

CLIVAR REPORT

Climate and Ocean: Variability, Predictability, and Change



Report on the 14th Session of CLIVAR Pacific Region Panel (PRP)

Meeting Report

19-20 October 2019, Victoria, Canada

January 2020

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Action Items

Action 01: To setup a group of researchers that agree to be part of the ENSO Conceptual Model Working Group and submit the formal working group proposal to CLIVAR SSG in early 2020 (Jerome).

Action 02: PRP members to provide feedback to the ENSO Metrics group, including its user interface, governance, and observational reference datasets (all).

Action 03: To request CLIVAR/WCRP's endorsement for the ENSO Metrics package and its continued development (Andrew).

Action 04: To explore links between ENSO metrics and ENSO Conceptual models (Andrew & Jerome)

Action 05: To request access from the publisher to an e-version of the AGU monograph on ENSO, both for the authors and for use in the ENSO Summer School (Mike McPhaden).

Action 06: To include the ENSO Metrics as topic for the 2020 ENSO Summer School (Antonietta).

Action 07: To promote the creation of an international working group on the ITF (Antonietta).

Action 08: Authors of the TPDV science paper to provide comments on revising the figures and text to the manuscript to Scott Power by October 2019. TPDV manuscript was submitted to the journal in December 2019. Updates on the submission status will be provided to the PRP and broader Authorship (Scott).

Action 09: PRP will continue a close dialogue with the US CLIVAR Ocean Isotope Working Group and provide support to meet its needs (Sam).

Action 10: The PRP will maintain a close dialogue with TPOS2020, and provide input to the implementation plan, once further details on the approach and strategy are provided by TPOS2020.

Action 11: To seek interactions with BGC expert groups interested in the whole Pacific basin (PICES is primarily focused on the North Pacific), and develop a plan for a Pacific-wide study of marine heat waves, a topic of great urgency and interest to the marine ecosystem community.

Action 12: To establish a dialogue with the NORP and SOPR CLIVAR panels to identify areas of common interest and possibilities of collaboration (co-chairs).

Action 13: To respond to Annalisa that Mike/Rene will be the PRP contact points for possible future cooperation with the ANDEX project (Antonietta/Matt).

Action 14: Agreed among panel members that the following core topics should be tackled in the next couple of years by the panel, including: 1) ENSO conceptual models; 2) Oceanic mechanisms driving TPDV variations; 3) Pacific-wide marine heat waves in relation to climate change.

Action 15: Co-chairs of PRP will contact the member who hasn't been active in the past two years to make sure the person is still interested in being a member of the panel.

Action 16: Co-chairs of PRP will circulate a proposal for panel members rotation. It will be sent to SSG once approved by the panel.

Action 17: Matt and Antonietta will take the lead to prepare the draft of the 2018-2019 Annual Report for PRP and circulate it for comments from the panel.

Background

The 14th Session of CLIVAR Pacific Region Panel (PRP) took place on 19 October 2019, in Victoria, Canada, alongside the 2019 PICES Annual Meeting. During the meeting, updates on in 2018-2019 panel activities have been briefed to the meeting, including the ENSO Conceptual Model, status and next steps of ENSO Metrics, update on Wiley book on ENSO in a changing climate, preparation of 2020 ENSO Summer School in Trieste, Western Boundary Current and Indonesian Throughflow activities and Tropical Pacific Decadal Variability Science paper, etc. The workplan for 2020 and onwards have also been discussed by all members during the meeting, including the potential cross-activities with US CLIVAR on ocean isotope, the way forward with TPOS2020, possible panel activities including marine biogeochemistry and cooperation with PICES WG-40, potential interactions with other core projects of WCRP and the Southern/Northern Region Panel of CLIVAR, as well as the way forward after the completion of the TPDV paper. Panel membership and next panel meeting were also discussed at the end of the day. More detailed information for the meeting is available at <http://www.clivar.org/events/14th-session-clivar-pacific-region-panel>.

