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SHIP OBSERVATIONS TEAM
THIRTEENTH SESSION

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Session Report Version 1.0

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NOTES

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EXECUTIVE SUMMARY

The 13th Session of the Ship Observations Team (SOT-13) was held in Brest and hosted by Ifremer and OceanOPS from 31 March to 4 April 2025. This regular session of the SOT was held as a hybrid meeting which allowed for far greater participation than we have seen in the past. A total of 222 participants representing 50 countries attended the session, with 66 attending in person and 156 joining virtually. With respect to WMO's commitment to gender equality there were about 70 female participants accounting for approximately 31% of the meeting.

The meeting emphasized the growing need to strengthen upper-ocean data collection in light of recent climate anomalies, particularly record-breaking sea surface temperatures. Leadership from the WMO and IOC underlined the importance of sustained and coordinated observing systems to improve ocean and weather forecasting capabilities.

Participants reviewed the structure and performance of the core SOT networks—Voluntary Observing Ships (VOS) Scheme, Ships of Opportunity Programme (SOOP), and the Automated Shipboard Aerological Programme (ASAP)—and heard from a broad range of emerging and established initiatives including fishing vessel-based observations, citizen science projects, and innovative platforms such as Plankton Planet and OceansX. The increasing diversity of contributors highlighted the need for improved coordination, governance, metadata standards, and harmonized data flows to manage the increasing number of ocean observing activities.

A major theme was the development of stronger partnerships with the commercial shipping industry. With only 3% of global ships currently participating in ocean observing programs, the meeting explored ways to dramatically expand engagement, with a vision to equip 10,000 ships by 2030. Presentations from private sector partners, such as Brittany Ferries, Kongsberg, and Monaco Explorations, showcased the potential for modular instrumentation and scalable, low-cost observing systems.

The future of TurboWin, a key software platform for ship-based weather reporting, was also discussed. With its end-of-life approaching in 2028, the session launched a coordinated effort to identify and develop a replacement system. This work will involve collaboration between public institutions, private companies, and current users, and is seen as critical to maintaining the operational integrity of VOS.

Panel reports confirmed the ongoing contributions of the SOT's networks but also highlighted operational challenges. VOS recorded more than 4.5 million real-time observations in 2024 yet delayed-mode data submissions remain inconsistent. SOOP emphasized the unique long-term value of XBT data for monitoring climate variability and proposed rebranding to clarify its role. The ASAP panel reviewed data quality issues and evolving instrumentation requirements, calling for increased participation.

OceanOPS presented detailed system performance reviews, highlighting gaps in data submission and metadata completeness. The need for timely migration to standardized station identifiers and more comprehensive metadata submissions was emphasized. OceanOPS also introduced its initiative to develop a fleet of 10,000 ships through industry partnerships, aligning with the broader goals of the UN Decade of Ocean Science.

More than 30 actions and recommendations were proposed, addressing industry engagement, metadata and website improvements, and data and metadata standards. Key priorities include securing letters of support from international organizations to

foster industry trust, replacing TurboWin with a next-generation solution, and fostering collaboration with citizen science initiatives and sailing programs like the Vendée Globe.

13th SHIP OBSERVATION TEAM (SOT-13) SESSION REPORT

1. OPENING OF THE SESSION

1.1. Opening Remarks from the host

Mr. Mathieu Belbeoch, Manager of OceanOPS welcomed participants to the Thirteenth Session of the Ship Observations Team, hosted by Ifremer, Brest. Ifremer's focal point, Ms. Lucie Cocquempot (Oceanographic Observation Coordinator) expressed thanks to all attendees, particularly the OceanOps team for their efforts in organizing and coordinating the meeting. Ms. Lucie provided background information on Ifremer, informed the room of the scheduled group tour arrangements and expressed great eagerness to further connect with members particularly at the upcoming United Nations Ocean Conference in June.

1.2. Opening Remarks from WMO

The Director of the Infrastructure Depart of WMO, Mr. Nir Stav remotely welcomed meeting participants and thanked Ifremer for hosting the meeting, along with partners at OceanOps and IOC. Mr Stav spoke about the critical challenges we are facing globally, with particular reference to the record-breaking sea surface temperatures of recent years. Being largely unpredicted, Mr Stav highlighted our lack of understanding of upper ocean processes and expressed the importance of building our knowledge of temperature gradients in the upper levels of the ocean. Mr Stav went on to say that to understand something, we need to measure it, and only then can we start to predict it. He expressed how critical our ocean observing community is to this task, with the need for more observations being flagged as a critical aspect.

Mr. Stav closed by praising SOT community and sister organisations for their success in creating a coordinated system of voluntary ocean observations to better understand the global oceans and expressed an eagerness to continue working together.

1.3. Opening Remarks from IOC

IOC representative, Mr. Vidar Helgese (UNESCO Secretary) greeted the room and thanked Mr. Nir Stav for his talk. Following a similar theme, Mr Helgese emphasised the importance the IOC places on learning more about the oceans to further improve our predictions. Given the importance to global maritime and terrestrial economies and public safety, ocean observing has never been more important and remains a critical infrastructure for society. Mr. Helgese highlighted the upcoming UN ocean conference and the need for a new, systematic approach to influence the declaration coming out of Nice.

Mr. Helgese went on to suggest that with the current state of global finances, we are unlikely to have increased support from governments, so private sector engagement at scale will be vital to mobilise a wider range of data sources and collection modalities, across a wide range of partners. Looking to capitalise on IOC's positive discussions with shipping companies, they wish to establish a network of positive actors wanting to contribute to this task, whilst acknowledging the issues that are associated. Mr. Helgese closed by expressing his hopes that we will take the opportunity to discuss how the WMO and IMO can continue to work together to maximise benefits to both parties.

Mr. Mathieu Belbeoch thanked both organisations and emphasised his vision for a new support dynamic to develop a new, global ocean observing system.

1.4. Opening Remarks from SOT Chair

The SOT Vice-chair, Ms. Elizabeth Kent, expressed her enthusiasm for an energetic SOT meeting and thanked the outgoing chair, Mr. Huai-min Zhang for his efforts guiding and leading the SOT in the intersessional period; and additionally, NOAA NCEI for their support in this role. To enable coordination of the meeting on-site, Ms Kent nominated Mr. Joel Cabrie to chair the meeting. The Team agreed to this suggestion by acclamation.

1.5. Adoption of the Agenda

The chair of the meeting, Mr. Joel Cabrie, coordinated the adoption of the Agenda. Ms. Kent was thanked for the opportunity to take on the role and expressed desire to engage with many participants over the course of the week. Mr. Cabrie advised of some minor amendments made to the agenda and invited participants to view and familiarise themselves with the revised timetable. SOT panel approved meeting agenda for the Thirteenth Session of the Ship Observations Team is provided in Annex 1.

1.6. Housekeeping Instructions

The OceanOps Technical Coordinator, Mr Martin Kramp, gave housekeeping instructions for the smooth running of the meeting on site and provided details of the upcoming social events. Ifremer were thanked for sponsoring the ice breaker event. Mr. Kramp highlighted the poster exhibition displaying member national reports and invited participants to peruse them during the coffee breaks and engage in discussions.

1.7. Working arrangements, and instructions for those participating virtually

Mr. Kramp gave guidance to meeting rapporteurs to help compile the meeting report, due to reduced support from the Secretariat. He highlighted the particular importance of capturing meeting actions and recommendations. Mr Kramp also reminded online participants of the online etiquette and requested that any outstanding presentations are submitted in advance so they can be shared in the meeting.

2. SETTING THE SCENE: INTRODUCTION OF SHIP-BASED OBSERVING NETWORKS/PROJECTS (FLASHTALKS)

Mr. Martin Kramp presented a map of the One Ocean Observing system, illustrating the operational platforms monitored by OceanOps. He posed a question to the participants in Session 2: which ship-based programmes should be coordinated under the SOT umbrella?

2.1. SOT: VOS, SOOP, ASAP

Mr. Joel Cabrie, chair of the meeting, provided an overview of the SOT networks. He offered a brief history of SOT and its current structure, comprising the VOS, SOOP, and ASAP networks. He explained how these networks support research, climate forecasting, numerical weather prediction, and maritime safety services, among other applications.

Maps and statistics displaying the operational status of the combined and individual networks were shown, highlighting strong coverage of shipping lanes while also noting significant data gaps in areas such as the Southern Ocean.

2.2. Repeat Hydrography: (Euro-) GO-SHIP

Ms. Elaine McDonagh, Co-Chair of GO-SHIP, provided an overview of the programme's work. A map displaying the 52 reference sections surveyed by GO-SHIP was shown. The OCG core network began its fourth decadal survey in 2024, focusing on coast-to-coast, full-depth, Level 1 parameter measurements. These measurements and their data flow were detailed. The well-established network of ships from 10 nations is supported by an international steering committee, a data management team, and standardized best practices. Funding is provided by Euro-GO-SHIP and NOAA through OceanOps. The initiative includes a wide range of variables and platforms, without focusing on a single platform type. Current relevant and affiliated projects include Argo, CalVal, BioGO-SHIP, the Ocean Decade project "GO-SHIP Evolve", EU TRICUSO, and AMRIT. There is potential for increased interaction with SOT regarding underway data.

2.3. Underway CO2: SOCONET and TRICUSO

Mr. Tobias Steinhoff of GEOMAR, Germany, summarized the status of the Surface Ocean CO2 Observing Network (SOCONET) and the TRICUSO project (Southern Ocean Carbon Observations). He traced the history of global collaboration on pCO2 observations and noted that the surface ocean carbon community was not well organized over the past decade. While some activity occurred under SOOP-CO2, it never fully integrated into that framework. A major step forward came with the 2023 pCO2 workshop in Oostende. SOCONET coordination is now funded for four years by NOAA and TRICUSO, an EU project, through IOCCP and OceanOps. SOCAT and SOCOM will collaborate to manage the resulting data.

2.4. Shaping an Ocean Of Possibilities: The “German SOOP”

Mr. Tobias Steinhoff of GEOMAR introduced "Shaping an Ocean Of Possibilities" (German SOOP), a national initiative operated by three German marine research institutions (Hereon, AWI, and GEOMAR). The initiative seeks to develop a global network of atmospheric and ocean observations from non-scientific platforms. Its three pillars are: co-development of sensor technology and platforms for easy-to-use observation systems, enabling ocean observations on non-scientific platforms, and employing a business model to scale up the work. The project is currently in the build-up phase, aiming for operational status by 2027. Mr. Steinhoff shared an example of collaboration involving private companies, sailing vessels, DWD, and OceanOps.

