DATA BUOY COOPERATION PANEL

Thirty-Ninth Session

24 – 27 October 2023

Denpasar, Bali, Indonesia

(Hybrid Meeting)

Meeting Report No. 70

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WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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Table of Content

Executive Summary

The Thirty-ninth Session of the Data Buoy Cooperation Panel (DBCP 39) was kindly hosted by the Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia (BMKG) at the Marriott hotel, Denpasar, Bali, Indonesia, as a hybrid event from 23 – 27 October 2023. Over two hundred participants from 57 countries representing buoy operators, network managers, researchers, buoy manufacturers, telecommunication providers, and others involved in data buoy activities participated in the meeting.

This year's meeting continued the enhanced focus on the following:

- Improve buoy metadata quality, and availability to satisfy user requirements
- Stronger engagement with the DBCP user community
- Science and Technology workshop – ocean data for research and user impact
- Environmental Stewardship
- Increase the value and impact of buoy observations

Prof. Dwikorita Karnawati, the head of the BMKG; Dr. Joanna Post, Director of the Global Ocean Observing System (GOOS) office of the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO); Ms. Champika Gallage, Scientific Officer on Ocean Observations representing the World Meteorological Organization (WMO), and the Chair of the DBCP, Dr. Nelly Florida Riama from BMKG provided welcome remarks. During the welcome remarks, the speakers highlighted how to empower developing countries, the priorities of WMO, IOC, and the United Nations Decade of Ocean Science for sustainable development (UN Decade) activities, and how DBCP contributes to those priorities. Further, the speakers emphasized the importance of accurate early warnings and how DBCP contributes to that. They also highlighted how WMO and IOC collaborate between priority activities such as the WMO Rolling Review of Requirement (RRR) and the co-design project under the UN Decade to deliver for the common good.

The Science and Technology (S&T) workshop focused on the "Impact of Observations and Applied Data Usage for Coastal and Marine Communities." Eighteen abstracts were received, and fifteen were accepted for presentation at the session. Annex 2 provides a compiled list of the abstracts.

Twenty-five national reports were submitted to this session, where fifteen countries presented their reports. Those fifteen countries were Australia, Benin, Brazil, Canada, China, France, Germany, Hong Kong of China, India, Indonesia, Morocco, Peru, Portugal, the United Kingdom, and the United States of America. Additionally, the following countries also completed their national reports: Argentina, Colombia, Ecuador, Japan, Netherlands, New Zealand, Russian Federation, South Africa, Spain, and Tanzania. The National reports identified current and planned networks as well as gaps and opportunities. From the national reports, it was apparent that there are gaps in the number of platforms operating at the national level and relevant information available in the OceanOPS database. Platform operators are requested to work with OceanOPS to fill the metadata information gap and get assistance in sharing their data on the Global Telecommunication System (GTS/WMO Information System 2.0 (WIS2.0)) wherever possible. The Panel discussed the importance of metadata submission and the role OceanOPS plays in providing the metadata to the WMO Observing Systems Capability Analysis and Review tool (OSCAR). The Panel had concerns about the mismatch of OSCAR metadata requirements and what OceanOPS provides to OSCAR. Thus, the Panel would like to clarify what the OceanOPS

metadata is intended for and whether the metadata provided by OceanOPS to the OSCAR system satisfies the WMO GTS data user requirements.

Three invited speeches were delivered on the *socio-economic value of ocean observations* by Dr. Anastasia Rita Tisiana, the head of the Center for Marine and Fisheries of the Socio-Economy Ministry of Marine and Fisheries, Indonesia, *DBCP contribution to strengthening the WMO observations* by Ms. Estelle Gruter, the chair of the Standing Committee on Earth Observing Systems and Monitoring Networks (SC-ON), and *the impact of drifter buoy data for the quality of satellite sea surface temperature (SST)* by Dr. Gary Coriett from the European National Meteorological Services (EUMETNET) who is the chair of the Task Team on Global High-Resolution Sea Surface Temperature (GHRSST). Dr. Tisiana urged interdisciplinary collaboration to develop resilient strategies for both ecosystems and human communities, emphasizing the importance of socio-economic perspectives in shaping policy options. Ms. Gruter emphasized that Sea Level Pressure (SLP) observations are among the most impactful for National Weather Prediction (NWP) and requested buoy operators to equip all drifters with SLP observations. Dr. Coriett emphasized the vital contribution of drifting buoy current capabilities that drive satellite SSTs. During panel discussions, it was noted that it is crucial to accurately and completely describe metadata for users, including for satellite validation. Collaboration across communities was also identified as a key by all three speakers.

The DBCP chair, Dr. Nelly Florida Riama , who is the first female elected chair of the DBCP, provided an overview of the evolution and achievements of the Data Buoy Cooperation Panel. She highlighted the importance of DBCP as part of the Observation Coordination Group (OCG) and its contribution to WMO's and IOC/GOOS's strategic objectives. She emphasized collaboration, information sharing, and community engagement to achieve DBCP's strategic goals outlined in the *DBCP 2020-2027 strategy [hyperlink to the file]*. The DBCP Technical Coordinator (TC), Dr. Long Jiang, reported on the status of DBCP networks and addressed challenges, such as metadata integration with OceanOPS, correct metadata representation of joint efforts on platform operations, specification sheets for tropical moored buoys and tsunami buoys, and dialogue with emerging GOOS networks.

Task Teams (TTs) reported on how the work of the TTs aligns with the DBCP Strategy, highlighted the work accomplished during the previous inter-sessional period, and the key focus areas for the next inter-sessional period. Metadata was the primary topic of the Task Team on Data Management (TT-DM), Task Team on Moored Buoys (TT-MB), and Task Team on Wave Measurements (TT-WM). All those TTs highlighted the challenges of submitting metadata to the satisfaction of data users. The Task Team on Environment Stewardship (TT-ES) and Task Team on Capacity-Building (TT-CB) made progress in their respective activities, broadened their contribution and engaged more stakeholders. The panel approved the Terms of Reference (ToR) of the Task Team on Data Value and Impact of Buoys (TT-VID) (Annex 4) and agreed to disband the Task Team on Data Buoy Best Practices Technology Development (TT-DBPD).

Action Group (AG) reports identified key areas of activities and challenges for the panel. Some of the key activities included planned E-SURFMAR moored buoy deployments in the Mediterranean region, a significant (12) number of tsunami buoy contributions from New Zealand, planned moored buoy sensor intercomparison, re-establishing RAMA moorings and data transmission. AG reports also identified challenges in populating the Eurasian Basin of the Arctic Ocean and the Antarctic region with observations.

Reports were provided by representatives from OCG, WMO, and IOC. Presentation from OCG explained the mechanisms to engage in OCG network activities and pathways to

become a OCG network. The IOC report highlighted the progress made to increase engagement with regional and national bodies. The WMO report highlighted flagship activities such as Rolling Review of Requirements (RRR), Global Basic Observing Network (GBON), Systematic Observations Financing Facility (SOFF), Early Warning for All (EW4All), Global Greenhouse Gas Watch (G3W), and how the DBCP community can contribute and take advantage of those.

The DBCP financial report demonstrated a healthy balance of funds but with a decreasing number of donors. The Secretariat cautioned the need for more contributions to continue the same level of service. The panel approved the spending plan for the next inter-sessional period. While thanking all DBCP members making continuous contributions to the DBCP Trust Fund (TF) over the years, other members are requested to contribute. Dr. Riama announced that BMKG is working on contributing to the DBCP TF.

The Panel elected two new executive members for the two vacant positions: Dr. Andri Ramdhani on operational excellence and Dr. Pattabhi Rama Rao on international cooperation. This completed the Executive Board membership with eight members.

The next DBCP session in 2024 marks the 40th anniversary of DBCP. To commemorate this event, the panel agreed to launch a few special events and collected ideas from the participants. The panel agreed to form a committee to organize the 40th-anniversary activities. Mr. Pattabhi Rama Rao from the Indian National Centre for Ocean Information Services (INCOIS) expressed their interest in hosting the next DBCP-40 meeting in Hyderabad towards the end of 2024 (mid-October to mid-November). The DBCP chair and the Secretariat thanked everyone for contributing to a very successful DBCP session, and the meeting convened at 15:00 on Friday, 27 October 2023.

GENERAL SUMMARY OF THE WORK OF THE DBCP-37 SESSION

1. Opening and Welcome to the DBCP-39 Session

Dr. Joanna Post, the director of the Global Ocean Observing System (GOOS), addressed the Panel on behalf of IOC/UNESCO. She highlighted the four decades of history of the Data Buoy Cooperation Panel (DBCP) and emphasized the importance of the work of DBCP in delivering essential information for climate, weather, ocean conditions, and ocean health, which are also the impact areas for GOOS. Dr. Nelly Florida Riama, the Chair of the DBCP, provided the opening remarks and reminded that DBCP is a community of collaboration where all members come together to exchange knowledge, experiences, and aspirations in promoting the use of data buoys as well as collecting and sharing oceanographic and meteorological data. She further mentioned that all DBCP members share the same ownership and have a collective responsibility of understanding and delivering towards the vision of DBCP, which is to deliver actionable and timely data needed for researchers, policymakers, and citizens worldwide to address environmental challenges, make an informed decision and safeguard the world's oceans and water bodies. Ms. Champika Gallage, on behalf of the WMO Secretariat, mentioned the long-term vision of WMO and how the work of DBCP aligns with the overarching goals of the next financial period of 2024-2027 and delivering for the high-level new initiatives of WMO.

Professor Dwikorita Karnawati, the Permanent Representative of Indonesia with WMO and the Head of the Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia (BMKG) provided opening remarks focusing on how to empower developing countries in implementing more ocean observations. She underscored the impact of climate change on Indonesia's weather, highlighting land-see interaction and the Indian Ocean Dipole as crucial factors. The geographical positioning of Indonesia between the Indian and Pacific Oceans complicates climate conditions, leading to challenges like a severe drought driven by El Niño. Prof. Karnawati stressed the critical importance of accurate early warnings, which heavily rely on ocean observation data. She expressed Indonesia's commitment to collaborative marine weather prediction despite disruptions from the COVID-19 pandemic. Global cooperation was emphasized, and gratitude was expressed to the DBCP for its contributions to oceanography and climate science. Open data was hailed for disaster preparedness and climate justice, providing early information to mitigate impacts on developing countries. She opened the event with a call to appreciate the island's beauty, encouraging a break to enjoy the ocean and coastal areas.

2. Adoption of the agenda and working arrangements

Participants approved the agenda for the 39th session of the DBCP, acknowledging that there will be minor adjustments to accommodate remote presenters' time zone challenges. The panel-approved timetable is provided in Annex 1. While providing working arrangements, Ms. Gallage mentioned the two vacant executive board positions on international cooperation and operational excellence. Participants were requested to prepare to propose members for those on the last day of the meeting. Ms. Anni Arumsari Fitriany from BMKG provided working arrangements for the meeting and local information.

3. Scientific and Technology workshop

Ms. Rita Esteves and Dr. Marc Lucas chaired the Science and Technology (S&T) workshop under the theme of "Impact of Observations, Applied Data Usage for Coastal and Marine Communities." Eighteen abstracts were received, and 15 of them were accepted to present at the session. Annex 2 provides the compilation of abstracts of the S&T workshop. The majority of presentations were pre-recorded to avoid any technical issues while presenting

remotely. The abstracts were categorized into community, science, technology, and local activities.

Several presentations highlighted the importance of data sharing, standardized access to the data (GTS, climate data repositories), and the need for more data.

Drifters' wave measurements provide promising results to cover the wave observation gaps in the global ocean, and the speaker highly appreciated this new technology, which can fill global wave observation gaps. East and West Africa, the Southern Ocean, and the Pacific Islands are identified as wave data-sparse areas. The speaker highly recommended deploying drifter platforms with wave measurements, which will also have the potential to derive winds with a few assumptions.

A presentation on Automatic Identification System (AIS) highlighted how AIS can be used to protect the integrity of the buoy system against accidents or incidents through communication in data buoys for vessel proximity monitoring. This technique of communicating vessel proximity can be used to prevent buoy vandalism. The speaker introduced a new "CHIP" application (Cheap Proximity Report Alert and Surveillance) that utilizes AIS to monitor vessels around a buoy and report only those posing a real risk. The system provides continuous monitoring and remote information, aiding incident response and establishing responsibility. This commercially available product with the power consumption of 12.5W uses a typical satellite as the communication channel, but other options like radio or mobile phones can be considered.

Action 3/1: *Requested to have wave measurements from the tropical moored array.TT-WM and TT-MB are requested to look into this and report back to the DBCP (TT-MB and TT-WM; DBCP-40)*

Action 3/2*: India offered to explore the possibility of assisting in getting the data from the coastal wave rider buoy in the Seychelles, which is not currently made available in real-time. TC to assist with these efforts (NFP of India assisted by TC; DBCP-40)*

Action 3/3*: DBCP session presentations, including S&T workshop presentations, should be given in person or online, and pre-recorded presentations will be used only as backups. Suggested to include this information in S&T callout at DBCP-40 (DBCP-EXB; DBCP-40)*

4. National Reports

Mr Samuel Radityo moderated the National Reports session. 25 countries and territories submitted national reports and fifteen of them were presented at the session.

Mr. Joel Cabrie from the Bureau of Meteorology in Australia provided the Australian National Report, noting a current deployment of 17 drifting buoys, a decrease from previous years due to personnel changes. Six barometer-upgrade buoys and 20 SVP buoys were deployed. The bureau owns two wave buoys, one near Kangaroo Island and one off the west coast in Tasmania, and operates two IMOS-funded buoys in Darwin and Tasmania. Mr. Cabrie mentioned third-party wave data collaboration and plans for regular buoy deployments, emphasizing sustainability in procurement. The bureau also engages in educational activities, loaning modified SVP buoys for meteorological training. Challenges included personnel changes and delays in migrating to buffer for wave buoy operations, with a focus on improving forecast verification using national wave buoy data.

Benin's national report was presented by Mr. Zacharie Sohou. He mentioned the only moored buoy owned by Benin is funded through the UNDP and having difficulties to maintain the buoy due to valdalism by the fishermen. The buoy provides real-time data on various parameters, including temperature, wind speed, direction, and humidity. He mentioned that challenges include vandalism by fishermen and putting efforts to address these issues. The data collected is utilized by MS and PhD students, supporting research in hydrology and oceanography. The buoy system is crucial for forecasting models, including the ToMac model. Challenges include equipment maintenance, capacity development, and limited international collaboration due to communication issues. Mr. Sohou highlighted current and planned regional and international projects, such as with the University of Ghana, First Institute of Oceanography in Qingdao, China, and with France, Canary Islands, Morocco, Senegal, Brazil, Argentina, Colombia and Peru. He then suggested collaboration with DBCP for capacity building and enhanced communication.

Mr. Leonardo Rabetim de Oliveira presented Brazil's national report on buoy projects involving various institutions such as the Brazilian Navy, Ministry of Science and Technology, research institutes, and universities. The projects utilize four types of buoys, including BMO, Atlas, and Spotters. Currently, 90 buoys are transmitting data, accessible on the project's website. The program aims to support safe navigation, validate forecasting models, and contribute to oceanographic research. Technical developments include the creation of a national resource buoy (BMO VR) to reduce project costs. Challenges highlighted include vandalism and fishing nets affecting buoy operations. Despite difficulties, the program is expanding its activities, launching buoys in the Antarctic region and the northeast coast of Brazil. The presentation also mentioned the acquisition of a glider for monitoring oceanographic parameters and efforts to modernize by utilizing autonomous vehicles to reduce costs. Mr. Rabetim de Oliveiraexpressed gratitude for the attention concluding the presentation.

Mr. Alexander Zucconi, the Marine Network Manager at the Meteorological Service of Canada, provided an overview of Canada's buoy networks, comprising 43 buoys across the country, with 39 core buoys and four ocean protection plan (OPP) buoys. The core buoys report hourly, while OPP buoys report every 10 minutes, all data are available on the GTS and in buffer format. However, challenges include difficulties in obtaining ship time for maintenance, resulting in several buoys being down or at critical mooring points, especially in the Atlantic. The drifting buoy network focuses on the Arctic deployed 27 buoys measuring sea surface temperature (SST) and positional information via Iridium. Plans included integrating new Watchman 500 payloads and tri-axis G3 wave sensors and revising operational standards. Mr. Zucconi mentioned that challenges involve station access issues, reliance on military partners for drifting buoy deployments and exploring alternatives, such as partnerships with private companies for data acquisition from navigational buoys.

Ms. Xinyang Yue from China's National Marine Data and Information Service provided an overview of China's national buoy network which is managed by three agencies (NRC, SOA and CMA). They have deployed 60 moored buoys, 58 Argo floats, and two drifting buoys for research and operational forecasting. She said that technical developments include AI algorithms and edge computing for marine process identification, high-speed imaging systems on wave profilers, and collision avoidance systems. Quality control methods are being explored using AI and machine learning. She highlighted that China is planing to deploy 14 new moored buoys to contribute to the TAO array. Data distribution from these buoys to the GTS is not yet celar as the buoys are managed by the Natural Resources China and the data need to get to CMA for GTS distribution.

Mr. Christophe Guillerm from Meteo France presented the national report from France. He mentioned that MeteoFrance manages five moored buoys and deployed seven drifting buoys, including the new moored buoy "Ajaccio" near Corsica. Three new wave riders and meteorological sensors were deployed last year. Various laboratories, including CNRS (The French National Center for Scientific Research) and IRD, contribute to maintaining and deploying buoys, aiming to collect high-frequency observations continuously. He highlighted the collaboration with Germany, Portugal, the UK, Italy, the USA, Canada, the Netherlands, and others to deploy drifting buoys in the Atlantic and 18 buoys in the Indian Ocean. In response to the Corsica thunderstorm incident on 18 August 2022 (5 dead and 500 boaters rescued), MeteoFrance will deploy five more moored buoys in the region. Plans include deploying additional buoys in the Mediterranean.

Mr. Kai Herklotz presented the German national report. He mentioned that in Germany, two active institutes, including the Alfred Wegener Institute for Polar Research, operate buoys for polar research, utilizing snow buoys, ice buoys, drifters, and moored buoys in the Arctic and Antarctic regions. The Federal Maritime and Hydrographic Agency (BSH) manages the German Argo program deployed 59 Argo floats last year, totaling 227 operating floats. BSH also oversees a Marine Environmental Network, observing the North Sea and Baltic Sea. He further mentioned that there was no vandalism reported, and technical developments include the development of a monitoring buoy to replace outdated lightships measuring atmospheric and water profiles. Lidar buoys with sensors to monitor wave conditions were being developed. Additionally, a portal with automatic quality control has been established for public access to wave and water level data. He said that this initiative aligns with wind farm construction efforts in German waters.

Mr. C. K. Chow presented the Hong Kong-China report. He reported that the Hong Kong Observatory deployed five SVP buoys to monitor tropical cyclone activities in the South China Sea and Western North Pacific. Unfortunately, two buoys were damaged in September, impacting the operational count. The 2024 program plans to deploy three to five SVP buoys and a new type of drifting buoy with wind and wave sensors, as well as a solar panel for power supply. Technical developments include acquiring ocean buoys with upgrades, such as GPS, Iridium transceivers, and pressure sensors. Deployment areas cover regions south of Hong Kong, the western Pacific east of the Philippines, and areas east of Hong Kong. Real-time data, including pressure and temperature, is transmitted through Iridium satellites, contributing to tropical cyclone monitoring and forecasting capacity. Challenges include vandalism incidents and ongoing exploration of additional equipment for enhanced monitoring. Mr. Chow requested DBCP to explore new types of drifting buoys with wind and wave sensors and to explore new equipment for measuring ocean heat content with a view to deriving tropical cyclone heat potential.

