CLIVAR

CLIVAR Report

Climate and Ocean: Variability, Predictability and Change

Workshop Report

Pacific Region Panel workshop on Pacific Atmospheric Teleconnections in a Warming Climate and Tropical Pacific Biogeochemical–Physical Interactions

21-22 May 2026, Tokyo, Japan & Online

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WMO
unesco Intergovernmental Oceanographic Commission
International Science Council
WCRP World Climate Research Programme

Photo: Workshop participants online and in person

Photo: Workshop participants in person

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1. Introduction

The CLIVAR Pacific Region Panel organised a Workshop on Pacific Atmospheric Teleconnections in a Warming Climate (PATAC) and Tropical Pacific BGC-Physical Interactions (BGC-PI) at the University of Tokyo, Hongo Campus, Japan, on 21-22 May 2026.

The two-day workshop brought together members of the Pacific Region Panel (PRP) and the PATAC and BGC-PI working groups motivated by the need to strengthen coordination, advance ongoing activities, and identify future collaborative research priorities. Particular emphasis was placed on developing PRP deliverables, including an explainer on tropical Pacific observations and an article for the AMS ENSO Special Collection, as well as advancing ongoing workgroup activities.

Since their establishment in 2024, both PATAC and BGC-PI had made substantial progress through virtual meetings involving participants across multiple time zones. However, the increasing scope of activities and the need to integrate diverse perspectives highlighted the value of dedicated in-person discussions.

PATAC in particular was established to consolidate and advance understanding of Pacific atmospheric teleconnections, with a focus on future projections and the role of ENSO diversity. The workgroup agreed to a review paper as a key deliverable, and substantial progress has been made since it began. Regional teleconnection subgroups were established based on members' expertise, and significant progress was made on literature synthesis and drafting. As the review paper evolved, the challenge of integrating perspectives across different regions and scientific communities highlighted the value of dedicated in-person discussions. The workshop therefore provided a timely opportunity to consolidate progress, identify major knowledge gaps and uncertainties, and further develop the scientific framework and key messages of the review.

The BGC-PI working group was established to advance research and collaborations on Pacific biogeochemical processes and their interactions with climate and ocean physical dynamics. Initial discussions in online meetings helped define knowledge gaps, emerging priorities, and collaborative directions, but an in-person workshop served as an important next step in transforming these initial discussions into coordinated research activities, identifying remaining gaps and priorities in observations and modelling with expert guest speakers, and synthesising the working group discussions for future deliverables.

Bringing PATAC and BGC-PI members together in person was therefore essential to review progress, identify key scientific gaps and uncertainties, strengthen collaborations, and develop coordinated plans for future research and community deliverables.

2. Programme

The programme included invited talks from leading experts, discussions on pressing issues and emerging science, and hands-on sessions (writing and reporting back). These included synthesising current understanding of biogeochemical–physical interactions in the tropical Pacific, progressing deliverables related to tropical Pacific observations, and advancing the PATAC review paper through collaborative writing and discussion.

Invited talks were open to the broader CLIVAR community, while discussions and hands-on sessions primarily engaged PATAC and BGC-PI members. Hybrid participation was available for selected activities to facilitate collaborative document development and discussion of future research priorities.

2.1. PRP TPOS Session

The PRP Tropical Pacific Observing System (TPOS) Session consisted of talks and two collaborative sessions to (1) develop an Explainer about TPOS and (2) advance an outline for a BAMS article on the ENSO Special Collection.

The first part of the PRP session opened with four invited speakers, all experts on ocean observations, who discussed the status of the observing system from different perspectives.

- Sophie Cravatte (LEGOS) introduced TPOS, talked about the importance of the monitoring system for ENSO and MJO forecasting, explained the current status of the program, and discussed the issue of the missing moorings in the western Pacific.

- Iwao Ueki (JAMSTEC) presented the Japanese observations in the western tropical Pacific, in particular over 10-year measurements from a mooring deployed at the edge of the warm pool (13° N, 137° E), and discussed changes in TPOS investments from Japan.

- Shoichiro Kido (JAMSTEC) presented the SynObs project, demonstrated how in-situ observations reduce uncertainties in equatorial Pacific forecasting models, and explained how Argo and moorings are complementary and that both are needed for model validation and an accurate understanding of Pacific processes.