2.5. FerryBox

Ms. Anna Wilstrand Wranne, Co-Chair of the EuroGOOS FerryBox Task Team, presented the background, structure, and current status of the team established in 2015. The team now includes two chairs and 15 partners. The system features a modular, core flow-through design that can be installed on any vessel, with ferries being the primary platform. The system's flexibility allows for the integration of various sensors, many of which are becoming increasingly affordable. The task team coordinates the European component of the global community that uses ships of opportunity, collaborating with groups such as

WG, ROOS, GOOS, OceanOps, ICOS, and other complementary initiatives. Plans are underway to develop white papers explaining the system. Data sharing is managed via EuroGOOS ROOS data portals, which also incorporate quality procedures and links to CMEMS and EMODnet. Like SOCONET, FerryBox includes numerous sensors and does not fit neatly within the EOV framework. Mr. Martin Kramp, the Technical Coordinator, noted that Brittany Ferries operates such a system, which is currently unfunded. The vessel's captain will present later in the session.

2.6. GACS CPR Survey

Ms. Clare Ostle, Chair of the Global Alliance of Continuous Plankton Recorder Surveys (GACS), reported on the group's history and recent activities. She explained the data collection methodology, which has remained largely unchanged since 1958. All collected samples are archived in a biological library. The survey holds the Guinness World Record as the longest and most extensive marine biological survey. A map and associated statistics of the alliance's operations were shared, showing extensive coverage of the North Atlantic and the Southern Ocean near Australia. Several ongoing projects, meetings, and their organizers were listed. Training support has been provided for new participant groups in China. Potential links between CPR data and global policy frameworks were mentioned. Data are distributed to several regional portals based on funder requirements. Efforts are underway to group plankton into biologically significant categories to improve understanding, supported by a new online tool: the Plankton Lifeform Extraction Tool (PLET). Additional collected parameters include temperature and other sensors. The contributions of all GACS participants were acknowledged.

2.7. Plankton Planet

Mr. Colomban de Vargas, Research Director at CNRS Roscoff, introduced Plankton Planet, a citizen science initiative aiming to measure the surface ocean microbiome globally by 2030. The project involves the collection of standardised, tree-of-life scale plankton biodiversity data by "seatizens", using simple and cost-effective tools and protocols. The mission is to create a universal standard for tracking plankton biodiversity changes and developing ocean health indexes, supporting both scientific understanding and marine ecosystem management. Data types, open-access data flows, and the managing teams were presented. A map from the 2015–2016 proof-of-concept using 20 sailing boats was shown. Other missions, including those with the French Navy, are ongoing. A training workshop has been conducted. The next steps include scaling up internationally, conducting more workshops at marine research centres, and expanding to cargo ships with dedicated instrumentation. A question was raised regarding the integration of data flows into GOOS, SOT, and OceanSites.

2.8. RV Underway Data Project of DAM

Mr. Gauvain Wiemer, Head of the Core Area "Data Management and Digitalization" at the German Marine Research Alliance (DAM), presented a project focused on research vessel data. The goals include: utilizing German research ships as permanent measurement platforms, enhancing data management through digitalization and infrastructure, supporting quality control, and publishing FAIR and open data from permanently installed instruments (e.g. ADCP, CTD, bio-optical sensors, TSG, Multibeam Echosounder). A map of RV track lines from 2019 to 2025 was shown, along with a harmonized data flow diagram from observation to archiving, quality control, and analysis. The data will be deposited into PANGAEA, ready for FAIR and AI applications. An example map from the Marine Data

Portal illustrated multibeam echosounder data visualisation. A table listed the installed instruments and the responsible data stewards for both near-real-time and delayed-mode data. Mr. Wiemer expressed interest in strengthening collaboration with the GOOS Observations Coordination Group (OCG), SOT, and OceanOPS.

2.9. Global Ocean Surface Underway Data: GOSUD

Mr. Ludovic Drouineau, Data Manager at Ifremer, presented the history and work of the Global Ocean Surface Underway Data (GOSUD). Established in 2001 under the IODE/IOC framework, GOSUD is tasked with acquiring, quality controlling, standardising, and disseminating sea surface salinity data. A diagram illustrated data flow from platforms such as RVs, SOOP TSGs, FerryBox systems, and saildrones to the Coriolis database. Dissemination pathways include delayed-mode and real-time services, the ERDDAP server, and links to Copernicus and EMODnet Physics. The 12 steering group members were listed. GOSUD data support 10–15 publications per year and are used for satellite calibration and validation, ocean dynamics studies, biogeochemistry, environmental monitoring, and climate indicators. GOSUD contributes to ONERC/BACC for climate change monitoring. References and resources were shared. Mr. Drouineau highlighted the potential for strengthening ties with SOOP under GOOS.

2.10. Australian FishSOOP

Ms. Véronique Lago from the University of New South Wales presented the Australian FishSOOP initiative, which collects temperature profile data using fishing nets. Since launching in 2023, the programme has filled coastal data gaps around Australia. The project employs a circular data pathway, where data collection benefits both scientific forecasting and industry. The initiative has expanded to New Guinea and the Solomon Islands. A citizen science component helps build trust among fishers by ensuring anonymity regarding fishing locations. An example from New Zealand illustrated how fishing vessel data improved RMSD forecasts for heat content and temperature. A list of participating programmes and fishing vessel communities was shared.

2.11. SEAMAP Targeted Underway Bathymetry

Mr. Lars Rüpke presented the SEAMAP project focused on underway bathymetry. The project brings together principal investigators from various German institutions to optimize the use of underway research vessel data for mapping seamounts. These features are important for navigation safety, vertical mixing, and biodiversity. SEAMAP requested small adjustments to RV tracks, particularly during transits, to support seamount mapping during trial cruises. The successful 2024 trial resulted in funding for planned transits in 2025 and 2026, aiming to systematically chart over 60 uncharted seamounts and promptly share data with the international seamount research community.

2.12. SPC FishSOOP

Mr. Jerome Aucan, from the Pacific Community Center for Ocean Science, The Pacific Community (SPC), presented their initiative involving commercial fishing vessels as ships of opportunity. These vessels utilize their nets as platforms to collect temperature data. The Pacific Community is an intergovernmental organization comprising 22 members. Most small island developing states in this region lack dedicated scientific institutions. A temperature profile data map illustrated the scarcity of subsurface data in the region. In

collaboration with PIGOOS/SPC and IMOS/UNSW, they are expanding the FishSOOP program, which provides low-cost subsurface temperature profiling. Mr. Aucan explained the sensor specifications and the advantages of the system, and he shared deployment schedule statistics. While Argo floats are highly effective, they do not collect data in shallow continental shelf regions. Opening the exclusive economic zones (EEZs) of island nations increases potential coverage areas. Quality-controlled data becomes immediately available to the vessels. The program has partnered with SOT-VOS to conduct a PMO training workshop and is also working to expand the deployment of meteorological stations on fishing vessels.

2.13. Fishing Vessel Observing Network: FVON

Mr. Cooper Van Vranken, Co-Chair of the Fishing Vessel Observing Network (FVON), presented the group's work using a variety of fishing vessels, from factory trawlers to canoes, as platforms to collect salinity and temperature profile data. FVON has been recognized by GOOS as an emerging observing network. The group employs standardized quality control routines and has developed best practices for data collection. Mr. Van Vranken shared a map showing the vessels engaged by five related programs. To date, over 36,000 profiles have been collected. He also highlighted future opportunities, including testing of surface meteorological stations, FerryBox systems, and the potential integration of their data streams with the VOS network.

2.14. SAMOS

Mr. Shawn Smith, Chair of the Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative from Florida State University, United States, reported on activities carried out during the intersessional period. SAMOS aims to improve the quality of meteorological and near-surface oceanographic observations collected in situ on research vessels (R/Vs).

The initiative focuses on high-temporal-resolution (1-minute interval) meteorological and near-surface oceanographic data collected using scientific instrumentation systems permanently installed on individual R/Vs. SAMOS does not provide instrumentation to vessels, but instead leverages equipment already owned by the R/V operators. Between 15 May 2023 and 17 March 2025, the Marine Data Center at Florida State University processed approximately 17 million one-minute SAMOS data reports from 32 R/Vs operated by the United States, Australia, and New Zealand.

Given the absence of a unified global data management strategy for underway data from research vessels, SAMOS operates as a third-party data stewardship program. The initiative receives data from ships of opportunity, performs quality evaluation, provides feedback to operators, and serves the data to a broad user community. Data are released in a slightly delayed mode, with the first records typically available about one day after collection. Access to SAMOS data is free and open, with no restrictions on use or reuse. There is an opportunity for SAMOS to collaborate with VOS focal points and PMOs when R/Vs are recruited by national observing programmes.

Experts from the SAMOS team actively support GOOS through contributions to the SOT Task Team on Instrument Standards and Calibration (TT-ISSC) and the Task Team on Expansion of Independent-Class Observations (TT-EICO). The team also contributed to a best practice document on Shipboard Radiometers (Riihimaki et al., 2024), which was submitted to the IODE Ocean Best Practices System (OBPS). In addition, SAMOS participates in the development of controlled vocabularies for sea-going events,

instrumentation, and air-sea flux terminology, in collaboration with the UN Decade of Ocean Science for Sustainable Development initiative on Observing Air-Sea Interactions Strategy and the U.S. Rolling Deck to Repository (R2R) project.

2.15. Science RoCS

Mr. Shawn Smith, from Florida State University, also introduced the Science Research on Commercial Ships (Science RoCS) initiative. This ad hoc, multi-institutional group includes scientists, engineers, data managers, marine operations specialists, and administrative personnel. Their goal is to transform ocean science by equipping commercial ships with suites of "maritime-appropriate" scientific sensors.

These integrated observing systems, hosted on commercial vessels, are designed to advance interdisciplinary research in areas such as air-sea interactions, oceanographic and atmospheric dynamics, forecasting, and feedback processes involving ocean physics, biology, and chemistry. Mr. Smith presented current activities, including pilot programs on three commercial vessels. He displayed maps showing the operational routes of each vessel and outlined the range of instrumentation deployed on board.

2.16. Discussion

Mr. Martin Kramp emphasized the need for collaborative communication to prevent overwhelming commercial operators with redundant or uncoordinated outreach.

Mr. Darin Figurskey inquired whether German SOOP data is made available to forecasters and/or used in numerical models. Mr. Ludovic Drouineau responded that GOSUD receives the data via email, which is then transmitted to the GTS and Copernicus, where it contributes to model forecasting. Mr. Tobias Steinhoff added that while some data is sent immediately, the process depends on the data type. VOS data from these vessels is posted to the GTS via DWD.

Regarding GO-SHIP, it was noted that underway data collection includes the use of multi-beam shipboard ADCPs. A question was raised about the use of fisheries echosounders; while this presents a challenging trade-off, efforts are being made to integrate them aboard French vessels.