Mr. Pattabhi Rama Rao from Indian National Institute for Ocean Information Services (INCOIS) presented the Indian national report. He mentioned that in India, the Ministry of Earth Sciences oversees the ocean observing network implemented by institutions like INCOIS, the National Institute of Ocean Technology (NIOT), and others. The network includes Argo floats, automatic weather stations, research vessels, tide gauges, gliders, and more. He further said that the country deploys drifters and wave rider buoys along its coasts, contributing to real-time data for operational oceanography, forecasting cyclones, and validating forecasts. India is also part of tsunami buoy networks, a Southern Ocean wave monitoring program, and recently introduced coastal buoys with biogeochemical parameters. Technical developments include indigenized drifters and sensor calibration facilities. Data management and dissemination are facilitated through the National Oceanographic Data Centre, with innovative applications like Digital Ocean and collaborative efforts like the Ocean Moored Buoy Network for Northern Indian Ocean (OMNI) data portal with the Pacific Marine and Environmental Lab (PMEL). India's ocean

observations support diverse services, including fishery advisories, algal bloom alerts, coral bleaching warnings, and more. The country actively contributes to global ocean science through publications and continuous efforts in monitoring and research. Vandalism remains a challenge, primarily in open ocean areas. Iridium satellite telemetry was implemented in Indian moored buoys, including tsunami buoys. Mr. Rama Rao mentioned that Iridium use in the Indian Exclusive Economic Zone (EEZ) is currently addressed, and the plan is to have Iridium telecommunication from the Indian EEZ.

Mr. Iyan Turyana presented the national report from Indonesia. He mentioned that BMKG has deployed fourty-one drifters, twenty-seven floats, and one wave spotter buoy. The opportunity for future deployments is promising in Indonesia. He said that Indonesia has several programs, including contributing to the Rama array with National Oceanic and Atmospheric Administration (NOAA) collaboration, the Indonesia Prima programme with NOAA collaboration, and the YMC program in partnership with Japan Agency for Marine-Earth Science and Technology (JAMSTEC). The tsunami program, initiated in 2006, faces challenges in achieving its goal of deploying twenty-three buoys due to vandalism and the vast Indonesian territory. He said that currently, there are six operational tsunami buoys. BMKG plans to deploy six more Argo floats, fourteen coastal buoys, ten other buoys, and gliders to strengthen and improve the Indonesian observation system. The data obtained, especially from the tsunami observation system, is used for validation and impact assessments. Indonesia is also developing met-ocean buoys, leveraging its experience in creating smaller versions. He mentioned that the focus is on sustainability and implementing AI for faster tsunami detection. The hope is for more technical cooperation and frequent coordination meetings with the international community for sustainable progress.

Morocco's national report was presented by Mr. Chair Adil, Physical Oceanographer from the Moroccan Fisheries Institute. He mentioned that they operate one METOCEAN buoy, which monitors physical, chemical, and biological parameters in the Bay of Moroccan Atlantic coast for aquaculture purposes. The program aims to collect data on weather conditions and hydrological measurements and implement a numerical model for predicting the hydrodynamic variation. The overall goal of the program is to understand the impact of coastal upwelling on the aquaculture ecosystem in the Dakhla Bay of the Moroccan Atlantique coast. This buoy has experienced three vandalism incidents within the last year.

Mr. Gonzalo Agurto Barragan from the Directorate of Hydrography and Navigation of the Peruvian Navy, presented the national report from Peru. He discussed four different monitoring programs along the Peruvian coast, including island-based buoys, gprogramrgo floats, and private company-installed buoys. He emphasized the importance of these systems for monitoring El Niño conditions and enhancing maritime operations. The future plans include deploying additional buoys, expanding glider projects cautiously, and deploying more Argo floats. The data collected is considered reliable, aiding in wave and wind warnings, model validation, and sea surface temperature monitoring. Mr. Barragan sought international collaboration, especially for sharing data and incorporating their buoys into global networks. He further mentioned that challenges include harsh marine conditions, the need for maintenance training, and improving the anti-vandalism system. The presentation concluded with a call for support from the DBCP community to improve buoy maintenance, network integration, telecommunication through GOES, and anti-vandalism measures. Peru is willing to share the data with the international community and working towards it.

Ms. Rita Esteves from the Portuguese Hydrographic Institute from the Portuguese Navy presented Portugal's national report. She mentioned the collaboration between three

institutions managing 14 marine buoys in Portugal, the Azores Islands, the Madeira Islands, and the Portuguese Navy. The Portuguese Hydrographic Institute serves as the national focal point, providing quality data to the GTS. The offshore buoys measure various parameters such as waves, atmospheric pressure, air temperature, winds, sea surface temperature (SST), and currents. They undergo maintenance ideally twice a year. She mentioned the ongoing wave intercomparison of Spotter and Datawell buoys. She also mentioned participation in the Jerico project, a European initiative for collaborative ocean observations. The presentation highlighted technical cooperation and data sharing with partners, including a buoy deployment in collaboration with São Tomé and discussions on potential redeployment after vandalism incidents. The data collected is used for model validation, research, aquaculture, nautical sports, renewable energy, and extreme events. Ms. Esteves acknowledged challenges in convincing upper management of the organization to share data due to limited public funding for the network but emphasized the importance of open data practices recommended by international organizations.

Mr. Fraser Cunningham, Marine observation manager from the United Kingdom (UK) Met Office, reported on the UK buoy programmes. He mentioned that the UK moored buoy network is primarily used by the Met Office for forecasting and early warning of severe weather conditions, forecast verification, and validation of wave model forecasts, which are also used in data processing and monitoring and in marine climate datasets and studies. Technological developments included the deployment of a new generation of buoys with advanced loggers and communication systems. He also mentioned that the BUFR transition has been operational since April 2023. Mr. Cunningham discussed the delay in transitioning to an in-house data processing architecture but expects to make the shift in January 2024. He touched on challenges such as failures and vandalism, with a focus on a specific incident (e.g., E1 site) where a tower broke off, leading to equipment loss. He highlighted drifter deployments and the use of social media to communicate observational efforts. Mr. Cunningham also mentioned other organizations in the UK involved in marine observations, such as Cefas WaveNet, Cefas SmartBuoys, and RigNet MetReach. Impact and value are illustrated through examples like the importance of wave data for forecast verification and collaborations with the Maritime and Coastguard Agency.

Dr. Rick Lumpkin presented the national report from USA. He provided an overview of various global buoy programs, including the Global Drifter Program (GDP), National Data Buoy Center's (NDBC) coastal weather buoys, NDBC tsunameters, Tropical Atmosphere Ocean (TAO) Array, Prediction and Research Moored Array in the Tropical Atlantic (PIRATA), Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA), Coastal Data Information Program (CDIP), and the US Interagency Arctic Buoy Program (USIABP). His report included deployment and operational statistics for each program as of July 31, highlighting international collaboration. He further noted technical developments which included the NDBC’s readiness to publish global drifter data on their website, with ongoing buoy recapitalization projects. The impact and value are demonstrated through 49 peer-reviewed publications during the intersessional period, showcasing the contribution of buoy data to advancing scientific research in ocean and atmosphere state estimation, forecasting, and coastal warnings. He also highlighted that most of the data are available in near-real time for ocean and atmosphere state estimation, forecasting, and marine/coastal warnings. Dr. Lumpkin’s report concluded with gratitude for the contributions of many members of the community.

Based on the national network information presented, it was apparent that a number of platforms operating at national level are not visible in the OceanOPS database. National platform operators are requested to work with the TC to fill the gap in the metadata information at OceanOPS and to get assistance in sharing their data on the GTS/WIS2.0 wherever possible. The panel discussed in detail the importance of metadata submission

and the role OceanOPS plays in providing the metadata to the WMO OSCAR system. The OSCAR system provides the metadata required to interpret the real time data transmitted through the GTS. The panel had concerns about the mismatch of OSCAR metadata requirements and what OceanOPS provides to OSCAR. Thus, the panel would like to clarify what the OceanOPS metadata is intended for and whether the metadata provided by OceanOPS to the OSCAR system satisfies the WMO GTS data user requirements.

Action 4/1*: TC is requested to provide necessary assistance to Morocco to get their MB information into the Ocean OPS and share the data on WIS2.0/GTS. (TC; DBCP-40)*

Action 4/2: *TC will provide a summary of platform information available on GTS, OSCAR and OceanOPS for each country two months before the DBCP session. This will facilitate operators to identify issues with data and metadata flows and fix them. (TC; July2024)*

Action 4/3*: Review the OceanOPS auto-generated National report (Action 3.2) and submit feed back to the TC. (NFPs, August 2024)*

Action 4/4*: Submit metadata of missing platforms on the GTS, especially the ones reported by DBCP national focal points (including deployment plans) to OceanOPS (NFPs and related operators, ongoing)*

Action 4/5*: Submit vandalism incidents with detailed metadata (date, location, type, etc. to the TC two months before the DBCP session (NFPs, Ongoing)*

5. Invited Speeches

Dr. Verena Hormann moderated this session. Three speakers were invited to talk about how buoy observations impact and assist in products for societal benefits.

5.1 METOCEAN Data: Socio-Economic Perspective

Dr. Anastasia Rita Tisiana, the Head of the Center for Marine and Fisheries of the Socio-Economy, Ministry of Marine and Fisheries, Indonesia, discussed the socio-economic perspective of ocean data and its impact on coastal communities, focusing on Indonesia. She highlighted the high poverty rates in coastal areas, emphasizing the vulnerability of fishermen and fish farmers. Dr. Tisiana stressed the need to move beyond traditional ecological and social science boundaries, integrating multi-dimensional aspects, including the social and economic dimensions, when finding solutions for environmental extremes. She presented a framework that links climate systems, marine ecosystems, and human systems, demonstrating the interconnectedness of these elements. The presentation included research projections on the impact of climate change on Indonesian fisheries and coastal communities, emphasizing the vulnerability of the region. Dr. Tisiana concluded by urging interdisciplinary collaboration to develop resilient strategies for both ecosystems and human communities, emphasizing the importance of socio-economic perspectives in shaping policy options. The audience acknowledges the importance of such perspectives in justifying the maintenance of ocean observations, particularly in budget discussions.

5.2 Ocean observations and WMO Standing Committee on Observing Networks

Ms. Estelle Gruter, the chair of the Standing Committee on Observing Networks (SC-ON) talked about a number of high-priority SC-ON activities which are important for DBCP. She offered a comprehensive overview of initiatives and activities within the Infrastructure Commission of the WMO, which are directly related to ocean observations. Ms. Gruter

stressed the significance of collaboration among various communities, particularly between oceanographers and meteorologists, to enhance the development and maintenance of observation networks. Key topics covered included the Global Basic Observing Network (GBON), requirements for ocean observations, the ongoing rolling review of requirements (RRR), and the introduction of a tiered network approach. GBON was emphasized, particularly for its significance in providing essential data for various applications and the GBON ocean observation requirements. The concept of a tiered network approach was introduced, suggesting different levels of observation quality and coverage to optimize resource allocation and enhance the utility of existing data. The discussion touched upon the protection of radio frequency challenges, metadata standards, and the implementation of the WMO data policy. Notably, the speaker underscores the importance of clarity and collaboration to prevent duplication of efforts and promote synergies among different initiatives. The overarching objective is to foster strong links and collaboration between diverse teams and communities for a common understanding, efficiently leverage observational data, and address shared challenges in ocean observations. Ms. Gruter highlighted that ocean observations are relevant in many SC-ON activities, and establishing links between the right teams and people through AG-Ocean is very helpful.

SLP is one of the most impactful observations for NWP. Panel members are requested to equip all drifters with barometers. She talked about the WMO RRR and Ocean Application areas, which are in different stages of maturity. She also mentioned the GBON ocean integration and tired network, including its definition and advantages.

Coastal forecasting and forecast products are also important.

5.3 Global High-Resolution Sea Surface Temperature (GHRSST)

Dr. Gary Coriett from EUMETNET, the chair of the Task Team on GHRSST, presented outcomes of GHRSST activities important to the panel. He mentioned that the pilot initiative between GHRSST and DBCP aimed at enhancing drifter data quality for satellite sea surface temperature (SST) retrievals. With the project now a decade old, the presentation aimed to assess progress and lingering challenges. He emphasized the need for independent SST measurements for satellite SST generation, algorithm development, and uncertainty assessment. Dr Coriett acknowledged the significance of drifter data in this context. The evolution of satellite SST estimation methods is outlined, emphasizing improvements over time. He shared the project's journey, starting with a visit to Mr. David Meldrum in 2010 and leading to the establishment of the DBCP GHRSST pilot project in 2013. Notable improvements in drifter data quality and a significant reduction in standard deviations between satellite and drifter SSTs are highlighted. Future challenges include applying knowledge gained from recent drifters to historical data, ensuring traceability to the SI temperature scale, and addressing geophysical modeling discrepancies between satellites and drifters. Dr. Coriett also acknowledged the TRUSTED project and collaborative efforts with the European metrology network for calibration. The presentation underscored the collaborative efforts between GHRSST, DBCP, and other entities, expressing gratitude to key contributors.

Dr. Coriett identified minimum drifter metadata specifications to use the data. Among some of the missing metadata elements are sensor depth, programme identification, pre-deployment sensor calibration date, and drogue depth. The next step for GHRSST is to push for satellite SST to "climate quality" standards, which need better calibration of all the buoy thermometers to <0.05k and understand uncertainties better. He emphasized the vital contribution of drifting buoy current capabilities that drive satellite SSTs.

Panel discussion on this topic highlighted that accurate and complete metadata availability is extremely important to using the data for satellite validations. It was also mentioned that there are challenges around Indonesia where there are difficulties in getting satellite observations in addition to in-situ observations.

Collaboration across communities is identified as a key by all three speakers.

***Action 5/1**: The panel discussed the importance of engaging early career professionals in DBCP activities. The executive board is requested to discuss and come up with a plan to engage early career scientists in DBCP activities. (DBCP EXB; DBCP-40)*

6. DBCP Status

6.1 DBCP Chair's Report

DBCP chair, Dr. Nelly Florida Riama provided the history and overview of the DBCP. She highlighted the major accomplishments of the DBCP during previous years. Dr. Riama specifically mentioned the first drifter donation programme to the Soloman Islands, which was a success.

Dr. Riama provided an overview of the evolution and achievements of the DBCP. The DBCP's history spans four significant periods, starting with its first meeting in 1979 in Geneva and its formalization by the Executive Council of the WMO in 1985. The DBCP has expanded from primarily drifting buoys to include mooring buoys, and in 1999, the first Chico buoy was deployed. By 2005, over 1000 drifters were in operation.

The chair emphasized the importance of DBCP as part of OCG and its contribution to WMO's and IOC/GOOS's strategic objectives. The presentation detailed the organizational structure of DBCP, highlighting the Executive Board's different roles. She also highlighted the key DBCP activities: scientific workshops, impact assessments, capacity-building workshops, and environmental stewardship initiatives, to name a few. Dr. Riama encouraged the active involvement of members in DBCP activities and provided a link for more information about DBCP. The presentation concluded with updates on ongoing projects, such as the Wave Drifter Pilot to the Solomon Islands and a call for nominations for vacant Executive Board positions. In summary, the chair emphasized collaboration, information sharing, and community engagement to achieve DBCP's strategic goals outlined in the DBCP 2020-2027 strategy.

6.2 DBCP and OceanOPS Report

Dr. Long Jiang reported on the TC activities and OceanOPS activities. He commended Indonesia for contributing 215 stations, including Argo floats, automatic weather stations, and drifters. The DBCP is part of a comprehensive global network involving drifting buoys, coastal and moored buoys, tropical moored arrays, and fixed platforms. The speaker emphasized that data sharing to the GTS is crucial for global ocean observing activities.

The technical perspective of the DBCP in the past inter-sessional period was discussed, covering data trends, operational units, data quality, and challenges. On network status, Dr. Jiang reported that the global drifter array averaged 1,321 operational units in the past 12 months, while it experienced drawbacks from December 2022 to March 2023, which is partially due to communication outages and an increase in costs. He reported that coastal moored buoys maintained stable status around the targeted 300 operational units, with a monthly average of 324. BUFR migration in TM315008 format leaped from 61% of the last intersessional period to 79%. The Global Tropical Moored Buoys Array reported that its overall performance has crept over the past 12 months, averaging 67 operational

units against the target of 100. There was a slight pickup in the Indian Ocean for RAMA-OMNI in early 2023, then stagnated. For tsunami buoys, the past intersessional period saw a major increase of operational units with the new deployments from New Zealand (12) and Ecuador (2), in addition to sustained stable operations by NOAA. Real-time data delivery to the GTS from drifting buoys within one hour has been steadily over 95%, averaging 28.7 minutes. Sea Level Pressure (SLP) observations from drifters had been progressively increased from 62% to 67%. Wave measurements from drifters also stepped up from less than 1% of the global array to 6% in July 2023, with deployments from the USA, Japan, and India.

The TC highlighted the imbalance in drifter platform distribution in different ocean basins and emphasized the need for increased deployment efforts in the Indian Ocean, tropics, and Southern Ocean.

Key points included improvements in metadata quality, challenges in gap regions, and variations in operational units. Dr. Jiang also highlighted the relevance of DBCP activities to WMO initiatives such as GBON and the importance of meeting OSCAR requirements.

The presentation included updates on support to DBCP Task Teams, coordination with other organizations, and ongoing projects such as the TRUSTED project for high-resolution sea surface temperature (SST) drifters. The financial challenges faced by OceanOps, which supports DBCP and other OCG networks, were also discussed, including resource constraints and proposals for addressing issues like operational cost increases.

Dr. Jiang concluded by presenting proposals for addressing challenges, such as metadata integration with OceanOPS, correct metadata representation of joint efforts on platform operations, specification sheets for tropical moored buoys and tsunami buoys, and dialogue with emerging GOOS networks.

7. Data and Metadata

7.1 Drifting Buoy data and metadata management

7.1.1 Task Team on Data Management (TT-DM)

Mr. Lance Braasch reported on the activities of the TT-DM and the summary of his presentation is provided below.

Receive and Review Reports

The GOOS OCG Cross-Network Data Implementation Strategy (v1.4) was released prior to the OCG annual meeting in June, 2023 and was presented at that meeting. There was a lot of excellent discussion during that session, including a relevant intervention by the DBCP co-chair in requesting clarity of the meaning of the word metadata used in the OCG data requirements. This feedback was taken into account in the latest revision of the data implementation strategy. The revised strategy is undergoing final review by the OCG Executive Board before its release in November 2023.

OCG vice-chair for data is eager to work with the DBCP community to begin implementing the requirements in the data strategy. These include, as top priorities, the integration of delayed mode data into ERDDAP services, some of which have already begun. Equally important to support the data strategy is the implementation of automated metadata flows between DBCP partners and OceanOPS. This metadata flow is critical for connecting the DBCP community to stakeholders such as WMO, IODE, and other UN Decade programs and activities.

TT-DM will continue to participate in OCG data implementation workshops, contribute to documents as requested, and adhere to their actions and recommendations accordingly.

