



Report of the
6th Meeting of the
TPOS 2020
Steering Committee

5-7 November 2019

Second Institute of Oceanography,
State Oceanic Administration,
Hangzhou, China

22 May 2020

Version - Final

Project Website: www.tpos2020.org

Report Outline

1. Meeting Goals and Objectives
2. Meeting Highlights
3. Key Outcomes
4. Actions
5. Appendices
 - a. [SC-6 Agenda](#)
 - b. [List of Participants](#)
 - c. [Final Report Outline](#)
 - d. [Technical Workshop Agenda and Report](#)
 - e. [TPOS Resources Forum Ocean Obs '19 Luncheon Notes](#)

This Report focuses on the outcomes from the 6th Steering Committee Meeting (SC-6) of the Tropical Pacific Observing System 2020 (TPOS 2020) project. There was also a technical workshop held on Monday, 4 November 2019 at the State Key Lab in Hangzhou. References to that meeting will be found throughout this report. A summary of the Technical Workshop can be found in the Appendices.

The Steering Committee of TPOS 2020 would like to sincerely thank the Second Institute of Oceanology for graciously hosting these meetings.



Report prepared by Shelby Brunner, Project Manager, and reviewed by xxxxxx.

1. Meeting Goals and Objectives

The TPOS 2020 Co-Chairs outlined 4 meeting goals for SC-6. These include:

- Identifying the necessary activities and deliverables to successfully complete Project phase of TPOS 2020;
- Developing an endorsed outline of the Final Report and list of proposed chapter lead authors;
- Discussing how to continue offering scientific advice into TPOS 2020 once Project ends; and
- Understanding governance and implementation considerations from sponsoring agencies.

Co-Chair Billy Kessler also provided a charge to the SC-6 participants at the opening of the meeting. He stressed that as the design phase of this Project is concluding, we now need implementers on board to ensure the hard work of TPOS 2020 is not “failed to act on.” It was noted that now is the time to create a governance structure for successive members and to create an integrated vision for the project. For example, there should be a mechanism in place for continued evolution of the observing system. Billy also encouraged everyone to advocate for agency buy-in so we can see implementation begin before the end of 2020. He challenged SC-6 attendees to identify challenges in the design and set-up the implementation team. Other desired outcomes that Billy shared with the participants include:

- Developing a clear understanding of implementation schedule and tasks;
- Developing a clear schematic of future governance and who needs to be part of it;
- Agreement to need for an assessment strategy for ongoing evaluation, such as new technology and process studies; and
- Identifying the incomplete elements that will need to be continued after 2020.

2. Meeting Highlights by Session

a) Organizational Updates

NOAA, MNR/SOA, JAMSTEC, BoM and IMOS provided agency updates to the Steering Committee. NOAA’s four technology pilot studies are in their final year and will need to be assessed for their applicability to the sustained observing system. There was discussion on the technology evaluation process outlined in the Second Report as a starting point for these assessments. It would be useful to see the implications of these pilots and “lessons learned” at SC-7.

Action 6.1: Invite NOAA presentation on “Lessons learned from TPOS Technology Pilots” at SC-7.

The Ministry of Natural Resources (MNR)/State Oceanic Administration (SOA) update focused on the planned Chinese mooring contribution – the Ding array. The Ding array will help with monsoon prediction and should contribute to advances in Western Pacific subseasonal to seasonal predictions. The “mooring technical document” and necessary

intercomparisons outlined at the Technical Workshop will be integral in helping Chinese preparations to implement an operational moored array.

JAMSTEC shared updates on their cruises for maintenance moorings and a process study on the eastern edge of the warm pool, as well as a 2021 GO-SHIP cruise and testing of shallow profiling floats (500 m depth). It was also noted that JAMSTEC would no longer maintain two additional TRITON sites due to a shift in priorities. However, continuing their participation in TPOS 2020 through performing pilot and process studies was emphasized. The Steering Committee was particularly interested in the shallow profiling floats due to the cost savings they provide, as well as potential for intercomparisons and focused regions. There was concern that the shallow profiling floats would not fulfil the Argo mission and could not be counted towards doubled Argo.

The Bureau of Meteorology is strongly supportive of the Second Report recommendations, particularly around model development. They will continue reanalysis assessments for seasonal prediction, but no TPOS 2020 focused investments are being planned.

Australia's Integrated Marine Observing System (IMOS) continues to contribute to TPOS 2020 through Argo, Ships of Opportunity, and funding research on forecasting models. IMOS will have relatively secure funding for the foreseeable future, part of which they intend to put towards increasing biogeochemical Argo float investments. It was noted that these investments will focus primarily on the Southern Ocean.

This year, the World Meteorological Organization (WMO) and CLIVAR's Pacific Regional Panel (PRP) also provided updates for TPOS 2020. The significant WMO update is the WMO Reform, including a new strategic plan, includes support for formation of a centralized "Oceans Office." Part of the Oceans office will include a newly formed Global Ocean Observing System (GOOS) Office in Geneva. Katy Hill of WMO shared that TPOS 2020 has been touted as an exemplar program within WMO because it spans research and operational drivers, has strong connections to forecast systems, and works across regional governance constructs. There is much potential to use the ties with WMO to build capacity in the east and west Pacific through creation of specific projects and Ocean Decade focused efforts.

A brief update from GOOS focused on the new 2030 Strategic Plan that GOOS has created, focused on deepening engagement and impact, system integration and delivery, and building for the future.

The CLIVAR PRP has been discussing TPOS 2020 and has engaged through the Backbone Task Team. BB-TT co-chair Sophie Cravatte also recently met with members of the PRP to discuss forward progress. The PRP would like to be involved with the implementation plan and evaluating new technology. TPOS 2020 could leverage this group to help with eastern and western Pacific regional coordination.

Action 6.2: Backbone Task Team and other relevant members to follow-up with CLIVAR Pacific Regional Panel regarding coordination efforts for the eastern and western Pacific.

b) Steering Committee and Task Teams: Reprise, reflect, and project forward

Each of the Task Teams and focus areas (e.g. coupled weather prediction) were invited to reprise achievements to-date through TPOS 2020 publications and other outputs, reflect on

aspects that need additional attention for their area, and reflect on implementation recommendations and actions including responsible parties for carrying them forward.

Yuhei Takaya presented on “Coupled weather prediction and Subseasonal requirements,” highlighting progress from various operational forecast centers and developing efforts from the OceanPredict OSEval Task Team to regularly evaluate impacts of ocean observations on S2S predictability. The OSEval TT is proposing developing an annual report on the use of observation data as a way to help decision making on investments and to create dialogue between observational and modelling communities. TPOS 2020 was happy to learn about this and believes it would value from such an initiative. Three areas that should be addressed within the Final Report include 1) coupled weather and climate predictions, 2) subseasonal forecast research updates, specifically results from Subramanian et al. 2019, and 3) seasonal to multi-annual forecasts, including ENSO prediction.

Action SC-6.3: Address the three points above in the Final Report.

Action SC-6.4: TPOS 2020 should follow developments of the OSEval-TT and engage as appropriate.

Arun Kumar reviewed progress made towards “Subseasonal to Interannual predictions and modelling” through the first two TPOS reports and an Ocean Obs ’19 breakout event. The First Report recommended two pilots to assess the impact of ocean observations on ocean state estimation and near-term predictions. The Second Report had entire chapter on this topic (Chapter 2) that reviewed existing models and current state of development, based on a survey of operational centers. Finally, the OO’19 breakout event saw a reiteration on the need for observing system evaluations (OSEs) and support for an “Ocean Observations Impact Annual Report” (see above paragraph). The need for continued engagement between modellers and observationalists to see improvements, such as through a second “Bridging observations and modelling” workshop, was discussed.

Action SC-6.5: Revisit the need for a second “Bridging Observations and Modelling” workshop to continue building engagement between these communities.

Neville Smith discussed data management achievements and gaps. It was noted that while Chapter 8 in the Second Report was dedicated to this topic, a major achievement, and covered key needs, the content really only addressed a narrow set of topics and challenges. Second Report Recommendations 8.3 and 8.4 should be focused on to see greatest results. Moving forward, data management should be considered by the future SC/ Science Advisory Committee in a focused way, particularly around data quality control, data exchange, and testing a pilot implementation of a data system outlined in Figure 8.2 of the Second Report.