Ms. Rebecca Cowley asked Ms. Clare Ostle if CPR (Continuous Plankton Recorder) temperature data is available. Clare clarified that although the temperature sensors are not calibrated for absolute accuracy, the data is useful for detecting fronts and observing local relative changes. She added that temperature data can be requested directly if needed.

Mr. Kramp noted that several presenters expressed interest in becoming more involved with GOOS. In response, Mr. Mathieu Belbeoch explained that there is significant overlap between networks, presenting opportunities for synergies. He highlighted that successful observing networks require clear structure, governance, objectives, data strategies, and international coordination.

Ms. Emma Heslop elaborated on the benefits of joining GOOS and outlined the role of OCG, which includes coordination of best practices. She offered to share a link to the OCG network attributes. Emma remarked that the session demonstrated the emergence of new networks. She suggested that if ships serve as a unifying element, it may be worth establishing a task team (TT) to support better integration, a topic to raise at the upcoming

OCG meeting. Mr. Richard, attending online, supported the idea, emphasizing the importance of collaboration across groups.

Mr. Belbeoch proposed that SOT should initiate the formation of a TT and begin preliminary work before formally presenting it to OCG. Ms. Emma Heslop added that OCG could potentially assist in establishing such a task team. Ms. Joanna Post highlighted the IOC's dual role: coordinating with SOT and engaging in parallel outreach with the private sector.

Mr. Kramp clarified that surface drones are currently not part of SOT activities. However, unmanned surface vehicles (USVs) are emerging as a network and will be further discussed at the upcoming OCG meeting.

Mr. Colomban de Vargas asked about opportunities for biological observations under GOOS (bio-GOOS). Ms. Heslop noted that expert panels exist to coordinate bio-eco data flows and that platforms are increasingly integrating physical and biological data. Mr. Belbeoch pointed out that while bio variables are not currently mapped, existing physical networks are gradually incorporating biological components. Participation in GOOS can support and enhance these synergies.

In Summary, numerous networks and organized initiatives currently use, or are planning to use, ships of opportunity as platforms for data collection. During the session, these groups presented their organizational status to illustrate the wide range of efforts underway. It became clear that the number and diversity of activities exceed the capacity of the SOT panel and its sole technical coordinator to manage effectively. This highlights the need for improved coordination and potential structural support to bring these efforts under a more unified framework.

Recommendation 2.1 *SOT to consider whether any of these groups/activities should belong under the SOT umbrella.*

3. OCEAN OBSERVING UNDER UN UMBRELLA

3.1. Crowdsourced bathymetry: Experience from IHO

Mr. Sam Harper, of the International Hydrographic Organization (IHO), provided an update on bathymetry survey efforts, focusing on crowdsourced bathymetry. The IHO operates an opt-in policy for crowdsourced bathymetry, with 37 states currently having opted in. Efforts continue to expand the crowd, include depth as an Essential Ocean Variable (EOV), and maintain ongoing international representation to promote the project. A CSB Tools workshop was held in New Zealand in March 2025 to assist members in improving their capabilities for collecting and processing bathymetry data. The data collected are now accessible through the IHO bathymetry data portal.

3.2. Role / needs of IMO; 2024 IMO-WMO symposium on extreme weather

Mr. Osamu Marumoto, representing the International Maritime Organization (IMO), presented on IMO's roles, which include maritime safety, security, pollution prevention, and facilitation of maritime traffic. Shipping operations involving multiple countries are coordinated under the IMO using the SOLAS Convention. Weather warnings and forecasts are produced from ships at sea, with agreements under IMO conventions to collect meteorological information from vessels. Meteorological organizations provide these forecasts and warnings to ships. Several sections of SOLAS were highlighted to demonstrate the interaction between shipping and weather data collection. Additional

guidance documents relevant to the Ship Observations Team (SOT), such as the International Convention on Standards of Training for Seafarers, were also introduced. Recently, IMO and WMO have held two joint symposiums to encourage coordination between the two organizations; key outcomes are available on the IMO community webpage. It was noted that Automatic Identification System (AIS) signals have become congested in certain ocean areas, and new technology, such as the VHF Data Exchange System (VDES), is under investigation.

Mr. Hideki Noguchi, also from IMO, provided further information on the role of VDES within IMO. He introduced the new VHF data transfer system, which comprises four communication components to expand ship communication capacity. Unlike AIS, which only detects signals, VDES allows for data upload and operates faster due to its higher bandwidth.

3.3. EW4All, G3W: Leadership of the WMO

Mr. Nir Stav, Director of the Infrastructure Department at WMO, presented on the 'Early Warnings for All' (EW4All) initiative. This initiative aims to ensure that no one is left without weather warnings. Initial roll-out countries have been prioritized based on the hazards they are most likely to encounter. EW4All seeks to enhance global infrastructure and provide technical support to regional and national interventions. Using the Global Basic Observing Network (GBON) framework, members are obligated to share surface marine data within Exclusive Economic Zones (EEZs) at 500 km spatial resolution, on an hourly basis. To assist members in meeting this obligation, the Systematic Observations Financing Facility (SOFF) was established, with a focus on prioritizing Small Island States. Additionally, the Global Greenhouse Gas Watch (G3W) flagship project was introduced, which aims to establish a global system for monitoring greenhouse gas emissions.

3.4. The 2025 UNOC, and 20231-2030 UN Ocean Decade

Ms. Joanna Post provided a summary introducing the Essential Ocean Variables (EOVs). The GOOS 2030 Strategy envisions a truly global ocean observing system that delivers sustained observations for a broad range of applications. The strategy incorporates Ocean Best Practices, Ocean Decade Programmes, and efforts towards a Digital Ecosystem. Future development efforts include partnerships with the private sector, tracking human impacts via EOVs, and strengthening coordination through GOOS Regional Alliances. Focus areas of the GOOS steering committee were also presented.

3.5. Discussion

The discussion focused on engaging the shipping industry to fill existing data gaps, drawing parallels to the efforts of the ICAO organization in coordinating aircraft observations. Questions were raised as to why barometers and anemometers are considered non-essential instruments on vessels. It was noted that IMO sets minimum standards for navigation and communication but does not specify requirements for weather-related instruments. A possible mechanism for IMO to provide guidance to shipping companies on this matter was discussed, with responsibility resting on member countries to advocate for such recommendations to IMO — Australia was mentioned as a potential lead. It was also suggested that the Data Buoy Cooperation Panel (DBCP) has a Task Team on impact and that it may be timely for networks to establish a similar Task Team at the GOOS level.

Recommendation 3.6/1*: Australia to put a proposal to IMO to direct shipping companies to information on essential weather measuring equipment for making meteorological observations.*

4. EVOLVING PARTNERSHIPS WITH SHIPPING INDUSTRY

4.1. Introduction

The session opened with brief remarks from Ms. Joanna Post, who recalled the discussions that began at the WMO Symposium in London, where it was revealed that only 3% of commercial vessels participate in the VOS (Voluntary Observing Ship) network. This low percentage pointed to a vast opportunity to strengthen ocean observations by engaging more ships. She emphasized the need to scale both temporally and spatially, and handed over to Mr. Belbeoch for a more in-depth introduction.

Mr. Belbeoch presented a comprehensive vision for expanding ship-based ocean observations under the framework of the UN Decade of Ocean Science. He advocated for growing the observing network to 10,000 ships by 2030, highlighting the need to develop partnerships beyond academia, particularly with the shipping industry. He proposed creating a working group of private sector partners, supported by clear value propositions and simplified communication materials tailored for decision-makers. Mathieu stressed three key challenges: defining a collective ambition, coordinating more efficiently with shipping companies, and forming a structured alliance. He also emphasized the importance of a strategic shift from fragmented and scattered initiatives toward a standardized, top-down approach, supported by public-private cooperation. A side event at the UN Ocean Conference was proposed to build momentum and seal commitments. He concluded by urging the community to organize, innovate, and scale up, leveraging the private sector's infrastructure and motivation.

In the discussion that followed, the idea was raised of offering modular observation packages, and Mr. Belbeoch confirmed preliminary costing, suggesting a basic atmospheric system might cost around $10,000. Ms Isabella Glusauskaite asked about technical limitations; several PMOs replied that fleet management and maintenance would be a major challenge, with systems requiring multiple annual calibrations. It would require many PMOs or a new system approach. Others stressed that while initial costs matter, companies may invest due to regulatory pressure and the operational value of data. Participants supported starting small with pilot projects and emphasized the need for clear benefits and scalable solutions. Several others underlined the importance of simplifying both the technical setup and governance models while training personnel and engaging manufacturers. Discussions also touched on integrating sensors early in ship design and the potential for philanthropies to play a key role. Ms Justine Parks called for basic oceanographic measurements to be included from the start, noting the importance of multidisciplinary approaches while balancing complexity. Ms. Post and Mr. Belbeoch closed this segment by calling for practical steps toward a shared vision, emphasizing the potential of SOT to lead this transformation.

4.2. Partner presentation: Brittany Ferries

Mr. Erwann Gabriel, from Brittany Ferries, shared practical insights from his company’s engagement in ocean observation. He outlined how Brittany Ferries integrates monitoring systems on their vessels, emphasizing the operational realities and internal motivations that make their participation possible.

Participants expressed interest in how Brittany Ferries' approach could be replicated or expanded. Questions focused on logistics, equipment standards, and maintenance planning. Mr. Gabriel responded with examples and noted the value of early integration in shipbuilding and collaboration between technical and scientific partners.
Also, the measures of the company to comply with the CSRD (Corporate Sustainability Reporting Directive) were raised – The company implemented actions in terms of decarbonization, social responsibility.
Another question was regarding the return of investment for the observation infrastructure provided by the company. Mr. Gabriel emphasized that in this respect it has to be made sure that observations are used in the models, routing software etc.

The session concluded with acknowledgment of the momentum and collective support among participants to further develop and implement the ideas presented.

4.3. Partner presentation: Kongsberg

Mr. Peer Fietzek from Kongsberg Discovery presented on opportunities for strengthening the VOS scheme through greater private sector involvement. He emphasized the need for improved coordination across the ocean observing community and questioned how the private sector fits in as collaborators or service providers. Kongsberg, a Norwegian state-majority-owned technology company, supports maritime innovation, but Mr. Fietzek noted that despite the growing $2.6 trillion global ocean economy ("Blue Economy"), ocean observation remains under-recognized economically.

He introduced the concept of the "Ocean Enterprise" initiative, which aims on developing and maturing market components for ocean observations. It includes public, private, and academic actors in the ocean observing value chain. This sector, however, remains underdeveloped, with small sensor companies and limited market maturity. A roadmap supported by MTS, NOAA, and GOOS proposes elevating ocean observation into a recognized market with clear contributions to global GDP. Peer highlighted the U.S. Ocean Enterprise Initiative, which has received $3.9 million in direct funding and over $50 million in accelerators, as a model to replicate globally.