Liaise on Requirements for Data Buoy Observations

Following review of the recommendations from the v1.4 OCG Data Implementation Strategy, TT-DM has encouraged Drifting Buoy and Moored Buoy metadata templates to meet minimum metadata requirements outlined by OceanOps, which shall adhere to minimum WIGOS metadata requirements, use controlled vocabularies such as Climate and Forecast Metadata conventions and the WIGOS metadata standard, and noted that operators shall exchange metadata using machine-2-machine services and avoiding redundant annual transmissions.

The document describing recommended data formats for Iridium transmissions, maintained by Météo-France can be accessed through the website[1].

Manufacturers are invited to use the existing active templates prior to the creation of their own. In case none of the existing templates is suitable for a given set of buoys, a new one may be designed in coordination with the DBCP TT-DM team.

Real-time Distribution of Data

The Lagrangian Drifter Laboratory at the Scripps Institution of Oceanography (LDL-SIO) disseminates real-time data via GTS (under headers IOBX02 KWBC and IOWX02 KWBC) as soon as drifters are deployed. On October 1, 2023, the LDL-SIO posted observations from 1,111 unique drifters, comprised of contributions from the GDP and its sensor (e.g., barometer) upgrade partners, as well as from other scientific programs.

LDL-SIO acquires region-less WMO IDs through the OceanOps WMO ID interface. This interface provides access to region-less WMO IDs that may be assigned as early as the time of hardware procurement and manufacturing, ensuring timely required metadata reporting to OceanOps. The tool also generates a WIGOS Station Identifier (WSI), which is paired with the drifter at the time of WMO ID assignment.

The LDL-SIO hosts an ERDDAP service for open access to real-time distribution of GTS data, such as for the 2021-2023 Atlantic Hurricane seasons.

AOML DAC monitors data on the GTS for drifters managed by AOML and advises the GDP at SIO to take sensor data and/or positions off GTS once their data becomes unreliable.

Météo-France (MF) and Centre de Météorologie Marine (CMM) monitor data on the GTS for the platforms managed by MF and by other operators (CLS and SIO, for example). As of this writing (October 2023), MF and CMM hourly processes around 115 operational drifting buoys sending data through Iridium SBD transmission (most of them using #003 format). In addition to the four moored buoys and three wave riders operated by MF, three new wave riders were deployed off Martinique island during the intersessional period (Sainte-Lucie, Fort de France, and Basse Pointe - BUFR messages produced with header IOBE02 LFPW). Furthermore, following extreme weather events in the Mediterranean Sea in 2022, it has been decided to deploy five new offshore moorings in addition to the two already in this area. The first one ("Ajaccio") has been deployed off Corsica this year (BUFR messages produced with header IOBD02 LFPW). The other four will follow in 2024-2025 in French EEZ. Data of CEREMA network wave riders are also processed by MF for BUFR production. Data received from these drifting and moored buoys are used to produce and disseminate GTS BUFR messages following TM315009 and TM315008 templates, respectively. In the

[1] http://esurfmar.meteo.fr/doc/o/db/others/DB_Iridium_formats.pdf

frame of Coriolis Data Center, Météo-France provides IFREMER / Coriolis with raw Iridium SBD messages received from operational drifting buoys.

Delayed Mode and Archive of Data

Historical, 6-hourly interpolated drifter data are available through the AOML web page[2], NetCDF versions of all the 6-hour quality-controlled data are available at the [3]. The latest update is through May 30th, 2023, as of Oct 30th, 2023.

Global hourly location and velocities[4] from GDP surface drifters tracked by Argos or GPS, as described in Elipot et al. (2016), "A global surface drifter dataset at hourly resolution," J. Geophys. Res.Oceans,121 doi:10.1002/2016JC011716 and Elipot, S., Sykulski, A., Lumpkin, R. et al. A dataset of hourly sea surface temperature from drifting buoys. Sci Data 9, 567 (2022). https://doi.org/10.1038/s41597-022-01670-2, are also available on the AOML ERDDAP server[5]. These data are a subset of the historical 6-h data when hourly resolution became possible.

AOML GDP works closely with NOAA NCEI, Coriolis, and NOAA OSMC to streamline the data transfer, distribution, and archival of delayed mode data. There are a total of 27,502 drifters in the AOML historical database and a total of 1,079 active drifters as of Oct 16th, 2023.

Meteo-France provides every week Coriolis with a global surface current product derived from drifter locations, based on Elipot et al. 2016 (http://dx.doi.org/10.1002/2016JC011716) and which is part of INSITU_GLO_UV_NRT_OBSERVATIONS_013_048 ("in-situ Near real-time observations of ocean currents") Copernicus product. Data users of real-time, delayed mode, and archive data are recommended to contact their data providers directly regarding questions pertaining to data usage, license (e.g., CC-BY-4.0 license), and proper citation to ensure attribution of the data source and data provider(s).

Metadata

During the inter-sessional period, several meetings were held specifically regarding platform metadata and their mappings onto OSCAR/Surface. Topics discussed include attribution of platform upgrade partners, metadata flows and their authoritative sources, and procedures for submission and update of existing metadata records.

During inter-sessional TT-DM discussions, it was noted that platform metadata on OSCAR/Surface does not accurately reflect the attribution of drifter partners and stakeholders in cases of sensor upgrades such as the barometer upgrade. Such fields found to be inaccurate relate to the drifter owner and the upgraded sensor's owner. TT-DM is fostering discussions between platform operators and OceanOps to resolve such inaccuracies along with the affected stakeholders so that metadata are made accurate and in good agreement with the parties involved.

In a discussion with TT-MB, it was noted that their work with OceanOps for a Mooring Metadata Template did not explicitly consider WIGOS descriptors. TT-DM recommends the

[2] https://www.aoml.noaa.gov/phod/gdp/interpolated/data/all.php

[3] https://urldefense.com/v3/__https:/erddap.aoml.noaa.gov/gdp/erddap/info/index.html?page=1&itemsPerPage=1000__;!!Mih3wA!Bx8chH6XHiXmPdV__MPsC4-rNReqqX76Y58ePAe-9pkpvpdJX7upw7t_Cp_X0sj32S0W7wn8QcvvcpHvlkHcCg$

[4] https://www.aoml.noaa.gov/phod/gdp/hourly_data.php

[5] https://erddap.aoml.noaa.gov/gdp/erddap/tabledap/drifter_hourly_qc.html

Moored Buoy metadata template use standardized vocabularies and consider direct mapping to WIGOS metadata descriptors to ensure their metadata is accurately represented within OSCAR/Surface.

These metadata discussions have culminated in the draft DBCP Platform Metadata Best Practices to ensure accurate metadata with relevant attributions and their availability to data end-users. The best practices document is also in accordance with OCG Data Implementation Strategy recommendation OCG-R10. The best practices document identifies pathways for submission of authoritative metadata, their corrections, and updates such that they are disseminated into downstream metadata repositories in an efficient manner.

AOML GDP continues to gather metadata from all GDP drifters directly from manufacturers where available.

Information from the specification sheets that is relevant and that can be made public is posted on the AOML website[6]. Deployment information from GDP drifters is received at AOML via web form or e-mail from deploying agencies. For all other drifters (ex. Meteo-France, UK Met Office, etc), metadata are gathered from different sources, compiled, and made available via web:

http://www.aoml.noaa.gov/phod/dac/dirall.html,

http://www.aoml.noaa.gov/phod/dac/deployed.html,

http://www.aoml.noaa.gov/phod/dac/Drifter_Specifications.html (and .csv),

http://www.aoml.noaa.gov/phod/dac/Barometer_Metadata.html (and .csv)

http://www.aoml.noaa.gov/phod/dac/Drogue_Specifications.html (and .csv)

The daily export of drifter metadata is produced every day by CMM and sent to OceanOPS, AOML, and SIO. Modification of the export format is currently under development; future export format will follow OceanOPS machine-to-machine format[7].

Review Relevant Publications and Documents

OCG released the v1.4 draft of their Data Implementation strategy at OCG-14. DBCP submitted comments with regard to OCG-R7, OCG-R8, and OCG-R9 for clarification within WMO guidance on WIGOS metadata.

In accordance with OCG Data Implementation Strategy OCG-R10, TT-DM has also drafted a DBCP Platform Metadata Best Practices document.

Future Work for 2023-2024 Intersessional Period

During the 2023-2024 inter-sessional period, TT-DM will review Appendix II on the DBCP Data Policy. Modifications to the document following the review will be made available to the DBCP Panel for comments during the inter-sessional period and adopted at DBCP-40.

TT-DM continues to recommend operators map their platform metadata onto WIGOS Metadata Descriptors to ensure accurate metadata within OSCAR/Surface. Platform operators providing data onto the GTS shall ensure their metadata are available on OSCAR/Surface. Platform operators should provide the assigned WSI within the BUFR

[6] https://www.aoml.noaa.gov/phod/gdp/
[7] https://www.ocean-ops.org/metadata/#InputsTableSection

message using descriptor 3-01-150 to facilitate data users accessing their platform metadata from OSCAR/Surface.

DBCP Platform Metadata Best Practices will be circulated during DBCP-39 for comments and to be adopted at DBCP-40.

Decisions and asks from OCG

OCG data/metadata roundtable discussions continue into the next inter-sessional period. TT-DM will participate in ongoing OCG round table discussions, contribute comments and feedback as necessary, and ensure work plans are aligned with OCG actions and recommendations.

Updated ToR Provided in the Annex

The panel inquired about the reasons for OceanOPS to retrieve data from OSCAR. Some DBCP members, including PMEL and NDBC voiced their concerns on having complete metadata available in the OSCAR system.

Action 7.1.1/1*: Drifting Buoy and Moored Buoy metadata templates shall meet minimum WIGOS metadata requirements as well as the minimum metadata requirements and use controlled vocabularies such as Climate and Forecast Metadata conventions and the WIGOS metadata standard. (TT-DM; DBCP-40)*

Action 7.1.1/2*: Operators shall exchange metadata using machine-2-machine services and avoid redundant annual transmissions. (DBCP members; Ongoing)*

Action 7.1.1/3*: Platform operators providing data onto the GTS shall ensure their metadata are available on OSCAR/Surface. (platform operators; Ongoing)*

Action 7.1.1/4*: Platform operators shall provide the assigned WSI within the BUFR message using descriptor 3-01-150 to facilitate data users accessing their platform metadata from OSCAR/Surface. (Platform operators; by DBCP-40)*

Action 7.1.1/5*: Review and adopt DBCP Platform Metadata Best Practices (TT-DM; by DBCP 40)*

Action 7.1.1/6*: Review Appendix II on the DBCP Data Policy (TT-DM; by DBCP 40)*

Action 7.1.1/7*: Review OCG Data Implementation Strategy v1.5 and provide feedback to the OCG Data vice chair (TT-DM; by the next OCG Round Table discussion)*

Recommendation 7.1.1/1*: Data users of real-time, delayed mode, and archive data are recommended to contact their data providers directly regarding questions pertaining to data usage, license (e.g., CC-BY-4.0 license[8]), and proper citation to ensure attribution of the data source and data provider(s)). (Data users; ongoing)*

7.1.2 Global Data Assembly Center (GDAC)

In the Marine Climate Data System (MCDS) scheme, two Drifting Data Buoys Global Data Assembly Centres (DDB GDAC), have been established, led by Fisheries and Oceans Canada (DFO) and Coriolis (French organization including Météo-France and Ifremer).

[8] https://urldefense.com/v3/__https:/joinup.ec.europa.eu/licence/creative-commons-attribution-40-international-cc-40__;!!Mih3wA!FqRL4yyhlSzuzih0NVJ_UIj3vx3MhrDCgcpMGB96WnCp4Dx2MBGfyN4XN3kk1mdgm6uF13KnuxzWnw$

Both GDACs acquire data circulated on the GTS of WMO. Additionally, Coriolis acquires data from Copernicus Marine Service. The GDACs aim to consolidate near-real-time and delayed-mode data to deliver a comprehensive best version archive of data and metadata.

Both GDACs routinely compare GTS bulletin headings and data volume received and have ways to make data available to requesters (DFO: through an offline form request system, France: through the Copernicus Marine Environment Monitoring Service[9].

In addition, a public FTP server distributing data and metadata as one file per drifting buoy is operated in France[10](NetCDF format), and Canada distributes data grouped in monthly files on their FTP server[11] in CSV format.

The two GDACs are working together to establish the DDB GDAC organization document and user manual to formulate exchanges and best practices between the two GDACs.

GDAC Status Report - Coriolis, France

Mr. Ludovic Drouineau reported on the activities of the GDAC at Coriolis, France. He provided an overview of the near real-time activities related to drifting buoys. The data collection involves multiple sources, including Iridium Short Bust Data (SBD) messages, GTS, MetOffice, FTPs, and collaborations with organizations like OceanOPS and Euro-Argo. He mentioned a parity check is done annually with LDL-SIO to fill in the missing information in the database. Real-time quality control involves various tests, including position verification and physical parameter checks. Metadata are regularly requested from OceanOPS, and the data are archived and distributed to Copernicus and other services.

The presentation included a scheme illustrating data flow and statistics about platform repartition in Coriolis' database. Cooperation between France and Indonesia is highlighted, with the first drifting buoy data received from Indonesia. Machine learning activities for detecting drifter buoy drouge losses were discussed, showing an 86% success rate.

Monitoring tools and statistics about downloads and providers are presented, emphasizing the importance of monitoring the number of data downloads to understand the impact of data. Mr. Drouineau introduced Copernicus tools for accessing data and mentioned the ongoing development of a drifting buoy dashboard.

The presentation included information about the Copernicus marine service, wave and surface current data products, the evolution of wave platforms, and spectral data from drifting buoys. Slides related to the TRUSTED and Copernicus Reprocessing of Argos and Iridium Drifters (C-RAID) projects were presented, showing the real-time quality control of Iridium messages, NetCDF files, and data visualizations. The C-RAID project aims to improve historical drifting buoy data by integrating satellite messages, conducting quality control, and performing visual inspections.

The presentation concluded with discussions about spectral data, collaborations with the European Space Agency (ESA), and potential improvements in data access tools. Mr. Drouineau emphasized the ongoing efforts to enhance data quality, metadata completeness, and collaboration with various organizations.

The panel appreciated the work on tracking the number of downloads, which provided information on the impact and value of data.

[9] http://www.marineinsitu.eu/access-data/
[10] ftp://ftp.ifremer.fr/ifremer/dbcp-drifter/
[11] ftp://ftp.meds-sdmm.dfo-mpo.gc.ca/pub/dribu_bufr

In response to a question on the citation, to ensure that the credits are properly attributed to the original data provider, the speaker mentioned that the original data provider should be appropriately credited and included in the NetCDF file. Otherwise, it is an issue on the Coriolis side and needs to be fixed. The panel suggested including the information on proper attribution methods in the best practices document under preparation.

Action 7.1.2/1*: Panel members are requested to try out the new services provided by the GDACs and provide feedback as needed. (DBCP members; DBCP-40)*

Action 7.1.2/2*: Include the data citation information to the metadata best practices document (TT-DM; DBCP-40)*

Action 7.1.2/3*: Organize a meeting between drifter DACs and GDACs to compare data/products and fill the gaps (TC;DBCP-40)*

Recommendation 7.1.2/1*: Drifter DACs are encouraged to forward at regular intervals (either in near-real-time or in delayed mode) the Iridium SBD drifter messages to the Coriolis GDAC. (DACs; ongoing)*

GDAC Status Report – MEDS

Mr. Trajce Alcinov, who represents the Marine Environmental Data section (MEDS) of the Canadian Department of Fisheries and Oceans, provided an update on the GDAC activities of MEDS. The primary focus of GDAC is monitoring drifting buoy data flows, including volumes of real-time buffered messages and unique platform origins. Over the past year, data volumes have been comparable but somewhat lower, with a notable drop in platforms from NOAA in November 2022.

Data is archived monthly and made available through their FTP site. Access has become subject to request to MEDS, with login information provided to authorized users. Mr. Alcinov discussed the temporary measure taken after last year's DBCP meeting to avoid unrestricted data distribution and emphasized the need for discussions on identifying different tiers of datasets.

He presented an overview of the types of messages archived and mentioned the ongoing modernization of infrastructure and practices at MEDS, including automation of data quality control and the adoption of new distribution protocols.

Challenges faced included resource constraints, metadata management, and developing policies for data publishing terms and conditions. MEDS-GDAC seeks input on mechanisms for data owners to communicate distribution requirements and is working on providing clarity and guidance on metadata management for users.

7.2 Moored Buoy data and metadata management

7.2.1 Task Team on Moored Buoys (TT-MB)

Dr. Kenneth Connell reported on progress and activities completed during the intersessional period by the Task Team on Moored Buoys (TT-MB). The TT-MB has increased engagement with other DBCP Task Teams during the inter-sessional period, especially with TT-DM and TT-WM.

During the intersessional period, the TT-MB continued to focus on evaluating metadata limitations and improving metadata implementation in OceanOPS. TT-MB addressed Action 25 (DBCP-38) by participating in quarterly round tables. In particular, TT-MB engaged in a detailed metadata round table discussion in November 2022. Following this round table,

TT-MB supported OceanOPS with the categorization of the moored buoy platform models and mandatory metadata attributes.

Global Moored Buoy (MB) real-time data transmissions have experienced significant impacts resulting from the COVID-19 pandemic and the inability to schedule regular maintenance cruises. These impacts are described in a paper about the effects of the Pandemic on observing the global ocean (Boyer, et al., 2023). Indian Ocean MB data returns, in particular, remain very low[12]. One of the focus areas of the inter-sessional period was to recapitalize tropical moorings to replace moored buoys lost at sea following extended periods of deferred maintenance cruises during the pandemic. The recapitalization of the lost mooring equipment was completed this year, but only some of the moorings have been re-established. Another focus area was to leverage of Indian Ocean partnerships to resume RAMA cruises to address Indian Ocean data gaps to re-establish data throughput >70% by the end of 2023. Unfortunately, this goal will no longer be attainable by the end of 2023. Although there was one RAMA cruise in 2023, several other RAMA cruises were postponed or canceled, and the bulk of the planned moorings to be reestablished have not yet been deployed. These moorings will now be deployed in 2024 following rescheduled cruises.

Considerable progress has been made toward establishing a GDAC for moored buoy and wave data (Action 26; DBCP-38). Coriolis expressed interest in being recognized as a moored buoy GDAC. During the inter-sessional period, Coriolis obtained internal approvals to proceed with a GDAC application and is currently preparing the GDAC application to WMO. This will remain as an action for TT-MB following DBCP-39.

A new action was identified following the last inter-sessional TT-MB. This action is to audit the DBCP moored buoy metadata template tables to evaluate how well the attributes integrate with the OSCAR/WIGOS metadata standards. As it is planned to transition from GTS to WIS 2.0, it will be important to adopt WIGOS metadata standards accordingly and without ambiguity. OceanOPS supports a reference table for vocabulary mapping with WIGOS that may be leveraged for this metadata audit and evaluation.

The panel requested that pressure and wave measurements be added to all tropical moored buoys. It was mentioned that adding barometric pressure is underway for the TAO array. Adding wave measurements to the tropical moored buoys is technically and financially challenging. It needs more planning, testing, and resources and will take a longer time to accomplish this. Additionally, some sacrifices have to be made to the sub-surface measurements to add wave sensors. Therefore, this is still not feasible at the moment.

Members highlighted the importance of having access to all specifications, best practices, and technical guidance documents in a single location. This will make it easier for new operators at the initial establishment of the programme.

