9th Session of the JCOMM Observations Coordination Group

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Report Title: Data Buoy Cooperation Panel report to OCG-9

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1. SUMMARY

This document summarizes the status of the work of the Data Buoy Cooperation Panel (DBCP) and issues/actions to be noted by OCG. The DBCP oversees a number of distinct networks:

- global drifter array
- coastal/national moored buoy networks
- tropical moored buoy array
- high latitude (Arctic/Antarctic) buoy networks
- tsunami buoy network
- (third party) fixed platforms.

The network status (for March 2018) is shown in Figure 1. At that time there were 1,435 drifting buoys, 385 moored buoys and 95 fixed platforms reporting data to the GTS. The drifting buoys comprise: the global drifter array, Arctic/Antarctic drifters and ice buoys, and the moored buoys include: national/coastal moored buoy networks, the tropical moored buoy array and the tsunami buoy network. There will be 17 buoys deployed in the Eurasian Arctic for the winter special observing period of the Year of Polar Prediction (YOPP) in 2018. Since June 2016 Key Performance Indicators (KPIs) for these networks have been reported monthly by JCOMMOPS.

More detailed information on the DBCP and the status of the networks under its remit is given in Annex A.

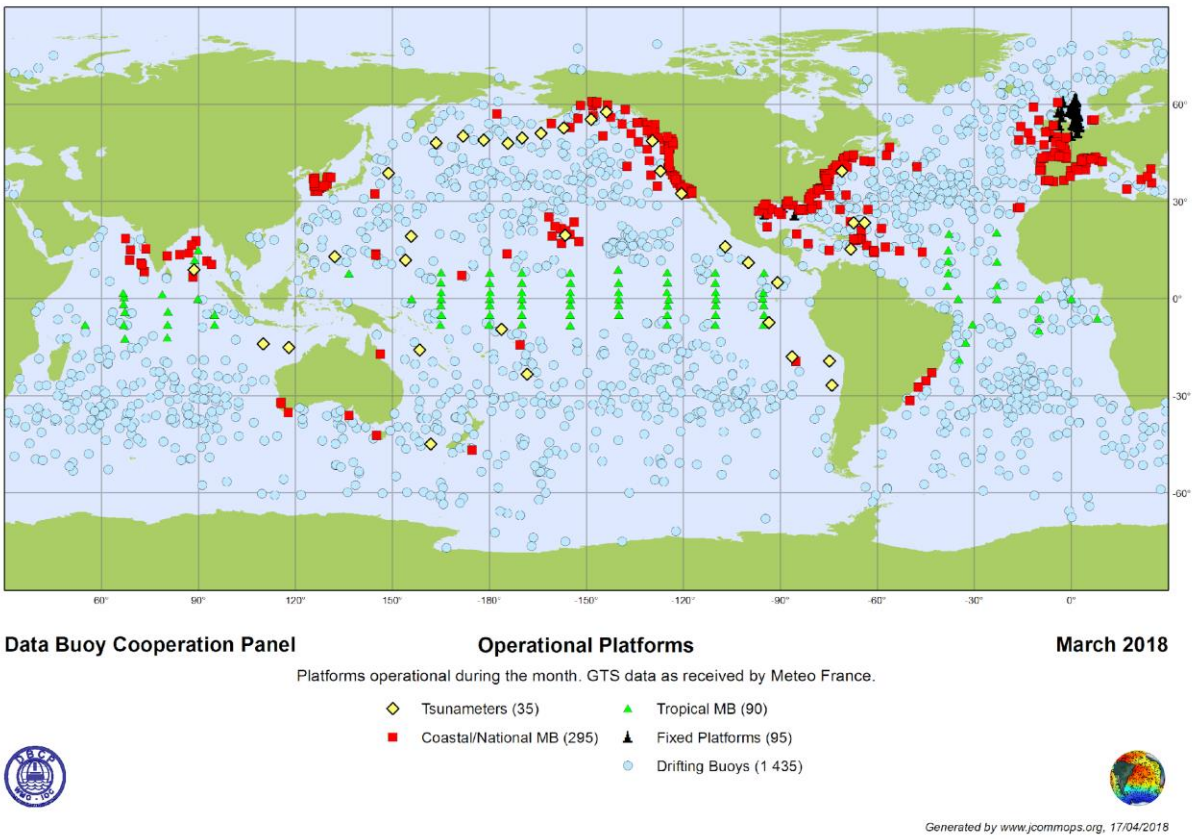

Figure 1 - Status of the DBCP networks from JCOMMOPS.