During the discussion, Ms. Heslop stressed the importance of linking ship-collected data to operational tools like routing software and port decision-making. She asked which platforms are commonly used in the industry and suggested partnerships to ensure data utility. Mr. Gabriel responded that his company uses tools like Windy and WindBlow, along with human forecasting support from sailing race experts. He emphasized the need for skillful interpretation of model data and described how ship digitalization now integrates navigation with energy management.

Mr. Cabrie proposed a centralized data node for real-time sharing between ships and land-based operators. Mr. Gabriel welcomed the idea, noting its value for situational awareness. Ms. Joanna Post closed the session, highlighting the strong interest in collaboration and the need to continue building cross-sector partnerships.

4.4. Partner presentation: OceansX

Mr van de Kraats presented the "Xploration seafarers & scientists" initiative which is about Building communities for ocean observations based on: "Pilots and initiatives", "Collective missions", "Common Value". OceansX enables project with the aim to "Converting potential value into revolving funds and return on investment". The company delivers conceptual approaches, clarification of roles and responsibilities in project planning.

Action 4.1/1 *Structure the private engagement within SOT by establishing a "Corporate SOT group" for contacts with the shipping industry.*
***Action* 4.1/2** Expand the "VOS third party TT" into "SOT third party TT" to be more inclusive regarding other networks.

5. PARTNER PROGRAMS

5.1. Other GOOS networks which require assistance from ships

Mr. Martin Kramp moderated the session on other networks that require assistance from ships. Presentations were given by representatives from various fields, ranging from research vessel operators to skippers of ocean racing yachts.

5.2. The EU-AMRIT Project

Mr. Laurent Mortier presented the EU-AMRIT project, focusing on how marine research infrastructure can better support sustained ocean observing. Over the past 2 decades a huge amount of investment has been put into research infrastructure. Now in the last 2-3 years the European Commission has invested in putting real integration across all these research infrastructures. The project aims to build a Technical Support centre which is a federation of existing and new systems supported by many IT developers across 30+ organisations who were previously working in silos.
Next stages will be an EOOS Control & Command Support centre to provide a single point of entry for all operators.

5.3. IRSO, ERVO and Eurofleets: Role and organization of research vessels

Mr. Giuseppe Magnifico, Director of the Office for Research Infrastructure at the National Research Council of Italy, presented ongoing initiatives by research vessel managers to better support marine scientific research efforts at sea. These initiatives include three specific programs: the International Research Ship Operators (IRSO), the European Research Vessel Operators (ERVO), and the new pan-European program EuroFleets. IRSO is an open group that includes approximately 100 of the world's leading marine scientific research vessels from 32 countries. The group meets annually to coordinate activities; the 35th Annual IRSO meeting was recently held in Vancouver, Canada, in September 2024. The next session is scheduled for Bergen, Norway, in September 2025, hosted by the Institute of Marine Research (IMR).Similarly, ERVO is a forum that meets annually to share experiences of common interest and explore cooperation opportunities. The 27th ERVO session will be held at the Faroe Marine Research Institute in the Faroe Islands. EuroFleets is a new research infrastructure, formally established in March 2025, consisting of 99 vessels operated by 62 operators from 23 countries. Its aim is to facilitate access to multipurpose marine infrastructure for a wide user community, enabling research, increasing cooperation in technical development, and sharing knowledge in research vessel operations and management. A general meeting will be held at the United Nations Ocean Conference aboard the RV Thalassa to formalize the enlargement of EuroFleets, inviting all European fleet operators wishing to join.

The discussion following the presentation focused on ensuring that all research vessels are equipped with suitable weather stations and contribute observations to the Voluntary Observing Ships (VOS) program.

5.4. The IOC-IMOCA and recent Vendée Globe Race partnership

Ms. Clare Vayer, Sustainability Manager for the IMOCA Class and in charge of the science coordination program, presented on IMOCA's activities and the Vendée Globe race. IMOCA is committed to scientific observations and frequently races in data-sparse areas, hosting two major races per year plus a championship race every four years. They have had a strong collaboration with IOC/UNESCO and OceanOPS since 2015 (COP21). Ms. Vayer showed a short video portraying ocean racers as citizen science heroes.

IMOCA Class rules now include an incentive to encourage participation in deploying instruments (buoys or floats) and carrying underway systems. Media coverage around the race provides a great opportunity to promote Ship Observations Team (SOT) programs. Commitment to science has been growing since 2020, with now 50% of the fleet participating in ocean science efforts, five scientific partners, three educational programs reaching 10,000 children, and 80 platforms deployed.

The Vendée Globe race saw a record-breaking commitment, with 25 out of 40 boats participating in scientific data collection. For the next cycle, they plan for 100% of the fleet to carry scientific instruments onboard during the two round-the-world races.

Mr. Boris Hermann also presented a short recording about the scientific work conducted on his boat, Malizia, during the Vendée Globe race.

5.5. Operational challenges with underway Data from sailing yachts

Mr. Stefan Raimund from The Ocean Race discussed the challenges of collecting underway data from sailing yachts. He reviewed the long history of sailing and science, presenting a timeline of advancements over the past 20 years, leading up to recent developments such as the compact FerryBox, Ocean Pack.

Key technical challenges include power consumption, weight and size constraints, mechanical stress, user-friendliness, and access to clean water supply. Logistical challenges include obtaining research permits, data handling, import/export regulations, shipment of samples and instruments, and training of the crew.

5.6. Innovative ship, innovative instrumentation with Monaco Explorations: MODX70 and SailBox

Mr. Stephen Deschner introduced the SailBox, a development funded by the Helmholtz Association (GEOMAR, AWI, Hereon). This cost-efficient, pumped, multiparameter underway system is designed for use on smaller vessels such as sailing boats. It is a compact, modular system capable of sampling several Essential Ocean Variables (EOVs) via a single flow chamber and is compatible with a variety of sensors.

The SailBox has undergone extensive testing, including numerical investigations, laboratory, and field testing to verify its functionality. It is now ready for technology transfer to an industry partner for manufacturing.

Mr. Orens Pasqueron de Fommervault then presented Monaco Explorations' recent project, 'Mediterranean Missions'. The project aims to conduct two missions per year in the Mediterranean (2024–2030) using a vessel equipped with a pocket FerryBox and SailBox. The vessel will be a MODX 70, an environmentally friendly sailboat powered 100% by

renewable energy sources, including inflatable wings, electric motors, wind turbines, and solar panels.

5.7. Research Vessel + Ocean Racer = Research Racer: About Team Malizia

Mr. Boris Hermann, Skipper of Malizia, presented a short recording about the scientific work conducted by his team, with particular focus on a new research sailing vessel (Malizia Explorer) operated by Malizia in addition to the IMOCA racing yacht. He highlighted the unique opportunity to contribute to science in areas where traditional scientific platforms are unavailable or too costly.

6. TURBOWIN

6.1. Report from Turbowin Partnerboard Chairperson

Mr. Jean-Baptiste Cohuet, Chair of the TurboWin Partner Board, presented the report. TurboWin is an open-source program developed and maintained by KNMI for 20 years. It enables the creation of weather reports onboard by entering measured and observed weather parameters, which are then sent to a National Meteorological Service (NMS). The system can connect to various digital sensors or automatic weather stations (EUCAWS/AMOS2X) to display current measured values or enhance automatic data with additional eye observations.

According to metadata entries on ocean-ops.org, TurboWin(+) is the number one observation system, through which more than half of the 5.4 million observations received annually from the world's oceans are obtained whether as the primary or secondary system in conjunction with an AWS.

Since the last SOT-12 meeting, two new TurboWin+ versions (4.5 and 4.6) have been released (https://gitlab.com/KNMI-OSS/turbowin/turbowin). The partner board uses GitLab for evolution or correction requests and technical maintenance tasks, deciding which content to develop. KNMI prepares a release candidate, which is tested by partner board members before official release.

6.2. Developing a way forward for collecting data from VOS post June 2026

Ms. Jacqueline Sugier, EUMETNET Observations Capability Area Manager, explained that TurboWin+ will be discontinued by KNMI at the end of June 2026, as the software approaches its end-of-life. A complete replacement and rethinking of how these vital data will be securely accessed for the next 15–20 years is required.

This poses a significant challenge for the Voluntary Observing Ships (VOS) program, as TurboWin+ is the primary tool for obtaining visual meteorological information from the sea.

In autumn 2023, EUMETNET invited all stakeholders to join the Next Generation TurboWin Task Team (NGTW TT), an international community developing a strategy for the replacement system. The task team is seeking more stakeholders; interested parties are encouraged to contact Mr. Sugier.

EUMETNET is funding a market review to gather information from private companies regarding their approaches to replacing TurboWin+.

The Deutscher Wetterdienst (DWD) has offered to maintain TurboWin+ from June 2026 for the next 2–3 years, providing security patches, bug fixes, and minimal community support. No new features will be developed unless another organization contributes. Other organizations are encouraged to participate and may contact DWD to discuss further. KNMI supports the transition to DWD and has offered assistance during the handover.

6.3. Report on the market analysis for developing a system to replace Turbowin

Ms. Louisa Bloomer, Digital Technology Director for Asia Pacific at Stantec, presented the market analysis. Stantec was assigned by EUMETNET to investigate the commercial market and engage with various vendors to identify available replacement solutions for the new TurboWin - Next Generation Task Team (NGTT).

The presentation covered:

- Project overview
- Market trends and developments
- Must-have, should-have, and could-have capabilities
- Vendor findings
- Market analysis
- Risk considerations
- Next steps

The final report is expected in April 2025.

6.4. Discussion

The discussion brought forth many new ideas regarding new sensors that could be connected to a future TurboWin version, including sensors for waves and clouds. TurboWin is still mainly used for manual weather report creation, with an intention to ensure that all partners, including those with limited financial resources, can create and share reports. It was emphasized that innovative ideas and routine operations should be kept separate.

7. OCEANOPS

7.1. Report from Technical Coordinator

The OceanOPS Technical Coordinator (TC) for the SOT, Martin Kramp, presented status maps and performance indicators for individual SOT networks (VOS, SOOP, ASAP) and integrated SOT. He showed where these OceanOPS products and tools like maps or KPIs are available on the website and on which targets they are built on, showcasing near surface air pressure in global numerical weather prediction over the global ocean (OSCAR requirement #251), collected by SOT-VOS, and then integrating all GOOS platforms which collect air pressure, including drifters and moored buoys in an EOC/ECV approach.

He stressed that more than half of the almost 4000 SOT platforms which are not closed in the database have not provided data over the last 30 days, and that for more than 37% of these not-closed platforms the available metadata are too generic and must be reviewed/increased by the operators. Operators were also encouraged to finalize the migration to SOT-IDs as soon as possible.

