

TPOS 2020 Western Pacific Workshop

Summary Report

4-6 September, 2017
Blue Horizon Hotel, Qingdao

Hosted by the First Institute of Oceanography, SOA

1. Opening Remarks

Mr. Zhi Chen, Deputy Director General, SOA and Dr. FangLi Qiao, Secretary General, First Institute of Oceanography, SOA provided welcoming remarks. In those remarks, the relevance and importance of TPOS for China was emphasised, including for typhoon impacts and climate effects for agriculture.

2. Introductions, logistics

The Co-Chairs of the Workshop, Dr Weidong Yu, Dr Neville Smith and Dr Billy Kessler provided a brief introduction to the meeting and added their welcome. The full list of participants is provided at the end of this report, along with a copy of the agenda.

3. TPOS 2020 1st Report and implementation

Neville Smith provided a brief introduction to the TPOS 2020 Project, including conclusions from the TPOS 2020 [1st Report](#) and the outcomes from a successful second meeting of the [TPOS 2020 Resource Forum \(TRF-2\)](#). The presentation can be found [here](#).

Dr Smith noted the desired outcomes for the Workshop included:

1. Establishing a good dialogue on TPOS WP activities;
2. Clarity on the steps for implementation of the WP actions from the 1st Report;
3. Clarity on the next steps for the LLWBC Pilot (scope, purpose, likely activities, etc.); and
4. Improved understanding of the potential to support process studies

The discussion highlighted the importance of modelling for the topics on the agenda and the participants agreed to include a presentation and discussion of modelling under Item 5.

Jose Santos spoke to the importance of other regions of the tropical Pacific, particularly the eastern Pacific. The TPOS2020 Co-Chairs noted that similar attention was being devoted to that region but that it was at a different state of development.

4. Current activities in the western Pacific

The following presentations were provided for the session (links are provided for available presentations):

- Fan Wang, [Observational Progresses in western tropical Pacific by IOCAS in 2016](#)
- Zenghong Liu, [Status of China Argo and its Prospect in the Tropical Pacific](#)

- Yi Shao, [Status and Future Deployment of Mooring Buoy and COPEX Profiling Float in the West Pacific](#)

A key point that arose during these discussions was the importance of an effective and efficient data management process for TPOS. For the TPOS Backbone, the standard is real-time communication (or as close to real-time as is practical) and open exchange of data, provided through the information systems of the WMO and/or through dedicated data and product services (such as provided by PMEL for TAO/TRITON and the Argo data centres for Argo; see Liu presentation).

It was agreed to return to this topic later in the meeting.

The China Argo presentation provided optimism that TPOS may be able to achieve significant steps towards its 2xArgo goal. The Liu and Shao presentations also drew attention to the significant effort in technology development (communications, floats, buoys). Some flexibility in the operating cycle of the floats so as to address specific Western Pacific process studies also emerged as a theme.

The discussion highlighted the importance of standards and standard operating procedures for contributions to the TPOS Backbone.

5. Potential additions to the TPOS 2020 Backbone

(a) Western Pacific sustained networks

Ken Ando provided

- (i) an update on TPOS 2020 [Western Pacific Task Team](#) activities,
- (ii) introduced the [mooring/glider observation inventories](#) for the western Pacific (west of the dateline), and
- (iii) an update on the [status of TRITON](#).

Xiangzhou Song provided an overview from a national perspective ([presentation here](#)) and emphasised the considerable synergy with coastal networks. He also noted the need to take an integrated approach.

Weidong Yu provided [SOA's Perspective on TPOS 2020](#) and introduced SOA's preliminary plan for western Pacific Backbone (sustained) observations.

The workshop noted many activities relevant to the TPOS 2020 recommended Tropical Moored Buoy Array (TMA), and the potential for Backbone extensions motivated by specific interests in the western Pacific region. The WP TT has provided a valuable mechanism for gathering information about the purpose and achievements of these efforts (refer also to Fan Wang's presentation under item 4). These efforts included potential interest and contributions from KIOST (see [Janet Sprintall presentation](#) under Item 6).