Concerns were raised about the progress of metadata availability in the OSCAR system. The Panel agreed that it is essential to get the metadata to OSCAR, and there are constraints in getting the metadata through OceanOPS, at least for some major operators. The group agreed to raise these metadata issues with OCG-15. Dr. Connell welcomes participation from interested members in the TT-MB.

[12] https://journals.ametsoc.org/view/journals/bams/aop/BAMS-D-22-0270.1/BAMS-D-22-0270.1.xml

***Action 7.2.1/1**: Coriolis to submit WMO application towards establishing GDAC for Moored buoy data (TT-MB; DBCP-40)*

***Action 7.2.1/2:** Audit the DBCP moored buoy metadata template tables to evaluate how well the attributes integrate with the OSCAR/WIGOS metadata standards. (TT-MB; March 2024)*

***Action 7.2.1/3:** Liaise with TT-DM to support communicating OSCAR metadata requests to OCG-15. (TT-MB; March 2024)*

***Action 7.2.1/4**: Compile specification sheet[13] for Tropical moored Buoys and review the specification sheet[14] for coastal moored buoys as per OCG-14 recommendation.(TT-MB; DBCP-40)*

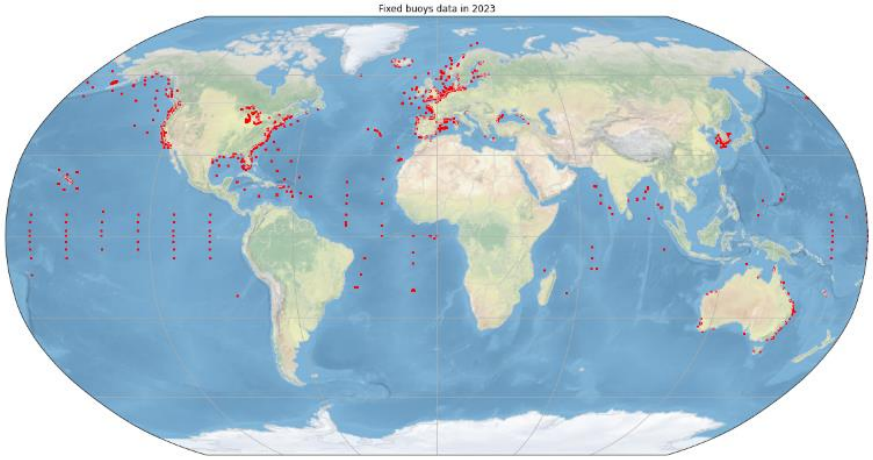
***Recommendation 7.2.1/1**: Re-establish Indian Ocean RAMA data throughput in 2024*

***Recommendation 7.2.1/2**: Incorporate barometric pressure measurements on all tropical moored buoys.*

7.2.2 GDAC for moored buoy data

Mr. Ludovic Drouineau presented the status of the moored buoy GDAC proposal. He mentioned that to date, there was no official GDAC for fixed buoys but there were discussions underway with Coriolis/France to apply and fill out documents to be such GDAC.
On behalf of the Copernicus Marine Service In Situ TAC contract, Coriolis is gathering and applying real-time quality control on data coming from fixed buoys.
Figure 1 shows the repartition of the fixed buoys currently in the Coriolis database. The fixed buoys collected by Coriolis come from:

- International networks like OceanSites,
- Tropical network : PIRATA, TAO, RAMA
- National Network: NDBC (National Data Buoy Center – USA), IMOS (Integrated Marine Observing System - Australia), Cerema (France), NNRCMP (National Network of Regional Coastal Monitoring Programmes – UK), ISPRA (Italia), MEDS (Marine Environmental Data Section – Canada)
- And other fixed buoys data collected from the GTS.



[13] https://www.goosocean.org/index.php?option=com_content&view=article&id=247
[14] https://www.goosocean.org/index.php?option=com_oe&task=viewDocumentRecord&docID=25387

Figure 1: Repartition of Coriolis fixed buoys

The panel appreciated the offer from the Coriolis to establish a GDAC for moored buoys. It was clarified that the GDAC will include moored buoys and oil rig platforms providing meteorological information. Coriolis will work with the WMO secretariat to get through the application process.

7.3 Task Team on Wave Measurements (TT-WM)

Val Swail and Robert Jensen reported on the progress of wave measurement activities undertaken during the last inter-sessional period. Continuous testing and evaluation of operational and pre-operational measurement systems continue to be essential components of a global wave observing system, with several evaluations in progress or recently completed and published or presented at the 17th Waves Workshop October 1-6, 2023[15].

A key priority of TT-WM has been to support the Task Team on Moored Buoys (TT-MB), the Task Team on Data Management (TT-DM), and OceanOps in the development of a complete metadata description for all current and historical wave measurements, consistent with the previously agreed moored buoy metadata template. Example cases from UKMO and ECCC are being used to demonstrate proof of concept at OceanOps, but no results have been seen yet.

A second priority for TT-WM is the development of a consolidated measured wave database with complementary metadata. Following DBCP-38, Coriolis, as reported elsewhere (see 7.1.2, 7.2.1), in conjunction with Copernicus, indicated a desire to submit an application to become a GDAC of the WMO MCDS for moored buoys, noting that they already provide such a function for drifting buoys. When completed, this would provide a near-complete global database for wave measurements, particularly if supplemented by near real-time and delayed mode wave measurements from other data providers, including the recently reported USACE Coastal and Hydraulics Laboratory Quality Controlled, Consistent Measurement Archive[16]. TT-WM will provide whatever support may be needed to assist in the GDAC certification process.

The Wave Measurement 2 virtual workshop, planned for the last quarter of 2023, has been deferred until 2024 due in part to slow progress on topic areas of metadata and the GDAC. These topics, as well as advanced user requirements for wave measurements, will be the focus of the 2024 workshop.

The DBCP would like to congratulate NDBC for moving to 30-minute reporting of waves from their moored buoy network in response to user requests. It is also acknowledged that, in response to previous recommendations, CDIP archives raw displacement values from its buoys at 30-minute intervals, and NDBC archives these and other operational information on an onboard flash drive that is locally archived for internal use.

After 15 years of leadership of TT-WM activities, going back to the initiation of the two wave Pilot Projects PP-WET and PP-WMD in 2008, Val Swail and Robert Jensen will be stepping down. The TT-WM recommends that Dr. Candice Hall take on the role of Chair, given her experience with wave measurements and the Task Team. The panel endorsed the nomination of Dr. Candice Hall to lead the TT-WM and congratulated her.

[15] www.waveworkshop.org
[16] https://www.nature.com/articles/s41597-022-01344-z

Action 7.3/1: *Organize the next proposed series of follow-up wave measurement workshops, including researchers in the field of wave measurements, institutional and other end users, data providers, and manufacturers. Potential topics include the dissemination of information to the user community on the progress with respect to wave metadata development, the Coriolis/Copernicus consolidated wave measurement database, and advanced user requirements for wave measurements. (TT-WM; by June 2024)*

Action 7.3/2: *Assist the efforts of OceanOps, with TT-DM and TT-MB, to improve cross-network metadata and data standard harmonizing to ensure user needs are being met.TT-WM; DBCP-40)*

Action 7.3/3: *Support the efforts of Coriolis/Copernicus, in cooperation with the TT-MB, the TT-DM, and the WMO Secretariat, to establish a GDAC for moored buoys in order to enable a consolidated database for moored buoy measurements, including wave measurements and complementary metadata.(TT-WM; DBCP-40)*

Action 7.3/4*: Provide documents on QC flag information on wind-generated surface gravity wave frequency spectra to the community in an easily accessible location (TT-WM with TC assistance; DBCP-40)*

Action 7.3/5*: Requested to add TT chairs' names as a member of all TT memberships (TC; Dec 2023)*

Recommendation 7.3/1: *Once established, encourage data management agencies to contribute near real-time and delayed mode measured wave data and accompanying metadata to the Coriolis/Copernicus GDAC for moored buoys.*

Recommendation 7.3/2*: Recommend establishing QC flags on wind-generated surface gravity waves frequency spectra in the form of a simple checksum factor, well described by CDIP and NDBC, coordinated with TT-MB, DM, and OceanOps, to be included by data providers.*

Recommendation 7.3/3*: Encourage buoy operators to collect, where feasible, time series of raw displacement for moored buoys in addition to spectral and integral properties and make these available to the user community.*

Summaries of all discussions are included under the relevant subject topic above.

8. Outreach and communications

8.1 Task Team on Environment Stewardship (TT-ES)

Ms. Karen Grissom, Chair of the TT-ES, provided an update on the progress made in the field of environmental sustainability within the ocean-observing community. Two meetings with the task team were held during the inter-sessional period, while additional interactions occurred with the WMO Environmental Sustainability Group. Four key actions were identified, focusing on membership, best practices, connection with other groups, and baseline survey. The baseline survey has been completed, identifying the top challenges and opportunities. She mentioned the importance of reviewing the assessment periodically. TT-ES participated in ES events organized by the WMO ES group: a webinar on ES, a discussion forum on ES, and a demonstration of a wooden buoy at the Meteorological Technology World Expo 2023. A few other achievements are publicity

efforts and the deployment of a wooden drifter in Brest, France. Future plans involve developing and disseminating best practices, strengthening connections with TT-CD, and building membership in the task team. Recommendations include maintaining collaborative ties with WMO and OCG and addressing connections between the TT-ES and other DBCP TTs. Ms. Grissom mentioned that there is a responsibility at the national and organizational level to include ES in their procurement process and also consider it throughout the lifecycle of the instruments. Ms. Grissom expressed her interest in being a member of the planned TT under the WMO INFCOM, which may be established during the INFCOM-3 session.

It was mentioned that GDP manufactures drifters with bio-plastic, and about 175 of those units are already deployed and operated in the field. This shows the emerging transformation of technologies towards ES.

***Action 8.1/1**: TT-ES to work with TT-CB to include environmental stewardship and awareness in the capacity building agenda (TT-CB; ongoing)*

***Action 8.1/2**: Develop standard language/text on environmental impact to assist members in their procurements. (TT-ES; DBCP-40)*

***Action 8.1/3**: Develop information for the public about reporting, recovery, and disposal of beached buoys. (TT-ES, DBCP-40)*

***Action 8.1/4**: Complete the literature study to identify the most impactful strategies to further the environmental stewardship of DBCP. (TT-ES; DBCP-40)*

***Action 8.1/5**: DBCP TT-ES must collaborate closely with WMO Environmental Sustainability Initiative and GOOS/OCG to influence green innovative technology and policy on ES of observing systems. (TT-ES; ongoing)*

8.2 Task Team on Capacity-Building (TT-CB)

The Chair of the TT-CB, Dr. Qui-Rachel Jiang, reported on the TT-CB activities. She highlighted that a wider range of ocean-observing communities are engaged in CB activities, and this has grown over the years. Identifying the highlights and achievements, she mentioned the first Mediterranean capacity-building workshop hosted by the Meteorological Service of Tunisia, which took place in Tunis. This was attended by 46 participants from 21 countries. The workshop was a success, with great diversity and inclusivity in participation and topics covered. She also reported on the progress of the first wave drifter donation by DBCP to the Solomon Islands. Key focus areas for the next two years will be organizing CB workshops in the Pacific Islands, Asia/Latin America, or the Caribbean. TT-CB is also planning to launch a questionnaire to collect feedback from previous participants to evaluate the impact of these workshops and to better serve the needs of the community. TT-CB is also planning to release a commemorative video on TT-CB activities to mark the DBCP's 40th anniversary. Dr. Jiang concluded the presentation with their plans to establish a coordination mechanism with OCG CB and explore more resources for TT-CB.

Mr. Rama-Rao mentioned that INCOIS operates an International Training Center for Operational Oceanography and offered to host a DBCP-CB workshop in collaboration with INCOIS. This center has the capability to include practical training on drifter and moored buoy deployment and data acquisition, processing, and application. Ms. Dea Nurina Bestari from the Regional Training Center (RTC), Indonesia, offered to assist with developing the questionnaire to evaluate the impact of the workshops as requested by the OCG.

***Action 8.2/1**: Establish the coordination mechanism between TT-CB and OCG Capacity development (TT-CB; March 2024)*

***Action 8.2/2**: Establish an ad hoc group to w the DBCP-CB activities since its inception, including but not limited to questionnaires and user stories, report back to the DBCP EXB as appropriate. (TT-CB; DBCP-40)*

8.3 Vandalism and Outreach

Ms. Karen Grissom reported on the activities of buoy vandalism. The small working group, consisting of Ms. Grissom and Dr. Riama, serves to monitor and collect ideas to prevent vandalism. There are vandalism cartoons developed in different languages to reduce and prevent vandalism events. Her presentation highlighted countries that contributed to vandalism reports, including Australia, Brazil, Ecuador, France, India, Morocco, Spain, and the USA. She emphasized the need to interpret the reported numbers cautiously, understanding that they reflect reporting mechanisms and trends rather than absolute numbers. There can be many buoy vandalism events out there that may not have been reported. Panel members are requested to record and report the vandalism events annually to the DBCP TC. The distribution of vandalism events was illustrated on a map, correlating with reporting countries. Based on the reported incidents, it was obvious that the Indian Ocean, the east coast of the USA, the Iberian Peninsula, and the tropical Pacific are hotspots for vandalism. This can be indicative of the countries that reported the vandalism events. The presentation concluded with slides showing vandalism incidents in Indonesia and educational initiatives, such as fisherman schools, to combat vandalism.

Ms. Grissom announced that she would step down as the lead of the vandalism group and requested a volunteer to lead this activity. Participants from South Korea and Indonesia (Ms. Anni Arumsari) expressed their interest in contributing to the vandalism prevention activities. DBCP executive board will look for a lead for the vandalism community.

8.4 Task Team on Data Value and Impact of Buoys (TT-VID)

Dr. Mark Lucas, the Chair of the Impact and Value Task Team (TT-DIV), reported on the progress of activities. He reported that the TT-DIV was officially set up in July 2023. Its first task was to recruit members during the DBCP 39 session. Dr. Lucas provided a draft ToR of the task team and the workplan for the panel review and approval. The panel approved ToR of TT-DIV, which is provided in Annex 4. He plans to engage with users, write an abstract for the WMO Impact workshop, and focus on community engagement. Dr. Lucas seeks guidance and suggestions from the community for effective participation in relevant meetings and events. The panel members are encouraged to contribute to abstract submissions for the upcoming WMO Impact workshop, and the importance of DBCP community representation at the workshop is recognized. The presentation concluded with an invitation to join the TT and feedback from the panel and the wider community on engagement with stakeholders.

The panel agreed that the priorities of the TT should include outreach towards various data buoy users communities such as marine users, scientific users, and wider community users. For each of these communities, a focal point will be chosen to interact with each community, with the support of other TT members. The plan is to have a good overview of the type of users within the next six months. Another priority task will be to define the impact KPI and how to monitor them.

8.5 Task Team on Data Buoy Best Practices Technology Development (TT-DBPD)

Dr. Rick Lumpkin, the Chair of the TT-DBPD discussed the history and current status of the TT. The TT was active from 2010 to 2011, addressing issues with drifting buoys. In the last few years, the TT was dormant, and Dr. Lumpkin suggested two options: either suspend the dormant TT or redefine its vision with a new chair. Participants suggested reviewing the terms of reference of the TT-DBPD and integrating relevant tasks into other existing TTs. Best practices and technology development towards ES were mentioned as emerging activities that can be integrated into the TT-ES. Participants went through the ToR of TT-DBPD and decided that almost all the activities could be integrated into other existing TT. The only item that needs to be handled is how to act in a technology-related crisis similar to the situation mentioned above on the drifters. All agreed that an ad hoc TT can be formed in such cases.

There is consensus to decide on the task team's fate during the agenda item on panel issues and decisions, with the possibility of updating existing TT terms of reference to incorporate TT-DBPD responsibilities as needed.

8.6 Discussion on DBCP outreach activities and Q&A

Summaries of discussion points are included under the relevant topic.

9. Action Group Activities

9.1 Global Drifter Programme (GDP)

Dr. Rick Lumpkin reported the Global Drifter Program (GDP). The GDP's primary mission is to maintain a global network of approximately 1300 satellite-tracked surface drifting buoys that provide crucial in-situ observations of ocean parameters such as currents, sea surface temperature (SST), atmospheric pressure (SLP), winds, salinity, and waves. These observations play a pivotal role in supporting various applications, including weather forecasting, ocean state estimation, short-term climate predictions, and climate research.

Over the past year, the GDP deployed 763 drifters, which is a substantial effort aimed at bolstering the global drifter array. In the upcoming year, the program plans to deploy 800 operational buoys and 200 consortium research buoys, totaling 1000 deployments. Additional deployments may be necessary to address gaps in the global array.

The report also emphasizes robust data management practices. The GDP maintains a Data Acquisition Center (DAC) and a Data Processing Center (DPC) for handling drifter data. Real-time data exchange ensures the timely dissemination of drifter data, with a focus on data quality and reliability. Delayed mode data distribution, with a delay of 3-4 months, provides quality-controlled and interpolated data to users.

Instrument practices are another crucial aspect of the program's operation. Technical developments, led by the LDL-SIO component of the GDP, aim to standardize and enhance drifter design. These improvements include ruggedized tether attachments, high-quality batteries, and recommendations for more precise measurements, like SST.

The report concludes by highlighting the evolution of the global drifter array, which averaged 1118 drifters over the past year. It began the year with 1309 drifters and ended with 1071 drifters, demonstrating the ongoing efforts to maintain and grow this essential network of drifting buoys. The document includes figures illustrating deployment locations and the size of the global drifter array.

In summary, the report underscores the GDP's commitment to maintaining and expanding its network of drifting buoys, ensuring the availability of vital oceanic data for a wide range of applications and research purposes.

9.2 Surface Marine Programme of the Network of European Meteorological Services, EUMETNET (E-SURFMAR)

E-SURFMAR manager, Mr. Olivier Desprez de Gesincourt, presented the activities of the E-SURFMAR programme. He mentioned that E-SURFMAR participated in various meetings, including EUMETNET, and discussed actions related to drifting buoy purchase, delivery, and deployments in the North Atlantic; their engagement in the TRUSTED and HRSST programs made them work closely with EUMETSAT and CLS. E-SURFMAR is responsible for deploying buoys in the Atlantic Ocean from the North Pole to 20^0 S where about 15 drifters per year are deployed. E-SURFMAR also tries to recover drifters; however, it was difficult last year due to resource issues. Exploring new observation capabilities, with the target to contribute to environmental sustainability. Towards this, E-SURFMAR works with a new UAV manufacturer[17], testing a wooden buoy with a pressure sensor, deploying drifters from cargo sailboats, and launching a research program for the development of a bio-plastic drifter. In addition to regular activities, E-SURFMAR worked with GDP and OceanOPS to improve metadata and, particularly, the drifter sensor ownership metadata during the last inter-sessional period. Work is also ongoing on developing a new version of the MeteoFrance daily export module of operational drifting buoy metadata to OceanOPS via machine-to-machine algorithms. There were discussions on how to engage and contribute to the WMO Data Quality Monitoring System (WDQMS).