The meeting noted that half of the non-closed VOS stations are presently from the US program (The broader analysis of global coverage etc was covered by the report of the corresponding network chair). With reference to the recoding of the SOT metadata webinar, Mr Kramp showed how metadata for stations/platforms and hosting ships can be submitted to OceanOPS through the web-editor or upload-tool for csv files, and how the WMO-OSCAR system is then populated by OceanOPS, following the OCG cross-network implementation strategy published in 2024.

The meeting noted that almost all GOOS networks require at some stage assistance from ships for deployment, recovery or maintenance, and that OceanOPS has tools in place to identify and exploit corresponding synergies across all networks. The meeting appreciated success with the sailing community, in particular in undersampled high latitudes.

The meeting agreed to discuss a strategy for the hosting of SOT and component network websites, with corresponding budget allocated by SOT. OceanOPS presently hosts these sites but has no resources (anymore) to properly maintain them.

With reference to the presentation of OceanOPS manager Mathieu Belbeoch, the meeting noted the progress made with the establishment of Service Level Agreements (SLA) for SOT networks. The meeting noted that OceanOPS is spearheading a UNOC initiative which focuses on the establishment of a fleet of 10000 GOOS-supporting ships equipped with instruments (and supply chain) funded by industry partners. More information are available from the website www.10000ships.org .

Mr Kramp thanked the SOT and OceanOPS Team for ongoing support.

The following actions were recommended:

- Meeting to decide on structure for (new?) Task Team meta/data, with focus on regular ref table updates (4 April 2025)
- KPI TT to review OceanOPS products with TC (Dec 2025)
- Meeting to decide if SOT static website should be outsourced from OceanOPS; if not, provide funding for maintenance (4 April 2025)
- OceanOPS to foster Sailing4Science Initiatives in remote areas (ong.)
- All Operators to set up new stations with SOT IDs, and to migrate existing stations where possible to SOT-IDs (ongoing)
- All Operators to provide all mandatory and as much as possible also optional station metadata to OceanOPS, m2m where possible
- TT Chairs to provide updated ToRs and member lists to OceanOPS (30 April 2025) and OceanOPS to update User Groups (31 May 2025)
- VOS/SOT to review challenges with UNCLOS, given eg G3W and IHO requirements, and advanced technology for 2way EEZ monitoring
  (SOT-Committee, Dec 2025)
- Operators to exploit OceanOPS computed Status Reports to identify gaps and make updates (metadata, contacts, etc)
- SOT-EB to work with IRSO, to recruit full int RV fleet for SOT (ongoing)
- Populate OceanOPS system with cruise information where possible (SOT members, through NFPs and Operators, ongoing)
- TT xxx to investigate if modern transportation industry has unexploited synergies, eg with sensors on containers (xxx, SOT14)
- SOT-EB to investigate how recently reduced TC support/SLA could be increased to former level (SOT14)
- Increase CD activities with the DBCP (RPT TT, SOT14)
- OceanOPS to continue highlevel discussion with shipping industry, and UNOC activities to foster industry engagement with SOT

- OceanOPS to extend data tracking to WIS and Coriolis if SLA permits

8. FOURTEENTH SESSION OF THE VOS PANEL (VOSP-14)

8.1. Report by the VOSP Chairperson

The VOS Panel (VOSP) chairperson Mr. Joel Cabrie reported on the activities of the Voluntary Observing Ship (VOS) Scheme, a network within the Ship Observations Team (SOT), during the last intersessional period.

VOS Panel - Terms of References

During SOT-13 VOS Breakout session the ToRs of the VOSP were reviewed and updated.

The Voluntary Observing Ship (VOS) Panel shall:

a) Review, recommend and coordinate the implementation of new and improved specialized shipboard meteorological instrumentation, siting and observing practices, as well as of associated software;
b) Support the development and maintenance of new pilot projects;
c) Oversee and encourage members to upgrade their VOS to report according to standards meeting climate user requirements, including reporting the required climate and ship parameters in both real time (GTS) and in delayed mode (via VOS GDAC);
d) Develop and implement activities to optimize ship inspections and recruitment, including promotional material;
e) Prepare annually a report on the status of VOS operations, data availability and data quality.

Activities of chairperson during intersessional period

- Regular SOT Tele-Conferences (Executive Board, Executive Committee, various Task Teams,...) as well as OCG roundtables were attended.
- Represented VOS at the Observations Coordination Group (OCG-15) meeting in Victoria, Canada from 13th – 17th May 2024.
- Planning and delivery of the 7th Port Meteorological Officers (PMO-7) regional workshop hosted by Pacific Community (SPC) in Nadi, Fiji on 31st Oct – 2nd Nov 2024.
- Liaising with the Directorate General of Shipping (DGS India) to resolve the Iridium ban issue in Indian waters. Resolution reached for VOS ships on 4th March 2024.
- Planning and delivery of the Cross Network (SOT/DBCP) Data Quality Webinar which was run on 18th March 2025.
- The chairperson attended SOT-13 in person.

Performance of Global VOS network in 2024

VOS fleet

- 2944 stations provided real-time observations to the GTS in 2024
  - increase ~2% compared to 2022
- ~26 % of the VOS fleet is automated. Stable since SOT-12

VOS real-time data (GTS, TAC or TDC)

- Total observations on the GTS in 2024 was ~5.6 million (including duplicates and unknown stations)
- Legitimate observations with supporting metadata reported and duplicates filtered:

- 4,521,043 VOS observations on the GTS in 2024 (Source: OceanOPS)
- 4,363,794 VOS observations on the GTS in 2024 (Sourtce: E-Surfmar Observation counter)
- Approx. 375,000 per month from ~1700 vessels
- 68% of active ships reporting at least 20 observations per month

VOS delayed mode data (IMMT)

- only 11 VOS programmes provided delayed mode data to the VOS GDACs in 2022
  - Decreased by 2 compared to 2022
- 3,428,126 IMMT observations were provided (nearly 76% of the 2024 VOS data!) to the VOS GDACs
  - Increased from only 32% in 2022

PMO network status

- 74 Port Meteorological Officers and Offices, providing service in 22 countries / territories, are listed in OceanOPS
  - Increased from 60 PMOs (15 countries) in 2022

8.2. E-SURFMAR Expert Team on VOS status report

E-Surfmar is the marine observation programme of Eumetnet, coordinating marine observation activities for VOS and buoys in Europe for 18 Countries. In 2024 E-Surfmar started a new phase (2024-2028).

The participating members are: Croatia, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Despite strong observation needs, the E-Surfmar budget has been reduced by 5% compared with the previous phase. This has resulted in a reduction in financial support for OceanOPS, and a reduction in financial compensation to our members for observations. As a reminder, this reduction has been applied to all Eumetnet programs.

E-Surfmar VOS status

Currently E-SurfMar members operate 676 AWS and 620 manual VOS platforms operational. This network consists of several types of stations such as AMOS, Mercury, BATOS, Turbowin+AUTO, EUCAWS, MiniEucaws stations.

EUCAWS Automatic Weather Stations

E-Surfmar works since 2009 on a common Automatic Weather Station (AWS). Following a European tender, the EUCAWS system is now available on the market, sold by Sterela, a French company, and is deployed in Europe since 2017. The current network consists of about 215 stations installed by several E-Surfmar members but also Indonesia & Australia. In 2024 20 new EUCAWS stations have been installed.

Research & Development: Mini-Eucaws

Our action launched in 2021 to develop a light AWS station is finished. The solution called Mini-Eucaws proposed by Sterela as WS200 is an Iridium data-logger. After a validation phase, solution was validated mid 2022 and now it’s operational. The Mini Eucaws is sold approximately 1500€ and almost 2000€ with the digital extension module. Integration has to be done by the users. To encourage members an adoption program was done in the

current phase. Currently 8 stations are installed and operational. The manufacturer Sterela is working on a integration of MiniEucaws. This will simplify installation. We encourage our European partners to implement this solution on their vessels. Currently Germany, Netherlands, Norway and France installed this type of stations.

Turbowin

Turbowin software is used by many ships recruited by Esurfmar members and other Met Services. Esurfmar program is strongly involved in Turbowin software development and in the coordination of its evolution through the Turbowin partnerboard. Indeed, E-Surfmar brings a financial support to KNMI for the software developpement.

The visual observation software Turbowin+ version 4.6 for Linux and Windows has been released by March 2025 and is now available. The Turbowin Partner board is working on new release for 2026.

Turbowin software developed and maintained at KNMI by a single developer. This person will retire in 2026. Unfortunately, the software will no longer be maintainable from mid-2026. At the same time, it is necessary to reevaluate the functional requirements we want to fulfill with this application. In 2022, Several meetings have been organized with the main actors and users of this program (METOFFICE/DWD/KNMI/Météo-France/BOM/NOAA/SOT/OCEANOPS). The goal is to find consequent financing allowing to have a new Turbowin operational in coming years. This is a financial and coordination challenge. In parallel, the consulting firm Stantec was chosen and financed by Eumetnet to conduct a study to identify companies capable of developing this new solution. The results of this study will be available in April 2025.

In addition to this, two other initiatives led by E-SurfMar VOS experts members: the review of Turbowin code by the DWD as part of the potential takeover of Turbowin maintenance after mid-2026 and Météo-France's reflection on the future of the Obs2Server application.

Data Management

E-Surfmar has brought most of its services back into service, following the problem with the E-SurfMar server, which was unavailable for 6 months in 2024. The service was reopened to members in mid-October. This includes our QC-Tools, Supervion Portal, VOS interface configuration and monthly reports. Only the mapping tool has not yet been re-established. It should be noted that all processing has been completed, and no data has been lost. We are up to date.

In parallel, a new marine architecture has been implemented at Météo-France to streamline processing chains, in particular all the dataflows collected for Esurfmar members (Eucaws, #101 messages, drifters). This includes:

- A unique architecture for processing all marine data flows
- A single BUFR encoder to feed the GTS,
- An easier maintenance of processing chains, and better flexibility
- use of OceanOPS metadata for all VOS data streams

This rationalization improves the sustainability of our E-SurfMar processing chains. In addition, E-Surfmar provides a detailed monthly report on the operational status of each member country's fleet.

Finally we can also point out the addition to QC-Tools and Supervision Portal of the third party ship from Maersk fleet. This highlights E-Surfmar's ability to be agile today and feet to the needs of our members and stakeholders.

Compensations

It should be noted that the financial compensation scheme has evolved for VOS. Previously, E-Surfmar compensated each offshore observation as well as the cost of sending the observation. For reasons of clarity, since 2024 this scheme has only financially compensated observations.