2. REPORT CONTENT

2.1 Networks status and KPIs (for March 2018)

Implementation KPIs for the various DBCP networks are given in Table 1.

Network	Implementation target	KPI	Trend since June 2016
Global drifter array	85% open-ocean coverage with 5º × 5º spacing (excluding death zones between 60 ºS and 60 ºN)	84%	—
Coastal/national moored buoys	300 operating	308*	—
Tropical moored buoy array	119 operating	90	▼
Tsunami buoy array	64 operating	34	▼
Arctic buoys	200 operating north of 60N	67*	▼
Antarctic buoys	180 operating south of 50S	73*	▼

* average values over previous 12 months (Apr 17 to Mar 18) given as the number operating shows significant seasonal variability

Table 1 – Implementation status for the various DBCP data buoy networks (March 2018)

Appendix A shows the trends in the implementation KPIs for the period from June 2016 for which they have been monitored by JCOMMOPS. It can be seen that the global drifter array and moored buoys are relatively stable, whereas the other the networks have declined slightly, but with the caveat that the trend period is less than two years.

2.2 Data management

Data management status for the various DBCP networks are given in Table 2.

Network	Data management targets		
	Real-time data availability (< 1 h)	Metadata availability	Quality/accessibility of archived data
Global drifter array	83%	●	●
Coastal/national moored buoys	●	36%	●
Tropical moored buoy array	77%	100%	●
88%Tsunami buoy array	**N/A**		
Arctic buoys	89%		
Antarctic buoys	87%		
Fixed platforms	●	●	●

symbol ● given where assessment is subjective

Table 2 – Data management status (where known) for the various DBCP data buoy networks (March 2018)

Real-time data on GTS. Over 80% of the global drifter array are now transmitting hourly data to GTS with <1h reception globally. Although all drifting buoy data are now issued to GTS in BUFR (TM 3-15-009) format there remains a need to progress the transition to BUFR (TM 3-15-008) for moored buoy data. As of July 2017 only 34% of moored buoy data were being issued to GTS using the correct template (TM 3-15-008), this had not increased over the previous year and a target of reaching 75% was set by DBCP-34 for October 2018. WMO will write to all Permanent Representatives identifying the issue with BUFR transition for moored buoys, and requesting the relevant organizations to make it a priority. A new BUFR sequence to report the first-five spectral directional wave parameters has been submitted to the WMO IPET-CM for approval for validation, which would be expected to be completed ahead of DBCP-34, ready for acceptance for operational use. The BUFR template TM 3-08-017 for fixed platforms has been validated but is not yet being used operationally.

Archived data/GDACs. At JCOMM-5, MEDS (Canada) was approved as a GDAC (Global Data Assembly Centres) for drifting buoy data, with the expectation that Coriolis (France) would also be approved as a GDAC during the inter-sessional period. For drifting buoys managed by MEDS, a new website layout is available with links to the Coriolis data selection tool (for drifter data back to 2002). Coriolis have developed a netCDF format for the drifter data that could be used for the archived data. However, it is recognized that the public (web) interface to the data could be improved as there are multiple on-line data sets serving different purposes. NOAA/AOML is working with the Observing System Monitoring Center to develop and improve data serving of both GTS and delayed-mode drifter data from 1979, which will be archived at NOAA/NCEI.

There remains a need to identify a candidate GDAC for moored buoy data, as presently many of the historical datasets are only available through the operating organizations. However the US NDBC are presently considering the requirements in hosting a GDAC. For wave data CDIP (the US Coastal Data Information Program) has the technical capability, but resources would need to be provided.

Metadata. Work is ongoing with JCOMMOPS to harmonize the available drifter metadata, which have been collected by David Meldrum under an ESA-funded contract, into a single complete global drifter metadata database, to be maintained by JCOMMOPS. Some moored buoy metadata have been submitted to JCOMMOPS, but have still to be integrated into the JCOMMOPS metadata database with development of appropriate tools for users to upload, view and download. This should include historical metadata from earlier or ceased moored buoy deployments as well as for presently operating systems.

Third-party fixed platform data. At present, data from around 100 offshore oil and gas platforms in the North Sea are being exchanged on the GTS (albeit in legacy code form). There are also a significant number of oil and gas platforms in the Gulf of Mexico for which NOAA has an agreement with the oil industry to make these data available, but very few are presently visible to JCOMMOPS although more are reporting on NDBC web-site. This is being followed up.