The Biogeochemical Task Team (BGC-TT) has been primarily focused on understanding the CO₂, oxygen, and nutrient signals in the Tropical Pacific. It has recommended maintenance and extension of the pCO₂ climate record through new CO₂ moorings and potentially Saildrone® as its potential is emerging. Oxygen on moorings was again discussed, but the primary source of oxygen data recommended at this time is through biogeochemical Argo floats. The need for ships as part of the system, particularly to assist with BGC Argo deployments, was emphasized and agreed upon. The BGC-TT still sees a role for them in supporting Saildrone-ship and Saildrone-mooring comparisons, working on BGC Argo data

exploration and expanding into biology and ecosystems. This last item, Biology and Ecosystems, will be the focus of the BGC-TT's contribution to the Final Report. The Steering Committee agreed with the assessment to keep the BGC-TT intact with a recommendation to reassess membership moving forward.

Action SC-6.6: The Biogeochemical Task Team should reassess its membership to ensure it can meet its current and future needs.

The Planetary Boundary Layer Task Team (PBL-TT) has addressed all of their Terms of Reference (ToR) in some form and has also led publication of an Ocean Obs '19 community whitepaper on "Air-Sea Heat Fluxes" that calls for creation of a global in-situ observing system. This whitepaper has led to formation of a GOOS/OOPC task team that will continue the legacy of the TPOS PBL-TT. New technologies that could contribute to a global in-situ heat flux observing system include Saildrone, which requires additional testing and cost evaluation, and Prowlers. The PBL-TT recommended that it be dissolved and reformed as a TPOS PBL expert team with new ToR focused on recommending implementation for meeting requirements and assessing quality assurance/control. The Steering Committee agreed to this pathway forward, provided that the PBL-TT contributed as required to the Final Report before disbanding.

Action SC-6.7: Dissolve the Planetary Boundary Layer Task Team for it to be reformed as an expert team after they have completed authorship of their relevant sections of the Final Report.

The Eastern Pacific Task Team (EP-TT) remotely presented its achievements over the last year, as well as progress towards Second Report Actions and their terms of reference. Many of the Second Report Actions related to the Eastern Pacific have been well received by the community and some plans are developing. Specifically, on Action 5.3 related to ITCZ/cold tongue/SPCZ pilot studies, the EP-TT asked if TPOS 2020 could fund a meeting to help draft proposals for this work. For Action 5.4 on initiating a pilot island observing system – Cocos Island is able to power a GPOS and meteorological station which will send real time data to the GTS and St Felix Island is being prepped for meteorological data collection. Action 5.5, related to the UN Decade of Ocean Science, has resulted in discussions around organizing a summer school in the Galapagos with topics relevant to TPOS 2020. It is especially noteworthy that South American agencies are willing to collaborate on projects under the banner of TPOS 2020, which underscores the international recognition TPOS has garnered. For this reason, among others, it is recommended to keep the EP-TT intact going forward to act as a focal point for coordination in the Eastern Pacific. Actions for the EP-TT going forward could include:

- Creating standard recommendations on mooring configurations and data repositories;
- Securing funding for postdoc and student travel; and
- Continuing to coordinate between regional partners towards a goal of identifying pathways forward to recognize the TPOS Recommendations and Actions.

Action SC-6.8: Keep Eastern Pacific-TT in TPOS 2020 structure moving forward, with updated terms of reference and/or goals.

Action SC-6.9: The SC Co-Chairs and EP-TT Co-Chairs should discuss development of a fund to support early career researchers in the area and identify how TPOS can best help.

The Backbone Task Team (BB-TT) reviewed its accomplishments, progress towards its Terms of Reference, and remaining issues to be addressed. The TT feels it has fulfilled its ToRs, but noted that there is additional work, such as filling gaps in its plan, recommending a transition and implementation plan and developing plans for a truly integrated approach. It was noted that the integrated approach is critical in ensuring that the new system is greater than just a sum of its parts and will require oversight from a post-2020 group and inclusion of groups working on data assimilation/blended products. Highlighted remaining issues for the BB-TT to work through include:

- Final location of the ITCZ and SPCZ sites, with EEZ and logistics considered;
- Tier 2 sites; and
- Further develop concept of Supersites, including uses and configuration.

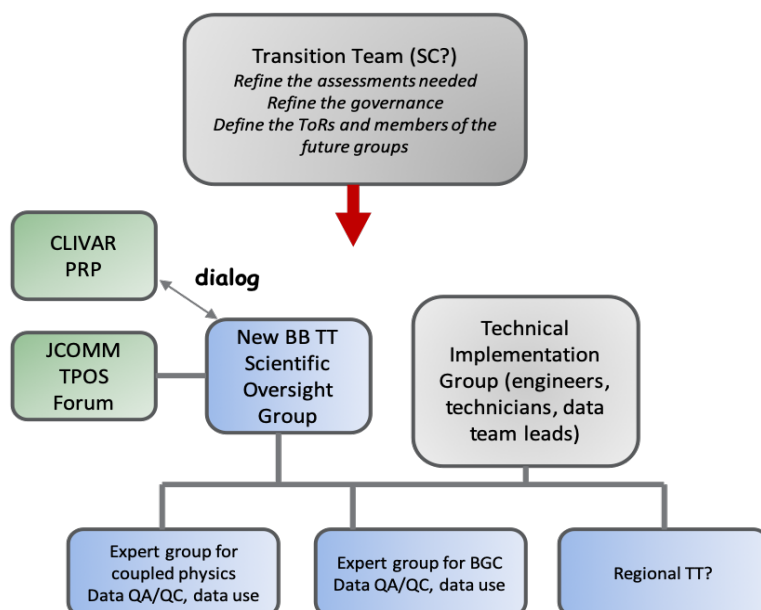
The BB-TT co-chairs suggested that the existing TT be dissolved and reformed as a scientific oversight committee, with some of the current members continuing for a few additional years. A proposed pathway forward and governance diagram (Fig. 1) for this new group was provided (more detail available in the presentation):

1. Provide ongoing scientific oversight;
2. Take on unfinished business;
3. Refine the design by providing priorities for funding agencies;
4. Tracking the whole system to ensure it is robust and integrated, in particular the key satellite data streams which might be at risk (e.g. microwave SST, SSS, vector winds);
5. Develop and detail transition assessment studies; and
6. Ensure a scientific and technologic watch to evolve the TPOS, considering new technology and pilot study results.

Other key messages for the Steering Committee from the BB-TT are:

- Intercomparisons between the TMA and Ding need to begin immediately, along with the finalization of the core TMA document, (which was discussed at the Technical Workshop);
- Advocation for TPOS 2020 plans at high level groups, such as CEOS, must continue;
- The system design must be open to evolution; and
- Actions towards filling gaps and creating assessment tools must be made quickly to continue making forward progress.

Figure 1: Proposed future governance structure of the new Backbone Task Team Scientific Oversight Group, highlighting important expert teams and functions. Figure created by S. Cravatte.



Action SC 6.10: The Steering Committee should review the proposed new TPOS structure and agree on a structure by the end of the meeting.

Action SC 6.11: The Backbone Task Team co-chairs will develop and seek approval for new ToR for the future Scientific Advisory Committee and Implementation Group.

The Western Pacific Task Team (WP-TT) has addressed many of the priorities outlined by TPOS 2020 and noted that several synergized activities are underway, such as pilot and process studies and development of the Ding array. One highlighted pilot study was the deployment of 20 shallow profiling floats by China to help with ENSO forecasting since core floats move quickly out of the tropical Pacific. The WP-TT identified a future role for themselves as supporting and seeking regional studies to move forward progress, similar to the EP-TT.

Finally, the Steering Committee also discussed new technology, how to evaluate advances, and a potential roadmap for transitioning in new technology if it was accepted.

Action SC-6.12: Draft a roadmap of guiding principles for evaluating new technology and transitioning it into the observing system if it meets the acceptance threshold.

c) Implementation Beyond 2020:

Managing the transition from the present design phase to implementation

The long-term success of TPOS 2020 is reliant upon a successful implementation and integration of the new observing system as outlined in the Reports. This will require broad community engagement from sponsoring agencies and interagency bodies, such as the World Meteorological Organization (WMO). Other key requirements moving forward include tighter engagement between science and implementation, stronger partnerships across

stakeholders, and more robust foundations that are responsive to needs. There will also need to be a “handover of responsibility” from the design phase Steering Committee to a future Technical/Implementation Group, ideally through a Transition Task Team.