1. Updates on Panel Activities

1.1 ENSO Conceptual Models

This new activity on ENSO Conceptual Models has been proposed by J. Vialard during the last PRP meeting, and complements the integration of the ENSO RF activities into the PRP activities. Due to the proposer's time constraints (J. Vialard), not much progress has been done this year but some key researchers on this topic have agreed to join that team (F.-F. Jin, A. Wittenberg, A. Fedorov, M. Lengaigne, A. Capotondi, S. McGregor). Answers from other identified researchers are being expected. The idea is to build a team selected from PRP, former ENSO RF members and invited experts, including theorists, modellers and observationalists, to work on the following questions: 1) What fundamental ENSO properties should a conceptual model represent? 2) What key physical processes are needed to account for these properties? 3) What are the strengths and weaknesses of various existing conceptual models? 4) What is the relevance of these conceptual models for identifying main ENSO biases in state-of-the-art coupled general circulation models? 5) What is the way forward to build improved conceptual models? The final outcome of this activity would be to promote new developments on ENSO conceptual models and a review paper summarizing the current knowledge. A formal working group proposal, with identified members, terms of reference and a precise goal (review paper on ENSO conceptual models, including a strategy for moving forward) will be sent to the CLIVAR SSG in early 2020. The ongoing H2020 European Commission funded ARiSE (Atmospheric Dynamics Research InfraStructure in Europe) project was introduced by Jerome during the meeting. This project may have the potential to cooperate with the WG in the future.

Action 01: *To setup a group of researchers that agree to be part of the ENSO Conceptual Model Working Group and submit the formal working group proposal to CLIVAR SSG in early 2020 (Jerome).*

1.2 ENSO Metrics

Community metrics remain a high priority to help integrate observations, models, and theory to better understand, predict, and project future ENSO behaviour. The ENSO metrics effort, which had proceeded under the *CLIVAR Research Focus (RF) on ENSO* and merged back into the PRP last year, continues to make excellent progress. The planned ENSO metrics activities will assist in evaluating and comparing model simulations, understanding ENSO

dynamics, and projecting possible future changes in ENSO. Andrew Wittenberg, a current PRP member and co-chair of the former ENSO RF, provided an update on the achievements of the ENSO metrics working group in 2018-2019, along with future plans.

The ENSO metrics group has implemented a Python package to diagnose and explore ENSO characteristics in the CMIP5 and CMIP6 models. The interactive capabilities of this package were demonstrated at the PRP meeting. To support model developers and users, the package is designed to plug into widely-used community diagnostic tools (including ESMValTool, CliMAF, and the PCMDI Metrics Package), and the ENSO metrics team maintains active dialogues with the developers of those community tools. Yann Planton, the main software developer of the ENSO Metrics package, has recently moved from IPSL to NOAA/PMEL to work with Mike McPhaden (PRP Ex officio member) for one year, where he will further develop the package and apply it to the CMIP5/6 models. A paper describing the metrics package and its applications to CMIP was submitted to BAMS in December 2019, and a beta release of the package will be available for testing by the PRP and the broader ENSO and modelling communities by May 2020.

The ENSO Metrics team invites feedback from the PRP on the initial implementation of the metrics package, including: (1) the chosen subsets and collections of ENSO metrics in the package, which are currently geared for a wide audience of model users rather than ENSO-dynamics experts; (2) the available selection of observational reference datasets; (3) the dataset durations and/or ensemble sizes needed for robust model evaluations; (4) the user interface; and (5) governance of future development and dissemination of the metrics package.

Continued support for ENSO metrics development is strongly encouraged and endorsed by the PRP. A WCRP/CLIVAR endorsement of the ENSO metrics project would help raise the visibility of the project, and attract support for continued development. Near-term plans are to (1) expand the existing metrics collections, for example by leveraging ENSO conceptual models (see Sec. 1.1 above); (2) develop new collections, e.g. climate change impacts on ENSO, ENSO-teleconnection processes, and ecosystem impacts (in consultation with PICES WG-40); (3) explore different approaches to model evaluation and selection/weighting, and (4) explore inter-model relationships among metrics, e.g. the relation of ENSO biases to mean-state biases, and emergent constraints for future ENSO changes.