(b) Modelling

Dr FangLi Qiao (and co-authors) kindly provided a presentation on [model development activities at FIO](#) to motivate this additional agenda item. In summary, he highlighted (i) modelling and data assimilation activities for weather and seasonal to interannual prediction, (ii) pilot observation activities in the tropical oceans from FIO, and (iii) modelling related to ocean satellite implementation plans till 2025, both in China and other countries.

Janet Sprintall highlighted a recent study on “[Estimation of the Tropical Pacific Ocean State 2010–13](#)” by Ariane Verdy, Bruce Cornuelle and others (see brief [presentation](#)).

The discussion highlighted the many areas where modelling could improve understanding, improve design, and enhance the impact of observations (improved models). Such activities are relevant to both the sustained Backbone development and implementation and to pilot projects and process studies, and modelling and data assimilation will be a focus of the TPOS 2020 2nd Report.

Neville Smith provided a [brief summary](#) of these different activities:

1. Build modelling in as an integral part of “pilot” backbone implementation in the W Pacific
 - Design; testing effectiveness; testing impact.
2. Model sensitivity studies for surface variables
 - E.g., Satellite observations.
3. Evaluation of sub-seasonal to interannual prediction modelling and DA systems.
4. Modelling in support of weather to subseasonal time scale prediction activities.
5. Modelling as an integral part of the LLWBC pilot project
 - Guiding design; part of monitoring.

(c) BGC/ecosystems

Pete Strutton opened discussion on this item and introduced Sayaka Yasunaka who provided a presentation on [BGC related measurements in the tropical Pacific](#).

Pete also provided some further general thoughts based on activities within the TPOS 2020 Backbone Task Team and plans for future activities (see [presentation](#)). He noted that corals in the western Pacific may emerge as a topic in future plans.

One theme that emerged from the discussion was the potential to enhance contributions to the Backbone through additional underway measurements as part of the development of the TMA component of the western Pacific Backbone, and the potential for additional BGC measurements on a subset of the backbone moorings and from profiling floats.

The discussion encouraged development of further advice relevant to the western Pacific, such as scale studies focused on western Pacific pCO₂ data, development of initial guidance for BGC-Argo, and western Pacific mooring “super site” development. For floats, there is strong interest in the community and there is an opportunity to bring some focus to the western Pacific region; the development of any such activity would fully take account of the end-to-end requirements of such a study, including data management capability.

6. Western Pacific Pilots and Process Studies

Ken Ando provided a recap of relevant activities of the Western Pacific Task Team that related to Pilot Projects and Process Studies (see [presentation](#)).

(a) WP TT projects (Northern Edge, Eastern Edge, etc)

Akira Nagano described JAMSTEC proposals for ocean and atmospheric observations at the eastern edge of the western Pacific warm pool ([presentation](#)). The main focus will be on the dynamics of subduction at the eastern edge of the warm pool. Some new technologies may also be trialled. The present plan is for this cruise to take place in early 2020 or late 2019 (not confirmed).

Masaki Katsumata (JAMSTEC) reported on a proposed process study for the northern edge of the western Pacific Warm pool ([presentation](#)). Cruises are planned for some time in the period of May-August 2018 (not confirmed) and June-July 2020 (First review was passed); the hope is that the eastern edge cruise will take place prior to the 2020 cruise.

Sections 6.2.2 and 6.2.3 of the [1st Report](#) provide additional background on these process studies.

The Workshop confirmed the support of TPOS 2020 for such studies and discussed several opportunities for additional supportive/complementary studies, including modelling. From these presentations and those under Item 4, there is evidence of strong scientific effort, with participation across different players/partners of TPOS 2020.

For now, the Workshop proposes that the TPOS 2020 SC continue to provide guidance and a broadly-based experimental framework to support and coordinate these efforts. It is important to maintain links with R&D coordination, e.g. through CLIVAR.

(b) The Low Latitude Western (Pacific) Boundary Current (LLWBC) Pilot

Four presentations were provided to background this discussion (Section 6.1.1 of the [1st Report](#) provides additional background).