The TPOS Transition and Implementation Task Team (T&I TT) was established in 2017 with Terms of Reference approved at JCOMM-5. However, the group has been relatively dormant waiting for resolution of design issues and for firm commitments from sponsors. Future work the T&I TT should consider undertaking includes:

- TMA planning and coordination
 - Who is doing what and when?
 - Mooring configurations being planned, including new enhancements such as real-time subsurface monitoring,
 - Data management requirements
- Profiling float coordination,
- Interfacing with WMO mechanisms (i.e. WIGOS and WIS), and
- Interfacing to JCOMMOPS for tracking progress against requirements.

The Steering Committee recognized it will need to hand off its work to implementers, but this is not happening as cleanly or as quickly as it was originally intended. Stakeholders in the room noted that while sponsors make the decisions, advice from the SC is highly valued. Ultimately, it was agreed that the TPOS 2020 implementation mechanism should be a shared approach, with separate science oversight and implementation groups having unique roles, with the latter being linked into intergovernmental implementation and the former through the GOOS SC.

It was agreed to have two groups, a Scientific Advisory Committee and a Implementation/Transition Group, replace the current Steering Committee in the future TPOS governance structure (see Figure 2). The Scientific Advisory Committee should closely follow the needs outlined the Backbone Task Team and expand as future gaps are identified. Task teams should be formed (or maintained) under the Scientific Advisory Committee as appropriate. It is also desirable to have some carryover of the current SC into this future group to help with knowledge transfer. The Implementation/Transition Group should be more technical in nature and will require recruitment of new members. The Steering Committee did agree to work on completing new ToR to assist in recruitment and that by SC-7 the new co-chairs of both of these groups should be identified and invited to the meeting.

Action SC-6.13: Continue discussions about who should chair the Scientific Advisory Committee and who from the current SC will continue into this new group.

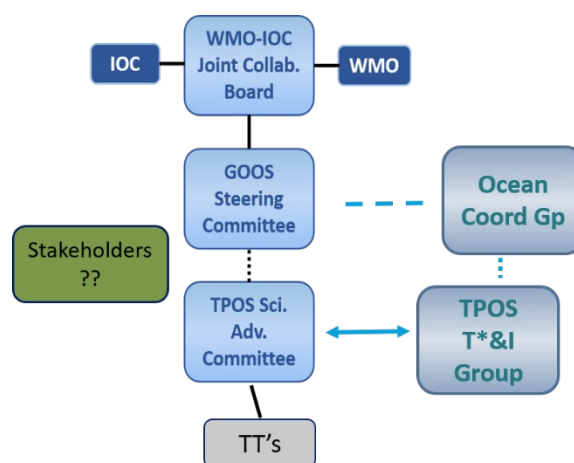


Figure 2: The strawman diagram for the future TPOS governance structure, with the two primary bodies being a Scientific Advisory Committee and a Transition and Implementation Group.

Action SC-6.14: Recruit two co-chairs, one from NOAA and one from MNR – the two major implementing agencies, for the Implementation Group before SC-7 and invite them to participate.

d) Future governance of TPOS 2020

A successful observing system relies on effective and appropriate governance. As TPOS 2020 transitions from “design project” to “implemented system phase,” a shift in governance is also required to ensure the updated system is meeting needs and expectations and is well coordinated and maintained.

Resources Forum chair David Legler gave a readout from the TRF luncheon at Ocean Obs ’19, which was a meeting focused on identifying required upper level governance for the future system and identifying current and future stakeholder needs. (Full meeting notes are available in Appendix E). Luncheon participants, a mix of TRF members and regional stakeholders, recognized that a great value of TPOS 2020 is as a coordination mechanism for regional activities, as noted by the regional task teams above. They also shared that the future TPOS group should provide scientific and technical oversight, increase its role in coordination of pilot and process studies, and enable mutually supportive partnerships. This final point is particularly important for stakeholders that want to get involved with TPOS for the mutual benefit of TPOS and themselves, but would not be major observational sponsors, such as the South Pacific Council (SPC). It is envisioned that the Resources Forum could evolve to a “Stakeholders Group” to be more encompassing moving forward. Finally, the participants discussed higher level governance arrangements for the post-2020 TPOS. It was agreed that TPOS should maintain connections to intergovernmental bodies such as WMO, the Intergovernmental Oceanographic Commission (IOC) and GOOS. It is important to have both WMO and IOC ties since TPOS sponsoring agencies respond to both of these bodies, but often not both.

Action SC-6.15: The Resources Forum will develop new ToR as it transitions to a Stakeholders group that is more inclusive beyond only sponsoring agency representatives.

The higher level governance recommendations, as discussed by both the TRF lunch participants and agreed to by the SC, are reflected in the top portion of Figure 2. Notably, the Scientific Advisory Committee should continue to engage at the GOOS Steering Committee, while the Implementation/Transition Group should coordinate through the GOOS Observation Coordination Group (OCG). The OCG is an advantageous venue because all of the major ocean-based observing platforms report to this body on annual activities, future plans, and work together in addressing challenges. Above the GOOS SC is the Joint Collaborative Board (JCB), which effectively replaces JCOMM, as a cross WMO-IOC body. Inclusion of the JCB is important so TPOS can have a presence at both WMO and IOC meetings as necessary because visibility at these bigger meetings important for higher level buy-in and support.

Action SC-6.16: The Distributed Project Office should refine Figure 2 for publication and socialization to the community.

Action SC-6.17: The SC Co-Chairs and Resources Forum Chair will discuss how to gain approval for the proposed governance changes to TPOS and pursue as appropriate.

e) Final Report

The TPOS SC Co-Chairs and DPO developed an initial outline of the Final Report for inspiration and discussion at the SC-6 Session. A Final Report is necessary to provide a summary of documentation and recommendations made for the community, both now and into the future. It can, and should, serve as a hand-off document for implementers and as a report to project sponsors. This Report should also provide recommendations on governance and implementation and additional information on modelling studies, biology and ecosystem, and a list of unresolved issues, particularly related to the core TMA. Ultimately, it was agreed that this Final Report would help move the “ball” forward while also summarizing progress to-date.

After a hearty discussion on the purpose of and needs for this Final Report, an updated Final Report outline was developed along with an initial indication of lead authors. Unfinished business, if it is underway, should be written as an Annex, while outstanding questions that need to be considered should live in Chapter 4a. The agreed to outline of chapters, authors and approximate page numbers is as follows:

- (1) Overview: Charge, purpose, process, principles, history (2 pages) – **Co-chairs**
- (2) Outcomes/conclusions
 - (a) Overview on conclusions from 6 years (6-8 pages), **B. Kessler, A. Kumar, S. Cravatte, S. Wijffels, J. Sprintall**
 - (b) Progress since R2 (12 pages)
 - (i) Biogeochemistry/ecosystems-- **P. Strutton, A. Sutton**
 - (ii) Modelling studies and progress -- **H. Hendon, Y. Takaya**
 - (iii) Data – **K. O’Brien**
 - (iv) Backbone moorings – **S. Cravatte, S. Wijffels**
 - (v) Western Pacific – **M. Katsumata, J. Sprintall**
- (3) Evaluation (8-10 pages)
 - (a) Success against our ToR (1 page) – **TBD**
 - (b) Emerging methods, Roadmap (2-3 pages) – **TBD**
 - (c) International/intergovernmental organizations (1-2 pages) – **K. Hill**
 - (d) Need/justification for additional resources (1-2 pages) – **N. Smith**
- (4) 2020 and Beyond (5-6 pages)
 - (a) Next steps: Big questions (e.g. prioritization), assessment, timeline (2 pages) – **TBD**
 - (b) Governance and ongoing structure (2 pages) – **D. Legler, N. Smith**
 - (c) Transition and Implementation (2 pages) – **TBD**
- (5) Conclusions (1 page) – **Co-chairs**
- (6) Appendices
 - (a) List of all Recommendations and Actions from R1/R2
 - (b) Core TMA document link and details– Team drafted (published before Final Report)
 - (c) Pilot and Process Studies: Updates on funded projects and lessons learned – **Bill Large, Kathy Tedesco**
 - (d) Other items?

Action SC-6.18: DPO to develop Final Report timeline and circulate outline, with page limits, and timeline to the authors.