Action 02: *PRP members to provide feedback to the ENSO Metrics group, including its user interface, governance, and observational reference datasets (all).*

Action 03: *To request CLIVAR/WCRP's endorsement for the ENSO Metrics package and its continued development (Andrew).*

Action 04: *To explore links between ENSO metrics and ENSO Conceptual models (Andrew & Jerome).*

1.3 Wiley Book: ENSO in a Changing Climate

The PRP actively contributed to different chapters of an AGU monograph written for the AGU Centennial titled *ENSO in a Changing Climate*. This book, edited by A. Santoso (former PRP member), W. Cai (SSG co-chair and former PRP co-chair and ENSO RF member) and M. McPhaden (PRP ex-officio member), provides a comprehensive review of ENSO and the effect of climate change on its dynamics, predictability, and impacts. Section 1 introduces what ENSO is, the basic characteristics and processes, including the climatology of the tropical Pacific and pertinent issues in ENSO research. The basic dynamics of ENSO is firstly covered in three chapters in section 2 largely using conceptual models with some mathematical equations. For the rest of the book, each chapter includes a perspective on climate change. Section 3 describes the three main tools to conduct ENSO research: observations, paleo-reconstructions, and models. This sets up the readers to understand the next sections, which

will utilize models, observations, and paleo records. Section 4 discusses external and remote forcing of the tropical Pacific, followed by Section 5 on predictions and Section 6 on teleconnection and impacts. Among the 20 chapters contained in this book, six of them were led by PRP members and ten members contributed to ten of these chapters. It was suggested to use this book as one of the references for the upcoming ENSO Summer School in 2020, and permission needs to be sought from the publisher, i.e. Wiley.

Action 05: *To request access from the publisher to an e-version of the AGU monograph on ENSO, both for the authors and for use in the ENSO Summer School (Mike McPhaden).*

1.4 2020 ENSO Summer School

Antonietta informed the PRP that the 3rd Summer School on Theory, Mechanisms, and Hierarchical Modeling of Climate Dynamics: Tropical Ocean, ENSO, and their Teleconnections proposed by PRP, will take place at the Abdus Salam International Center for Theoretical Physics (ICTP) in Trieste, Italy, from 3 to 14 August 2020 and is expected to gather ~50 students. The first week of the school will be entirely devoted to the discussion of different aspects of ENSO, including phenomenology, theory, modelling, and prediction. The school curriculum will be built on the content of the comprehensive AGU Monograph “El Niño Southern Oscillation in a Changing Climate”, as well as on the PRP activities on ENSO conceptual models. The organisers also plan to use concepts and tools from the work on ENSO metrics and the output of the CMIP6 models to design appropriate practical activities for the students. The second week will explore teleconnections from the tropical oceans to the extra-tropics, decadal variations of ENSO teleconnections, and inter-basin interactions. ICTP will provide the facility for the workshop, lodging for students and lecturers, as well as some funding for student travel costs, especially students from developing countries. Additional funding has been provided by NSF Physical Oceanography, and the NOAA Climate Program Office Climate Variability and Predictability (CVP) and Modeling, Analysis, Prediction and Projection (MAPP) Programs through US CLIVAR to support travel costs of some lecturers and students from the U.S. Additional funding may be provided by WCRP/International CLIVAR, and IRD in 2020.

Action 06: *To include the ENSO Metrics as topic for the 2020 ENSO Summer School (Antonietta).*