During the next inter-sessionsal period, E-SURFMAR plans to deploy five new moored buoys in the Mediterranean Sea, 25 drifter deployments towards TRUSTED, participate in the HRSST ice-buoy program, continue to improve E-SURFMAR quality-control (QC) tools, deploy 10-15 ice-buoys in the North Pole area, and work towards environmental stewardship. He also emphasized that E-SURFMAR will continue and strengthen collaborations with GDP and satellite agencies. Mr. Gesincourt requested the panel members to use the QC tools and provide feedback for improvements.

Answering a question on how effective the recovery mission of drifters is, once they are overaged or beached, he mentioned that when a buoy is approaching a coast or if they receive messages from civilians about a buoy, recovery is made through NMH or civilian contacts to pick it up. E-SURFMAR recovered 10 drifters last year, although it is a resource-crunching exercise that also needs a good network of volunteers. India mentioned that 5 of their buoys are beached, 3 in Sri Lanka and 2 in Myanmar, and requested panel members from those countries to assist them in recovering the buoys. Many members shared their experience with the recovery of buoys. India recovered a tsunameter buoy from Thailand and made arrangements to return it to the owner.

9.3 International Tsunameter Partnership (ITP)

Mr. Christopher Moore from the NOAA Center for Tsunami Research, who leads the Action Group (AG) on International Tsunami Partnership (AG-ITP), provided an overview of their activities. The ITP manages over 70 buoys globally, which were contributed by various countries, including Australia, Colombia, New Zealand, India, Ecuador, the United States,

[17] https://www.oshensail.com/

Chile, and Thailand. New Zealand has made a significant contribution to the array with 12 new 4G buoys in the Southwest Pacific.

Maintenance and deployment plans for the year include a total of 24 buoys, and the NOAA National Data Buoy Center (NDBC) is responsible for maintaining the US array. The transition to new 4G technology allows for improved data filtering and placement of buoys closer to the trench access.

All data are accessible through the NOAA NDBC web API and the GTS stream. Access to metadata is limited and is one of the group's actions for next year. He highlighted ongoing developments, including tsunami sensors in the Mediterranean, cable-based platforms with smart sensors, and planned buoy deployments in Greece, Italy, and Sicily off of the southern coast of Italy in the Ionian Sea. He mentioned that Smart cables use the same sensor technology used in tsunami buoys, and work is in progress for Smart cable installations in Portugal and the South Pacific off of New Zealand with government funding.

One significant challenge highlighted is the need for improved metadata access and updates. There are a number of places holding metadata, including NDBC, OceanOPS, and the IOC sea level group. However, none of them provide easy access to the buoy operators doing maintenance to update the information in real-time and provide the full array of metadata back to tsunami service providers in machine-readable format. Accurate buoy location information is crucial for forecasting, and Mr. Moore emphasized the importance of having a single clearinghouse for metadata updates across the entire array.

The presentation concluded with a mention of efforts to support tsunami sensors on Smart cables and a push for government funding in these endeavors. Mr. Moore stressed the need for an efficient system for buoy owners to update metadata during their maintenance cycles.

Answering a question from the audience, Mr. Moore mentioned that tsunameter metadata requirements are unique and cannot satisfy within the moored buoy metadata template. There is variety of platform types in operation globally and all of them have different parameters that need to be tracked. Tsunameters need to measure waves down to millimeter precision in real time, and that requires tracking a large number of metadata. Therefore the ITP group needs to work on the metadata in collaboration with data centers currently holding metadata such as NDBC, GSN of New Zealand and the IOC sea level group in addition to TT-MB and TT-WM. He thanked New Zealand for tracking metadata and the contribution of 12 new buoys to the global network.

Dr. Michel from Indonesia mentioned that Indonesia has maintained an operational cable base tsunameter system since February 2022.

9.4 Tropical Moored Buoys Implementation Panel (TIP)

Dr. Ken Connell reported on the TIP. He mentioned that most of the TIP activities were rolled into the TT-MB and presented under the TT-MB report. Presenting key highlights and achievements, Dr. Connell mentioned that one RAMA cruise was completed in partnership with KIOST, shifted the position of three surface moorings to align with observations surrounding the Seychelles-Chagos Thermocline Ridge (SCRT). With the transition of the TPOS-2020 pre-operational phase, it will become a WIGOS pre-operational regional pilot. Also, the TAO recapitalization pilot is underway in its early phases to test new mooring technologies. Key focus areas for the next inter-sessional period will be to re-establish RAMA moorings and data transmission, TAO reconfiguration and recapitalization, and a sensor intercomparison of land-based tropical moored buoy tower. TAO recapitalization will lead to a reduction in the number of tropical array

platforms but will reposition and increase the number of sensors/parameters with an increase in data transmission frequency.

Dr. Connell made an open invitation to the panel members operating in the tropics to participate in the planned MB sensor intercomparison. This intercomparison is in its early planning stages; however, it is targeting the inclusion of new technologies to test for about one year in a tropical location. The intercomparison will include radiometers, high-accuracy barometers, and full package (integrated sensor packages). USA, Japan, and China will join the intercomparison where the primary telemetry of this text bed is Iridium; however can integrate other telemetry systems.

9.5 Discussions and Q&A

Summaries of discussion points are included under the relevant topic.

9.6 International Arctic Buoy Programme (IABP)

The coordinator of the IABP, Dr. Ignatious Riger could not participate in presenting the information but provided the AG report. It identified that the lack of observations and difficulty in deploying buoys in the Eurasian Basin of the Arctic Ocean are primary challenges. Collaboration with the Arctic and Antarctic Research Institute (AARI) in St. Petersburg, Russia, and other Russian Agencies has ceased due to the Russian/Ukrainian War. However, the US-IABP has been able to leverage the International Cooperative Engagement Program for Polar Research (ICE-PPR) to deploy buoys along the Russian EEZ. Please refer to the IABP report[18] for detailed information.

9.7 WCRP-SCAR International Programme for Antarctic Buoys (IPAB)

Dr. Rigor, coordinator of the IPAB was not available to present the activities but provided a report, which is available through the session document portal[19]. The report highlights that there were only 10 buoys reporting in the area south of 55 deg. S, and only 4 of these were on sea ice in the Southern Ocean. Most of the Southern Ocean remains sparse, especially in areas of sea ice and along the Antarctic Coast. In the next inter-sessional period, IPAB will work with the International Cooperative Engagement Program for Polar Research (ICE-PPR) to coordinate a New Zealand Defense asset to deploy buoys on sea ice.

9.8 International Buoy Programme for the Indian Ocean (IBPIO)

No representation or report was available for IBPIO

9.9 International South Atlantic Buoy Programme (ISABP)

No representation or report was available for ISABP

9.10 DBCP-PICES North Pacific Data Buoy Advisory Panel (NPDBAP)

No representation or report was available for NPDBAP

9.11 Discussions and Q&A

Summaries of discussion points are included under the relevant topic.

10 Strategic Discussions

[18] DBCP-39-Doc 9.6-Action Group-IABP.docx

[19] https://wmoomm-my.sharepoint.com/:w:/g/personal/cgallage_wmo_int/EaVEil-ScqpBuVZUCOcFbhEBz4lqwDX2w0zZkthbUxFjIQ?e=yealbk

10.1 Report from Observations Coordination Group (OCG)

Dr. David Legler, Chair of the OCG, expressed gratitude for the opportunity and acknowledged the importance of ocean observing. He explained the OCG and its role in efficiently operating and coordinating various networks for ocean observing. He highlighted progress made in transitioning emerging networks, such as animal-borne telemetry, ocean gliders, and HF radar, to mature status. He discussed engagement with WMO in developing statements of guidance for observing systems and emphasized the importance of investing in ocean observing. Dr. Legler then mentioned the OCG's efforts in developing a data implementation strategy, encouraging best practices, and releasing the 2023 ocean observing report card. He highlighted that the major challenges include resource erosion, prioritizing observing activities and addressing the growing landscape of networks interested in joining OCG. He said that planned actions involve implementing the OCG data strategy, collaborating with UN Decade programs, participating in WMO impacts workshops, and discussing readiness metrics for observing networks. Dr. Legler encourages collaboration with DBCP, including the potential inclusion of the DBCP tropical moored buoy array as a sub-network of OCG, and emphasizes the importance of engaging with the private sector. The presentation concluded with a focus on connecting global and regional components within GOOS and expressing anticipation for continued engagement and leadership from DBCP.

In response to a question about the strategy for operators looking to engage in the complex organizational space of ocean observing, Dr. Legler advised operators to look to the communities of practice. He highlighted the existence of groups like the International Ocean Gliders group within the OCG, which develops best practices and models for data communication. However, he acknowledged the challenge of a small number of experts within OCG being unable to provide one-on-one guidance to the growing number of operators. Dr. Legler suggests that national and regional connections could offer assistance to new operators by providing resources and guidance. Additionally, he mentioned OCG's efforts to hold regional workshops, such as the one in South Africa, where operators can engage with OCG networks and experts for meaningful interactions. Dr. Legler recognized the need to develop the capacity to effectively engage with the increasing number of individuals and countries interested in contributing to ocean observing efforts.

It was suggested to appoint a DBCP member to the OCG Task Team on metrics for the readiness and maturity of networks to bring DBCP interests into the discussions.

10.2 Report from WMO

Ms. Champika Gallage provided a report on WMO activities that are directly related to the Panel activities. A summary of the topics presented is provided below.

WMO Strategic Plan 2024-2027[20]

The 19th Congress approved the WMO Strategic Plan for 2024-2027 (Draft Resolution 3.1(1)/1 (Cg-19)). The new strategic plan was developed taking into account the goal of the UN-wide Early Warnings for All Initiative (EW4All) to achieve universal protection by early warning systems for every person on Earth by 2027, its direct linkage to the organizations' overarching priorities, and the vital leadership role entrusted to WMO in

[20] Draft Resolution 3.1(1)/1 (Cg-19

shepherding the implementation of the EW4All Action Plan in support of climate adaptation, and WMO 2030 Agenda for Sustainable Development. Long Term Goal 2 (LTG 2) of the strategic plan focuses on enhancing Earth system observation and predictions to strengthen the technical foundation for the future. The long-term outcome of the LTG 2 is to have an integrated Earth system observational network, including hydrology, ocean, and cryosphere, increasingly automated and optimized to ensure effective and sustainable global coverage. High-quality, fit-for-purpose, traceable measurements feed a continuous, free, and unrestricted global data exchange in accordance with the WMO Unified Data Policy and are underpinned by data management and data processing mechanisms. DBCP is requested to adjust its work plan to align with these LTGs.

Rolling Review of Requirements

The revised WMO Rolling Review of Requirements (RRR) process consists of six application categories and twenty-nine application areas, where the ocean application category has seven application areas: Ocean Mesoscale Forecasting and Real-Time Monitoring (incl. marine heatwaves); Coastal Forecasting, Oceanic climate monitoring, and services; Tsunami monitoring and detection; Marine Environmental emergency response and Marine safety; and Ocean Biogeochemical(BGC) cycle.

WMO organized a series of round table discussions with ocean experts on the contribution of the ocean community to the WMO RRR process. GOOS agreed to take the co-ownership of some ocean application areas (i.e., ocean mesoscale forecasting and real-time monitoring, oceanic climate monitoring, and services) together with service commissions (SERCOM). IOC/GOOS was invited to use this RRR process to lead and own ocean applications that have not yet been identified as requirements of the National Weather Predictions (NWP). Accordingly, the ocean BGC cycle is notionally added to the list, which will be led by relevant experts from the GOOS.

The 8th WMO Workshop on the "Impact of Various Observing Systems on Numerical Weather Prediction and Earth System Prediction" will be hosted by the Swedish Meteorological and Hydrological Institute (SMHI) at their headquarters in Norrköping, Sweden, from 27 to 30 May 2024. The workshop will be held in a hybrid mode, thus also enabling online participation. The workshop abstract submission deadline is 15 December 2023. The abstracts should address one or more Science questions[21]. DBCP members are encouraged to submit abstracts and register for the Workshop.

Global Basic Observing Network (GBON)

Following Resolution 2 of the extraordinary Congress in 2021 (Cg-Ext(2021)) on GBON technical regulations that requested the Commission for Observation, Infrastructure and Information Systems (INFCOM) to explore, in collaboration with the Joint WMO-Intergovernmental Oceanographic Commission (IOC) Joint Collaborative Board (JCB), possible initiatives to strengthen the exchange of surface-based Earth system observations over the global ocean, a subgroup of experts from DBCP, SOT, satellite community/GHRSST, SIDS, and the forecasting community is working on developing guidance material for ocean integration in GBON. This subgroup will develop the technical guidance explaining the regulatory material to follow by the members.

[21] WMO CPDB Extranet - 2023-CL-I-8th-Wksp-NWP_Science_questions.pdf (sharepoint.com)

The EC-76 approved the draft Guide to the GBON through Draft Resolution 3.2(3)/(EC-76)[22], which will be included as a new chapter of the Guide to the WMO Integrated Observing System (WMO-No.1165)[23].

Systematic Observations Financing Facility (SOFF)

SOFF was established through Resolution 3 of the Extraordinary Congress (Cg-Ext) in 2021[24] . This is initiated as the primary vehicle to provide the necessary financial and technical support for the implementation and sustained operation of the GBON in the least developed countries (LDCs) and small island developing states (SIDS) and of the limited technical advisory support it provides to other developing countries.

SOFF is a United Nations Multi-Partner Trust Fund created by WMO in collaboration with the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the United Nations Multi-Partner Trust Fund Office. Members with capacity are requested to contribute financially and provide expert readiness technical advisories, including peer-to-peer, to support the implementation of SOFF.

SOFF will be available for ocean observations once the ocean domain GBON requirements are clearly defined and technical specifications are clarified and documented. A small group of DBCP and SOT experts are developing the technical specifications for GBON-Ocean requirements.

Early Warning for All (EW4All)

In March 2022, the United Nations Secretary-General Antonio Guterres announced a new UN initiative to ensure that everyone is protected by early warning systems within the next five years, and WMO is tasked to spearhead this activity.

People-centered Multi-Hazard Early Warning System (MHEWS) will support the EW4All initiative. MHEWS has four pillars: 1. disaster risk knowledge, 2. detection, observations, monitoring, analysis, and forecasting hazards, 3. warning dissemination and communication, and 4. preparedness and response capabilities, where WMO is responsible for pillar two while United Nations Disaster Risk Reduction (UNDRR), International Telecommunication Union (ITU) and International Federation of Red Cross (IFRC) will lead pillars 1, 3, and 4, respectively.

At COP27, WMO launched the Executive Action Plan 2023-2027 for EW4All[25]. The key action areas of pillar 2 identify the need to close the ocean observation gaps in the coastal regions.

Establishment of the Advisory Group on the Oceans (AG-Oceans)

INFCOM-2 established the Advisory Group on the Oceans (AG-Ocean) through Draft Resolution 5.2/1(INFCOM-2)[26] to provide overall coordination on the application of ocean monitoring, including but not limited to observations, data management, data sharing, data utilization, and products, and the activities related to the terms of reference of the Infrastructure Commission. AG-Ocean membership includes 18 experts representing the entire value chain, from observations to forecasting. AG-Ocean is working on a strategic

[22] https://meetings.wmo.int/EC-76/_layouts/15/WopiFrame.aspx?sourcedoc=/EC-76/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/EC-76-d03-2(3)-GBON-GUIDE-approved_en.docx&action=default

[23] https://library.wmo.int/doc_num.php?explnum_id=11536

[24] https://library.wmo.int/doc_num.php?explnum_id=11113

[25] https://library.wmo.int/index.php?lvl=notice_display&id=22154#.Y5hse-zMInc

[26] https://meetings.wmo.int/INFCOM-2/_layouts/15/WopiFrame.aspx?sourcedoc={FA12BBF8-083A-4828-9F31-FE401F173BC0}&file=INFCOM-2-d05-2-SUBSIDIARY-BODIES-draft1_en.docx&action=default

engagement plan to strengthen and improve working connections between meteorology and oceanography infrastructure in the context of the Earth system approach.

Global Greenhouse Gas Watch (G3W)

WMO organized a three-day symposium on International Greenhouse Gas Monitoring[27]. Outcomes of the symposium identified that WMO is uniquely positioned to significantly advance the scientific and technical coordination of activities such as observations, data assimilation, and modeling to develop products to inform policy decisions. Based on the symposium results, the 19th Congress endorsed the WMO-coordinated Global Greenhouse Gas (GHG) monitoring Infrastructure concept[28] and approved the establishment of the joint Study Group on WMO Greenhouse Gas Monitoring (SG-GHG). The Cg-19 also endorsed the new name of "Global Greenhouse Gas Watch" (G3W) and requested the INFCOM, SERCOM, and RB via the SG-GHG, to further develop the concept through a detailed implementation plan, building on existing capabilities and ongoing activities under the Global Atmospheric Watch (GAW).

WMO Education and Training Programme (ETRP)

The WMO Education and Training Programme (ETRP)[29] is to assist members, in particular, developing countries and countries with economies in transition, in obtaining personnel specially educated and trained to internationally agreed standards to carry out the activities and operations of National Meteorological and Hydrological Services (NMHSs) required at the global, regional, and national levels for the effective provision of meteorological and hydrological services in support of sustainable development of member countries. Most of these courses are delivered in collaboration with Regional Training Centers (RTCs). Online courses, including Marine Meteorology, are available through the ETR Moodle site[30]. One recently added online self-directed course is Public-Private Engagement in Weather, Climate, and Water Services. DBCP members are encouraged to make the best use of these resources.

Action 10.2/1*: DBCP is requested to align their work plans with the new WMO strategic plan for 2024-2027 (DBCP Exb, DBCP-40)*

Action 10.2/2*: DBCP members are encouraged to provide abstracts to the 8th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction and Earth System Prediction (DBCP members, 31 December 2023)*

Action 10.2/3*: As identified in the WMO data policy, Annex 1 section 6, DBCP members are urged to share core and recommended in-situ data in real-time using the recommended data formats (DBCP members, ongoing)*

10.3 Report from IOC/GOOS

Dr. Joanna Post, Director of GOOS, expressed gratitude for the work of DBCP and updated the audience on the work being done to enhance the Global Ocean Observing System (GOOS). She said that the focus was on building a system that caters to climate,

[27] https://community.wmo.int/en/meetings/wmo-international-greenhouse-gas-monitoring-symposium

[28] https://meetings.wmo.int/EC-76/_layouts/15/WopiFrame.aspx?sourcedoc=/EC-76/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/EC-76-d04(3)-GHG-MONITORING-INFRASTRUCTURE-approved_en.docx&action=default

[29] https://community.wmo.int/en/about-etr-programme

[30] https://etrp.wmo.int/

forecasting, and ocean health domains, aligning with international agreements. Dr. Post discussed the GOOS structure and collaborations with regional alliances and national focal points. Emphasis was placed on the importance of observations in addressing climate change, biodiversity, safety, and early warning systems. She outlined GOOS's strategy, ongoing projects, engagement with industry, and efforts to strengthen governance. She mentioned that plans for the future involve advocating for ocean observation, deepening engagement, and aligning with the UN Decade goals. Dr. Post acknowledged the challenges and opportunities with a commitment to optimizing resources and collaborating with organizations like WMO to meet the evolving needs of the global ocean community. Dr. Post mentioned that IOC recognized the need for more funding for the GOOS office, which is expected to be received in the next biennium. She is dedicated to doing the homework to look at how that funding will be used wisely in order to prioritize spending needs. The presentation is available on the meeting website[31].