2.3 Technology/capability development

The annual DBCP Technical and Scientific Workshop, held in conjunction with the main DBCP meetings provides an opportunity for the buoy community to share information on recent developments and is an important part of the annual DBCP sessions. At DBCP-33 it was considered that reducing this from a full day to half a day reduced the value of the workshop, however with the meeting duration being reduced to four days it will not be possible to revert to a full day. DBCP needs to have a focus on both the development and performance of sensors, as well as on platforms. Some of the specific initiatives being investigated under DBCP are noted below.

High Resolution drifter SST. Satellite estimations of sea surface temperature depend critically on validation from in situ measurements. To date the dataset of choice has been the global fleet of drifting buoys, despite the fact that drifters were never intended to generate data of the quality required for satellite validation in terms of resolution, accuracy and traceability. To help address this incongruity, ESA has commissioned a study of the traceability of drifter SST to SI standards, for both the historical and current datasets. A major objective of the study will be to debate and agree a community-wide protocol for the measurement and traceability of drifter SST (and this may become an issue with other measured variables). A follow-up initiative by EUMETSAT will fund the deployment of 100 high specification drifters in support of Sentinel-3 satellite cal/val. With this new impetus, the DBCP Pilot Project on drifter High Resolution Sea Surface Temperature (PP-HRSST) has been re-invigorated.

Wave measurements from drifters. Work is progressing on wave measurements from drogue-less drifting buoys at Scripps Institution of Oceanography. Wave drifters could provide a major improvement in our capability to deliver global observations of waves, as existing measurements are primarily from moored buoys and waveriders mainly deployed along coastlines. Global wave observations from drifters would be particularly valuable for calibration/validation of satellite derived wave measurements and it is anticipated that space

agency funding for the evaluation of drifter wave measurements will be forthcoming in the near future. At the time of writing 46 wave drifters have been deployed with promising early results. Nine are presently operating and another 25 are staged for upcoming deployments.

Wave measurements from moored buoys. With the emergence of new low cost motion sensors some operators are sacrificing wave quality by deploying modified or new wave measurement technologies with limited or no testing and evaluation. It is important to ensure that wave data of appropriate quality are measured for the benefit of a wide range of users, and not to sacrifice quality for quantity.

Unmanned Surface Vehicles (USV). A number of moored buoy operators are looking at the potential of USV for collection of metocean data as these could be used to provide cover during periods when moored buoys are out of service, or possibly even an alternative to operating moored buoys. There is an increasing number of USV that are commercially available including: Liquid Robotics Waveglider, MOST AutoNaut, ASV C-Enduro, Sailbuoy and Saildrone. However, despite the high profile of autonomous vehicles and the claims of manufacturers, at this time it is considered that the reliability of measurements from USV for sustained observations has yet to be fully demonstrated. Operational requirements demand reliable measurements from long term (six months or more) deployments.

2.4 Opportunities for improved coordination

DBCP oversees a range of different networks, encompassing moored and drifting buoys and from high latitudes to the equator, that deliver data to a wide range of operational and scientific users. As such, DBCP enables improved coordination and cross-fertilization across these networks.

DBCP and SOT. The possibility of holding joint (or parallel overlapping) DBCP and SOT meetings has been raised a number of times and was discussed at DBCP-33. At present DBCP meets annually in the autumn while SOT meets biennially in the spring. Annual meetings give the Panel the ability to deliver on agreed actions on a timely basis, which would be adversely impacted by moving to a biennial schedule. To a large extent, the buoy and ship communities involve different people, and a concern raised by the Panel was that some countries would not send both participants to joint/parallel DBCP and SOT sessions. From the Secretariat perspective, there are benefits and challenges in the proposal for joint meetings that need to be evaluated carefully, as it would be very challenging to manage a larger, more complex event of back to back meetings. DBCP-33 agreed it was important to examine the DBCP and SOT core functionalities and overlaps (if any), where a decision can only be made after careful considerations of all issues and factors. There is an action from DBCP-33 to develop a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis on a joint meeting between DBCP and SOT for presentation to the SOT 2019 meeting. 2020 is the earliest that a joint meeting could take place.