1.5 Western Boundary Current and ITF

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 Indonesia Throughflow Task Team (ITF TT), which focused on the oceanic connection between the Pacific and Indian Oceans through the Maritime continent were formally integrated in the PRP scope. Because of several other PRP activities and the lack of a formal link with previous ITF TT members, the PRP was unable to effectively develop activities around this scientific theme. However, the maritime continent remains in the PRP terms of reference (4), and is also the focus of new international interest through the Years of the Maritime Continent (YMC) effort. The PRP and the NPOCE have helped develop a strategy for an observational sampling of the Pacific Lower Latitude Western Boundary Currents (LLWBCs) and their connection with the Indonesian Throughflow. This has included the development of new technologies, such as subsurface mooring reporting in real-time and drifting floats. Some PRP members contributed to white papers related to the LLWBCs and ITF observations that were presented at the OceanObs’19 Meeting. Janet Sprintall and Xiaopei Lin from PRP both investigated the best way to move forward on this issue and

proposed the following actions: (1) Identify the key stations and transects that have been historically occupied in the LLWBC regions, (2) Coordinate observations among major countries to produce a coherent atlas of velocity measurements to enhance understanding of the flow in the boundary regions and help inform the development of an observational strategy, (3) Extend the research area of NPOCE and work with other projects in this region to better coordinate the observations, and (4) Potentially link to other operational systems, such as TPOS2020, for the forecast and prediction.

Action 07: To promote the creation of an international Working Group on the ITF.

1.6 TPDV Science Paper

One major PRP achievement was the PRP leadership and contribution to a new review paper on Tropical Pacific Decadal Variability (TPDV) which was submitted to *Science* in December 2019 (Power et al., submitted). This review paper was the outcome of two workshops on this topic held in Manglartalo, Ecuador (Oct. 2018) and Paris, France (Apr. 2019). This paper provides a comprehensive review of our current state-of-knowledge of TPDV, its spatial and temporal characteristics, its many proposed mechanisms, and the current ability of state-of-the-art climate models and prediction systems to simulate and predict TPDV. The review is based on analyses of a wide, diverse, and in some cases contradictory array of evidence from historical records, instrumental and paleoclimate data, theory, mathematical models of Earth's climate, and decadal prediction systems. From the critical synthesis of this information, the review concludes with a novel and informed set of recommendations to advance the understanding of TPDV and the ability to predict it. The review provides, in particular, a comprehensive and holistic synthesis of the natural (e.g., internal variability in the tropical and extra-tropical Pacific, influences from other ocean basins; explosive volcanic eruptions) and anthropogenic (e.g., emissions of greenhouse gases and sulfate aerosols) processes posited to cause or strongly influence TPDV, and the interactions between them. This review also provides the degree of confidence the Authors (many of which are world-class experts on the topic) have in the proposed mechanisms and the extent to which oceanic processes may provide some degree of predictability.

The PRP meeting participants provided constructive comments and suggestions on the draft of the manuscript, in particular regarding the figures. The broader authorship of the paper was requested to provide feedback to S. Power by the end of October 2019. The manuscript was submitted to the journal in December 2019.

Action 08: Authors of the TPDV science paper to provide comments on revising the figures and text to the manuscript to Scott Power by October 2019. TPDV manuscript was submitted to the journal in December 2019. Updates on the submission status will be provided to the PRP and broader Authorship (Scott).

1.7 Update on US CLIVAR Working Group on Ocean Isotope

Samantha Stevenson, a new member of PRP, briefly introduced the US CLIVAR Workshop on Water Isotopes and Climate, and identified some possible cross-activities between US CLIVAR Isotope Working Group and CLIVAR PRP. The workshop took place in Boulder, CO, USA on 1-3 October 2019, with the overall objective of developing new strategies for applying isotope ratio towards understanding and predicting the water cycle's role in climate variability and change. The major outcomes of the workshop include: 1) Combining isotope-enabled modelling with modern/proxy $\delta^{18}\text{O}$ data will provide better constraints on dynamical sensitivities to external anthropogenic CO_2 forcing; 2) Isotopes will shed light on regional

ocean circulation features as the isotope information has the potential to generate dynamical ‘fingerprints’; 3) The biophysical isotope modeling will be useful for understanding the dynamics of local hydrological processes; and 4) Complexity of atmospheric processes will require detailed *in situ* observations to evaluate the physics, for which isotopes can also help. It was recommended that further efforts may focus on: 1) dedicated observations to facilitate process understanding; 2) proxy “super sites”; 3) precipitation and seawater isotopic monitoring; 4) development of better infrastructure for data/model synthesis; 5) advanced isotopic monitoring from routine platforms; and 6) need for better modeling support tools (reanalyses, free-running models). The possible interactions with PRP efforts may include: 1) TPOS2020: develop more detailed plan for isotopic monitoring; 2) Isotopic data: additional insight into low-frequency climate variability; and 3) Precipitation monitoring: possible interaction between ANDEX/other working groups and the isotope community.