It should also be noted that a discussion about SuperSites (or Tier 3 moorings) and a potential partnership with the Deep Ocean Observing System (DOOS) was had as a follow-on to initial conversations at Ocean Obs '19. Meghan Cronin led this discussion since she had attended the DOOS event at Ocean Obs. DOOS could provide areas for these moorings to be located. DOOS has a need for baseline data, both in the water column and on the seabed. TPOS 2020 and DOOS could be a unique partnership, as both shiptime and funding opportunities could be leveraged for the two groups. TPOS should consider following up on this with DOOS as the SuperSites are being developed in more detail. The contacts for this are Lisa Levin, Co-Chair of DOOS, and Luciana Genio, from the International Seabed Authority.

Action SC-6.19: TPOS 2020 to keep dialogue with DOOS Project as SuperSites concept develops for potential collaboration.

f) Ideas for future process and pilot studies

The Steering Committee invited Dr. Kim Cobb to present on stable isotopes as a way to track freshwater exchanges in the climate system. Specifically, deuterium ($^2\text{H}/^1\text{H}$) and oxygen-18 ($^{18}\text{O}/^{16}\text{O}$) have been successfully to calculate boundary layer kinetics in the global ocean. Other applications include weather prediction and mesoscale atmospheric variability tracing. Other areas where water isotopes have application, but need improvement, are moisture source regions, latent heat transport pathways, paleoclimate inferences, and convective mixing/entrainment. Furthermore, samples can be collected on a variety of platforms, from underway sampling systems to land-based towers and even through integrated satellite retrievals, which make this a highly adaptable approach. Field stations exist currently at the Galapagos and Christmas Islands, as well as on Boreno and Papua New Guinea.

Dr. Cobb and colleagues have formed a Water Isotopes working group as part of US CLIVAR to increase coordination and use of this technique. This group intends lead advances in data-model comparisons and serve as a conduit with relevant international efforts, such as an ECMWF warm conveyor belt workshop in 2020.

The Steering Committee was intrigued as to the potential for this technology in the Tropical Pacific. It was discussed that a station in the Intertropical Convergence Zone could help with calculating Hadley cell level variability. Tracing the source of atmospheric rivers, specifically at the process level for regional ocean modelling systems, was another TPOS 2020 relevant application that was discussed for the Eastern Pacific. Dr. Cobb is also interested in exploring putting a collection system on moorings, which would be a novel approach but aligns with the SuperSite concept that TPOS has been discussing.

Action SC-6.20: Steering Committee and Final Report authors to consider applicability of stable water isotopes as a potential pilot study for TPOS 2020 to include in the Final Report.

g) Intersessional Activity

TPOS 2020 was prominently featured at the decadal Ocean Obs '19 conference held in Honolulu, Hawaii, USA. The efforts of TPOS to identify the best observing system through a requirements driven process was commended at several of the panels throughout the meeting, including a few of the plenary sessions. Shelby Brunner also gave a lightning talk on TPOS 2020 efforts at the NOAA booth.

Co-Chair Yu provided the Steering Committee an overview on the UN Decade for Sustainable Oceans. There are 6 major thematic areas for the Decade, through which developments in applied or solutions-based ocean research are expected, such as how data transfers to applications that are societally relevant. Regional workshops, including the Western Pacific meeting held in summer 2019 where TPOS 2020 was represented, are being used to generate Science and Implementation plans. “Big ideas” from the community at large are also being welcomed by the UN Decade planning committee. Proposals will be evaluated against sustainable development goals and the overall impact the proposal could generate. One idea that has stemmed from TPOS 2020 and led by the PBL-TT Co-Chairs is a global ocean surface flux network and modelling, which could help small island nations and coastal communities greatly. Another idea that TPOS could champion is improved ocean data assimilation and modelling through requirements driven improvements in the observing system. The official launch of the Decade for Sustainable Development is the 2021 UN General Assembly.

Action SC-6.21: SC Co-Chairs and interested SC members to develop a TPOS 2020 proposal for UN Decade.

NOAA’s Climate Variability Program (CVP), which is currently funding 8 pre-field modeling studies related to PUMP (Pacific Upwelling and Mixing) and the Eastern Edge of the Warm Pool, has announced dates for the field program that will follow these modelling studies. Meghan Cronin has agreed to circulate the dates with the group and emphasized that another US CLIVAR Workshop would be needed to develop a thoughtful plan. Notionally, the projects are scheduled. The international community is welcomed to engage and show their support for this initiative. One such venue for doing so is at the Ocean Sciences 2020 Meeting, which will feature a TPOS 2020 Session and Side Event.

Action SC-6.22: Meghan Cronin to circulate CVP plans for a field study following the completion of the funded pre-field modelling studies.

Beyond the presence of TPOS 2020 at the 2019 WMO Congress and Intergovernmental Oceanographic Commission’s General Assembly, TPOS 2020 should also be forward leaning in engaging with groups involved with and workshops hosted by these two intergovernmental bodies. For instance, helping with planning Ocean Observations Workshop that was presented by Yuhei Takaya would be most advantageous. Another opportunity is to engage at the WMO-convened workshop on observation impact in Earth System models. Continuing to have a TPOS 2020 presence at these events will raise visibility of our work and ideally intrigue stakeholder support.

h) Other business

Discussions on progress with model implementation, changes to TPOS 2020 leadership and membership after 2020 and the location of SC-7 rounded out this Steering Committee meeting.

Steps towards implementing model improvements were outlined and notionally mapped out. The three main activity areas with examples of specific actions are:

1. Understanding the uptake and impact of observations,

Examples: Contributing to planning of ocean observations workshop in November 2020, engaging with Observation Impact Report initiative of the OSEval Task Team.

2. Performing process studies, and

Examples: Advocating for and engaging with established process study activities, plan workshops to inform studies such as “Bridging Observations and Modelling, Part II”

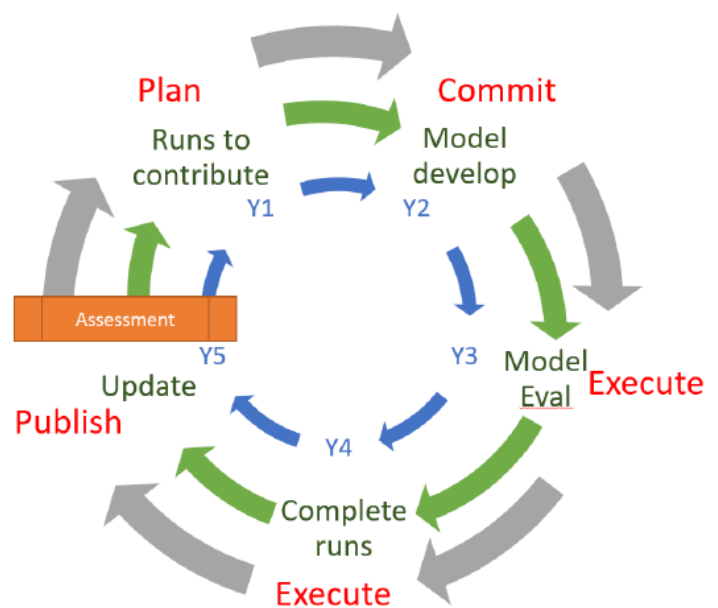
3. Model reanalyses.

Examples: Further develop ideas for EPAC and WPAC reanalysis, engage with activities of the OSEval Task Team, systematic model development utilizing Figure 3.

A common theme is that in order to recognize improvements, TPOS 2020 should build on the efforts of others instead of working in isolation. Participation in workshops and task teams are examples of ways to engage and promote TPOS 2020 plans. Advocating for improvements through official channels, such as writing letters to high level individuals in research centres, should also be considered.

Action SC-6.23: Engage in planning efforts for the ocean observations workshop planned in Yosuka, Japan for November 2020, as appropriate to help share the work TPOS 2020 has done and promote the potential of TPOS 2020 to recognize model improvements. (Complementary to Action SC-6.4).

Figure 3: A schematic showing three parallel cycles of activity needed for model and data assimilation improvement. See Chapter 2 in the TPOS 2020 Second Report for more information. This figure is Figure 2.8 in that report.



The Steering Committee revisited outstanding actions with the help of the Project Manager. The greatest gap is related to public facing communications about the TPOS 2020 project and process, such as an Eos article or updating slide decks on the website. It was agreed that this would be worth pursuing over the next year, especially as the project is approaching the end of design phase. In general, developing talking points for how we talk about TPOS 2020 and the transition and implementation phase will be useful for both project members and stakeholders.