8.3. Report from VOS GDAC

Mr. Callum Stone, representing the UK VOS-GDAC, provided an overview of the activities of the VOS Global Data Assembly Centres (VOS-GDAC). He outlined the background of the VOS-GDACs within the framework of the IOC/WMO Marine Climate Data System (MCDS), detailing the MCDS structure, the purpose of the VOS-GDACs, and the benefits derived from their work. Mr. Stone presented updates on key activities:

- Data processed by the VOS-GDACs in 2024, as reported in the VOS-GDAC annual report, including the total number of observations, a breakdown of observation types, and the number of contributing members (noting that only 11 of the 27 registered countries contributed).
- Software utilized by the GDACs, including progress on the modernization process and plans for future updates and releases.

8.4. US VOS report

The US VOS reported over two million observations, reflecting a significant increase in recent years.

8.5. Discussion

Access to VOS-GDACs

Action 8.1/1: All VOS operators to review and update their VOS metadata in the OceanOps metadata database (VOS operators, July 2025)

Action 8.1/2: All VOS operators are requested to provide quarterly delayed mode data to the VOS GDACs in IMMT format (VOS operators, quarterly)

Action 8.1/3: All VOS operators to encourage visual observations from participating vessels where possible (VOS operators, ongoing)

Action 8.1/4: VOS operators to encourage a target of one observation per watch (every 4 hours) from manual observing ships (VOS operators, ongoing)

Action 8.2/1-E-Surfmar encourages SOT members to consider the importance of visual observations made with Turbowin+ software for our end-users. E-Surfmar recommends that a financial commitment be made to ensure the sustainability of this tool beyond mid-2026. (VOS operators, 2026)

Action 8.2/2-E-Surfmar encourages all its members to join the Mini-Eucaws adoption program. (VOS operators, ongoing)

Action 8.2/3-E-Surfmar recommends QC-TOOLS for VOS fleet management. (VOS operators, ongoing)

Action 8.2/4- E-Surfmar to continue to support OceanOPS for Metadata management. E-Surfmar, ongoing)

Action 8.3/1: Members are encouraged to submit ship observation data to the GDACs. Members are also encouraged to provide feedback and user requirements for an updated or replaced format for the IMMT code. (VOS operators, ongoing)

9. SEVENTEENTH SESSION OF THE SOOP IMPLEMENTATION PANEL (SOOPIP-17)

9.1. Report from the SOOPIP Chairperson

Ms. Justine Parks, Co-Chair of the Ship Of Opportunity Programme Implementation Panel (SOOPIP) from Scripps Institution of Oceanography, provided a detailed overview of SOOPIP's history and its integration into the Ship Observations Team (SOT). She explained that SOOPIP functions as a comprehensive network for all ocean measurements collected via ships of opportunity, but its broad scope is unsustainable due to the diversity of supported activities. Ms. Parks presented statistics and maps illustrating Expendable Bathythermograph (XBT) data collection, noting significant discrepancies between transmitted data and data available at OceanOPS, with substantial data and metadata still missing. She emphasized that SOOP operational groups must collaborate with OceanOPS to identify and address the sources of these discrepancies.

Ms. Parks highlighted that the SOT panel's website, along with those of its networks, is outdated, static, and contains broken or irrelevant links identified through Google searches. She recommended that SOT fund and manage new domain registration fees to support updated websites, which could be developed and maintained by the networks. She further suggested that outdated websites be removed or redirected to the new ones. Ms. Parks underscored the ongoing importance of XBT data for: studies and monitoring of surface current variability, Meridional Heat Transport and Meridional Overturning Circulation assessments, contributions to upper ocean heat content studies, inputs for climate and weather forecast models, ocean dynamic research, determination of boundary regions in ocean currents, and long-term marine environment monitoring using over 50 years of observations. She noted that, unlike alternative methods such as Argo floats, XBTs provide critical repeated boundary current data, and their economical and sustainable operational model should be preserved.

Ms. Parks identified several challenges facing the network: loss of funding and key personnel from NOAA, insufficient support from SOT, WMO, and IOC for industry engagement and ship recruitment, and reluctance from some shipping companies to participate without letters of indemnity. She discussed the potential renaming of SOOPIP to the XBT Network to clarify its focus on this essential ocean variable and method, addressing confusion with other SOOP networks. Additionally, Ms. Parks noted ambiguity in the SOT panel's purpose and membership, urging SOT to unify its representation of network members and define which networks should be included to maximize synergies. She highlighted the need for harmonized, high-level communications with partners on behalf of the entire SOT panel, not solely the Voluntary Observing Ship (VOS) program.

Achievements included: co-organizing and presenting at the joint IQuOD/GTSPP/GOSUD/SOOP/XBT Science meeting in Bologna, Italy, in October 2024; obtaining GOOS endorsement for "Vessel Recruiting Best Practices v2"; and completing

the SOT-12 Actions and Recommendations, except for an IOC letter for ship riders, which IOC was unable to provide. Ms. Parks proposed securing a letter of support from IMO, WMO, and IOC to present to industry partners.

9.2. Report from 2024 joint GOSUD/GTSPP/IQUOD/SOOP meeting

Ms. Simona Simoncelli, a member of the steering team from INGV Italy, reported on the joint GOSUD/GTSPP/IQUOD/SOOP meeting held in October 2024. The meeting aimed to unite scientists from diverse communities, providing an interactive framework to discuss challenges and explore opportunities for future collaborations and synergies. Ms. Simoncelli outlined challenges faced by each participating network, identifying common issues: an immediate 35% cut to the US XBT program, shortages of personnel, and limited access to data products. She highlighted future priorities, including sharing software and procedures, enhancing data management, advancing data rescue efforts, distributing benchmark datasets for reanalysis and validation, and establishing a working group to better understand interconnections among the groups.

9.3. XBT Data flow and transmission

Mr. Joaquin Triananes from NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) outlined the purpose of the SOOP XBT program, which supports both scientific and operational efforts. He noted that the network, operational for over 60 years, continues to evolve to integrate measurements into observation systems using a low-bandwidth interface tailored to stakeholders' specific needs. Mr. Triananes described the process from data collection (encompassing XBTs, XCTDs, and AXBTs) to report generation, real-time dashboard displays with metrics and key performance indicators, transmission to the Global Telecommunication System (GTS), and storage in AOML databases. Achievements included: operating 11 transects, deploying over 6,000 XBTs annually in low-density mode, achieving over 90% automated quality control with real-time transmission via Iridium, and submitting approximately 95% of data to GTS after delayed-mode quality control.

9.4. Field Personnel Solutions

Mr. Avery Snyder from Ocean Tech Connection (OTC) discussed the company's role in providing ocean instrumentation, field support, services, and development for research operations. He emphasized the benefits for stakeholders with insufficient resources to meet all staff needs in-house.

9.5. Discussion

Mr. Shawn Smith from Science ROCS (WHOI) highlighted their strong relationship with the shipping industry, focusing on deploying oceanographic equipment. Mr. Alejandro de la Maza from CCES (Chilean Navy) noted their operations crossing the South Pacific. Ms. Emma Heslop suggested that the Observing Coordination Group (OCG) could assist in securing letter support from both IOC and IMO. Mr. Zachary Barton emphasized that XBTs are low-impact, making them appealing to ship captains, but letters of indemnity remain a significant obstacle. He added that captains prefer a single point of contact and feel that SOT prioritizes the VOS program, often overlooking their needs.

Action 9.3/1: *Accelerate transition to standardized netCDF (template) and interoperable services (ERDDAP/TDS) – XBT data management team, before next SOT*

Action 9.3/2: *Minimise manual processing by implementing automate robust pipelines for data processing and early error/issue detection – XBT data management team, before next SOT*

Action 9.3/3: *Implement a unified AQC framework (e.g. via Github) – XBT data management team, before next SOT*

Action 9.3/4: *Advance in design and implementation of unified, quality-controlled database for global XBTs. – XBT data management team, before next SOT*

Recommendation 9.1/1*: Draft letter of support for SOT activities from IMO, WMO and IOC to industry partners.*

Recommendation 9.1/2*: SOT engagement with industry partners, particularly at high levels (executive) to enlist participation spanning from basic cooperation to "moonshot" financial support, and to use language to be more inclusive of all SOT networks.*

10. SECOND SESSION OF THE ASAP PANEL (ASAP-2)

10.1. Report by the ASAP Chairperson

The number of ships performing upper air soundings is up to 25 worldwide. Around 2/3 of these ships provide regular soundings year-round. Global ASAP activities are characterized by two groups of ships, European E-ASAP fleet and Individual ships.

E-ASAP fleet (mainly merchant ships):
12 out of 16 ships of the European E-ASAP fleet are merchant ships in regular service between North America and Europe. The remaining four ships are governmental ships (two German research vessels, one Norwegian research vessel, and one Spanish hospital ship).

The total number of E-ASAP soundings on the GTS was 2808 in 2024 (plus 1571 descent profiles from falling radiosondes). Taking into account the total number of launches on board versus the received soundings on the GTS, the average output (GTS/Launches) was 86%. Main reasons for failed launches are:

- technical problems of the equipment,
- unfavourable wind conditions at 15-20 knots sailing speed,
- inexperienced operators, and
- poor satellite communication.

Individual ships (mainly research ships):
The German research vessel Polarstern provided 313 soundings (plus 307 descents) mainly from the Arctic and Antartic. The three Japanese research vessels transmitted 441 soundings to the GTS (West Pacific around Philippine Sea). Further 625 soundings were received from the Research Vessels Araon (South Korea), Oden (Sweden), and Investigator (Australia). The expedition cruise ships Viking Polaris and Viking Octantis provided 60 soundings.

In total, 3762 soundings were received in 2024 globally from all ASAP stations. The distribution is as follows:

- 75% E-ASAP (year-round, mainly North Atlantic),
- 8% RV POLARSTERN (year-round, mainly Arctic and Antarctic),
- 17% Six other research vessels and two cruise ships (specific expeditions).

10.2. Data issues and developments

ASAP data are transmitted in BUFR format. Soundings from the European E-ASAP fleet are semi-HiRes data with levels of 10-20 sec (plus standard and significant levels). Several stations provide ascent and descent profiles (thus doubling the number of profiles). Data in Traditional ASCII Code (TEMP messages) are not monitored any more.

10.3. Review and approval of ASAP Terms of Reference

The Terms of Reference (as decided by SOT 9) remain unchanged:

The Task Team shall :

1. Coordinate the overall implementation of the ASAP, including recommending routes and monitoring the overall performance of the programme, both operationally and in respect of the quality of the ASAP system data processing;
2. As may be required by some members, arrange for and use funds and contributions in kind needed for the procurement, implementation and operation of ASAP systems and for the promotion and expansion of the programme;
3. Coordinate the exchange of technical information on relevant meteorological equipment and expendables, development, functionality, reliability and accuracy, and survey new developments in instrumentation technology and recommended practices;
4. Review all relevant JCOMM Publications to make sure they are kept up to date and comply with Quality Management terminology;
5. Prepare annually a report on the status of ASAP operations, data availability and data quality.