- Janet Sprintall provided an overview from the perspective of the WP TT Co-Chair and summarised relevant activities and measurements from international programs within the Indonesian seas, a Western Pacific LLWBC overview, and as captured at the recent Solomon Sea workshop ([presentation](#));
- Dongliang Yuan (and co-authors) described observations of the Pacific western boundary currents and the Indonesian Throughflow at the Pacific entrance of the Indonesian seas ([presentation here](#));
- Ju Chen presented progress with monitoring of the South China Sea Through-flow ([Ju Chen presentation](#)); and
- Billy Kessler discussed results for the Solomon Sea using spray gliders, as an example of a LLWBC strategy for TPOS 2020 ([presentation](#)), and potentially for helping to close some key budgets of the tropical Pacific.

Taken together with the presentations on day 1, the workshop concluded that the level of interest and investment of effort, was sufficient to move toward a coordinated LLWBC Pilot. At this point in the workshop it was less clear what form that should take (but see discussion and conclusions under Item 9).

(c) Opportunities for TPOS 2020 – CLIVAR cooperation

Jose Santos provided a [brief presentation](#) highlighting the many links from the TPOS 2020 community to CLIVAR and vice versa. The Pacific Regional Panel provides a coordination mechanism for Pacific research that complements the WP and Eastern Pacific Task Teams, and TPOS 2020 more generally. The TPOS 2020 DPO Qingdao node is co-located with the CLIVAR Office, facilitating close coordination.

The Workshop and TPOS 2020 more generally appreciate the many links and TPOS will continue to coordinate/communicate with CLIVAR as it progresses.

(d) New technology options

Ken Ando provided a presentation on TPOS new technology (much as given at TRF2 – see [here](#)). The TPOS 2020 SC Co-Chairs noted that, based on Ken Ando’s presentation, TRF2 provided strong encouragement to explore new technology options and in turn TPOS 2020 has agreed to include a chapter in the second Report providing an update.

Xiujun Sun (SOA) discussed wave glider experiments and the concept of a [Global Array of Wave Gliders -- An Array for Real-time Oceanography and Marine Meteorology](#).

The Workshop agreed that opportunities to test/trial new technology should be promoted through all layers of TPOS activity, from process studies and pilots, through to the development and evolution of the Backbone.

7. The western Pacific sampling strategy and implementation

Billy Kessler introduced this item ([see presentation](#)). He provided an overview of the analysis undertaken for the 1st Report and of the logic behind the actions discussed in Chapter 7 of the Report (Figure 7.2.2). The complementarity of different contributions (e.g., altimetry, TMA and Argo) was an important feature. The reconfigured TMA would be both more capable and more relevant to the issues of today.

There are several options for meeting the requirements for western Pacific Backbone of TPOS; floats and TMA were the focus of most of the discussion but it was recognized that satellites, GO-SHIP, SOOP, drifters etc. all play important roles.

The Workshop agreed that the different activities supporting implementation should be drawn together as a single pilot/demonstration project (WP Backbone Implementation Pilot Project). The project would be part of the TPOS 2020-led Transition and Implementation effort. It would:

- Have a 3-4 year time-line, now-2020;
- Be open to all who wish to contribute to the development of the WP Backbone;
- Focus on TMA and Argo (and equivalents);
- Include new technology: encourage testing and evaluation; and
- Undertake to document and communicate lessons learned for the benefit of other TPOS regions

An outline of the TPOS western Pacific Tropical Moored Buoy Array was discussed (contact Weidong Yu for details):

- Follows recommendations/actions of the 1st Report Chapter 7;
- Includes SOA “big cross” extensions and the JAMSTEC super site at 13N, 137E;
- Notes the opportunity to develop BGC contributions; and
- Identifies potential contributions to this plan from SOA, JAMSTEC, NOAA, and others.

The Workshop also produced an outline of a possible 2xArgo approach (which will need to be coordinated through the Argo SC):

- Floats should have short surface times (minimise meridional dispersion);
- There is a case for dedicated deployment along equator;
- Tentative indications for around 75% of the required floats, over the 2018-2020 period;
- The WP TPOS effort may include floats capable of directed rapid shallow cycling in cyclogenesis regions (the Argo implications will need to be considered); and
- It should include a BGC-Argo component.