In regards to TPOS 2020 future leadership, the need to identify new co-chairs for the Scientific Advisory Committee and Implementation Group was reemphasized. These individuals should be invited to the next Steering Committee meeting to help with hand-off. The SC Co-Chairs and DPO should also consider having an additional side meeting to the larger SC Session with the incoming co-chairs to aid in transition efforts.

Finally, several locations were identified as potential sites for the 7th Steering Committee meeting. Harry Hendon offered to host in Melbourne, Australia on behalf of the Bureau of Meteorology and Sophie Cravatte offered Toulouse, France on behalf of IRD. As a way of attracting more regional stakeholders to participate the Philippines and Samoa were suggested. It was agreed to follow-up on these locations and make a decision as soon as possible.

Action SC-6.24: The DPO will evaluate the proposed SC-7 meeting locations, including finding contacts in the Philippines and Samoa, and will set a date as soon as possible.

3. Key Outcomes and Wrap-up

The major outcomes from this meeting include:

1. Evaluation of progress towards TPOS 2020 Terms of Reference and identification of future needs for various groups and foci areas.
2. Discussion and approval of a strawman future-TPOS governance structure.
3. Outlining of the Final Report.

There are a number of other notable results from this session, including renewed energy to complete the “Core TMA technical document” and generally encouraging reports from agency partners in their direction related to TPOS 2020. The Steering Committee also has an increased awareness on the importance of higher level governance connections for the success of TPOS going forward. It was also recognized that some SC members should continue on into the new governance framework to help with knowledge transfer and preliminary discussions were had about who might be interested.

The task teams have done an excellent job achieving their Terms of Reference which is a good starting point for the self-evaluation in the Final Report. Some teams feel they are ready to be wrapped up, while others clearly identified a need to continue. As the final Steering Committee approaches for TPOS 2020, there will need to be discussion about how groups are folded up once they have contributed to the Final Report and the best method for communicating out about the changes. The new governance structure, with identified task teams, should be in place by beginning of 2021.

4. Actions

Note to reader: These actions are only from the primary Steering Committee Session. Additional actions from the Technical Workshop are located in Appendix D.

Action 6.1: Invite NOAA presentation on “Lessons learned from TPOS Technology Pilots” at SC-7.

Action 6.2: Backbone Task Team and other relevant members to follow-up with CLIVAR Pacific Regional Panel regarding coordination efforts for the eastern and western Pacific.

- Action SC-6.3:** In the Final Report address coupled weather and climate predictions, subseasonal forecast research updates and seasonal to multi-annual forecasts.
- Action SC-6.4:** TPOS 2020 should follow developments of the OSEval-TT and engage as appropriate.
- Action SC-6.5:** Contribute to development of a second “Bridging Observations and Modelling” workshop to continue building engagement between these communities and for informing the NOAA process studies.
- Action SC-6.6:** The Biogeochemical Task Team should reassess its membership to ensure it can meet its current and future needs.
- Action SC-6.7:** Dissolve the Planetary Boundary Layer Task Team for it to be reformed as an expert team after they have completed authorship of their relevant sections of the Final Report
- Action SC-6.8:** Keep Eastern Pacific-TT in TPOS 2020 structure moving forward, with updated terms of reference and/or goals.
- Action SC-6.9:** The SC Co-Chairs and EP-TT Co-Chairs should discuss development of a fund to support early career researchers in the area and identify how TPOS can best help.
- Action SC 6.10:** The Steering Committee should review the proposed new TPOS structure and agree on a structure by the end of the meeting.
- Action SC 6.11:** The Backbone Task Team co-chairs will develop and seek approval for new ToR for the future Scientific Advisory Committee and Implementation Group.
- Action SC-6.12:** Draft a roadmap of guiding principles for evaluating new technology and transitioning it into the observing system if it meets the acceptance threshold.
- Action SC-6.13:** Continue discussions about who should chair the Scientific Advisory Committee and who from the current SC will continue into this new group.
- Action SC-6.14:** Recruit two co-chairs, one from NOAA and one from MNR – the two major implementing agencies, for the Implementation Group before SC-7 and invite them to participate.
- Action SC-6.15:** The Resources Forum will develop new ToR as it transitions to a Stakeholders group that is more inclusive beyond only sponsoring agency representatives.
- Action SC-6.16:** The Distributed Project Office should refine Figure 2 for publication and socialization to the community.
- Action SC-6.17** The SC Co-Chairs and Resources Forum Chair will discuss how to gain approval for the proposed governance changes to TPOS and pursue as appropriate.
- Action SC-6.18:** DPO to develop Final Report timeline and circulate outline, with page limits, and timeline to the authors.
- Action SC-6.19:** TPOS 2020 to keep dialogue with DOOS Project as SuperSites concept develops for potential collaboration.

Action SC-6.20: Steering Committee and Final Report authors to consider applicability of stable water isotopes as a potential pilot study for TPOS 2020 to include in the Final Report.

Action SC-6.21: SC Co-Chairs and interested SC members to develop a TPOS 2020 proposal for UN Decade.

Action SC-6.22: Meghan Cronin to circulate CVP plans for a field study following the completion of the funded pre-field modelling studies.

Action SC-6.23: Engage in planning efforts for the ocean observations workshop planned in Yosuka, Japan for November 2020, as appropriate to help share the work TPOS 2020 has done and promote the potential of TPOS 2020 to recognize model improvements.

Action SC-6.24: The DPO will evaluate the proposed SC-7 meeting locations, including finding contacts in the Philippines and Samoa, and will set a date as soon as possible.

5. Appendices

Appendix A: SC-6 Agenda



TPOS 2020 SC-6 FINAL AGENDA

TPOS 2020 SC-6 Desired Outcomes:

- 1) Identify necessary activities and deliverables to successfully complete Project phase of TPOS 2020;
- 2) Endorsed outline of the Final Report and list of proposed chapter lead authors;
- 3) Discuss how to continue offering scientific advice into TPOS 2020 once Project ends;
- 4) Understand governance and implementation considerations from sponsoring agencies.

Location: Meeting Room No. 3, Jinxi Hotel, Hangzhou, China

Host: Second Institute of Oceanography

5-7 November 2019

Remote access: <https://global.gotomeeting.com/join/900151821>

- 1) Introduction
 - a) General Welcome Jian Yu,
DDG
 - b) Opening and Welcome Fei Chai
 - c) Charge to the meeting SC Co-
Chairs
- 2) Agenda discussion and approval
- 3) Organizational Updates: Second Report response + General Updates
 - Agencies
 - i) NOAA
 - ii) MNR/SOA
 - iii) CMA
 - iv) JAMSTEC
 - v) BoM
 - vi) IMOS
 - vii) KIOST
 - b) International
 - i) WMO
 - ii) GOOS
 - iii) CLIVAR and CLIVAR PRP
- 4) Steering Committee & Task Teams: Reprise, reflect and project forward

- For each area, reprise what has been achieved through Reports 1 and 2, the Community White Paper, and other outputs of TPOS 2020 (major reviews, recommendations, actions).
 - Reflect on the extent to which this work has accomplished our [Terms of Reference](#) and the goals we set ourselves.
 - Reflect on aspects that need additional attention and/or require new attention as we project forward to the end of the project and beyond.
 - Reflect on implementation recommendations/actions and who should be responsible for carrying them forward
 - As appropriate, consider the future role of Task Teams, including beyond 2020.
- a) Coupled weather prediction and Subseasonal requirements Yuhei T, Harry H
 - b) Subseasonal to Interannual predictions and modeling Arun K, Bill Large, Neville S, Dake C,
 - c) BGC Pete S, Adrienne S
 - d) Planetary Boundary Layer Meghan C, Tom F
 - e) Eastern Pacific Yolande, Boris, Billy
 - f) Western Pacific Masaki, Janet S, Weidong
 - g) Backbone Sophie C, Susan W
 - h) Data management Neville S
 - i) **Technology** **
- 5) Implementation beyond 2020
Managing the transition from the present design phase to implementation
- b) Defining the need Neville
 - c) Data quality and integration,
 - i) Summary from Technical Workshop SC Co-Chairs
 - d) Progress with current process studies
 - i) NOAA Billy
 - e) Recommendations and actions for attention/focus (from Item 4) SC Co-Chairs
 - f) Membership and leadership of the Transition Team; ToR Neville
 - g) Membership of other post-2020 bodies
- 6) Future Governance of TPOS 2020
- a) Readout from TRF lunch at OO'19 David L.
 - b) Partnerships necessary to maintain an integrated system
 - c) Roundtable discussion with Stakeholders and Steering Committee
 - d) Actions and deliverables necessary for successful completion of TPOS 2020 "Design Phase"
- 7) **Final Report Outline**
Identify potential lead authors for each section
- a) Defining needs of maintaining a quality Backbone: Sophie C
 - i) Data quality and management
 - b) Evolution of the Backbone Sophie C, PBL, BGC
 - i) T2 Sites: Objectives? How many and where?
 - ii) Role and need for Super Sites: DOOS Discussion PBL/Meghan C.
 - iii) Meridional extensions