- Pete Strutton (UTAS) highlighted the main recommendations of BGC observations, discussed the needs and the current status of TPOS BGC observations, and explained why Argo BGC floats are needed to measure chemical and biological quantities and close the global carbon.

Together, the presentations highlighted the critical role of sustained tropical Pacific observations for monitoring climate variability, improving prediction systems, supporting biogeochemical observing capabilities, and identifying emerging gaps in the observing network.

The second part of the PRP session consisted of an activity to progress an Explainer about TPOS. The idea originated at the Pan-CLIVAR meeting in September 2025 to raise awareness of the state of ocean monitoring among the broader scientific community. An initial rough outline was circulated among PRP members and workshop attendees before the workshop, and the session aimed to make progress on the key messages and structure of the Explainer.

In the session, it was agreed that the Explainer main aim was to communicate about the vital need for a strong, internationally coordinated TPOS, in an accessible way for non-experts in the area and set the scene for a Policy Brief led by the TPOS Steering Committee in collaboration with the PRP that will come with specific recommendations and actions targeting decision-makers and governments of Pacific nations. The session also identified the targeted audience (non expert scientists, national stakeholders and forecasting agencies) and the format of 3-4 pages, plus illustrations.

The attendees worked in five separate groups that mapped the main parts of the Explainer, namely, history of TPOS, users and usefulness of observations, different observing systems, TPOS data management and distribution, and current status and gaps. The Explainer is a work in progress. Participants developed a preliminary structure of the Explainer, providing a foundation for further drafting after the workshop.

The third part of the PRP session was a breakout session where attendees worked on an outline of an article for the AMS Special Collection on the "2014-24 Atypical ENSO Decade" (https://journals.ametsoc.org/collection/ENSO2014) that was organised by the PRP in collaboration with the Research Foci Marine Heatwave and Tropical Basin Interactions, and the CLIVAR Steering Group. This Special Collection is currently open for submissions and 14 papers have already been published in the collection as of May 2026.

The proposed article aims to explain what made 2014–2024 an unusual ENSO decade, synthesise insights from the 14 papers published in the Special Collection, and identify key uncertainties and future research directions. Participants worked in breakout groups to discuss and highlight findings across four broad themes represented in the collection: ENSO physical mechanisms, challenges in predictability, ENSO teleconnections and regional impacts, and biogeochemical impacts. Good progress was achieved, with participants identifying key themes, proposing figures, and developing a preliminary manuscript structure. The discussions helped establish a common narrative for the article and identify lead contributors for the next stage of drafting.

2.2. PATAC

Two PATAC sessions were run in the afternoons of 21 and 22 May and they aimed at advancing a draft of a review paper on Pacific atmospheric teleconnections in the historical climate and future warming scenario. Prior to the workshop, PATAC members had developed substantial draft material through regional subgroups focused on teleconnections within their areas of expertise. The workshop provided an opportunity to integrate these contributions, refine the emerging synthesis, and

coordinate the next stage of manuscript development. The activities were organised to work with the in-person attendees in small groups (2-3 people), have a short discussion, writing work, and quick synthesis, primarily writing text directly in the shared PATAC draft document.

In the first PATAC session, the members updated the status and key messages of the regions they had worked on in groups. They then worked in pairs to refine the current text about the historical teleconnections, reviewing whether descriptions of regional teleconnections adequately captured ENSO diversity, were supported by quantitative evidence, and reflected the current literature. This was essential to clarify the structure of the first part of the draft about the present climate, to reach consensus on the main teleconnection pathways, clarify mechanisms, and agree on references about the current knowledge of ENSO influence in the present climate. PATAC members also highlighted major climatic extreme events that coincided with ENSO (i.e. drought, extreme rain events) and discussed ideas for presenting the results in figures.

In the second PATAC session, the members worked on the future projections of ENSO teleconnections, summarising areas of agreement across CMIP6 projections, discussing known model biases, and identifying areas of uncertainty, including alternative future scenarios not accounted for in climate models, and proposing ways to illustrate the key teleconnection changes in figures and schematics.