Answering a question on how to get new players engaged in GOOS, Dr. Post mentioned that GOOS could serve as an interface to enhance the identification and visibility of work done at the national and regional levels. She emphasized the need to bring the community together, make their work more visible, and create a space for collaboration. There's a suggestion to create a LinkedIn space where operators can engage, share practices, and build a community. Additionally, she talked about the opportunity to develop guidance for national-level benefits and reciprocal information sharing with GOOS. The idea is to strengthen the identity of GOOS and improve collaboration within the community, possibly through a dedicated webpage or other focused platforms.

To better support the community, GOOS has established GOOS National Focal Points. There are 76 GOOS NFPs. Dr. Post mentioned that there have been discussions on how best to connect NFPs from different communities (i.e., GOOS, DBCP, SOT, etc.) to coordinate and evolve implementation plans at the national and international levels. GOOS will act as a hub to facilitate such efforts.

10.4 Discussions and Q&A

Regarding the WMO presentation, a question was raised about how GBON compliance will be evaluated, which requires accurate platform and instrument metadata. The speaker emphasized the importance of precise and detailed metadata in the OSCAR system to provide accurate GBON compliance analysis. Precise information is more important for drifting buoys as the ownership of some sensors differs from platform ownership.

The panel agreed that a lack of observations from many parts of the globe impacts not only the long- and short-term weather forecasts but also accurate climate predictions. Therefore GBON plays a significant role in filling the observational gap. Wave measurements are important for weather and climate forecasts; thus, the panel hopes that waves will soon be added to GBON compliance.

The panel had a question on how earthquakes are considered in the EW4All initiative. The speaker explained that EW4All considers weather and climate-related disasters; however, she was not certain about earthquake-related disasters and agreed to find the answer from the group working on EW4All.

[31] https://wmoomm-my.sharepoint.com/:p:/g/personal/cgallage_wmo_int/EWX0ZH1F4INMhzTIELYNZJ8BhxHPI_AauFqefMrq-fwRQg?e=kzytbS

10.5 DBCP Strategy Implementation and DBCP Executive Board Report

Vice Chair of the DBCP, Dr. Lance Brassch, presented an overview of the DBCP strategy, emphasizing the importance of turning strategy into action. He highlighted how the DBCP strategy aligns with the WMO strategy. The alignment with the WMO strategy, particularly the WIGOS metadata, OSCAR Surface initiatives, and transition to WIS 2.0 was highlighted as crucial for DBCP contributing to enhance Earth system observations and predictions. He listed the activities completed and planned toward the seven pillars of the DBCP strategic plan.

Key points discussed included the establishment of a value and impact task team, outcomes of the first Mediterranean training workshop, which took place in two parts as virtual and hybrid, the wave drifter pilot project with a donation to the Solomon Islands, and the webinar on environmental stewardship. He mentioned that the executive board meeting discussed the DBCP's 40th-anniversary plans and made an open call for nominations for vacant positions in the executive board. He further elaborated on the special activities proposed for the 40th-anniversary commemoration and the considerations on potential frequency change of DBCP meetings, including discussions on whether they should be held every other year.

A significant point raised was the potential change in the level of support from the WMO Secretariat (excluding the DBCP TC). The Panel strongly agreed that WMO Secretariat support at some level is essential due to strong links with DBCP deliverables to the NWP community of WMO. Mr. Brassch suggested considering whether the DBCP wishes to continue with the current status quo of WMO Secretariat support or explore alternative scenarios. The discussion is open to questions and feedback from the DBCP community.

10.6 Discussions and Q&A

A number of panel members raised their concerns about a possible reduction of the current level of Secretariat support to the panel. The panel members stressed that the interface between the DBCP and WMO beyond the TC is critical to ensure proper communication channels between the DBCP and WMO and also to understand some of the complexities of WMO. Some members identified a number of examples from past projects that were not possible without strong WMO Secretariat engagement as proof of the importance of this engagement. It was noted that OceanOPS tentatively agreed to support more in DBCP annual sessions. Some suggested getting junior-level staff to assist with annual meeting preparation and keeping the WMO Secretariat to provide strategic guidance. Reducing the frequency of the DBCP meetings was proposed as another option to consider, which will also reduce the burden on the WMO Secretariat. However, the panel requested to continue the current level of WMO Secretariat support and left the discussions on reducing meeting frequency to be further discussed at the DBCP-40.

11. Panel Issues and Decisions

11.1 Financial Report

Ms. Gallage presented the financial report and highlighted that there are seven regular contributors (E-SURFMAR, Meteorological Services of New Zealand, Environment and Climate Change Canada (ECCC), Bureau of Meteorology, Australia (BoM), National Institute of Ocean Technology (NIOT), India, South African Weather Service (SAWS), and Federal Maritime and Hydrographic Agency (BSH), Germany) to the DBCP activities through the DBCP Trust Fund (DBCP-TF) at WMO. In 2022, DBCP-TF received funds from only six regular contributors; SAWS has informed WMO of their inability to contribute due

to financial difficulties. Annex 1 provides a copy of the 2022 financial report of the DBCP-TF at WMO[32]. Some of the contributions earmarked for 2022 arrived in late 2021 (BoM) or in early 2023 (ECCC); therefore were not included in the financial report provided in Annex 1. Out of seven regular contributors to the DBCP-TF at WMO, only ECCC from Canada has an official funding agreement with WMO for their contribution to the DBCP-TF. The five-year agreement with ECCC expired in March 2023. WMO was in the process of establishing a new agreement with ECCC.

Ms. Gallage mentioned that the Ministry of Natural Resources (MNR) in China provides a regular contribution of US$ 15,000 towards the DBCP Capacity Development activities to the DBCP -TF managed in IOC.

She futher said that the DBCP Technical Coordinator's salary is paid through the Woods Hole Oceanographic Institution(WHOI) funds from NOAA under a five-year contribution agreement. The existing agreement with NOAA will expire in June 2025, and the WMO Secretariat is in the process of preparing another five-year agreement. The Financial Statement of WHOI TF for 2022 is provided in Annex 2 of the financial report[32].

A summary of contributions towards DBCP activities in 2022 is provided in Table 1 below.

Table 1: Summary of 2022 National Contributions and distribution among the different budget lines

Contributor	Regular contributions in Currency of Payment	2022 contribution in US$	WMO/DBCP TF in US$			IOC Special Account
			OceanOPS	DBCP	SOT	DBCP
E-SURFMAR	€55,000	$ 62’785	$ 38’927	$ 9’418	$ 9’418	
Meteorological Services of New Zealand*	€1,800	$ 2’027	$ 1’257	$ 608	$ 162	
Environment and Climate Change Canada**	CAD$ 35,000	$ 28’760	$17’831	$8’628	$2’301	
Bureau of Meteorology, Australia*	$11’700	$13’176	$8’169	$3’953	$1’054	
National Institute of Ocean Technology, India*	$5’000	$5’000	$3’100	$1’500	$400	
BSH, Germany***	$3’600	$3’916	$2’428	$1’175	$313	

[32] https://wmoomm-my.sharepoint.com/:f:/g/personal/cgallage_wmo_int/EqKa8AKRPkFNvNkQgpq-xSsBJ2tgAWxQZPmxoDp8K_pu1A?e=b6UrXd

South African Weather Service, South Africa	€4,000	$0	$0	$0	$0	
Total		**$115'664**	**$71'712**	**$25'281**	**$13'648**	**$15,000**
Ministry of Natural Resources -China ****	US$15,000	$15,000				$15,000
NOAA/WHOI, USA	US$470,868					

* received in 2021 December
** received in 2023 February
*** Received payments in 2022 for 2022 and 2023
**** received in 2023

Ms. Gallage mentioned that similar income and expenditure is expected in 2023. Table 2 below provides the transaction details for 2023 (January to June). The interim statement for 2023 (January to June) of the DBCP TF at WMO is provided in Annex 3 of the financial report[32].

Table 2: Financial transactions for DBCP activities in 2023 (January-October)

ITEM	DBCP TF (US$)	IOC Special Account (US$)
Balance Brought Forward from the previous year (2022)	$124'746	$41,275
National Contributions*	$21'887	$30,000
Funds Available for 2023	**$146'633**	**$71,275**
Task Team activities		
Capacity Development	$8'513	$19,293
DBCP travel	$1'214	
DBCP Chair travel (after 30 June 2023	$3'200	
Expenses (Direct & Indirect costs)**	$388	$1'351
Expected balance in Dec 2023	**$133'318**	**$50,631**

* Assuming all regular funds will arrive as usual
** 3% support cost at WMO and 7% support cost at IOC

With the expectation that all regular contributions will be made in 2024, the DBCP Executive Board proposed the below expenditure plan for the 2024 financial year for the panel discussion and approval.

Table 3: 2024 estimated DBCP Panel budget for DBCP-39 approval

ITEM	DBCP TF (US$)	IOC Special Account (US$)
Balance Brought Forward from previous year 2023	$133’318	$50,631
National Contributions	$21’887	$15,000
Funds Available	**$155’205**	**$65,631**
DBCP 40th anniversary activities	$40’000	
Expenses (Executive Board travel)	$8000	
Capacity Development	$20,000	$20,000
Other DBCP activities	$5’000	
Expenses (Direct & Indirect costs)**	$1’200	$1,400
Balance at Dec 2024	**$81’005**	**$44,231**

** 3% Support cost at WMO and 7% support cost at IOC

The panel approved the maximum expenditure plan provided in Table 3 budget for 2024.

OceanOPS provides global coordination of ocean observation activities and receives financial contributions from multiple sources. To properly manage and report OceanOPS's financial transactions, WMO Finance proposed creating a new trust fund for OceanOPS. Pure DBCP and SOT financial management will stay in the current DBCP-TF. This transition will take place intesessionaly during the upcoming months. WMO Secretariat with the DBCP Executive Board will work on the revised Terms of Reference for the DBCP-TF and provide it for panel review, expecting to approve it at DBCP-40.

Ms. Gallage emphasized that DBCP operates with a significantly small budget, and with the increasing cost of activities, it becomes more and more challenging to manage limited activities in the future. Therefore, panel members were requested to make contributions towards the DBCP activities. One-time contributions were also encouraged. DBCP Chair Dr. Riama announced that BMKG is working on making a contribution to the DBCP-TF.

11.2 DBCP Operating Principles and Terms of Reference

DBCP Vice Chair Mr. Brassch mentioned that DBCP Operating Principles (DBCP-OP) get reviewed and updated as needed and are discussed and approved by the panel at regular sessions. The last update to the DBCP-OP was in 2021. However, updates are required to the DBCP Data Policy (Appendix II) to reflect recent updates to the OCG data strategy inspired by the WMO and IOC Data Policies. He mentioned that TT-DM will review the DBCP Data Policy and propose updates for panel review and approval at the DBCP-40 session. Ms. Gallage mentioned that, as indicated during the DBCP financial reporting, changes proposed to the DBCP-TF need to be reflected in the ToR of the DBCP-TF (Appendix VI). Updates will be made to the ToR of the DBCP-TF and will be made available for the Panel to review and update at the DBCP-40 session.

11.3 DBCP Groups and Task Teams and Groups

The panel discussed the activities of the DBCP TTs and AGs presented under agenda items 7, 8, and 9. Accordingly, the panel agreed to disband the TT-DBDP for the moment and integrate the remaining activities into the existing TTs. The panel approved the ToR of the newly established TT-DIV. Updated and panel-approved ToRs of the TT-DM and TT-DIV are provided in Annex 3 and 4, respectively. Panel members identified the lack of reports from a few AGs and suggested revisiting the importance of the AGs and ways to refine the AGs into a lesser number without compromising their activities.

12 Selection of DBCP new EXB members

Ms. Gallage reminded the panel that the DBCP executive board has eight seats, including the chair. Three of those members (Chair, Impact and Value, and Technology Innovation) are still serving their first term, and three members (Scientific Excellence, Environmental Stewardship, and Diversity and Inclusivity) are completing their first term (two years) and are eligible for re-election. As there were no other nominations for these three positions and the three members were willing to continue in their respective positions, those three members were re-elected for another term.

There were two vacant positions on the executive board for operational excellence and international cooperation. Nominations were called for those two vacant positions. Dr. Pattabhi Rama Rao from INCOIS, India, was nominated by Dr. Kenneth Connell and seconded by Mr. Kai to the executive board membership on International Cooperation. Dr. Andri Ramdhani from BMKG, Indonesia, was nominated to the executive board membership on Operational Excellence by Dr. Michael Andreas Purwoadi and seconded by Dr. Kenneth Connell.

13 Review of Actions/Recommendations

The panel reviewed action items and recommendations from the DBCP-39 session. The list of actions and recommendations is provided in Annex 5. Panel members are requested to review the actions and recommendations further when the session report is made available for final review.

14 DBCP 40th anniversary

The panel discussed the ideas to commemorate the 40th anniversary of the DBCP. A number of ideas were proposed. Chairs reminded the panel of the positive impact DBCP has made in the community while delivering to the growing demand for ocean observations for weather, climate, research, and EW4All. A committee was formed to organize the 40th-anniversary activities together with the DBCP executive board. Ms. Anni Arumsari Fitriany, Dr. Verena Hormann, Dr. Kenneth Connell, Mr. Sebastien Pere, Mr. Joel Cabri, Mr. Samuel Adiprabowo, and Dr. Michael Andreas Purwoadi, Dr. Karen Grissom, Dr. Luca Centurioni, Mr. Fan Jiang, Dr. Rachel Jiang, volunteered to be part of the organizing committee. The following suggestions were proposed by the Panel for the committee's consideration and further evaluation that can increase the impact and awareness of the DBCP.

1. DBCP-40th anniversary edition in Oceanography
2. Drifter donation and deployment at DBCP-40 with panel signatures
3. Video montage of DBCP evolution
4. DBCP-40 S&T workshop theme around the DBCP evolution
5. A pin or mug with a DBCP-40 special logo

The panel suggested considering DBCP pillars when organizing the 40th anniversary activities.

15 Date and Place of the next session

Following the DBCP operating principles, DBCP annual sessions are in Geneva or Paris alternatively. Accordingly, DBCP-40 is supposed to take place in Paris or a location organized by the IOC. As the DBCP-40 is an exceptional occasion, the DBCP decided to have the DBCP-40 session in a region where DBCP has not been held in the last few years and also in a region where observation gaps are prominent such as the Indian Ocean, South America, and Africa. Accordingly, the invitation from Dr. Pattabhi Rama Rao announced their intention to host the DBCP-40 in a location closer to INCOIS Hyderabad from mid-October to mid-November 2024. Dr. Rama Rao agreed to work with the WMO Secretariat to work on the formalities of this arrangement.

16 Closing of the session

DBCP-39 session was convened at 15:00 on Friday, 27 October, 2023.

Annex 1
Agenda

1 Opening and Welcome to DBCP-39

2 Adoption of the agenda and working arrangements

3 Scientific and Technical Workshop

4 National Reports

5 Invited Speeches

6 DBCP Status

6.1 Chair's Report

6.2 DBCP and OceanOPS Report

7 Data and Metadata

7.1 Task Team on Data Management (TT-DM), including GDAC status reports

7.2 Task Team on Moored Buoys (TT-MB), including the development of a GDAC for moored buoy data

7.3 Task Team on Wave Measurements (TT-WM)

7.4 Discussion on data and metadata and Q&A

8 Outreach Activities

8.1 Task Team on Data Buoy Best Practices Technology Development (TT-DBPD)

8.2 Task Team on Environment Stewardship (TT-ES)

8.3 Task Team on Capacity-Building (TT-CB)

8.4 Vandalism and Outreach

8.5 Discussion on DBCP outreach activities and Q&A

9 Action Group Activities

9.1 Global Drifter Programme (GDP)

9.2 International Arctic Buoy Programme (IABP)

9.3 WCRP-SCAR International Programme for Antarctic Buoys (IPAB)

9.4 International Buoy Programme for the Indian Ocean (IBPIO)

9.5 International South Atlantic Buoy Programme (ISABP)

9.6 DBCP-PICES North Pacific Data Buoy Advisory Panel (NPDBAP)

9.7 Tropical Moored Buoys Implementation Panel (TIP)

9.8 International Tsunameter Partnership (ITP)

9.9 Surface Marine Programme of the Network of European Meteorological Services, EUMETNET (E-SURFMAR

9.10 Discussions and Q&A

10 Strategic Discussions

10.1 Report from WMO

Annex 2
Science and Technology Workshop – Abstracts

Direct usage of data in early warning systems for the benefit of coastal communities such as fishermen, maritime transport, and leisure activities

Lorenso Kasmani

Suriname is located on the northeastern coast of South America. Its territorial waters extend from the coastline into the Atlantic Ocean. The extent of Suriname's territorial waters is typically recognized as 12 nautical miles (approximately 22.2 kilometers) from its baseline, which is generally the low-water line along its coast; the country has control over these waters and the resources within them, including fisheries and natural resources (Marine Regions · Surinamese Exclusive Economic Zone (EEZ), z.d.). The coastal region is characterized by diverse landscapes, including mud beaches, mangrove swamps and estuaries. The weather conditions along Suriname's coastline are influenced by its tropical climate and proximity to the Atlantic Ocean.

- Tropical Climate
- Rainfall
- Hurricane Risk
- Sea Breezes
- Oceanic Influences

When it comes to the forecast area as well as the issuance of warnings from the Meteorological Services of Suriname, a much larger area is taken into consideration; from 45W-60W and 05N-15N.

Earth observations (EO) play a critical role in monitoring coastal hazards and providing valuable data for warning systems in Suriname, especially for users within the marine sector. These observations provide essential information for early detection, timely warnings, and effective response to coastal hazards such as high seas, swells and extreme weather phenomena. Data is derived from buoy data, meteorological observations, satellite monitoring, geospatial analysis and information from all stakeholders within the marine sector. EO in Suriname, especially when it comes to coastal management is used within:

- Early Detection of Hazardous Conditions
- Tracking Weather Patterns
- Modeling and Predictive Analysis
- Sea-Level Monitoring
- Remote Sensing for Mapping Coastal Changes/ Coastal Erosion
- Early Warning Systems
- Mangrove Mapping
- Communication and Public Awareness
- Integration with Decision-Making
- Data Sharing and International Cooperation

In Suriname, these capabilities can be leveraged to strengthen the country's capacity to monitor and respond to coastal hazards effectively. Collaborations with meteorological agencies, disaster management organizations, research institutions, and international partners are key to developing and maintaining a robust coastal hazard monitoring and warning system. Incorporating data from various sources such as meteorological stations, ocean buoys, satellites, and computer models into early warning systems enables coastal communities in Suriname to proactively mitigate risks and make well-informed decisions. These systems play a crucial role in safeguarding lives, property, and livelihoods, while also enhancing the resilience of coastal regions.

Oceanographic Mooring Buoy Monitoring in the ecosystem of Dakhla Bay (South of Morocco)

Adil Chair, Ahmed Makaoui, Aziz Agouzouk, Omar Ettahiri, Jamal Chioua, Khalid EL Khalidi

Dakhla Bay (23°30'N-16°W) is located in the Dakhla Oued Eddahab area, in southern Morocco. Oceanographic monitoring using mooring buoys in Dakhla Bay. Certain underwater areas of great ecological interest need to be monitored. In this zone, resources of aquaculture and numerous pelagic species and organisms live and find food and protection from predators in the seagrass beds. It is considered a bio indicator of the quality of coastal marine waters. It is important to monitor them and keep these ecological communities as clean as possible. In this work, we present an oceanographic monitoring buoy installed in Dakhla Bay. It collects hourly water data such as salinity, temperature, dissolved oxygen, chlorophyll a, current speed, turbidity and meteorological conditions such as wind and temperature over the period October and November 2022. The aim of the study is to monitor exchanges between water masses in the Bay and offshore waters influenced by upwelling, and to track the impact of hydrodynamic conditions such as tide and wind on oceanographic parameters in order to control and supervise aquaculture activities in the Bay.