- iv) Overlap, intercomparison and evaluation as the TMA evolves
- v) BGC advances and planning
- vi) Other?
- c) Current status of Implementation Neville/David/Weidong
- d) Pathway for evaluation: Integrating lessons from the pilot studies
- e) Goals and needs for potential process studies
- f) Building and maintaining connections to users
(e.g. Met Services, forecast centers, Pacific Islands, etc)
- g) Governance and Structure (i.e., results of item 5 above)

- 8) Ideas for future process and pilot studies?
Leveraging TPOS 2020 Framework/Process to promote collaboration between agencies.
How to evaluate the impact of changes?
 - a) Tracking freshwater exchanges (**Thursday 0900 AM**) Kim Cobb

- 9) Intersessional Activity (previous and upcoming) overview
 - a) Outreach activities
 - i) Readout on UN Decade Weidong
 - b) WMO Katy H.

- 10) Recap and actions

- 11) Other business
 - a) Steering Committee and Task Team Membership
 - b) Next meeting

Appendix B: List of Participants

TPOS 2020 Steering Committee Members

Kentaro ANDO (**Apology**)

Research Scientist

Japan Agency for Marine-Earth Science and Technology, Yokosuka

Research Institute for Global Change Japan Marine Science and Technology Centre 2-15

Natsushima-cho

Yokosuka

Japan

Tel: +81-46-867-9462

Fax: +81-46-867-9835

Email: andouk@jamstec.go.jp

Dake CHEN (**Host**)

Professor

Second Institute of Oceanography, SOA

No.36 baochubei Road

310012 Hangzhou

Zhejiang

China

Email: dchen@sio.org.cn

Sophie CRAVATTE

Researcher

Institut de Recherche pour le Développement, LEGOS

14 avenue Edouard Belin

31400 Toulouse

France

Email: sophie.cravatte@ird.fr

J. Tom FARRAR

Researcher

Woods Hole Oceanographic Institution

Woods Hole MA 02543

United States

Email: jfarrar@whoi.edu

Harry HENDON

Bureau of Meteorology, Melbourne

700 Collins Street

Docklands

GPO Box 1289

Melbourne VIC 3001

Australia

Email: h.hendon@bom.gov.au

Dr Dongchull JEON (**Apology**)
P.I. of POSEIDON Project/KORDI
Korea Institute of Ocean Science and Technology
787 Haeanlo
Ansan 426-744
Korea Rep
Tel: +82 010 3305 6124
Email: dcjeon@kiost.ac

William KESSLER (Co-Chair)
NOAA Pacific Marine Environmental Laboratory (PMEL)
7600 Sand Point Way NE, Bldg. 3
Seattle WA 98115
United States
Email: William.S.Kessler@noaa.gov

Arun KUMAR
Principal Scientist, Climate Prediction Center
National Centers for Environmental Prediction, NOAA
5830 University Research Court
College Park Maryland 20740
United States
Tel: (1) 3016833385
Fax: (1) 3016831557
Email: arun.kumar@noaa.gov

William LARGE
University Cooperation for Atmospheric Research
3090 Center Green Drive
P.O.Box 3000
Boulder Colorado 80301
United States
Email: wily@ucar.edu

Dean ROEMMICH (**Apology**)
Scripps Institution Oceanography
La Jolla, California
United States
Email: droemmich@uscd.edu

Neville SMITH
Australia
Tel: +61 407 824 129
Email: nsmi3118@bigpond.net.au

Peter STRUTTON
University of Tasmania, Institute for Marine and Antarctic Studies
Private Bag 129
Hobart TAS 7001
Australia
Email: peter.strutton@utas.edu.au

Boris DEWITTE
Research Scientist
Centre of Advanced Studies in the Arid Zones
La Serena
Chile
Email: bx.dewitte.legos@gmail.com

Yuhei TAKAYA
Senior Researcher
Japan Meteorological Agency
Japan
Email: yuhei.takaya@mri-jma.go.jp

Weidong YU (Co-Chair)
Senior Scientist
National Marine Environmental Forecasting Center
State Oceanic Administration
First Institute of Oceanography, SOA
6 Xian-xia-lin Road
High Technology Park
266061 Qingdao
China
Tel: + 86 532 88967403
Fax: +86 532 88967403
Email: wdu@fio.org.cn

Task Team Co-Chairs

Meghan CRONIN (PBL Task Team)
NOAA PMEL Bldg #3
7600 Sand Point Way NE
Seattle, WA 98115
United States
Tel: +1 206-526-6449
Email: Meghan.F.Cronin@noaa.gov

Yolande SERRA (EP Task Team)
JISAO
University of Washington
Box 357941, Seattle, WA 98195
United States
Email: yserra@uw.edu

Janet SPRINTALL (WP Task Team, **Apology**)
Scripps Institution Oceanography
La Jolla, CA
United States
Email: jsprintall@ucsd.edu

Masaki KATSUMATA (WP Task Team)
Senior Researcher
Ocean-Atmosphere Climate Research Group
Japan Agency for Marine-Earth Science and Technology
Japan
Tel: +81-46-867-9466
Email: katsu@jamstec.go.jp

Adrienne SUTTON (BGC Task Team, **Apology**)
Research Scientist
NOAA PMEL
United States
Tel: +1-206.526.6879
Email: adrienne.sutton@noaa.gov

Susan WIJFFELS (BB Task Team, **Apology**)
Senior Scientist
Physical Oceanography
Woods Hole Oceanographic Institute
Woods Hole, MA 02543
United States
Tel: +1 508-289-2546
Email: swijffels@whoi.edu

Organisation Representatives

David LEGLER
Division Director
Ocean Observing and Monitoring Division
NOAA
1315 East West Highway (SSMC3)
Silver Spring, MD 20910
Tel: +1 301 427 2460
Email: david.legler@noaa.gov

Kathy TEDESCO
Program Manager
Ocean Observing and Monitoring Division
NOAA
1315 East West Highway (SSMC3)
Silver Spring, MD 20910
Tel: +1 301 427 2462
Email: kathy.tedesco@noaa.gov

Iwao UEKI
Senior Research Scientist
Research and Development Center for Global Change
JAMSTEC
2-15 Natsushima, Yokosuka 237-0061
Japan
Tel: +81-468-67-9468
Email: uekii@jamstec.go.jp

Observers and local organisation

Fei CHAI
Director
State Key Laboratory of Satellite Ocean Dynamics
Second Institute of Oceanography
Ministry of Natural Resources
Hangzhou
China

Xiaopei LIN
Professor
College of Physical and Environmental Oceanography
Ocean University China
238 Songling Road
Qingdao 266100
China
Tel: +86-532-66782853
Email: linxiaop@ouc.edu.cn

Xiaoyan CHEN
International Affairs Specialist
State Key Laboratory of Satellite Ocean Dynamics
Second Institute of Oceanography
Ministry of Natural Resources
Hangzhou,
China
Tel: +86 571 81963198
Email: cheyxy@sio.org.cn

Jingjing LI
International Affairs Specialist
State Key Laboratory of Satellite Ocean Dynamics
Second Institute of Oceanography
Ministry of Natural Resources
Hangzhou
China
Email: lijingjing@sio.org.cn

Secretariat/Distributed Project Office

Katherine (Katy) HILL
GOOS/GCOS Programme Specialist
World Meteorological Organization
7bis, avenue de la Paix
Case Postale 2300
1211 Geneva
Switzerland
Tel: +41 (0)22 730 80 83
Fax: +41 (0)22 730 8052
Email: khill@wmo.int

Shelby BRUNNER
Sr. Project Manager
NOAA Ocean Observing and Monitoring Division
1315 East-West Highway
Suite 2701
Silver Spring, Maryland 20910
USA
Tel: 301-42702473
Email: Shelby.brunner@noaa.gov