The last part of the PATAC session was dedicated to the discussion and emerging perspectives section of the draft. An activity was conducted in which individuals brainstormed open questions and research gaps to inform future directions. A few questions were posed to the group to stimulate the activity:

- What do we still not understand mechanistically in PATAC?
- What limits predictability?
- What will likely matter most under warming?
- What should governments need to know regarding climate model projections for planning for climate adaptation?
- What should be the research priority in teleconnections in future climate topic?

Several common themes emerged, including the need to better understand ENSO influences on climate extremes, compound events, and regional risk; limitations imposed by predictability barriers; opportunities to improve prediction using alternative ENSO indices (RONI vs ONI), emergent constraints, storylines, and AI approaches; persistent model biases and resolution limitations; interactions between ENSO diversity and other climate modes; and the possibility of future changes in ENSO behaviour and Pacific warming patterns under climate change. It was also important to highlight areas of certainty such as precipitation response for a given warming sea surface temperature anomaly.

The answers were collected in sticky notes to further help inform the overarching question 'What is the most important research gap(s) in Pacific teleconnections under climate change?' The results will be collated and used to guide the structure of the latter sections of the review paper.

Given the extent of the work done, participants agreed that the scope and length of the draft were more suited to a comprehensive review article and decided to target Reviews of Geophysics. A timeline was established to advance the manuscript toward submission in 2026–27, with the aim of informing the upcoming IPCC AR7 WGI assessment report.

There was a common sense that the PATAC workshop was productive and advanced the draft writing, thus meeting its objectives. The PATAC sessions not only advanced the manuscript structure but also refined key scientific messages and identified priority research gaps. By the end of the workshop, Sections 3 and 4 had been substantially revised, key messages for Section 5 had been agreed upon, and a shared framework for future drafting had been established.

Photo: PATAC participants

2.3. BGC-PI

The BGC-PI workshop opened with presentations by Yassir Eddebbar and Sayaka Yasunaka, who framed the discussion around the need to better understand interactions between ocean physics and biogeochemistry in the tropical Pacific. Participants discussed the workshop outcomes and deliverables for the workgroup, and agreed on a perspective paper that summarises community priorities for observations and modelling of tropical Pacific BGC-PI. The workgroup reviewed their scope which aims to i) advance research on how ocean physical and climate variability and change

influence biogeochemical processes; ii) how biogeochemical feedbacks affect ocean physics and climate; and iii) how biogeochemical tracers can provide insights into physical variability. The co-chairs synthesised the prior year's presentations and discussions, identified remaining gaps and opportunities not addressed by the working group on BGC-PIs, and sought feedback for developing an outline, agreeing on a format, and identifying the main messages and key sections for the group's deliverable. The group concluded with an outline for a perspective article that will summarise community needs and priorities for BGC-PI research, observational and modelling development in the tropical Pacific.

The BGC-PI also included additional presentations from working group members and invited guest speakers on remaining knowledge gaps and opportunities not previously addressed in prior working group meetings. Yohei Takano gave a presentation titled "Modeling Ocean Biogeochemical Cycles: Perspectives from the Gap Between Models and Observations," who identified the key challenges facing ocean and Earth system models with a focus on oxygen and carbon cycles. This was followed by a talk by Dan Whitt on "Observations at the Physics-BGC Interface," which explored challenges and opportunities in observing BGC-PI at scales below the mesoscale, including turbulent mixing and sub-mesoscale fronts. Tomoki Tozuka gave an overview and research updates on "Assessing the Importance of Phytoplankton-Mediated Feedbacks in the Tropical Pacific," from recent model studies. Tatiana Rykova provided new perspectives on the importance of BGC Argo for oxygen observations using OSEs. Shoshiro Minobe shared his idea about opportunities for big-data analyses of ocean physical and biogeochemical variables from climate model outputs. Sayaka Yasunaka provided an overview of a recent process study on BGC-PI at small and fast scales using BGC-equipped autonomous floats and ship-based observations, including new insights on the diurnal cycle of ocean BGC and lessons learned from a multi-platform process study.

Finally, there was a recap of key messages on the previous talks, which highlighted strong links across scales, from small-scale processes to basin-scale variability, while also identifying important gaps in understanding and observing ecosystems, fisheries, nutrient cycling, and the role of iron. Participants agreed that future priorities should be guided by scientific importance and societal relevance rather than traditional disciplinary boundaries.