Backyard Buoys: a project at the intersection of new technologies and indigenous knowledge

Sebastien Boulay, Jan Newton, Sheyna Wisdom, Melissa Iwamoto, Roxanne Carini, Jordan Watson, Duncan Mactavish

Under the National Science Foundation (NSF) Convergence Accelerator program, Team Backyard Buoys brings together regional ocean observing networks (PACIOOS, NANOOS, AOOS) of the U.S. Integrated Ocean Observing System (IOOS), underserved Indigenous coastal communities, and a sensor company as partners working collectively to democratise local wave measurements and provide a solution to the existing hurdle of observing technologies that are too expensive to purchase and to sustain.
This project is not about putting buoys in the water, but identifying the barriers and challenges that communities will run into as they attempt to get buoys in the water. We are the explorers together. Backyard Buoys continues to advance the convergent achievements of the Phase I effort (presented at DBCP38), fostering the original partnerships while adding new partners focused on education and project management. We are sharing training and activities on various aspects, including: Sofar wave buoy operations, mooring design, data analysis, Indigenous knowledge integration, wave and climate modeling, engagement, and education. The Indigenous communities engaged during Phase I are the ultimate stewards of the wave buoys within their own waters throughout the project and beyond. To date, they have identified their optimal locations for deployments and are conducting deployment and recovery tasks. The communities are doing this themselves, rather than sending a researcher to each community, and have autonomy over data sharing. This aspect is a switch from the typical ocean research model, where the communities are simply told what is going to happen in their community, without much consideration for their needs or broader goals.
Our team makes progress through Working Groups that have been established to provide a shared forum for technical support and to identify expansion opportunities. Working Groups include Buoy Operations, Data Tools, Educational Development, and Co-Design. One of the primary tools is the development of Community Research and Implementation Plans (CRISPs) that are used by community stewards to execute the Backyard Buoy project. CRISPs are developed with a user-friendly web-based tool designed to encourage community involvement. Low-bandwidth data tools such as Text-a-Buoy and a mobile app have been co-designed to provide the necessary real-time wave data. We are implementing wave buoys in all three regions, along with the data dissemination applications. An education and translation layer focuses on engaging the communities

more fully by developing educational materials that will be used in the region. To grow community participation in the project, each region will provide opportunities aimed at inspiring a younger generation to participate in ocean observation.

The biogeochemical and ecological functioning of the emerging fisheries of the North Kenya Banks critical oceanic ecosystem

Joseph Kamau, Zoe Jacobs, Fatma Jebri, Stephen Kelly, Edward Kimani, Amina Makori, James Mwaluma, Elizabeth Mueni, Harrison Ong'anda, Matthew Palmer, Ekaterina Popova, Michael Roberts, Sarah Taylor, Juliane Wihsgott, Stuart Painter

Kenya's tropical coastal zone is characterized by a narrow continental shelf that broadens at the northern part near the Somalian border referred to as the North Kenya Banks, where it spread out to about 60 km offshore. The bank is approximately 4325 km2 lying between 2◦S and 4◦S. The North Kenya Banks have long been considered an important emerging fishery with the potential to spur economic growth for local fishing communities. As a regionally important extension to the otherwise narrow East African continental shelf, the North Kenya Banks remain under studied with implications for efforts to develop a sustainable fisheries management strategy. The local marine ecosystem is known to be strongly influenced by wind driven upwelling processes with seasonal variability driven by the changing monsoon seasons being of particular importance. Hydrodynamic processes are the basic agents that influence the concentration and spatial distributions of important nutrients and pollutants in an ecosystem. Nevertheless, the Western Indian Ocean is warming due to anthropogenic climate change with evidence indicating reduced ocean productivity in the future. How the ecosystem of the North Kenya Banks will respond is currently uncertain but is of great importance due to the significance of coastal fishery resources to coastal communities, and growing Blue Economy initiatives to exploit the North Kenya Banks fisheries more widely. There is, however, limited knowledge of the processes influencing productivity over the North Kenya Banks regions and currently there is no management plan in place to sustainably manage the fishery resources. Here, information about the North Kenya Banks fisheries are examined in relation to environmental processes and threats from climate change impacts with suggestions for future management directions

Near-surface velocity and sea surface temperature observations from Lagrangian drifters in the California Current system

Verena Hormann, Luca Centurioni

The California Current system (CCS) of the subtropical Northeast Pacific is a coastal region of great ecological and socioeconomic relevance and quarterly surveyed by the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program. This provides ample opportunity for regular deployments of Lagrangian Surface Velocity Program (SVP) drifters measuring near-surface currents and sea surface temperatures (SSTs), with 10-16 SVP drifters released during each CalCOFI cruise since July/August 2021. As this region is not only affected by El Niño – Southern Oscillation (ENSO) events but also marine heatwaves (MHWs), these observations are of prime importance to monitor such climate extremes affecting coastal and marine communities in real time near the coast where satellite measurements may not be accurate.

The drifter observations can further be used in various kinds of model studies including validation and data assimilation. Here we will present first results of these recent CCS measurements and their variability which can be contextualized using the historical Global Drifter Program (GDP) database as well as ancillary datasets. The GDP data and in particular observed SSTs can also provide insights into coastal extreme events such as MHWs in other regions of the World Ocean which are expected to increase with climate change and will be subject to future work.

Data fusion: altimetry and drifting buoys to access the high frequency currents signal

S. Jousset, M. Ballarotta, C. Ubelmann and G. Dibarboure

For more than 23 years, the multi-satellites DUACS system has been providing high quality multimission altimetry Sea Level products for oceanographic applications, climate forecasting centers, geophysics and biology communities. As part of DUACS project, this study aims to improve the L4 mapping by considering different data sources. Here the idea is to combine drifting buoy currents data with altimetry data to improve ocean topography and surface currents by resolving ageostrophic phenomena. In particular, we are interested in representing Near Inertial Oscillations (NIO), a fast ageotrophic phenomenon that is a key challenge for satellite observation of surface currents (SKIM mission concept (Ubelmann et al., 2021), ODYSEA mission).
In this study, we try to demonstrate the feasibility of reconstructing inertial signals, exploiting their spatio-temporal coherence. The method was previously tested through Observing System Simulation Experiment (OSSE) as part of the SKIM (Sea surface KInematics Multiscale monitoring) mission concept (Ubelmann et al., 2021). MIOST (Multiscale Inversion for Ocean Surface Topography) is used here with real data, to combine currents measured from the hourly AOML drifter database (Elipot et al, 2016), providing NIO information to the system, and altimeter data. These first experiments were carried out in the center of the gyre in the North Atlantic in 2013, a particularly favorable period and zone for the number of drifters available. The reconstructed currents are compared with the currents obtained from various products: the Copernicus-Globcurrent total surface current (MULTIOBS_GLO_PHY_REP_015_004) and the North Atlantic Total Surface Current from ESA WOC project.

Study of Near Inertial Oscillations signals from drifter database support of ODYSEA mission

H. Etienne, S. Jousset, C. Ubelmann and G. Dibarboure

Total surface currents are composed by a wide variety of dynamical components (geostrophy, winddriven component, tide ...), a few are observed and/or predict today. To measure the sum of these different components, the ODYSEA (Ocean Dynamics and Surface Exchange with the Atmosphere) satellite mission concept is proposed as a NASA Earth System Explorers satellite, thanks to a strong partnership with CNES. The mission will provide measurements of total surface currents in the global ocean along with simultaneous measurements of ocean-surface vector winds.

We are going to focus here on ODYSEA's ability to separate and map the different components of the current, particularly the fastest ones, such as Near Inertial Oscillations (NIO). In fact, the time sampling frequency of this mission is close to the period of the NIO and this will induce aliasing of the measurements. So, a key challenge is to be able to reconstruct this fast signal and separate it from the total surface current measured.

To address this challenge, we estimate a decorrelation spatial scale of the NIO signal to evaluate ODYSEA capability to deal with this signal. This study relies on the hourly AOML drifter database (Elipot et al, 2016) which is an extremely rich and interesting database of surface total current observations and is based on the association of buoys by pairs and by geographical area (depending on the latitude which determines the frequency of the NIO). Several diagnostics and thresholds are investigated. This work follows the methodology first discussed in the SKIM project by Ifremer (A. Ponte).

Data need for the lead centre for wave forecast verification

Jean-Raymond Bidlot – ECMWF

Comparisons of ocean wave forecast data from different models were first informally established in 1995 by scientists working on wave models. The comparisons were based

on a monthly exchange of model analysis and forecast data at the locations of in-situ observations of wave and wind available via the Global Telecommunication System (GTS) from moored buoys and fixed platforms.

The Expert Team on Wind Waves and Storm Surges of the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) noted the value of the exchange during its meeting in Halifax, Canada, in June 2003 and endorsed the expansion of the scheme to include other wave forecasting systems. However, the informal character of the exchange prevented a rapid adaptation to new data and needed a more reliable exchange of model data.

For these reasons, the World Meteorological Organization (WMO) established in 2016 a Lead Centre for Wave Forecast Verification (LC-WFV) with clearly defined interfaces between the participants and the Lead Centre. ECMWF started working on the LC-WFV in 2017, with dedicated web pages documenting progress, gathering of data in earnest from 2018 onwards. This transition was absolute necessary to insure the future of the project.

Having gathered all model fields, it is now possible to look at the feasibility to extend to other data type/source. In particular with recent developments and deployments of wave measuring capabilities on drifting buoys and other type of floats.

Sofar Ocean Technologies
Duncan Mactavish

Sofar Ocean Technologies (Sofar) aims to update DBCP-39 attendees about the Sofar Spotter sensor network's status and the Sofar ocean science division's recent progress in ensemble-based data assimilation of Spotter wave spectra data and satellite altimeters into a global operational wave model, among other topics.
Furthermore, Sofar would like to provide an update on its plans to expand its non-commercial data access program, which provides historical data from Sofar Spotter global network to academic researchers at no cost; and highlight some of the research outputs the program has enabled to date.
Lastly, Sofar will introduce Bristlemouth, an open-source marine connectivity standard developed in partnership with various other partners in the marine technology space. This standard is intended to lower the cost and complexity of marine sensor integrations and enable more flexible sensor platforms.

Use of AIS communications in data buoys for vessel proximity monitoring
Pablo PARRA, Cécile ZANETTE

The acquisition, installation and operation of data buoys can be costly and their locations at sea may present challenges to guarantee their integrity and of the equipment they integrate. Those can be accidental caused by collisions or may be the consequence of vandalism either active (removal of solar panels, batteries, etc.) or passive (inappropriate use of the buoy as a mooring buoy or other).

There are many ways in which those risks may be mitigated through the buoy design and datalogger programming, but, in some cases, it might be important to be able to determine vessels that may have been involved in such damages whenever possible, especially to take appropriate action.

Using AIS communications, the buoy can gather key data emitted by the AIS transponders of vessels in proximity and send it to the control centre for a monitoring of the activity around the buoy allowing to attribute responsibilities in case of damages to the system.

Two examples of the implementation of such a system will be presented, one case with an asset in the Baltic Sea in an open sea location, and the second one with an asset in the South Atlantic Ocean in a coastal location.

Analysis of descriptive wave parameters collected by inertial sensors
Ekias de Castro Nadaf

The measurement of ocean waves is essential for various applications, such as weather forecasting, coastal process monitoring, and coastal engineering projects, among others. Currently, there is a wide range of sensors for this purpose. These sensors, commonly referred to as wave sensors, employ different methods of acquisition, operating principles, accuracy, and precision. One of the most widely accepted methods involves the use of accelerometers combined with gyroscopes and compasses. Systems of this kind are capable of reproducing the main wave descriptors. However, measurement uncertainties increase with the quality of these components and the processing algorithm behind the hardware. The present study provides a preliminary inertial sensor (sensor A) data analysis configured for the collection of descriptive wave parameters. For comparison basis, data from a commercial wave sensor (sensor B) were used. Both sensors were installed in the center of gravity of the same buoy (hull model 3M - AXYS) and subjected to field testing. To assess the qualities of the measurements, the time series of the data recorded by both sensors, scatterplots and subsequent implementation of statistical metrics were plotted RMSE, MAE and Pearson's Correlation. Most of the errors are concentrated at the extremes, both in terms of period and height. The lowest and highest values show a weak correlation between the records of each sensor. The results show an good convergence between the results for Wave height, a tolerable error for Period and unsatisfactory performance for Wave Direction.

Drifting buoy R&D's as part of the environmental sustainability of the E-SurfMar network
Olivier Desprez de Gésincourt

The need for environmentally sustainable solutions for observing network is urgent, none more so than in the field of drifting buoys, which are rarely recovered. There is a growing concern amongst funding agencies and deployment partners about the pollution impact of current platform which are often large and plastic heavy.

E-SurfMar has been looking at various solutions to lighten the environmental impact of the systems it operates, not only by using sailing vessel for deployments but also by revisiting the material composition of the platform and the energy consumption. Over the last couple of years, this latter activity has focused on a full environmental Impact Assessment of the buoy and the investigation of alternative materials such a fully biodegradable polymers and wood. Indeed in 2023, 4 wooden prototypes have been built and will be tested in the last quarter.

In parallel, E-SurfMar will also press ahead with the definition of the best suited environmentally friendly polymer in order to progress towards the manufacturing of a prototype hull. The aim is to provide demo unit, communicate and advance these topics within our community, with the ultimate goal of providing solutions to sustain our observation networks by addressing these environmental challenges.

A closer look of Inner Indonesian Seas through float profilers deployments
Adiprabowo, S Prasetyo, M A Rahman, M F Geonova, A Ramdhani, E Prasetyo, N. F. Riama

The marine weather information demand increases alongside the marine activities around Indonesian waters. Additionally, ocean observation supports the marine weather forecast

operation by assimilating, validating, and improving data accuracy. Indonesia's weather authority (BMKG) initiated the float profilers and drifters deployments to support the marine weather forecast operation through MMS - I (Maritime Meteorological Strengthening) Program. During the 2022 to 2024 period, this program deploys 48 floats around Indonesia's prime and strategic waters, i.e., Natuna Sea, Karimata Strait, Java Sea, Makassar Strait, Flores Sea, Banda Sea, and the other future deployment spots. The ongoing deployments provide numerous ocean data. The visualized data provides a comprehensive view of the seasonal ocean dynamics in Indonesia. These dynamics are influenced by various factors, primarily the monsoon patterns and other natural forces. We gather crucial information about the ocean's stratification and deep profile, including temperature, salinity, and density. Furthermore, the continuous deployments of these profilers offer valuable insights into how the ocean's behavior changes in response to the monsoon activity, particularly in regions such as the Natuna Sea, Karimata Strait, and the Java Sea. Further investigation and an extended data period are necessary to gain long-term variability of ocean dynamics in order to understand our changing ocean.

A new branch of Indonesia Throughflow and the intraseasonal subsurface in the Eastern Indian Ocean

Salvienty Makarim, Weidong Yu, Zainal Arifin, T. Rameyo Adi

The Eastern Indian Ocean (EIO) is a unique region for the air-sea interactions, also serves as a bridge for the Indo-Pacific ocean-atmosphere teleconnection. The intraseasonal and interannual variability are the dominant signals in the EIO, and recently those variations are intensively explored. Besides, the Pacific water modulated in the Indonesian seas (Indonesian Throughflow-ITF) is flowing to the Indian Ocean and stratifying the EIO. However, the oceanic subsurface variations are far less explored, partly due to lack of data. This study analyzed the thermohaline structure during the Global Warming and its slowdown period, and explore the oceanic subsurface using the Bailong buoy data observation in the EIO. Here, we found a new branch of ITF reaching off Sumatra when the ITF was stronger. The stronger Easterly wind from the Pacific triggered the South Java Current (SJC) moving to Sumatra. Our analysis also showed the intraseasonal subsurface linking to the Madden Julian Oscillation (MJO) through the intraseasonal variation of Barrier Layer Thickness (BLT).

Analysis of the effect of oceanographic parameters and the ENSO phenomenon on catch results and catch per unit effort (CPUE) in the waters of north Sulawesi (case study december 2014 – november 2019)

Astrid Lasut, Diana Siregar, Regina Ninggar

The waters of North Sulawesi have a strategic location surrounded by the Sulawesi Sea and the Maluku Sea, considered the gateway to the water masses of the Pacific Ocean, which has a lot of fish potential and fishing areas. One of the problems naturally faced by fishermen is the impact of El Nino Southern Oscillation (ENSO), which can affect the fertility of the water, sea surface temperature variability, and chlorophyll-a in the waters of North Sulawesi. This research focuses on examining the variability of oceanographic parameters to determine fishing areas in the Sulawesi Sea using AQUA-MODIS satellite data and analyzing how ENSO influences catches and CPUE in North Sulawesi waters. The variability of oceanographic parameters such as sea surface temperature, chlorophyll-a, and surface winds was analyzed temporally, and correlation tests between parameters using the Pearson correlation method were used to measure the relationship of the Nino 3.4 Index to catches and CPUE. Temporal variability of oceanographic parameters shows relatively the same pattern in each seasonal period. Temperatures tend to be warm, and chlorophyll-a concentration values are low in the west monsoon period to transition season I, while in the east monsoon period to transition II, temperatures tend to be colder, and chlorophyll-a concentration values are high. Surface winds show relatively high wind speed

values in the east season. The correlation test of the Nino 3.4 Index on catch results and CPUE has a negative or inverse relationship, and the effect is quite significant.

Annex 3
Terms of Reference of the Task Team on Data Management (TT-DM)

As approved at the DBCP-39,

The DBCP Task Team on Data Management shall:

1. Receive and review reports from the Data Management Centres specializing in drifting buoy data, i.e., (i) the Coriolis/France, and (ii) MEDS/Canada; reconcile any overlaps with emphasis on differences;
2. Liaise on requirements for data buoy observations for all relevant applications and submit them in a consolidated way to the related WMO expert groups;
3. Suggest improvements and address issues to do with real-time distribution of data, including GTS issues, timeliness, and methods to improve data flows;
4. Suggest improvements and address issues relating to delayed-mode distribution and archiving of the data, with consideration to GOOS OCG data management;
5. Seek input from stakeholders on which metadata is most important and how it is best managed and coordinate and ensure integration with the OceanOPS;
6. Review all TT-DM circulated publications and documents to make sure they are kept up-to-date and comply with Quality Management terminology and to ensure these documents to be linked with the OBPS repository when ready;
7. Make sure that the developments and activities proposed by the Task Team are consistent with the governing principles of WMO and IOC;
8. Make recommendations to the DBCP Executive Board or the DBCP members for addressing the issues above;
9. Propose to the DBCP and its Executive Board any evaluation activities and pilot projects that it deems beneficial to buoy operators and
10. Report to the DBCP Executive Board and the DBCP at its annual Sessions.