Action 09: *PRP will continue a close dialogue with the US CLIVAR Ocean Isotope Working Group and provide support to meet the working group needs (Sam).*

2. Workplan for 2020 and Onward

2.1 Way Forward with TPOS2020

The PRP provided feedback on the first and second reports of TPOS2020 which has improved its scientific capacity. The overall goal of TPOS2020 is to build a robust observing system of the Tropical Pacific that can detect and diagnose expected and unexpected changes, due to both ENSO and anthropogenic climate change. The feedback provided by the PRP revolved around ensuring the project did not sacrifice continuous long temporal coverage from the pre-existing moored array for improvements in spatial resolution through the increase in Argo density and remotely sensed winds, as both aspects are fundamental to the detection of both natural or anthropogenically driven changes. In particular, there was consensus within the PRP that TPOS2020 did not sufficiently prioritize sustaining decade-long moored time series, and did not convincingly justify the removal of so many long mooring records. The feedback from PRP led to changes in the proposed TPOS observational network, such that it now provides a better balance between long continuous records and improved spatial coverage. Matt has been contacted by Sophie Cravatte from the TPOS2020 Steering Committee to discuss the implementation of TPOS2020. A supervising team is scheduled to be setup by TPOS2020, to ensure that the data transmission and data quality meet the needs of users; to follow closely all the components of the observing systems (satellite included) to make sure that the requirements are fulfilled; and to evaluate on a regular basis the ongoing pilot studies and their eventual integration in the TPOS design. The 6th Steering Committee Meeting of TPOS2020 was organized from 5 to 7 November 2019 in Hangzhou, China, and was intended to cover the discussion of the above-mentioned topics. Xiaopei Lin represented PRP at the meeting, and re-iterated the points raised by the PRP to TPOS2020 as mentioned above. He also expressed the willingness of the PRP to provide input to the TPOS2020 implementation plan.

Action 10: *The PRP will maintain a close dialogue with TPOS2020, and provide input to the implementation plan, once further details on the approach and strategy are provided by TPOS2020.*

2.2 Possible Panel Activities involving Marine Biogeochemistry

The potential areas for PRP’s future cooperation with the biogeochemical (BGC) community may include: 1) marine ecosystems; 2) fish and fisheries; and 3) ocean chemistry (Oxygen, pH, CO₂). It was discussed whether the PRP should try to expand of those areas or remain

focused on the physical drivers of the biogeochemistry. According to the new CLIVAR Science Plan, there are many open questions related to the biogeochemistry. For example, 'constraining ocean carbon uptake and storage' is one of the open questions that CLIVAR will tackle in the next decade, which include: 1) addressing carbon cycling biases in ocean and Earth system models; and 2) mechanisms driving future feedbacks in the ocean carbon system. Another open question is the 'constraints of plenary energy imbalance'. One of the specific topics that has been identified by PRP, and is somewhat related to the second open question, is the relationship between dominant modes of climate variability and marine heat wave over the Pacific basin. Meanwhile, participants also agreed that biogeochemistry could help improve the understanding of physical oceanography.

Cooperation with PICES (through its WG 40) has been initiated. A joint workshop between PRP and PICES WG40 on the 'Climate and Ecosystem Prediction in the North Pacific' took place on 20 October 2019, in Victoria, Canada, right after this panel meeting. It was suggested to further explore possibilities of cooperation with EBUS RF and other international efforts (e.g. IMBeR, Future Earth, IOCCP of IOC-SCOR, and etc.). Also, it was suggested that review articles on the relationship between climate variability (e.g., ENSO, PDO) and biogeochemistry (e.g., fisheries) in the Pacific should be shared among PRP members.