Discussion then focused on the development of a community perspectives paper structured around key themes including oxygen dynamics, carbon cycling, primary productivity and feedbacks on ENSO, and biogeochemical dynamics and feedbacks at mesoscales and smaller scales. A paper structure was proposed based on the following thematic sections: (1) Large scale variability of BGC and feedbacks, (2) BGC dynamics and feedbacks at the mesoscale and below, and (3) Emergent phenomena and future outlook. The perspective paper would be in a 6-page format aiming for Nature Comms E&E Perspective. Key messages emerging from the session were that biogeochemical processes are tightly coupled to ocean physics, with important implications for the carbon cycle, ecosystems, and climate; that many of these interactions remain poorly understood; and that future progress will require leveraging recent advances in observing systems, biogeochemical tracers, and modelling capabilities.

The discussion was concluded with a brief introduction of a CLIVAR research focus proposal currently under review by Taka Ito, which highlighted the potential for continuing the BGC-PI activities beyond the lifetime of the working group, expanding the scope of these activities beyond the tropical Pacific.

2.4. Interactions between PATAC & BGC-PI

The PATAC BGC-PI Joint Session was planned to encourage discussion on the links between Pacific climate teleconnections and biogeochemical processes, while also encouraging future collaborations between the two working groups. Four experts in PATAC and BGC were invited to present their research to the group. To promote discussions between the topics, the invited speakers were asked to reflect on how their work relates to both teleconnections in a changing climate and biogeochemical processes, where relevant.

Shoshiro Minobe – "A Physics-Based Diagnostics Framework for Global Temperature Surges: Integrating Earth's Energy Imbalance and El Niño Heat Redistribution". Shoshiro used a heat budget analysis to show that the exceptional global heat observed during 2023–24 resulted from the combined effects of the high Earth's Energy Imbalance (EEI) and El Niño-driven release of heat from the subsurface tropical Pacific ocean to the near-surface ocean and atmosphere (Minobe et al. 2025, https://doi.org/10.1038/s41612-025-00996-z). The anomalously high EEI contributed to making the 2023–24 warming event exceptional relative to previous El Niño events. The presentation highlighted the value of tracking ocean heat content, especially subsurface heat storage and release, as a diagnostic for understanding and potentially anticipating future global temperature variations. Shoshiro also discussed implications for PATAC (e.g. the unprecedented southern zonal wave 3 in June to August 2023 and Antarctic sea ice) and implications for the O_2 global inventory. He highlighted the importance of monitoring ocean heat content and heat redistribution for understanding global temperature variability and future climate extremes.

Malte Stuecker – "Global climate mode resonance due to rapidly intensifying El Niño-Southern Oscillation". Malte presented his recent work, Stuecker et al. (2025, https://doi.org/10.1038/s41467-025-64619-0), on how ENSO behaviour may change in a warming climate. Results from the high-resolution AWI-CM3 model suggest that greenhouse warming could lead to stronger and more regular ENSO variability by about 2050. The implication for PATAC is that this resonance is accompanied by increased synchronization between ENSO and other major climate modes, including the Indian Ocean Dipole, Atlantic variability, and the North Atlantic Oscillation, with important implications for seasonal predictability and regional climate impacts. Malte also discussed possible factors that led to ENSO resonant in the model by using Sen Zhao's XRO model to explain those changes in the future and then Bjerknes instability index. The presentation highlighted both opportunities and challenges for climate prediction, emphasising the need for climate models to accurately represent ENSO dynamics and feedbacks in order to provide robust projections of future climate variability and its impacts.

Sharmila Sur – "Predicting ENSO and its impacts beyond a season". Sharmila Sur presented recent advances in predicting ENSO beyond seasonal timescales using the SEAS5-20C climate prediction system, in a collaboration between the Australian Bureau of Meteorology and ECMWF. Using 110 years of hindcasts (1901–2010), she showed that ENSO prediction skill has improved substantially from 1901-2010 to 1961-2010 and to 1981-2010, with forecasts able to predict ENSO up to 18 months in advance. The results also demonstrated promising capability for predicting associated regional climate impacts, including Australian rainfall and temperature anomalies. Challenges still remain, though, including weaker simulated teleconnections and uncertainties arising from subseasonal atmospheric variability and air–sea coupling processes. Sharmila also presented preliminary results from the ACE2 AI climate emulator, arguing improved prediction skills relative to fully dynamical models, and potential for improving long-range climate prediction with machine learning approaches.