Annex 4
Terms of Reference of the Task Team on Data Value and Impact of Buoys(TT-DIV)

As approved at DBCP-39,

The DBCP Task Team on Data Value and Impact of Buoys shall,

1. Focus on understanding our users' needs along the value chain and deepen our relationships with them.
2. Promote evaluations, such as observations impact studies, which seek to maximize user benefits through optimizing observing system design, in collaboration with other sustained global ocean observing networks and the satellite and modelling communities.
3. Promote the use of data from ocean buoys among DBCP members, partners, and other users for scientific research into air-sea interaction, ocean circulation, extreme events, and climate, ocean, weather, and earth system prediction.
4. Contribute to and provide leadership in both scientific understanding and technology development that deliver new knowledge and applications to address greatest user needs.
5. Identify priority users and ensure they are represented in the Panel.
6. Derive and report on metrics and key performance indicators based on user impact and value, in partnership with other global ocean observing networks and through WMO and GOOS processes.
7. Drive a culture of continuous improvement to grow and sustain time series of essential ocean and climate variables (including biogeochemistry) that underpin responses to societal grand challenges.
8. Follow and promote international data-sharing practices consistent with WMO and IOC data principles[1] to make our data freely available to maximize impact and value for our users.

[1] including the FAIR (Findable, Accessible, Interoperable and Reusable) principles

Annex 5
Actions and Recommendations

Actions:

1. Action 3/1: *Requested to have wave measurements from the tropical moored array.TT-WM and TT-MB are requested to look into this and report back to the DBCP (TT-MB and TT-WM; DBCP-40)*

2. Action 3/2*: India offered to explore the possibility to assist in getting the data from the coastal wave rider buoy in the Seychelles, which is not currently made available in real-time. TC to assist with these efforts (NFP of India assisted by TC; DBCP-40)*

3. Action 3/3*: DBCP session presentations, including S&T workshop presentations, should be given in person or online, and pre-recorded presentations will be used only as backups. Suggested to include this information in S&T callout at DBCP-40 (DBCP-EXB; DBCP-40)*

4. Action 4/1*: TC is requested to provide necessary assistance to Morocco to get their MB information into the Ocean OPS and share the data on WIS2.0/GTS. (TC; DBCP-40)*

5. Action 4/2: *TC will provide a summary of platform information available on GTS, OSCAR and OceanOPS for each country two months before the DBCP session. This will facilitate operators to identify issues with data and metadata flows and fix them. (TC;July2024)*

6. Action 4/3*: Review the OceanOPS auto-generated national report (Action 3.2) and submit your feedback to the TC (NFPs, August 2024)*

7. Action 4/4*: Submit metadata of missing platforms on the GTS, especially the ones reported by DBCP national focal points (including deployment plans) to OceanOPS (NFPs and related operators, ongoing)*

8. Action 4/5*: Submit vandalism incidents with detailed metadata (date, location, type, etc. to the TC two months before the DBCP session (NFP, Ongoing)*

9. Action 5/1*: The panel discussed the importance of engaging early career professionals in DBCP activities. The executive board is requested to discuss and come up with a plan to engage early career scientists in DBCP activities. (DBCP EXB; DBCP-40)*

10. Action 7.1.1/1*: Drifting Buoy and Moored Buoy metadata templates shall meet minimum WIGOS metadata requirements as well as the minimum metadata requirements and use controlled vocabularies such as Climate and Forecast Metadata conventions and the WIGOS metadata standard. (TT-DM; DBCP-40)*

11. Action 7.1.1/2*: Operators shall exchange metadata using machine-2-machine services and avoid redundant annual transmissions. (DBCP members; Ongoing)*

12. Action 7.1.1/3*: Platform operators providing data onto the GTS shall ensure their metadata are available on OSCAR/Surface. (platform operators; Ongoing)*

13. Action 7.1.1/4*: Platform operators shall provide the assigned WSI within the BUFR message using descriptor 3-01-150 to facilitate data users accessing their platform metadata from OSCAR/Surface. (Platform operators; by DBCP-40)*

14. Action 7.1.1/5*: Review and adopt DBCP Platform Metadata Best Practices (TT-DM; by DBCP 40)*

15. Action 7.1.1/6*: Review Appendix II on the DBCP Data Policy (TT-DM; by DBCP 40)*

16. Action 7.1.1/7*: Review OCG Data Implementation Strategy v1.5 and provide feedback to the OCG Data vice chair (TT-DM; by next OCG Round Table discussion)*

17. Action 7.1.2/1*: Panel members are requested to try out the new services provided by the GDACs and provide feedback as needed. (DBCP members; DBCP-40)*

18. Action 7.1.2/2*: Include the data citation information to the metadata best practices document (TT-DM; DBCP-40)*

19. Action 7.1.2/3*: Organize a meeting between drifter DACs and GDACs to compare data/products and fill the gaps(TC;DBCP-40)*

20. Action 7.2.1/1*: Coriolis to submit WMO application towards establishing a Global Data Assembly Centre (GDAC) for Moored buoy data (TT-MB; DBCP-40)*

21. Action 7.2.1/2: *Audit the DBCP moored buoy metadata template tables to evaluate how well the attributes integrate with the OSCAR/WIGOS metadata standards. (TT-MB; March 2024)*

22. Action 7.2.1/3: *Liaise with TT-DM to support communicating OSCAR metadata requests to OCG-15. (TT-MB; March 2024)*

23. Action 7.2.1/4*: Compile specification sheet[33] for Tropical moored Buoys and review the specification sheet[34] for coastal moored buoys as per OCG-14 recommendation.(TT-MB; DBCP-40)*

24. Action 7.3/1: *Organize the next proposed series of follow-up wave measurement workshops, including researchers in the field of wave measurements, institutional and other end users, data providers, and manufacturers. Potential topics include the dissemination of information to the user community on the progress with respect to wave metadata development, the Coriolis/Copernicus consolidated wave measurement database, and advanced user requirements for wave measurements. (TT-WM; by June 2024)*

25. Action 7.3/2: *Assist the efforts of OceanOps, with TT-DM and TT-MB, to improve cross-network metadata and data standard harmonizing to ensure user needs are being met.TT-WM; DBCP-40)*

26. Action 7.3/3: *Support the efforts of Coriolis/Copernicus, in cooperation with the TT-MB, the TT-DM, and the WMO Secretariat, to establish a Global Data Assembly Centre (GDAC) for moored buoys in order to enable a consolidated database for moored buoy measurements including wave measurements and complementary metadata.(TT-WM; DBCP-40)*

27. Action 7.3/4*: Provide documents on QC flag information on wind-generated surface gravity wave frequency spectra to the community in an easily accessible location (TT-WM with TC assistance; DBCP-40)*

28. Action 7.3/5*: Requested to add TT chairs' names as a member of all TT memberships (TC; Dec 2023)*

29. Action 8.1/1*: TT-ES to work with TT-CB to include environmental stewardship and awareness in the capacity building agenda (TT-CB; ongoing)*

[33] https://www.goosocean.org/index.php?option=com_content&view=article&id=247
[34] https://www.goosocean.org/index.php?option=com_oe&task=viewDocumentRecord&docID=25387

***30. Action 8.1/2**: Develop standard language/text on environmental impact to assist members in their procurements. (TT-ES; DBCP-40)*

***31. Action 8.1/3**: Develop information for the public about reporting, recovery and disposal of beached buoys. (TT-ES, DBCP-40)*

***32. Action 8.1/4**: Complete the literature study to identify the most impactful strategies to further the environmental stewardship of DBCP. (TT-ES; DBCP-40)*

***33. Action 8.1/5**: DBCP TT-ES must collaborate closely with WMO Environmental Sustainability Initiative and GOOS/OCG to influence green innovative technology and policy on ES of observing systems. (TT-ES; ongoing)*

***34. Action 8.2/1**: Establish the coordination mechanism between TT-CB and OCG Capacity development (TT-CB; March 2024)*

***35. Action 8.2/2**: Establish an ad hoc group to w the DBCP-CB activities since its inception, including but not limited to questionnaires and user stories, report back to the DBCP EXB as appropriate. (TT-CB; DBCP-40)*

***36. Action 10.2/1**: DBCP is requested to align their work plans with the new WMO strategic plan for 2024-2027 (DBCP Exb, DBCP-40)*

***37. Action 10.2/2**: DBCP members are encouraged to provide abstracts to the 8th WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction and Earth System Prediction (DBCP members, 31 December 2023)*

***38. Action 10.2/3**: As identified in the WMO data policy, Annex 1 section 6, DBCP members are urged to share core and recommended in-situ data in real-time using the recommended data formats (DBCP members, ongoing)*

Recommendations:

***1. Recommendation 7.1.1/1**: Data users of real-time, delayed mode and archive data are recommended to contact their data providers directly regarding questions pertaining to data usage, license (e.g. CC-BY-4.0 license[35]) and proper citation to ensure attribution of the data source and data provider(s)). (Data users; ongoing)*

2. *Recommendation 7.1.2/1: Drifter DACs are encouraged to forward at regular intervals (either in near-real-time or in delayed mode) the Iridium SBD drifter messages to the Coriolis GDAC. (DACs; ongoing)*

3. *Recommendation 7.2.1/1: Re-establish Indian Ocean RAMA data throughput in 2024*

***4. Recommendation 7.2.1/2**: Incorporate barometric pressure measurements on all tropical moored buoys.*

***5. Recommendation 7.3/1:** Once established, encourage data management agencies to contribute near real-time and delayed mode measured wave data and accompanying metadata to the Coriolis/Copernicus GDAC for moored buoys.*

[35] https://urldefense.com/v3/__https:/joinup.ec.europa.eu/licence/creative-commons-attribution-40-international-cc-40__;!!Mih3wA!FqRL4yyhlSzuzih0NVJ_UIj3vx3MhrDCgcpMGB96WnCp4Dx2MBGfyN4XN3kk1mdgm6uF13KnuxzWnw$

6. Recommendation 7.3/2*: Recommend establishing QC flags on wind-generated surface gravity waves frequency spectra in the form of a simple Checksum factor, well described by CDIP and NDBC, coordinated with TT-MB, DM, and OceanOps, to be included by data providers.*

7. Recommendation 7.3/3*: Encourage buoy operators to collect, where feasible, time series of raw displacement for moored buoys in addition to spectral and integral properties and make these available to the user community.*

8. Recommendation 8.2/1*: DBCP Members /Member states are requested to express their interest in hosting capacity-building workshops , especially integrating the drifter deployment activities and workshops (DBCP panel members; March 2024)*

Carryover Actions from DBCP-38

1. Request an update from Solomon Island met service on wave buoy and include it in DBCP-40 Agenda (DBCP chair; DBCP-40)

2. DBCP drifter buoy operators are requested to increase the number of barometer drifter deployments and/or to take advantage of the barometer upgrade programme (DBCP Operators; ongoing)

3. WMO WIGOS manual (WMO No. 1160) provides "Attributes specific to surface marine stations" (Appendix 5.2). DBCP members are requested to provide as many meteorological variables as possible among those listed in Attachment 5.1 (DBCP Operators; ongoing)

4. Drifter buoy operators are requested to plan their deployments to close the primary data gaps in the Indian Ocean (IBPIO; ongoing)

5. Investigate the opportunities to collaborate with the Southern Ocean Observing System (SOOS) in the Antarctic observing activities(IPAB; DBCP-40)

6. Connect with Animal Borne Ocean Sensors (AniBOS) to find potential collaboration to deploy more sensors (i.e. air pressure) using the AniBOS network (IPAB; DBCP-40)

7. Suggested to coordinate with South African Polar Research Infrastructure (SAPRI)in marginal sea ice research (IPAB; DBCP-40)

8. Develop data flow diagram and GOOS specification sheet for the tsunami buoy network (ITP; DBCP-40)

9. Provide information on the data and products made available by each DAC and GDAC on the DBCP website (TC; DBCP-40)

10. Aggregate information of the DBCP programs-related scientific publication information provided through a variety of sources, including National reports and report them under the Scientific Excellence at DBCP annual sessions (EXB member on Scientific Excellence with the assistance from TC; DBCP-40)

Annex 6
List of Participants

NO	NAME	AFFILIATION	COUNTRY
1	A. M Al Janahi	Marine Emergency Mutual Aid Centre	Kingdom of Bahrain
2	Abdalbast H. I. Fadel	Libyan Intergovernmental Oceanographic Commission of UNESCO	Libya
3	Acharya Raja	IMD	India
4	Adil Chair	National fisheries research institute Morocco	Morocco
5	Adji S. H. Lubianashari	Agency for Meteorology, Cl;imatology, and Geophysics of the Republic of Indonesia (BMKG Indonesia)	Indonesia
6	Agie Wandala Putra	BMKG Indonesia	Indonesia
7	Alex Matygin		
8	Alex Velasco	AXYS Technologies	Canada
9	Alexander Zucconi	Meteorological Service of Canada	Canada
10	Alfi Rudiansyah	BMKG Indonesia	Indonesia
11	Alvaro Scardilli	Servicio de Hidrografía Naval	Argentina
12	Ambesi Hans Ndonwi	Department of National Meteorology	Cameroon
13	Amr Zakaria Hamouda	National Institute of Oceanography and Fisheries	Egypt
14	Anastasia Rita Tisiana Dwi Kuswardani	Agency for Marine and Fisheries Research and Development of the Republic of Indonesia	Indonesia
15	Andri Ramdhani	BMKG	Indonesia
16	Anni Arumsari Fitriany	BMKG Indonesia	Indonesia
17	Arul Muthiah	NIOT	India
18	Astrid Yesica Lasut	BMKG Indonesia	Indonesia
19	Audia Azizah Azani	BMKG Indonesia	Indonesia
20	Bagas Ega	BMKG Indonesia	Indonesia
21	Basanta Kumar Jena	National Institute of Ocean Technology	India
22	Bruce Howe	JTF SMART Cables, Univ of Hawaii at Manoa	United States
23	Candice Hall	USACE ERDC	United States
24	Caridad Ibis Gonzalez	GDP/AOML/NOAA	United States
25	Champika Gallage	WMO	Switzerland
26	Charina Lyn A. Repollo	Marine Science Institute, University of the Philippines	Philippines

27	Ching-chi Lam	Hong Kong Observatory	Hong Kong, China
28	Chow Chi Kin	Hong Kong Observatory	Hong Kong, China
29	Christopher Moore	NOAA Pacific Marine Environmental Lab	United States
30	Chunying Liu	NOAA/NCEI	United States
31	Citra B. Saldy		
32	Constanza Ricaurte Villota		Colombia
33	Damayanti Sarodja	National Research and Innovation Agency of the Republic of Indonesia	Indonesia
34	David Legler	NOAA	United States
35	David W. Velasco	Nortek Group	United States
36	Dea Nurina Bestari	BMKG Indonesia	Indonesia
37	Deni Saiful	BMKG Indonesia	Indonesia
38	Denizhan Erol	Turkish State Meteorological Service	Turkey
39	Dewdath Bhaggoe	Ministry of Public Works, Meteorological Department Suriname	Suriname
40	Diana Cahaya Siregar	BMKG Indonesia	Indonesia
41	Dickson Dick-Shum LAU	Hong Kong Observatory	Hong Kong, China
42	Dijana Klarić Rebac	Meteorological and hydrological service of Croatia	Croatia
43	Dilwei M. Ngemaes	NOAA National Weather Service, WSO Palau	Palau
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Annex 7
Table of Abbreviations

AG	Action Groups
AG-ITP	Advisory Group on International Tsunami Partnership
AG-Ocean	Advisory Group on the Oceans
AIS	Automatic Identification System
AOML	Atlantic Oceanographic and Meteorological Laboratories
BMKG	Indonesia Agency for Meteorology Climatology and Geophysics
BoM	Bureau of Meteorology
BUFR	Binary Universal Form for Representation of meteorological data
CDIP	Coastal Data Information Program
CMA	China Meteorological Administration
CMM	Centre de Météorologie Marine
CSV	Comma-Separated Values
DAC	Data Acquisition Centre
DBCP	Data Buoy Cooperation Panel
DPC	Data processing centre
ECCC	Environment and Climate Change Canada
EEZ	Exclusive Economic Zones
EOV	Essential Ocean Variables
ES	Environmental Stewardship
ESA	European Space Agency
ESM	Earth System Monitoring
E-SURFMAR	Surface Marine Programme of the Network of European Meteorological Services
ETRP	WMO Education and Training Programme
EU	European Union
EUMETNET	European National Meteorological Services
EW4All	Early Warning for All
EXB	Executive Board
FAIR	Findable, Accessible, Interoperable and Reusable
FTP	File Transfer Protocol
G3W	Global Green house Gas Watch
GBON	Global Basic Observing Network
GCOS	Global Climate Observing System
GDAC	Global Data Assembly Centre
GDP	Global Drifter Programme
GHG	Greenhouse Gas
GHRSST	Global High-Resolution Sea Surface Temperature
GOOS	Global Ocean Observing System
GTS	Global Telecommunication System
HKO	Hong Kong Observatory
IABP	Interagency Arctic Buoy Program
IABP	Interagency Arctic Buoy Program
IBPIO	International Buoy Programme for the Indian Ocean
INCOIS	Indian National Centre for Ocean Information Services
IOC	Intergovernmental Oceanographic Commission
IPAB	International Programme for Antarctic Buoys
ISABP	International South Atlantic Buoy Programme
ITP	International Tsunameter Partnership
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JCB	Joint Collaborative Board
LDL	Lagrangian Drifter Laboratory

MB	Moored Buoy
MCDS	Marine Climate Data System
MEDS	Marine Environmental Data Section
MNR	Ministry of Natural Resources, China
NDBC	National Data Buoy Centre
NIOT	National Institute of Ocean Technology
NMS	National Meteorological Services
NOAA	National Oceanic and Atmospheric Administration
NPDBAP	DBCP-PICES North Pacific Data Buoy Advisory Panel
NWP	National Weather Prediction
OCG	Observations Coordination Group
OPP	Ocean Protection Plan
OSCAR	Observing Systems Capability Analysis and Review
PIRATA	Prediction and Research Moored Array in the Tropical Atlantic
PMEL	Pacific Marine and Environmental Lab
Q&A	Questions and Answers
QC	Quality Control
RAMA	Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction
RRR	Rolling Review of Requirement
RTC	Regional Training Centre
S&T	Science and Technology
SBD	Short Bust Data
SC-ON	Standing Committee on Earth Observing Systems and Monitoring Networks
SG-GHG	Study Group on WMO Greenhouse Gas Monitoring
SIDS	Small Island Developing States
SIO	Scrips Institute of Oceanography
SLP	Sea Level Pressure
SOA	State Oceanic Administration, China
SOFF	Systematic Observation Financing Facility
SOT	Ship Observations Team
SST	Sea Surface Temperature
SVP	Surface Velocity Programme
TAO	Tropical Atmospheric Ocean
TC	Technical Coordinator
TIP	Tropical Moored Buoys Implementation Panel
TPOS	Tropical Pacific Observing System
TT	Task Teams
TT-CB	Task Team on Capacity-Building
TT-DBPD	Task Team on Data Buoy Best Practices Technology Development
TT-DM	Task Team on Data Management
TT-ES	Task Team on Environment Stewardship
TT-MB	Task Team on Moored Buoys
TT-VID	Team on Data Value and Impact of Buoys
TT-WM	Task Team on Wave Measurements
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
WDQMS	WIGOS Data Quality Monitoring System
WG	Working Groups
WHOI	Woods Hole Oceanographic Institution
WIGOS	WMO Integrated Global Observing System

WIPPS	WMO Integrated Prediction and Processing System
WIS2.0	WMO Information System2.0
WM	Wave Measurements
WMO	World Meteorological Organization
WSI	WIGOS Station Identifiers