Jerome Vialard, former co-chair of IORP, described the experience of cooperation between IORP and SIBER (a project of IMBeR). In the Indian Ocean, several groups (including the CLIVAR/IOC-GOOS IORP, IOGOOS, IIOE-2, IRF, IOCINIO, etc) organised their business meetings back-to-back with each other, which helped foster some preliminary dialogue and cooperation between physical oceanography and biogeochemical community. Such interactions cannot be achieved in a short time.

Action 11: To seek interactions with BGC expert groups interested in the whole Pacific basin (PICES is primarily focused on the North Pacific), and develop a plan for a Pacific-wide study of marine heat waves, a topic of great urgency and interest to the marine ecosystem community.

2.3 Possible PRP Interactions with Southern/Norther Region Panels of CLIVAR

According to the SSG-24 resolution, it was recommended that 'despite the strong focus on ENSO, PRP should also cover other scientific issues in the Pacific Ocean. Stronger ties with NORP, SORP and CDP of CLIVAR would help in this regard'. Antonietta briefed the meeting that there will be a workshop on 'Heat and Freshwater Storage and Transports in Observations and Climate Models', which will be organised from 28th April to 1st May 2020, in Exeter, UK. The workshop will be co-ordinated by OOPC, GOOS and WCRP, and both NORP and SORP will be involved. This could be a good opportunity for PRP to explore the potential cooperation with NORP and SORP through assessing model biases in estimating the current state of heat and freshwater conservation in Earth system and climate models, which is one of the three objectives of the workshop.

Action 12: To establish a dialogue with the NORP and SOPR CLIVAR panels to identify areas of common interest and possibilities of collaboration (co-chairs).

2.4 Future Involvement with ANDEX

The PRP discussed the possibility of interacting with ANDEX Initiative, which is one of the WCRP crosscutting projects (Greenland melt, ANDEX, and TPI). There is an interest within the PRP to interact with the ANDEX, since ENSO provides a strong forcing for the atmospheric

circulation over the Andes. An initial contact was established with one of the co-Chairs of ANDEX, Dr German Poveda. A contact person from the PRP for this topic is Mike McPhaden.

Action 13: *To respond to Annalisa that Mike/Rene will be the PRP contact points for possible future cooperation with the ANDEX project (Antonietta/Matt).*

2.5 What's Next after Tropical Pacific Decadal Variability Paper

Since the TPDV is the main research focus in 2018-2019, it was agreed among panel members that the following core topics should be tackled in the next couple of years by the panel, including: 1) ENSO conceptual models; 2) Effectiveness and relative importance of oceanic mechanisms driving TPDV; 3) Pacific-wide marine heat waves in relation to climate change.

Action 14: *Agreed among panel members that the following core topics should be tackled in the next couple of years by the panel, including: 1) ENSO conceptual models; 2) Oceanic mechanisms driving TPDV variations; 3) Pacific-wide marine heat waves in relation to climate change.*

3. Other Panel Businesses

3.1 Membership

Matt and Antonietta led the discussion on PRP membership in 2020. There are five PRP members whose term expired at the end of 2019: *Matthieu Lengaigne, Xiaopei Lin, Janet Sprintall, Xuebing Zhang and Shayne McGregor*. One panel member has not been active and responsive. The co-Chairs have contacted him several times to inquire about his interest in remaining part of the panel, but they have received no response. The co-chairs of PRP finalised the membership proposal and circulated the document among PRP members for comments before submitting to the CLIVAR SSG before 15 November 2019.