Taka Ito – "Tropical Pacific Oxygen Variability and Trends from the GODIP dataset". Taka Ito introduced the Gridded Observational Dataset Intercomparison Project (GODIP-DO) initiative, an international effort to improve observational estimates of ocean oxygen variability and deoxygenation trends. He showed evidence of widespread oxygen loss (0.5-3.3% global oxygen loss from 1970 to 2010, IPCC) and changes in oxygen minimum zones since the late 1960s associated with large scale ocean warming, but with substantial uncertainties in observational reconstructions. He discussed input from bottle data, CTD, and increasing Argo data, and showed comparisons with CMIP6 models, revealing important differences in simulated oxygen trends, and underscoring the need for improved understanding of the links between ocean circulation, heat uptake, and biogeochemical change.

At the end of the session, Takeshi Izumo gave an interesting presentation on the Madden–Julian Oscillation (MJO), arguing that the phenomenon remains relatively unfamiliar to the public, and even to parts of the scientific community, partly because of its complicated name. He proposed renaming the MJO as "Ola" (Spanish for "wave") to increase its visibility and accessibility. The proposal sparked lively discussion among participants. Some suggested exploring names rooted in Pacific Island cultures and Indigenous knowledge systems. While some participants supported the idea of a more accessible name, others preferred to retain the existing terminology, noting that the MJO is not a wave in the classical dynamical sense and is not adequately described by traditional wave theory. The discussion highlighted broader questions about scientific communication and inclusivity, but no consensus was reached regarding a name change.

3. Summary of outcomes and main recommendations

- The TPOS Explainer has progressed with key messages, format, audience, and scope defined. The work will continue to deliver this outcome before the end of 2026. The PRP will then work together with the TPOS Steering Committee to help produce a follow up Policy Brief to advocate for maintaining and expanding the Pacific observing system across Pacific nations who benefit from improved ENSO forecast system.

- The draft about ENSO Atypical Decade has progressed with the 14 publications mapped to five main topics and an outline proposed. The draft will be aimed to the AMS Bulletin of American Meteorological Society. While it remains unclear whether ENSO variability and diversity during 2014–2024 were fundamentally different from previous decades, participants agreed that the sequence of events, forecasting challenges, and associated impacts warrant further investigation, particularly as ENSO will likely continue to surprise us due to ongoing background warming.

- The draft on ENSO teleconnections in a warming climate has progressed successfully with cleaner versions of section 3, and advanced text in sections 4 and 5, with ideas for illustrations. Priority research gaps include understanding future Pacific warming patterns, reducing model biases through higher-resolution modelling, improving representation of regional impacts and extremes, and assessing potential future changes in ENSO behaviour and teleconnections.

- The BGC-PI group agreed to develop a perspectives paper focused on the coupling between physical and BGC processes in the tropical Pacific, their implications for the carbon cycle, ecosystems, and climate, and highlight priorities for future observations and modelling efforts. An outline with specific sections and potential visualizations summarizing research gaps, observing and modelling challenges and outlook, was successfully developed. Additional discussions on remaining gaps and recent updates from the modelling and observational communities were also synthesised into the workshop outcomes and deliverables.

- Continued interaction between PATAC and BGC-PI should be encouraged through regular joint discussions within the Panel, including short scientific presentations during PRP meetings, to strengthen cross-disciplinary collaboration and identify opportunities for joint research activities and publications.

4. Leveraging on the international meeting

The workshop was strategically held the week before the 2026 joint JpGU-AGU Conference (24 to 29 May 2026) to help disseminate workshop themes to a broader international audience and strengthen collaborations across the Pacific climate research community. PRP, PATAC, and BGC-PI members served as convenors, invited speakers, oral presenters, and poster presenters, with topics including tropical climate variability, ocean–atmosphere interactions, marine heatwaves, biogeochemical processes, and ENSO teleconnections.