Capacity development. The DBCP strongly supports capacity development efforts, and in the last year has arranged the Fifth North Pacific Ocean and Marginal Seas (NPOMS-5) workshop on Applications of Ocean Observations for Improving Society's Understanding and Forecasting of Typhoons held in Tianjin, China from 4-7 July, 2017. The DBCP is organizing and sponsoring the Third Pacific Islands Training Workshop on Ocean Observations and Data Applications (PI-3) and the Fifth JCOMM Regional Marine Instrument Workshop for Asia-Pacific Region

(RMIC/AP-5), Hai Kou of Hai Nan Province (Island), China, 9-12 July 2018, at the kind invitation of NCOSM of SOA. With Dr. Sidney Thurston stepping down as Chair of the DBCP Task Team on Capacity Building (TT-CB) after ten years of service, a new Chair is being sought. It is recognised in future that the TT-CB should coordinate and report on DBCP TT-CB activities via the two new JCOMM-CD coordinators.

Logistics and resource issues. As noted last year, the lack of a dedicated Data Buoy TC adversely impacted DBCP activities, however with the recruitment of a new TC in November 2017, much better progress on various DBCP coordination activities and meeting actions is now being made. Members of the DBCP have provided financial contributions for the DBCP Technical Coordinator and JCOMMOPS infrastructures. However, as new programmes are supported by JCOMMOPS then those programmes must contribute financially if their expectations are to be met. National budgets are at best fixed and many are reducing, so meeting increased costs (e.g. due to inflation) is a major challenge. It is recognized that support from JCOMMOPS is vital to the Panel achieving its mission and for meeting users' needs and DBCP welcomes the JCOMMOPS Review that should consider many of these issues.

2.5 Buoy vandalism

For the tropical moored buoy and tsunami buoy systems, and many national networks (especially in Asia), vandalism of buoys remains a significant problem involving significant costs to the operating countries, despite best efforts to educate and inform the local communities. The DBCP Task Team on Buoy Vandalism has prepared an education and outreach strategy for reducing data buoy vandalism (document DBCP-TD-58), which was submitted to WMO EC-69 in May 2017 and to JCOMM-V in October 2017 where the strategy was endorsed and it was recommended that WMO EC and IOC Assembly adopt the strategy.

3. DECISIONS/ACTIONS/RECOMMENDATIONS

Specific actions and recommendations on the DBCP work plan are agreed by the Panel at its annual meetings. However, the DBCP pre-dates JCOMM, OCG, OOPC and many other bodies so perhaps needs to take a fresh look at how it engages with these groups. A SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis has been carried out and will be reviewed at DBCP-34 in October 2018. This, together with the various Community White Papers for OceanObs19 being authored, or contributed to, by DBCP members will provide the baseline material for refreshing the DBCP Implementation Strategy in 2019.

The main points for OCG to note are:

- the apparent slight decline in implementation of the various DBCP networks which, if real, should be more obvious in a year's time;
- the encouraging progress being made in developing wave measurements from undrogued drifters;
- to recognise the work being carried out in collaboration with the space community on improving the quality of drifter SST data;
- only a few of the fixed oil and gas platforms are visible to JCOMMOPS although more of the platforms are actively reporting and visible at NDBC, this is being investigated;
- that KPIs for DBCP data management activities need to be developed;

- the establishment of MEDS, Canada, as a drifter GDAC (to be followed by Coriolis, France);
- the need for GDAC(s) for moored buoy and buoy wave data; noting that the US NDBC are presently considering the requirements for the former;
- the ESA funded work on the traceability of drifter SST measurements;
- the work to integrate the ESA funded drifter HRSST global drifter metadata database into the JCOMMOPS database;
- action to develop a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis on a joint meeting between DBCP and SOT for presentation to the SOT 2019 meeting (2020 is the earliest that a joint meeting could take place).

Annex A

Overview

The Data Buoy Cooperation Panel (DBCP) is an official joint body of the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC). It consists of the data buoy component of the Joint WMO-IOC technical Commission for Oceanography and Marine Meteorology (JCOMM) and the Global Ocean Observing System (GOOS). The primary objective of the DBCP is to maintain and coordinate all components of the network of over 1,250 drifting buoys measuring SST and surface currents (with around 53% also reporting surface air pressure) and around 300 moored buoys, which provide a wider range of measurements such as waves, air temperature and wind speed and direction. The DBCP also explores and evaluates new technologies and encourages the implementation of those that can improve buoy capability and operations. Note that OceanSITES is now considered as a JCOMM Observations Programme Area network in its own right and is no longer an action group under DBCP.