10.4. Discussion

Questions were asked about whether the balloon launching equipment was commercially available for other national programs to consider implementing an ASAP program. Whilst the balloon launcher is not available to purchase, the drawings can be made available and they are quite simple to fabricate.

The representative from Chile expressed interest in performing upper air soundings from the tall ship, Esmeralda, on voyages between Valparaiso and Easter Island.

Other questions were raised about the viability of using drones from ships for upper-air soundings. The chair expressed concerns with operating such drones as the likelihood of losing the equipment when operating from a moving ship in high winds would be quite high and not worth the financial risk. Also, the drones are unable to sample to the same height as the current balloon program (i.e. 10,000m).

Other technologies discussed included recent developments with reuseable radiosondes with products such as Windsond. Whilst this is of interest, it would probably not be launched from a ship and wouldn’t be classified as an ASAP platform. The onboard generation of hydrogen was also mentioned but was deemed unlikely to be approved for use on board a commercial vessel due to safety concerns.

Recommendation 10.1/1: WMO members are encouraged to participate in global ASAP observations by installing and operating ASAP stations on board ships.

11. STRATEGIC DIRECTION FROM SECRETARIAT (WMO/IOC)

11.1. OCG

Mr. David Legler, OCG Chair, presented a recap of OCG activities since the previous session (OCG-15) highlighting that the OCG continues its central role in developing an efficient, coordinated ocean observing system. Some recent achievements, important initiatives and actions included:

- The advancement of the OCG Data Implementation Plan and its implementation within the networks.
- Endorsement of 3 new emerging networks (FVON, SOCONET and SMART Cables) with the USV network to be considered during the next session.
- Transition of OceanOPS IT to Ifremer and completion of the restructuring
- Finalized OceanOPS SLAs and letters of agreement
- Encouraging networks to get more best practices endorsed by GOOS and uploaded to the Ocean Best Practices System (OBPS).
- Some major challenges affecting many of the OCG observing networks include continued erodion of resources, and a lack of guidance to help support various activities such as:
- Prioritise observing activities
- Progress from emerging to mature network
- Determine value and impact of ocean observations
- Engaging with private sector

Ongoing work includes developing metrics to track maturity of OCG networks, expanding WMO GBON into ocean-based observations, risk management and developing stronger public/private partnerships.

11.2. IOC

Ms. Joanna Post, GOOS Director, presented on the IOC Functional Areas which include the following:

- Foster research to strengthen knowledge of ocean and coastal processes and human impacts upon them (Ocean Research);
- Maintain, strengthen and integrte global ocean observing, data, prediction and information systems (Observing Systems / Data Management);
- Develop early warning systems, services and preparedness for risks of tsunamis and ocean-related hazards (Early Warning and Services);
- Support assessment and provision of information through the science-policy interface (Assessment and Information for policy);
- Enhance ocean governance through a shared knowledge base and improved regional cooperation (sustainable management and governance); and
- Develop the institutional capacity in all of the functions above, as a cross-cutting function (Capacity Development).

Ms. Post also introduced the high-level objectives and priorities from the IOC Medium Term Strategy (2022-2029) which will be presented to the IOC Assembly in June 2025. This document acts as a member state guide for the work of the IOC. The objectives include:

- Healthy ocean and sustained ocean ecosystem services
- Effective warning systems and preparedness for tsunamis and other ocean-related hazards
- Resilience to climate change and contribution to its mitigation
- Scientifically founded services for the sustainable ocean economy
- Foresight on emerging ocean science issues.

Following on from this high-level overview, Ms. Post also presented on the focus areas of the GOOS Steering Committee. It was made clear that GOOS is co-sponsored by IOC and WMO and as such has mandates from both organisations.

The GOOS SC Focus Areas for 2025-27 include:

- Core Coordination: WMO/IOC, OceanOPS, GOOS SC and expert panels
- Observation System design and Development: Carbon plan, Biodiversity plan, WMO RRR and evolving GBON, refining EOV indicators
- Strengthening data integration and delivery: IOC data architecture, OCG and GOOS networks
- Supporting Implementation: Applications, National Focal Points and Global Regional Alliances
- Partners and Communication: Projects, partners (i.e. government, private sector, science), Communications toolkit, GOOS Status report card
- GOOS Reform: Double diamond approach to define mission and scope then implementation.

Finally, Ms. Post touched on expanding the SOT and captured some points about the benefits to both science and business, how to better coordinate outreach and suggestions on an opt-in option for observations in areas under national jurisdiction.

11.3. WMO

The third session of the Commission for Observation, Infrastructure and Information Systems (INFCOM-3) approved a revised version of the Guide to the WMO Integrated Global Observing System (WIGOS). This updated guide includes information on the integration of marine observations into the Global Basic Observing Network (GBON). Notably, WMO-No. 1165 (Chapters 11.2-11.4) outlines the methodology for calculating GBON compliance within Members' Exclusive Economic Zones (EEZs), with specific applications for small island developing states, where the EEZ surface area is significantly larger than the land surface area.

In June 2024, the 78th session of the Executive Council approved amendments to the Manual on the WMO Integrated Global Observing System (GBON) (WMO-No. 1160). These amendments request Members to operate GBON stations and platforms in areas of global commons, including the High Seas and Antarctica (Chapter 3.2.2.22bis).

The WIGOS Data Quality Monitoring System (WDQMS) web tool, developed by WMO and hosted by the European Centre for Medium-Range Weather Forecasts (ECMWF), has been designed to monitor the performance of all WIGOS observing components. This module evaluates the availability and quality of observational data based on near-real-time information from participating global Numerical Weather Prediction (NWP) centers: the German Weather Service (DWD), ECMWF, the Japan Meteorological Agency (JMA), and the United States National Centers for Environmental Prediction (NCEP). The ocean

observations monitoring module provides this information based on DWD and ECMWF near-real-time observation information and is now available within the web tool. It provides data quality assessments for atmospheric observations from buoys and ships. Future releases of the web tool will include ocean data availability and links to metadata.

WMO Information System 2.0 (WIS2.0) has successfully completed its pilot phase and is now in the pre-operational stage. One WIS2.0 node that delivers ocean observations (SCRIPS/LDL) participated in the pilot project and is now providing data through WIS2.0. The Global Telecommunication System (GTS), WMO's initial data delivery system, is scheduled to be phased out by 2033. Therefore, Members are encouraged to transition from GTS to WIS2.0 before this deadline. Beginning January 1, 2025, no data from surface land will be published in WIS2.0 without associated metadata records in the Observing System Capability Analysis and Review (OSCAR) tool. This requirement will soon extend to ocean data, making the incorporation of metadata into the OSCAR system imperative.

Following its inception in 2019, the first in-person WMO IOC Joint Collaborative Board (JCB) meeting took place in Paris, France, in September 2024. The outcome of the meeting was to work on four primary areas with mutual benefit to the two organizations in the following intersessional period. These areas include GBON expansion in the ocean domain, data management and interoperability, capacity development, and coastal and maritime resilience. Two subgroups of JCB will be formed to work on GBON and data management topics, and the respective JCB members will deal with the other two topics.

One of WMO's priority areas for the current financial period is the Global Greenhouse Gas Watch (G3W). The implementation plan for G3W was approved at the EC-78 session (Resolution 3.2/1). Several actions have been identified under the surface-based ocean observation theme, including enhancing a sustainable ocean CO_2 observational network and delivering routine global gridded products of air-sea CO_2 flux. The GOOS panel on Biogeochemistry (BGC) is actively engaged in WMO G3W activities representing the ocean community. Members of the DBCP are encouraged to contribute to the implementation of G3W, with coordination facilitated through SOCONET, an emerging OCG network.

Other related priority items that will be discussed at the upcoming 79th Executive Council Session include Artificial Intelligence: roadmap to evolve WIPPS and public private engagement in weather forecasting and climate monitoring and the progress of the Greenhouse Gas Watch implementation Plan.

11.4. Discussion

The discussion focused on the GBON Gap Analysis. Concerns about why spatial distribution was not taken into account when assessing compliance and only quantity of observations.

Action 10.3/1*:* Panel members are requested to work towards GBON ocean (EEZ) compliance in collaboration with their National Meteorological and Hydrological Services (SOT members, ongoing)

Action 10.3/2: Panel members are requested to work toward the transition from GTS to WIS2.0 for their data delivery before 2030. (SOT members, before 2030)

Action 10.3/3: Contribute towards the G3W observation requirements in coordination with SOCONET by adding CO2-related measurements into existing and new platforms and report the progress back to DBCP-41 (DBCP platform operators, DBCP-41)

***Recommendation X/X**:*

12. REPORTS FROM THE TASK TEAMS

12.1. Task Team on Recruitment, Promotion and Training (TT-RPT)

Mr Steffen Steinmöller presented on the activities of the TT-RPT during the last intersessional period which included:

- Planned and delivered the 7th Port Meteorological Officers (PMO-7) regional workshop, hosted by the Pacific Community (SPC) in Nadi, Fiji, from October 31 to November 2, 2023.
- Organized and conducted a Cross Network (SOT/DBCP) Data Quality Webinar on March 18, 2025, which attracted 140 participants from 50 countries.
- In October 2023, the team published a new Voluntary Observing Ship (VOS) Brochure.
- Under the PMO Buddy program, Ms. PMO Fremantle collaborated with the new Ms. PMO Vanuatu to recruit the first VOS-VU ship, utilizing equipment provided through the VOS Donation Program.
- Regarding the VOS Donation Program, two Mintaka Automatic Weather Stations (AWS) were delivered to two of the three successful nominees from SOT-12.
- Two Vaisala PTB220 barometers and one portable transfer standard PTB220 were delivered to each of the two successful nominees from the PMO-7 workshop. None of this equipment is operational yet, but progress is underway to deploy it in the coming months.
- Reviewed the IMO MSC Circular 1293 (Rev.1) and recommended a complete rewrite of the document.
- Reviewed the Marine Observer's Handbook for use in the Help sections of Turbowin, recommending the removal of obsolete content and the inclusion of relevant new content, particularly related to modern instrumentation.

12.2. Task Team on Metadata (TT-Metadata)

Emma Steventon (Chair) presented on the activities on the Task Team. The SOT Task Team on Metadata (TT-Metadata) did not meet regularly during the last intersessional period. During the previous intersessional period, the primary task was to complete phase 1 of the migration from WMO. Pub.47 metadata format to the new WIGOS compatible SOT Metadata format. This was achieved and during the most recent period, National Met Services have been gradually transitioning. A permalink to the SOT metadata format is available from https://www.ocean-ops.org/metadata/sot.