PRP members Sayaka Yasunaka, Andrea Taschetto, Yassir Eddebbar, and PATAC member Ingo Richter convened sessions at the JpGU meeting. Workshop participants were also actively involved in the scientific programme, with presentations by PRP members Sophie Cravatte, Antonietta Capotondi, Dhrubajyoti Samanta, Tsubasa Kohyama, Takeshi Izumo, Neil Holbrook, and Andrea Taschetto; PATAC member Nathaniel Johnson; and BGC-PI members Dan Whitt, Shoshiro Minobe, and Tomoki Tozuka.

Sophie Cravatte was featured as a Highlight Researcher, while Andrea Taschetto, Antonietta Capotondi, and Dan Whitt were invited speakers.

Details of the convened session, oral presentations, including invited talks, and poster presentations can be found in Appendix E.

The proximity of the workshop to the JpGU–AGU meeting significantly increased its impact by enabling participants to continue scientific discussions, engage with a wider community of researchers, and identify new opportunities for collaboration beyond the workshop.

5. Acknowledgments

We thank CLIVAR and the World Climate Research Programme (WCRP) for funding the workshop. We also thank AIMEC, Tohoku University, JAMSTEC, and the University of Tokyo for their extra funding and support and for providing meeting facilities. We are particularly grateful to Joana Gonzalez for coordinating funding arrangements, hybrid participation, and communications among the local organisers, WCRP, and workshop participants. We also thank the local organising committee, especially Tomoki Tozuka and Sayaka Yasunaka, for their outstanding and generous support in hosting the workshop and organising the workshop dinner, in addition to Yukito Tamura, Kento Usui, and Takeshi Anami who helped with the room allocation, hybrid setup, and session breaks. Finally, we thank all participants for their active engagement and contributions, which made the workshop a success.

Appendix A: Acronyms

AGU –American Geophysical Union
AIMEC – Advanced Institute for Marine Ecosystem Change
AMS – American Meteorological Society
ARGO – Array for Real-Time Geostrophic Oceanography
AR7 – Seventh Assessment Report
BAMS – Bulletin of the American Meteorological Society
BGC – Biogeochemistry
BGC-PI – Biogeochemical-Physical Interactions
CLIVAR – Climate and Ocean: Variability, Predictability and Change
CMIP6 – Coupled Model Intercomparison Project phase 6
CTD – Conductivity–Temperature–Depth
ECMWF –European Centre for Medium-Range Weather Forecasts
EEI – Earth's Energy Imbalance
ENSO – El Niño–Southern Oscillation
GODIP – Gridded Observational Dataset Intercomparison Project
GODIP-DO Gridded Observational Dataset Intercomparison Project - Dissolved Oxygen
ICPO – International CLIVAR Project Office
IPCC – Intergovernmental Panel on Climate Change
JAMSTEC – Japan Agency for Marine-Earth Science and Technology
JpGU – Japan Geoscience Union
LEGOS – Laboratory of Space Geophysical and Oceanographic Studies
MJO – Madden–Julian oscillation
ONI – Oceanic Niño Index
PATAC – Pacific Teleconnections in a wArming Climate
PRP – Pacific Region Panel
RONI – Relative Oceanic Niño Index
SynObs – Synergistic Observing Network for Ocean Prediction
TPOS – Tropical Pacific Observing System
UTAS – University of Tasmania
WCRP – World Climate Research Programme
WGI – Working Group I
XRO – eXtended nonlinear Recharge Oscillator

Appendix B: Organisers

Workshop organisers
Sayaka Yasunaka, Andrea Taschetto, Sophie Cravatte, Yassir Eddebbar, Sam Stevenson

Local organisers
Sayaka Yasunaka, Tomoki Tozuka, Yukiko Imada, Ingo Richter

Appendix C: List of participants

On-site (23):