Global Drifter Array

The global drifter array aims to maintain a global 5 x 5 degree array of satellite-tracked surface drifting buoys to meet the need for an accurate and globally dense set of in-situ observations of mixed layer currents, sea surface temperature and atmospheric pressure, and to deliver these data to operational (via the WMO Global Telecommunication System) and research users. A small number of drifters also measure winds and salinity.

Traditionally the target number of operating drifters has been 1,250, which has been exceeded in recent years, Figure A1 (left). A more meaningful statistic is the coverage of the array and the primary target for the array is now 85% coverage of 5° x 5° boxes (excluding marginal seas, latitudes >60° N/S and any box with a death rate >20% in 30 days, but including the near equatorial band 5° S – 5° N). Over the period the coverage has declined slowly and is presently around 83%, as shown in Figure A1 (right) which also shows that the % of drifters reporting air pressure has also declined. The long-term aim is for all drifters to carry pressure sensors, as this is a critical measurement for assimilation into Numerical Weather Prediction models and also called for under the GCOS Implementation Plan (Actions A7 and O47).

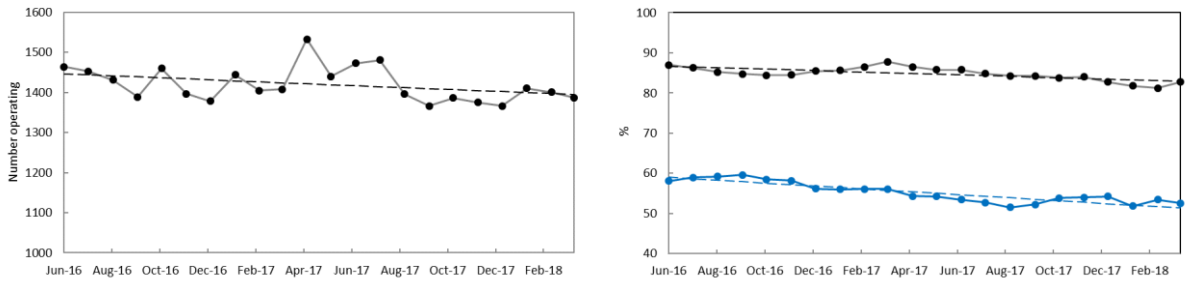

Figure A1 – (left) number of operating drifting buoys and (right) % coverage (●) and % of operating drifters delivering air pressure data (●). The trends are shown as dashed lines. Statistics from JCOMMOPS.

At present drifter SST falls short of the requirements of the satellite community in terms of accuracy, resolution, geo-location and the availability of metadata and this is being addressed in

collaboration with the Group for High Resolution SST (GHRSST) where the DBCP Pilot Project on drifter High Resolution Sea Surface Temperature (PP-HRSST) has been re-invigorated.

In March 2017 around 51% of drifters used Iridium for telecommunications, this has increased to 75% as all drifters being manufactured for the US Global Drifter Program, which presently contributes over 60% of the global drifter array, are now Iridium. This is associated with an increase in timelines of the real-time data on the WMO GTS with over 80% of drifter observations now available within 1 hour (compared to 60% in summer 2016).

As can be seen from Figure 1, there are a number of drifting buoys operating at high latitudes, with 71 in the Arctic (north of 60 ºN) and 91 (south of 50 ºS) in the Antarctic, as shown in Figure A2 (left). The numbers operating show an annual variation (deployments in the summer, failures in winter) with a suggestion of decline over the period since June 2016. Typically, around 70-80% of these are reporting air pressure.

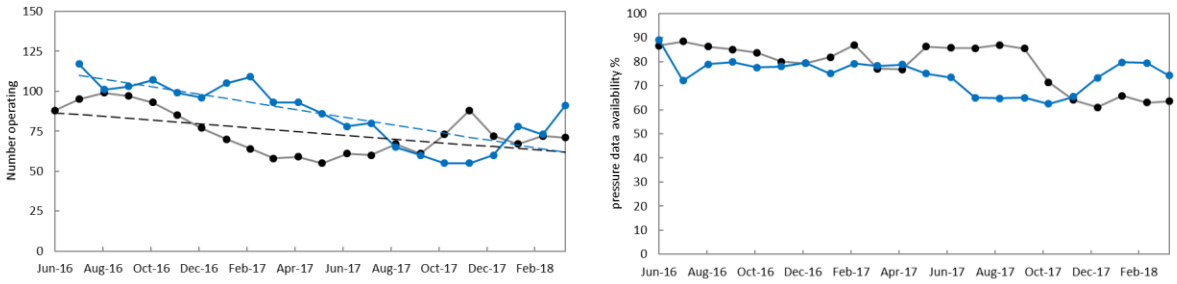

Figure A2 – (left) number of operating buoys in the Arctic (●) and Antarctic (●) and trends shown as dashed lines, (right) % of Arctic and Antarctic buoys reporting air pressure (target 80%). The. KPI statistics from JCOMMOPS.