Lucia UPCHURCH
Project Manager
NOAA PMEL Bldg #3
7600 Sand Point Way NE
Seattle, WA 98115
USA
Email: lucia.upchurch@noaa.gov

Guang YANG
Project Manager
Center for Ocean and Climate Research
First Institute of Oceanography
Ministry of Natural Resources
6 Xianxialing Road
Qingdao 266061
China
Tel: +86-532-88892983
Email: gyang@fio.org.cn

Appendix C: Final Report Outline

- (1) Overview: Charge, purpose, process, principles, history (2 pages) – **Co-Chairs**
- (2) Outcomes/conclusions
 - (a) Overview / conclusions from 6 years (6-8 pages), **B. Kessler, A. Kumar, S. Cravatte, S. Wijffels, J. Sprintall**
Includes any important conclusions from this Report
 - (b) Progress since R2 (12 pages)
 - (i) Biogeochemistry/ecosystems-- **P. Strutton, A. Sutton**
 - (ii) Modelling studies and progress -- **H. Hendon, Y. Takaya, A. Kumar**
 - (iii) Data – **K. O'Brien**
 - (iv) Backbone moorings – **S. Cravatte, S. Wijffels**
 1. Latitudes of moorings in extensions
 2. Role and need of T2 moorings
 - (v) Western Pacific – **M. Katsumata, J. Sprintall**
- (3) Evaluation (8-10 pages)
 - (a) Success against our ToR (1 page) – **TBD**
 - (b) Emerging methods, Roadmap (2-3 pages) – **TBD**
 - (c) International/intergovernmental organizations (1-2 pages) – **K. Hill**
 - (d) Need/justification for additional resources (1-2 pages) – **N. Smith**
- (4) 2020 and Beyond (5-6 pages)
 - (a) Next steps: Big questions (e.g. prioritization), assessment, timeline (2 pages) – **TBD**
 - (b) Governance and ongoing structure (2 pages) – **D. Legler, N. Smith**
 - (c) Transition and Implementation (2 pages) – **TBD**
Based on where progress is, or projected to be, in December 2020
- (5) Conclusions (1 page) – **Co-Chairs**
- (6) Appendices
 - (a) List of all Recommendations and Actions from R1/R2
 - (b) Core TMA document link and details– Team drafted (published before Final Report)
 - (c) Pilot and Process Studies: Updates on funded projects and lessons learned – **Bill Large, Kathy Tedesco**
 - (d) Other items?

Appendix D: Technical Workshop

SC-6 Technical Workshop Agenda

Second Institute of Oceanography, Ministry of Natural Resources

Building #1, 15th Floor

Bus departs Jinxi Hotel at 08:15

Monday, 4 November 2019

Remote access is available via GoToMeeting: <https://global.gotomeeting.com/join/900151821>

Objectives of workshop:

- 1) Develop data QC procedures and documentation. All data from the combined arrays should be transparent, with clearly-described QC methodology. Eventually, this would be consistent across TAO, the two remaining TRITON moorings, and the future Ding array. These are difficult questions that require careful consideration. We can't solve all issues in a short discussion, but let's give time to lay out the issues and define a path forward.
- 2) Share data distribution needs. How will the data be served? What is the path from real-time data to be updated with manual QC to be research-quality? Will each array's data be served separately, or will servers show the combined data across the three projects?

Agenda

09:00-09:15	Introduction and Welcome	Fei Chai, SIO/MNR
09:15-09:30	Data methodology for tropical moored array <ul style="list-style-type: none">• See above objectives• Get agreement for path forward	
10:30-11:00	Coffee Break and Group Photo	
11:00-11:20	Argo beyond 2020	Fei Chai, SIO/MNR
11:20-11:40	Potential contribution of IOCAS to TPOS 2020	Fan Wang, IOCAS
11:40-12:00	Perspective of the ocean observation in Qingdao National Lab for Marine Science and Technology	Xiaopei Lin, OUC
12:00-12:20	Western Pacific and Indonesian seas observations to improve ENSO and decadal prediction	Dongliang Yuan, IOCAS
12:20-12:40	Western Pacific Observation Plan from Ministry of Natural Resources	Wei Wang, NMTC/MNR
12:40	Lunch and Lab Tour	
14:00	Depart	

Abbreviated Report

Data Methodology for TMA

Technical experts from US's Pacific Marine Environmental Laboratory (PMEL) and China's National Marine Data Information Centre (NMDIC) shared data quality control processes and data distribution information for moorings. A broader conversation was had to help clarify what is necessary and desirable. The approach by NMDIC is consistent with PMEL's approach. To truly standardize the quality control process, however, it was recommended that algorithms and approaches for both realtime and delayed mode quality control be shared, particularly to assure that thresholds are consistent and methodologies align. One way to recognize this is through mirroring datasets between international partners, potentially in a way that end users can access all tropical Pacific data on one platform. Realtime data shared from a single harmonized system has immense potential and value to the community.

On land and in-situ intercomparisons were also discussed at length. On land, or "dry", intercomparisons should be between meteorological sensor packages located in the same area that is exposed to elements that will test the range of sensors. After a successful dry intercomparison, an in-situ, or "wet", intercomparison should be planned where moorings are deployed within 10 nautical miles of one another to test sensor readings, as well as evaluate data dissemination methods. A future intercomparison between moored $p\text{CO}_2$ systems was also suggested as a future activity.

Actions as a result from this discussion include:

1. Share technical details on realtime and delayed mode data quality control via email before intercomparisons begin.
2. Set-up a working team before end of week to work on core TMA documentation.
3. Complete core TMA documentation as soon as possible, but no later than mid-2020, using previous draft as a starting point.
4. Use China-US bilateral channels to list these technical collaborations and help cement work plans.

New technologies and various trade-offs between existing and future mooring configurations was also briefly discussed. It was recommended that technology and information sharing specialists attend the next workshop to help better understand these trade-offs and potential needs.

Science Presentation Highlights

A number of scientific presentations were prepared for this technical workshop. This section is meant to be a very brief overview on highlights from those.

- SIO, through Fei Chai's recommendation, is committing two biogeochemical Argo floats to the TPOS region for 2020 as a contribution to TPOS 2020 and to help recognize the future Argo design.
- The Chinese Academy of Sciences (CAS) has built a sub-surface moored array in the western Pacific along the northeastern upwelling and equatorial currents. They are working on transmitting subsurface data back to shore in real-time through a small surface modem and satellite connection.

- CAS is organizing a “Centre for Ocean Mega-Science” (COMS) to centralize ocean activities within China and is looking for how it can contribute to major initiatives, such as TPOS 2020.
- A recently submitted proposal by Dongliang YUAN proposes new observational sites near the Mindanao and ITF currents. This data could be shared with TPOS in addition to other planned contributions.
- China’s Ministry of Natural Resources has an extensive Western Pacific Observation Plan to fill needs outlined at the Marine Forecasting and Monitoring Center. These plans include:
 - 12 surface moorings with 6 coexisting subsurface moorings;
 - “Rapid emergency network of air-sea interface drifters” in 5x5 grid, especially in warm pool region;
 - Argo floats deployed in specific region, of which some will be biogeochemical;
 - Research vessel fleet priorities will include enhancing observations at the boundaries of the region; and
 - Ocean satellites, including two launched by end of 2020, with a new open data policy adopted.