Dan Whitt - NASA Ames Research Center, California, USA
Samantha Stevenson - University of California, Santa Barbara, USA
Malte Stuecker – University of Hawai‘ i at Mānoa, Hawaii, USA
Neil Holbrook – University of Tasmania, Hobart, Australia
Dhrubajyoti Samanta - Nanyang Technological University, Singapore
Tsubasa Kohyama - Ochanomizu University, Tokyo, Japan
Sayaka Yasunaka – Tohoku University, Sendai, Japan
Shoshiro Minobe - Hokkaido University, Hokkaido, Japan
Tomoki Tozuka – The University of Tokyo, Tokyo, Japan
Antonietta Capotondi – University of Colorado, USA
Andrea Taschetto – University of New South Wales, Sydney, Australia
Sophie Cravatte - LEGOS (Université de Toulouse/CNES/CNRS/IRD), Toulouse, France
Pete Strutton – University of Tasmania, Hobart, Australia
Yohei Takano - Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Japan.
Shoichiro Kido - Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan
Sharmila Sur - The Bureau of Meteorology, Melbourne, Australia
Yassir Eddebbar - Scripps Institution of Oceanography, California, USA
Takeshi Izumo - Institut de Recherche pour le Développement (IRD), Tahiti, French Polynesia
Ingo Richter – Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan
Iwao Ueki - Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka, Japan
Nathaniel Johnson – NOAA Geophysical Fluid Dynamics Laboratory (GFDL), Princeton, USA
Yukiko Imada – The University of Tokyo, Tokyo, Japan
Taka Ito – Georgia Institute of Technology, Atlanta, USA

On-line (7):

Tatiana Rykova - Commonwealth Scientific and Industrial Research Organisation (CSIRO), Hobart, Australia
Lucia Upchurch – University of Washington, Seattle, USA
Peter van Rensch – Monash University, Melbourne, Australia
Yuko Okumura – UT Institute for Geophysics, Austin, USA
Tao Geng – Laoshan Laboratory, Qingdao, China
Kewei Lyu – Xiamen University, Xiamen, China
Joana Gonzalez - International CLIVAR Project Office (ICPO), Qingdao, China

Appendix D: Agenda

21 May 2026

PRP TPOS Session @ Room105

Hybrid session – 9:00 AM – 1:00 PM (Asia/Tokyo): https://meet.goto.com/875613749
9:00am-9:03am: PRP Opening (3min)
9:03am-10:15am: TPOS Talks (72min): each 10min + 8 min Q&A
- Sophie Cravatte (IRD): the Missing Western Pacific Moorings
- Iwao Ueki (JAMSTEC): the Japanese observations in the western tropical Pacific
- Shoichiro Kido (JAMSTEC): the SynObs project
- Pete Strutton (UTAS): the needs and the current status of TPOS BGC observations

10:15am-10:45am: Explainer/Policy Brief Activity (30min)
10:45am-11:15am: Coffee Break (30min)
11:15am-11:45am: Explainer/Policy Brief Activity (30min)
11:45-12:30pm: AMS ENSO Decade Special Collection Article
- Working on an outline and progress of the ENSO Decade Special Issue for BAMS.

12:30pm-2:00pm: Lunch time networking

PATAC Workshop @ Room381

In person only activity
2:00pm-2:30pm: Updates from subgroups (5min each)
2:30pm-2:45pm: Outline and aims to guide subgroups + discussions
2:45pm-3:15pm: Activity 1 - Working on the writing in subgroups (Section 3)
3:15pm-3:45pm: Afternoon tea
3:45pm-5:00pm: Activity 2 - Working on the writing in subgroups (Section 3)

BGC-PI Workshop @ Room101

Hybrid session – 2:00 – 5:00 PM (Asia/Tokyo): https://meet.goto.com/487284093
Synthesis and Deliverable Discussion
2:00pm-3:15pm:
- Introductory WG Overview Talk by co-chairs on WG activities, outcomes, and deliverable
- General discussion on deliverable outline, content, remaining gaps and actions

3:15pm-3:45pm: Coffee break
3:45pm-5:00pm:
- Invited Talk by Yohei Takano on Modelling BGC-PI in the (Tropical) Pacific
- Specific deliverable discussion on Modelling gaps, challenges and opportunities, and outlook.