Moored buoy arrays

At present there are around 300 moored buoys being operated by 14 countries under the various national/coastal networks, with a clear seasonal effect since most systems are operated in the northern hemisphere with buoys often being serviced/replaced in the summer months. These have a wide range in capability including atmospheric (surface meteorological), oceanographic (sub-surface) and wave measurements, with 67%, 46% and 88% data availability to GTS respectively in March 2018, as shown in Figure A3 (right).

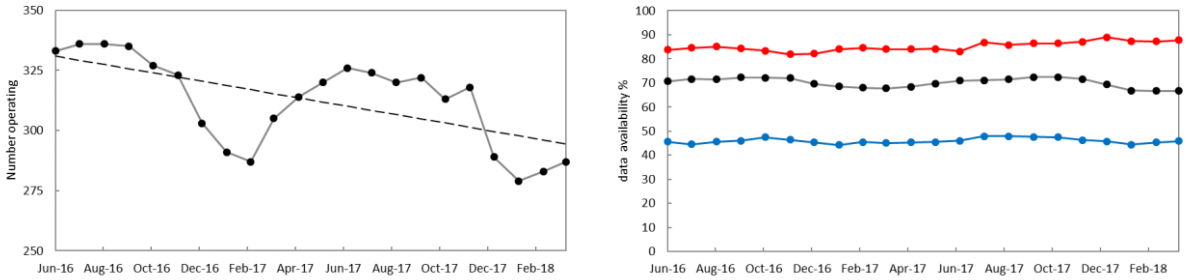

Figure A3 – (left) number of operating national/coastal moored buoys and trend, (right) % returning atmospheric (●), oceanographic (●) and wave (●) data. KPI statistics from JCOMMOPS.

The tropical moored buoy array has the following components: the Tropical Atmosphere Ocean / Triangle Trans-Ocean Buoy Network (TAO/TRITON) in the Pacific, the Prediction and

Research Moored Array in the Tropical Atlantic (PIRATA) and the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) in the Indian Ocean; with an array design of 132 moorings, focusing on atmospheric and oceanographic (upper 500 m) measurements. Figure A4 shows at present there are 91 tropical buoys reporting data (against a target of 119, 75% of the array design), where there has been an increase since summer 2017 reversing the decline seen before that. (Note that the array design of 132 moorings is expected to change in future as a result of the TPOS2020 (Tropical Pacific Observing System) project and the proposed revised RAMA (Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction) array design referred to as RAMA02.

At present there are 34 tsunami buoys operating against a target of 64 (i.e. 53%), with a gradual decline since August 2016. The DBCP tsunameter instrument standard is approved by the Tsunami Early Warning System (TEWS) and IOC. DBCP has arranged to have the tsunami buoy data sets from most of the operating countries available via the NDBC web-site.

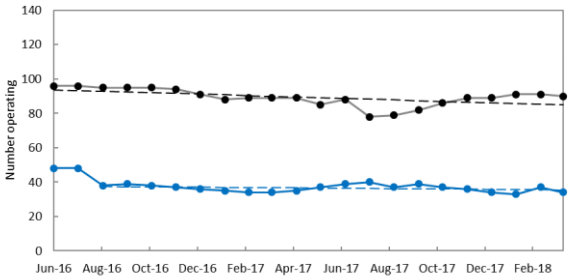

Figure A4 – (left) number of operating tropical moored buoys (●) and tsunami buoys (●). KPI statistics from JCOMMOPS.

For the tropical moored buoy and tsunami buoy systems, and many national networks (especially in Asia) vandalism of buoys remains a significant problem despite best efforts to educate and inform the local communities. The DBCP Task Team on Buoy Vandalism have prepared an education and outreach strategy for reducing data buoy vandalism. Both IOC and WMO adopted resolutions on data buoy vandalism in June 2016 and at JCOMM-5 in October 2017. DBCP and partners will need to work together in order to translate the strategy into actions.