Both plans will be discussed further at TPOS 2020 SC-4.

8. Technical issues around the TMA

This discussion was abbreviated in view of the lack of technical expertise available to the workshop. SC-4 provides an opportunity to discuss some of these technical issues. The workshop noted the following:

- The need to elaborate on the required flux variable observations (c.f. Section 7.4.4 of the first report), and technical specifications generally;
- Consider possible BGC extensions, particularly pCO₂;
- The need for further refinement of the likely TMA sites;
- The need to integrate underway measurements into plan;
- Need to develop TMA standards (TMA equivalent of Argo core); and
- Need to agree data management protocols and standards.

Additional Backbone follow-up

SC-4 provides a further opportunity to refine the western Pacific backbone implementation design. We will seek additional SOA/JAMSTEC advice on NW Pacific extensions and SC advice on southern sampling/extensions.

The SC should consider tapering 2xArgo over 10-20N.

The Workshop agreed that a ½ day workshop at the next SC could be used for making progress. The Workshop chairs will develop an agenda.

9. LLWBC strategic implementation plan (WP TT Co-Chairs)

The Workshop noted the significant past, present, and planned activities relevant to the LLWBC and concluded TPOS 2020 should progress toward the implementation of a Pilot Project.

Initial planning phase: Review and assessment of status (stocktake):

- Establish context within TPOS (why monitoring the LLWBC is important and relevant);
- Assess literature/knowledge as whole using a diversity of expertise, including experts not directly involved with current work;
- Refine what are the EOVs for the LLWBC and the requirements on those EOVs;
- Use existing LLWBC observations to assess gaps in the system;
- Bring in modelling, ENSO, ... expertise to assess potential for an integrated whole-of-LLWBC approach; and
- Use independent review to assure credibility.

The outcome could be in the form of a white paper and/or an initial LLWBC strategic implementation plan. Ideally this should be moved forward over the coming 6 months so that it can influence future budgets. This activity has been targeted as part of the SPICE LLWBC community and is also the focus of two sessions at Ocean Sciences 2018 meeting.

This would be used as a basis for a “call” for contributions to this plan.

10. Next steps

Neville Smith provided a [summary of the key conclusions](#) from the workshop (generally covered in the report above).

11. Close

The meeting closed at noon 6 September.

12. Participants

- ✚ Weidong Yu, FangLi Qiao, Yafeng Yang, Laoyu Li, Weiming Wang, Xinqiang Xu (FIO/NMEFC, SOA)
- ✚ Dake Chen, Jianping Xu, Zenghong Liu (SIO, SOA)
- ✚ Billy Kessler (NOAA)
- ✚ Neville Smith, Pete Strutton (Australia)
- ✚ Ken Ando, Akira Nagano, Masaki Katsumata, Sayaka Yasunaka (JAMSTEC)
- ✚ Janet Sprintall (Scripps)
- ✚ Andrea McCurdy, Guang Yang (TPOS 2020 DPO)
- ✚ Fan Wang, Dongliang Yuan, Hui Zhou, Xia Zhao, Shijian HU (IOCAS)
- ✚ Xiaopei Lin (OUC)
- ✚ Ju Chen (SCSIO, CAS)
- ✚ Hongzhou Xu (Institute of Deep-sea Science and Engineering, CAS)
- ✚ Licheng Feng (NMEFC, SOA)
- ✚ Xiujun Sun, Min JIANG, Yi Shao, Bin WANG (National Ocean Technology Center, SOA)
- ✚ Shouhua Liu (National Marine Data and Information Service, SOA)
- ✚ Jose Santos, Jing Li, Lei Han (CLIVAR)

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13. Agenda

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4. Current activities in the western Pacific
5. Potential additions to the TPOS 2020 Backbone
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 - The Low Latitude Western (Pacific) Boundary Current (LLWBC) Pilot
 - New technology options
7. The western Pacific sampling strategy and implementation
8. Technical issues around the TMA sites
9. LLWBC strategic implementation plan
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11. Close