Bayr, S. McGregor, M. J. McPhaden, S. Power, R. Roehrig, J. Vialard, A. Voldoire, 2021:** Evaluating climate models with the CLIVAR 2020 ENSO metrics package, *Bull. Amer. Meteor. Soc.*, **102**, E193-E217, <https://doi.org/10.1175/BAMS-D-19-0337.1>

Lee, J., Y. Y. Planon, P. J. Gleckler, K. R. Sperber, E. Guilyardi, A. T. Wittenberg, M. J. McPhaden, and G. Pallotta, 2021: Robust evaluation of ENSO in climate models: How many ensemble members are needed? *Geophys. Res. Lett.*, **48** (20), e2021GL095041. <https://doi.org/10.1029/2021GL095041>

Chen, H.C., F.-F. Jin, S. Zhao, A.T. Wittenberg, and S. Xie, 2021: ENSO dynamics in the E3SM-1-0, CESM2, and GFDL-CM4 climate models. *J. Climate*, **34** (23), 9365-9384. <https://doi.org/10.1175/JCLI-D-21-0355.1>.

Budget and other needs for 2021

Please keep in mind that the overall budget of CLIVAR is limited and this needs to be distributed between all activities and the SSG meeting.

Annex A

Proforma for CLIVAR Panel requests for SSG approval for meetings

Note: If your group has approved funds in 2020 that were not used because of Covid19, and you propose to use them in 2021, they should be included again in this request, in addition to any new request.

1. **Panel name:** Pacific
2. **Title of meeting or workshop:** ENSO School
3. **Proposed venue (Or indicate if online):** International Center for Theoretical Physics, Trieste, Italy
4. **Proposed dates:** Two weeks during July 18- August 5
5. **Proposed attendees, including likely number:** The school will include about 20 lecturers and 50 students
6. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** This school was originally planned for the boreal Summer of 2020, but was cancelled due to the pandemic. ENSO is one of the most influential modes of variability in the climate system, so that a school on this topic has a large educational value
7. **Specific objectives and key agenda items:** The objectives are mainly educational. Material from the book “ENSO in a Changing Climate” that the PRP was heavily involved with, will be used as part of the curriculum, while the ENSO metrics package will be used for students’ hands-on activities.
8. **Anticipated outcomes (deliverables):** We expect to prepare a report on the school.
9. **Format:** The school is currently planned as a in-person event. It will be virtual, if the in-person format is considered unsafe.
10. **Science Organizing Committee (if relevant):** Antonietta Capotondi (PRP), Michael McPhaden (PRP), Andrew Wittenberg (PRP), Eric Guilyardi (co-Chair of the ENSO in a changing climate focus group)
11. **Local Organizing Committee (if relevant):** Fred Kucharski, Riccardo Farneti
12. **Proposed funding sources and anticipated funding requested from WCRP:** We have applied for funding for US participants through US CLIVAR. We would like to request CHF 5000 from WCRP to support travel of non-US participants.

Annex B

Proforma for CLIVAR Panel requests for SSG approval for meetings

Note: If your group has approved funds in 2020 that were not used because of Covid19, and you propose to use them in 2021, they should be included again in this request, in addition to any new request.

13. **Panel name:** Pacific
14. **Title of meeting or workshop:** Panel meeting
15. **Proposed venue (Or indicate if online):** TBD (possibilities are the EBUS conference in PERU in September or AGU Fall Meeting in December)
16. **Proposed dates:** TBD
17. **Proposed attendees, including likely number:** Panel members plus a few guests
18. **Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Grand Challenges, and any cross-panel/research foci links and interactions involved:** The panel has not met in person in a long time, and an in-person meeting would be very beneficial to
19. **Specific objectives and key agenda items:** Science and business discussions
20. **Anticipated outcomes (deliverables):** Panel report
21. **Format:** One-day meeting with scientific presentation and panel business's discussions
22. **Science Organizing Committee (if relevant)**
23. **Local Organizing Committee (if relevant)**
24. **Proposed funding sources and anticipated funding requested from WCRP:**
We request CHF 5000 from WCRP to support travel expenses of some of the members