Action 15: *Co-chairs of PRP will contact the member who hasn't been active in the past two years to make sure the person remains the interest in being member of the panel.*

Action 16: *Co-chairs of PRP will circulate a proposal for panel members rotation. It will be sent to SSG once approved by the panel.*

3.2 Next PRP Meeting

Several options have been identified for the time and venue of 15th Session of the PRP meeting. The first option is to organise the PRP-15 on 2 August 2020 in Trieste, Italy, prior to the upcoming CLIVAR-ICTP Summer School on Theory, Mechanisms and Hierarchical Modeling of Climate Dynamics: Tropical Oceans, ENSO and their Teleconnections, which will take place from 3 to 14 August 2020. Other options may be to organise the PRP-15 in conjunction with AGU 2020 (7-11 December 2020, San Francisco, US) or ANDEX 2020 annual meeting (TBC).

The panel members will discuss via email to decide the time and venue for the PRP-15.

3.3 Panel Report to SSG

PRP has asked for an extension of 2018-2019 annual report submission to CLIVAR SSG, which should be due within 1~2 weeks after this panel meeting. Matt and Antonietta will take the lead to prepare the draft report and circulate for comments from the panel.

Action 17: *Matt and Antonietta will take the lead to prepare the draft of the 2018-2019 Annual Report for PRP and circulate it for comments from the panel.*



Group Photo of PRP-14 (Victoria, Canada, 19 October 2019)

Annex 1: Agenda

08:30 – 17:30, 19 October 2019

Venue: Colwood (Level 2), Victoria Convention Center, Canada

Time	Topic	Speaker
	1. Updates on panel activities	
09.00-09.15	1.1 Report on ENSO conceptual models	Jerome
09.15-09.30	1.2 ENSO metrics: Status and next steps	Andrew
09.30-09.45	1.3 Update on Wiley book: ENSO in a changing climate	Mike
09.45-10.00	1.4 Status of 2020 ENSO summer school	Antonietta
10.00-10.30	Coffee break	
10.30-11.30	1.5 Western Boundary Current and ITF activities: Report and way-forward towards unified multi-platform observing system	Xiaopei/Janet
11.30-12.30	1.6 Status of TPDV Science paper	Mat/Antonietta
12.30-14.00	Lunch break	
	2. Workplan for 2020 and onward?	
14.00-14.15	2.1 Report on US CLIVAR Working Group workshop on ocean isotopes and possible cross-activities	Sam
14.15-15.00	2.2 Way forward with TPOS2020	Mat/Antonietta
15.00-15.15	2.3 Possible panel activities including marine biogeochemistry	Antonietta/Mat
15.15-15.30	2.4 Possible PRP interactions with Southern Ocean and Arctic Panels	Antonietta/Mat
15.30-16.00	Coffee break	
16.00-16.30	2.5 Future involvement with ANDEX	Mat/Antonietta
16.30-17.00	2.6 What's next after Tropical Pacific Decadal Variability paper	Mat/Antonietta
	3. Other panel businesses	
17.00-17.30	3.1 Membership	Mat/Antonietta
17.30-17.45	3.2 Next PRP meeting	All
17.45-18.00	3.3 Panel report to SSG	All

Annex 2: List of Participants

Name	Affiliation	Country	Role
Matthieu Lengaigne	LOCEAN	France	PRP Co-chair
Antonietta Capotondi	University of Colorado	USA	PRP Co-chair
Xiaopei Lin	Ocean University of China	China	PRP Member
Janet Sprintall	Scripps Institution of Oceanography	USA	PRP Member
Xuebin Zhang	CSIRO	Australia	PRP Member
Jerome Vialard	LOCEAN	France	PRP Member
Yu Kosaka	The University of Tokyo	Japan	PRP Member
Samantha Stevenson	University of California at Santa Barbara	USA	PRP Member
Andrew Wittenberg	NOAA GFDL	USA	PRP Member
Michael McPhaden	Chair / Tropical Moored Buoy Implementation Panel	USA	PRP Ex-officio member
Jing-Jia Luo	Nanjing University of Information Science and Technology (NUIST)	Australia	Observer
Ryan Rykaczewski	NOAA National Marine Fisheries Service	USA	Observer
Shoshiro Minobe	Hokkaido University	Japan	Observer
Baolan Wu	Ocean University of China	China	Observer
Jing Li	International CLIVAR Project Office (ICPO)	China	ICPO Staff