Participants



Name	Affiliation
Jian Yu	Marine Warning Monitoring Division, MNR
Dongliang Yuan	Institute of Oceanology, CAS
Xiaopei Lin	Ocean University of China
Yan Du	South China Sea Institute of Oceanology, CAS
Wei Peng	National Ocean Technology Center, MNR
Chunlin Ning	First Institute of Oceanology, MNR
Weidong Yu	Sun Yat-sen University
Guang Yang	First Institute of Oceanology, MNR

Meng Wei	First Institute of Oceanology, MNR
Yue Fang	First Institute of Oceanology, MNR
Yi Wang	National Ocean Technology Center, MNR
Daji Huang	Second Institute of Oceanology, MNR
Jiangning Zeng	Second Institute of Oceanology, MNR
Fei Chai	Second Institute of Oceanology, MNR
Xiaoyan Chen	Second Institute of Oceanology, MNR
Jingjing Li	Second Institute of Oceanology, MNR
Xuelian Zhang	Second Institute of Oceanology, MNR
Peiyan Xie	Second Institute of Oceanology, MNR
Lei Lei	Second Institute of Oceanology, MNR
Shuyi Xie	Second Institute of Oceanology, MNR
Zhigang Gao	National Marine Data Information Center, MNR
Ting Yu	National Marine Data Information Center, MNR
Yang Yang	National Marine Data Information Center, MNR
Xinqiang Xu	First Institute of Oceanology, MNR
Arun Kumar	NOAA, Climate Prediction Center
Iwao Ueki	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Meghan Cronin	NOAA Pacific Marine Environmental Laboratory
Lucia Upchurch	University of Washington
Masaki Katsumata	Japan Agency for Marine-Earth Science
Peter Strutton	University of Tasmania
Sophie Cravatte	IRD (Institut de Recherche pour le Développement)
Yuhei Takaya	Meteorological Research Institute, Japan Meteorological Agency
Shelby Brunner	UCAR / NOAA
William Kessler	NOAA Pacific Marine Environmental Laboratory
Harry Hendon	Bureau of Meteorology Australian
Neville Smith	Private consultant
William Large	NCAR
J. Thomas Farrar	Woods Hole Oceanographic Institution
Kenneth Connell (remote)	NOAA Pacific Marine Environmental Laboratory

Appendix E: TPOS Resources Forum Ocean Obs '19 Luncheon Notes

TPOS 2020 Stakeholder Lunch Meeting
Wednesday, September 18, 2019
Minori Japanese Craft Tavern, Honolulu, HI, USA

Meeting objectives:

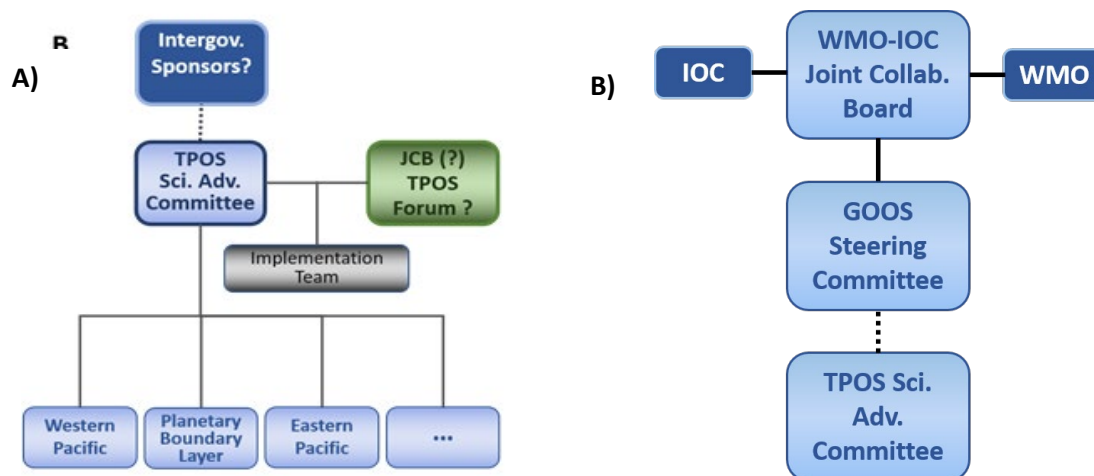
- Agree to roadmap of future TPOS 2020 Project transition
- Review draft decision concept document, including decisions/timeline/structure and consider additional needs
- Identify stakeholder needs and considerations, including appropriate agency sponsors, for transition and implementation beyond 2020

Divided by tables (see groupings in Appendix B), participants worked through the questions in the Agenda. Major outcomes are presented below.

Post 2020 Structure of TPOS

- The post-2020 TPOS requires a clear connection to the intergovernmental organizations, specifically the Joint Collaborative Board (JCB) since it provides connections to the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC).
 - The varying funding agencies will require strong ties to either WMO or IOC depending on which they more closely align with (e.g. Japanese Meteorological Agency to WMO), but usually not both. Therefore, strategically aligning to both is key for success in order to successfully engage TPOS Resource Forum (TRF) member support.
 - TPOS should make sure the importance of JCB for its future implementation and governance is highlighted at both the 2020 IOC Assembly and WMO Executive Council.
- A new high-level structure was proposed (see Figure 1). Additional notes on structural considerations:
 - Membership should reflect the users, stakeholders, and information flow between the groups
 - Expand the scope and membership of the TRF so it more adequately reflects how we work across the spectrum of activities.
 - Add additional feedback loops between TPOS Science Advisory and Governance bodies.
 - A “TPOS Inter-Basin Reference Group” could be created to neatly make connections with groups from the S-SW Pacific, Indian Ocean, and Southern ocean.
- Some unanswered questions remain:
 - Could (should) TPOS become a GOOS Regional Alliance (GRA)? And should TPOS leverage some of the same GRA governance principles?

Figure 1: (A) The proposed post-2020 TPOS structure provided to the participants; (B) a newly proposed TPOS structure for intergovernmental governance connections.



Future Functions

- A broad user perspective is advantageous and should be maintained, from coupled, weather scales through ocean and seasonal prediction to biogeochemical and ecosystem services.

End User Connections

- The “TPOS” organization should be maintained, with upward awareness (i.e. users, applications, requirements) and downward awareness (i.e. assessing what is possible – technically, feasibility, resource-wise, R&D, etc)
- Users want products, not raw data. How do we develop connections to the product developers? Do these already exist?
- A principal mechanism for connecting to end-users, e.g. through modelling and forecast centers, is needed and emphasizes the potential importance of a strong link to WMO.
- Weather and climate forecast improvements from TPOS can bring substantial benefit to Small Island Developing States. Promotion of capacity development and increased communication and outreach will be important to make sure these benefits are realized.
- More co-design and inclusivity from diverse communities is desired– maybe even requesting contributions from these different communities – not just traditional disciplines- but give everyone a stake and part in the system.
 - Request point of contacts for various organizations that are not currently as involved (e.g. BMKG, SPREP, NIWA, SPC). Help them understand how they can be involved, both with observations and utilizing data and products.

Points raised during the discussions:

- JAMSTEC plans to reduce their TRITON moorings from three to one in 2021. It is unlikely that JMA would replace these.
- Bureau of Metrology is exploring how it could become more involved in TPOS.
- How can we inspire nations, no matter how small their contribution, to be part of the TPOS? We need to have a methodology to present how contributions are given and recognized, through a document or specified mechanism.
- Connect with UN Decade, Indian Ocean, and other regional planning efforts to deliver greatest benefit of proposed changes.

Appendix A: Meeting Agenda

Meeting Goals

- Agree to roadmap of future TPOS 2020 Project transition
- Review draft decision concept document, including decisions/timeline/structure and consider additional needs
- Identify stakeholder needs and considerations, including appropriate agency sponsors, for transition and implementation beyond 2020

Agenda

- Welcome and Introductions
- Foci for TPOS 2020 post-2020 - Resources Forum Chair
- Transition from ‘Design Project’ to ‘Implementation Program’^
 - What functions does the Program need to have?
 - What organizational/structural changes are necessary?
 - What connections are required to various external bodies? (e.g. GOOS, Observation Coordination Group, WCRP, etc.)
- Beyond observations: How to deliver to the rest of the value chain?
 - How should TPOS 2020 plan to engage end users? How do we ensure value chain delivery and capabilities beyond just observations?
 - Is there a need to continued coordination support through a Project/Program Office?
- Wrap-up and summary

Appendix B: Participant list (by table)

- Table 1
 - Billy Kessler – NOAA
 - Shelby Brunner – NOAA
 - Nick A’Damo – IOC Perth
 - Meredith Kurz – NOAA
 - Zulfikar Begg – SPC
 - Darin Figurskey – NOAA

- Table 2
 - Etienne Charpentier – WMO
 - Tim Moltmann – IMOS
 - Weidong Yu – SOA
 - Ken Ando -- JAMSTEC
- Table 3
 - Mike Williams – NIWA
 - Duncan McIntosh – SPREP
 - Helmut Portmann – NOAA
 - Jennifer Lewis – NOAA
 - Boris Kelly-Gerreyn – BoM
 - Nelly Florida-Rama – BMKG
- Table 4
 - Neville Smith
 - Hendrik Tolman – NOAA
 - Eric Lindstrom – NASA
 - Sandy Lucas – NOAA
 - Jae Hak Lee – KIOST
- Table 5
 - David Legler – NOAA, TRF Chair
 - Katherine Hill – WMO
 - Michelle McClure – NOAA
 - Kelley Uhlig – NOAA
 - Kathy Tedesco – NOAA