22 May 2026

PATAC & BGC-PI Joint Session @ Room739

Hybrid session – 9:00 – 11:00 AM (Asia/Tokyo): https://meet.goto.com/889860805
9am-10:45am: Invited Talks (18 min + 7min Q&A each)

Opening - 2min

Shoshiro Minobe – "A Physics-Based Diagnostics Framework for Global Temperature Surges: Integrating Earth's Energy Imbalance and El Niño Heat Redistribution"

Malte Stuecker – "Global climate mode resonance due to rapidly intensifying El Niño-Southern Oscillation"

Sharmila Sur – "Predicting ENSO and its impacts beyond a season"

Taka Ito – "Tropical Pacific Oxygen Variability and Trends from the GODIP dataset"

Closing - 3min

10:45am-11:15am: Coffee Break

PATAC Workshop @ Room807A

In person only activity
11:15am-12:30pm: Activity 3 - Working on the writing in subgroups (Section 4)
12:30pm-2:00pm: Lunch time discussion
2:00pm-3:15pm: Activity 4 - Working on the writing in subgroups (Section 4)
3:15pm-3:45pm: Afternoon tea
3:45pm-4:45pm: Activity 5 - Working on the writing in subgroups (Section 5)
4:45pm-5:00pm: Subgroups presentation (where it stands, points still to address) + Wrap up

BGC-PI Workshop @ Room739

Hybrid session – 11:15 AM – 5:15 PM (Asia/Tokyo): https://meet.goto.com/152791853
Future Outlook in the tropical Pacific - WG talk and discussion
11:15am-12:30pm:

- Dan Whitt - on observations at the physics-BGC interface
- Deliverable discussion on Observations gaps, challenges, opportunities, outlook, and future collaborations with RF

12:30pm-2:00pm: Lunch time discussion
2:00pm-3:15pm:

- Tomoki Tozuka - on chlorophyll-variability and mixing processes
- Deliverable Discussion on Processes gaps, challenges and opportunities, and future outlook.

3:15pm-3:45pm: Afternoon tea
3:45pm-5:00pm:

- Concluding WG Overview discussion by co-chairs
- General discussion to revisit outline, major scientific questions to address, current knowledge and knowledge gap, future collaborations with RF

Appendix E: JpGU participation

Sessions and Convenors

A-OS19 - Multiscale Ocean Physical-Biogeochemical-Ecosystem Interactions: Theory, Observation, and Modeling. Convenors: Yohei Takano, Yassir Eddebbar, Lijing Cheng, Sayaka Yasunaka, Ryohei Ymaguchi, Takafumi Hirata
A-CG58 - Multi-scale ocean-atmosphere interaction in the tropics. Convenors: Ayako Seiki, Yukiko Imada, Ingo Richter, Tomoki Tozuka, Andrea Taschetto, Hug Bellenger
A-OS25 - Oceanography (General). Convenors: Sayaka Yasunaga (main), Mitsuru Hayashi, Yasushi Fujiwara, Hung-Wei Shu
U-07 - Ecosystem fluctuations in the Northwest Pacific and their linkages to global environmental change. Convenors: Toshio Suga, Niklas Schneider, Hatsumi Nishikawa, Daiki Ito, Yuma Kawakami, Sayaka Yasunaka

Oral Presentations

Eddy-driven equatorial Pacific upwelling and mixing - Daniel B Whitt (**invited speaker**)

Tropical Pacific Biogeochemical Variability at the Mesoscale and Below - Yassir Eddebbar

Marine Heatwave–Driven Biogeochemical Extremes in Southeast Asia: Insights from the Gulf of Thailand - Dhrubajyoti Samanta

Key role of the Madden-Julian Oscillation on tropical and subtropical humid heat and heatwaves - Takeshi Izumo

Marine Heatwaves (MHWs) in the Tropical South Pacific driven by multiscale air-sea processes - Sophie Cravatte (**highlighted researcher**)

The essential role of tropical-extratropical interactions in tropical Pacific decadal variability - Antonietta Capotondi (**invited speaker**)

Toward a mechanistic characterisation of marine heatwaves - Neil Holbrook

Why were the forecast winter impacts stronger for the marginal La Niña of 2024/25 than for the strong El Niño of 2023/24? - Nathaniel C Johnson

El Niño Southern Oscillation teleconnections to Australian weather and climate: A Review - Andrea Taschetto (**invited speaker**)

Poster Presentations

How Relative Sea Surface Temperature better explains tropical coupled modes and their impacts - Takeshi Izumo

Quantifying the Role of the Coastal Bjerknes Feedback in Coastal El Niño Events - Tomoki Tozuka

Strengthening ENSO influence on tropical Atlantic variability in global warming projections - Ingo Richter