SOT Metadata Format Migration Status

Phase 1: Complete

Phase 2: Originally scheduled to run until 2024, the focus was on migrating outstanding users, notably the USA and Germany from Pub47 to the SOT metadata format and continue to resolve bugs and inconsistencies in the OceanOPS user interface. The technical coordinator continued to work with the SOOP community to ensure their transition runs smoothly and their needs are met. This work is ongoing.

Currently the OceanOPS to Pub.47 format daily export still occurs in a slightly degraded version, but by the end of Phase 2, this export will end and all users must have migrated

to using the new SOT Metadata format. The daily exports of the SOT format are available from https://www.ocean-ops.org/share/SOT/Status/sot_all.csv

VOS-DWD was one of the remaining users of Pub47/Pub47+ metadata, but this was stopped around mid 2023.

Phase 3 was due to end by 2026 and would see WMO Pub.47 metadata submission no longer possible and migration to the SOT Metadata format considered complete. However, given that the US migration is the only VOS major programme outstanding, once this is complete by the end of 2025, the migration phase will be considered closed, so Phase 3 is now obsolete.

Task team activity during the intersessional period was via email, discussing inconsistencies between parameters and sensor model capabilities, and whether sub-surface sensors should be recorded as a positive or negative value.

12.3. Task Team on Instrument Standards and SatComm Systems (TT-ISSC)

During the last intercessional period, members of the Task Team on Instrument Standards and Satellite Communications Systems participated on the following tasks:

- **ISO standard:** The TT-ISSC contributed to finalize the ISO standard "Ships and marine technology — General specification for shipborne meteorological instruments". The standard has been published in 2024 under the reference ISO 23745:2024
- **GBON**: The TT-ISSC provided the GBON tender specifications for ship-based observations, in particular regarding sea level pressure and sea surface temperature, but also for a data acquisition system.
- **WMO n°8:** WMO is working on a new Volume on Ocean measurements to the *Guide to Instruments and Methods of Observation (WMO No. 8)*. The TT-ISSC was strongly involved to write the chapter 2 describing ship's observations. This chapter includes observations from the different panels (VOS, SOOP, ASAP), parameter by parameter. The current WMO n°8, Volume 2, Chapter 4 has been reviewed including information from the former Technical Report 63 describing algorithms for specific parameters like dewpoint, true wind... A section on oceanic parameters has been added. A first draft has been submitted to the Editorial Board. After considering the reviewers' comments, the new draft is ready to be submitted to the Editorial Board.

At the end of the intercessional period a review of the VOS dataflows is described below.
Systems and telecommunications used (VOS)

In 2024, **5 632 000** observations (FM13 & BUFR) from **4151** different GTS-ID have been received at French GTS node. The number of observations increased by 16% compared to 2022 but the number of GTS-ID remains stable.

Based on OceanOps Metadata database **27% of these observations are coming from systems without metadata** (10% are without any associated metadata in OceanOps, 17% are registered as a generic system). 300 stations registered as manual systems produced more than 3000 observations in 2024, which is impossible. In addition is has to be noted that Canadian stations send double messages, one with the SOT-ID, one with the ship call sign, which means that **the total number of unique observations is approximately 5.4 millions.**

This situation is not improving over the years and an action by members is necessary to improve the quality of the OceanOps metadata database. The quality is not enough to provide statistics and conclusions on the use of telecom systems.

BUFR monitoring (VOS)

The BUFR migration is progressing. Analysing the French GTS node, **only 4% of the messages are sent only in SHIP FM13 format** (mainly by Canada, Australia and Russia). Several centres finished their BUFR migration: 19 % of the messages are received in BUFR only. The only format seen on the GTS for VOS data is still 308009, despite the approval of format 308014 in 2016. The rest of the messages (73%) are sent both in FM13 SHIP and in BUFR. **This double diffusion leads to inconsistencies and has to be stopped.**

It is also noted that among the messages received using VOS template (FM13 or BUFR), 22% are coming from buoys.

A first initiative **to send 308014 BUFR messages on WIS 2.0** was done by Météo-France in March 2025.

12.4. Task Team on Key Performance Indicators (TT-KPI)

During the last intersessional period, the activities of the Task Team on Key Performance Indicators (TT-KPI) included the following:

- A preliminary review of static maps
- Contribution to OCG Task Team on Metrics and Maturity, Phase 1

Several members of the TT-KPI have retired, and there is a need to review and expand the current membership. This will help to restore expertise across the SOT Panels and also bring in new expertise, particularly with the use of the MeteoFrance QC tools. Commonalities between the TT-KPI and other SOT Task Teams were observed, particularly with the activities of the Task Team on Instrument Standards and Calibration Centres (TT-ISCC). Similar overlaps were also identified with the Task Team on Metadata (TT-Metadata), and potentially with the Task Team on Real-Time Procedures (TT-RPT) and the Task Team on Emerging and Innovative Communication Options (TT-EICO).

There is also a continuing need for engagement with the OCG Task Team on Metrics and Maturity. This collaboration is important for the production of summary metrics for the OCG Annual Report, and for enhancing the representation of SOT observations within the Global Basic Observing Network (GBON).

12.5. Task Team on VOS Delayed Mode data (TT-VOS-DMD)

Mr. Axel Andersson provided an overview of the activities of the Task Team on Voluntary Observing Ship (VOS) Delayed Mode Data (TT-VOS-DMD). He shared the Task Team's contact email (sot-tt-vos-dmd@groups.wmo.int) for those interested in reaching out with questions, reporting issues, or joining the group. Mr. Andersson presented the background and rationale for exploring a new data format to replace the existing IMMT (International Maritime Meteorological Tape) format, which is currently used for exchanging delayed mode VOS data. He outlined several key issues with the IMMT format, including uncertainties surrounding the IMO number, known deficiencies in the Marine Quality Control System (MQCS), incompatibility with the evolving VOS metadata structure, its

outdated column-based format, and limitations in supporting improvements to marine meteorological data exchange within the Marine Climate Data System (MCDS).

The ongoing focus of the Task Team is to complete the review of the IMMT format, including metadata requirements. The VOS Global Data Assembly Centres (GDACs) are expected to analyze incoming data to assess column usage rates. The ultimate objective is to propose a new data model or vocabulary for delayed mode data exchange that is transparent, easy to manage, long-lasting, flexible, and traceable, both at the file and observation level (e.g., with a unique identifier mechanism such as TT-UID). The new format should ensure metadata reproducibility, adherence to MQC standards, use of standard names, and compatibility with the WMO Climate Data Model (CDM). There is also discussion around whether this new, more generalized format could eventually replace the IMMA format.

Several open issues were raised, including technical implementation within tools like TurboWin and data centres, as well as how to maintain a repository for metadata history to ensure traceability over time. A secondary task is to review and provide feedback on upcoming changes to the MCDS.

Planned actions include continuing the revision of the IMMT and MQCS formats to ensure compatibility with BUFR-based parameters, flags, and accuracy values; improving flexibility for future field changes (e.g., IMO numbers); maintaining alignment with OceanOPS metadata structures; and improving the accuracy of quality flags. Additionally, the Task Team aims to ensure that VOS metadata history is archived consistently and to incorporate considerations for delayed mode data management in the development of a TurboWin replacement.

During the discussion, Mr. Jean-Baptiste referred to his previous work under the revised Terms of Reference (ToR) for the SOT, particularly in relation to his Task Team's efforts to monitor the implementation of Unique Identifiers (UIDs). He emphasized the importance of translating the vocabulary into a user-friendly format and advocated for generalizing the data format to enhance usability and interoperability.

A participant encouraged highlighted the importance of establishing Global Data Assembly Centres (GDACs), including GTS-enabled GDACs, to facilitate easier and more centralized access to the data. He noted that this approach aligns with the Ocean Observing Coordination Group (OCG) strategy and supports the development of a common data format across the community.

Additional information was provided regarding metadata management and station registration responsibilities, particularly through OceanOPS. It was noted that some registered stations store their data in various formats, reinforcing the need for enhanced coordination and standardization. Mr. Kramp confirmed the procedures for storing new metadata formats within OceanOPS. Mr. Andersson also provided clarification on how delayed mode VOS data is currently being collected and handled by relevant data centres.

12.6. Task Team on the Expansion of Independent Class Observations (TT-EICO)

Mr. Darin Figurskey, Chair of the Task Team on Engagement of Industry and Coastal Observing Communities (TT-EICO), provided an update on the group's activities. The primary focus of the Task Team has been the development of a guidance document aimed

at supporting the integration of third-party meteorological observations and associated metadata into National Meteorological and Hydrological Services (NMHSs). The initial scope of the document centers on entities already conducting some form of observation and possessing relevant equipment. The overall goal is to provide a clear pathway for these third-party observations to be properly recognized and incorporated into operational data systems.

A second major focus of the Task Team is the concept of a Trusted Node, a designated point of contact for data contributors that would work closely with OceanOPS to manage metadata, request identifiers, reformat data into GTS/WIS-ready formats, and ensure proper upload into these systems. The Trusted Node would also be responsible for conducting quality evaluations of the incoming data and metadata, and for staying updated with evolving technologies, formats, and data standards.

The guidance document will outline technical specifications, including sensor types and installation guidance, desired parameters and sampling rates, metadata requirements, and considerations for data quality. Mr. Figurskey noted that the Task Team is requesting feedback from SOT members by 2 June on whether the document should address data routing to the GTS, WIS, or provide guidance on transitioning from one to the other.

Looking ahead to the intersessional period leading up to SOT-14, the Task Team plans to prototype a Trusted Node model for third-party data contributors. Future iterations of the guidance document will expand its scope to include entities that do not yet have equipment in place, and provide more detailed advice on observation practices and data integration.

In addition, the TT-EICO is contributing to work related to the IMO Compendium on Facilitation and Electronic Business. Mr. Figurskey highlighted discussions held during the Second WMO-IMO Symposium on Extreme Maritime Weather, scheduled to take place in London in September 2024, which underscored the growing need for enhanced marine observations. As part of this work, the Task Team has proposed an update to the Compendium to include references to weather and ocean data. He clarified that this proposed addition is not intended to impose new data requirements on stakeholders but to serve as a facilitative tool, harmonizing definitions, formats, and data structures across the maritime domain. Mr. Figurskey presented a draft annex describing the proposed dataset and requested feedback from SOT members by 1 May 2025.

The Task Team’s future action plan includes:

- Continuing support for the TT-EICO's work.
- Providing feedback on the draft third-party observation guidance document.
- Encouraging one or more entities to prototype a Trusted Node for third-party data contributions.
- Submitting feedback on the proposed input to the IMO Compendium.
- Approving the updated membership and Terms of Reference for the Task Team.
- Preparing for the transition to SOT-14, including appointing a new Chair or integrating the TT into another relevant panel.

During the discussion, Ms. Champika Gallage suggested that the guidance document be submitted to the Ocean Best Practices repository to ensure greater visibility and a permanent home for the work. Mr. Figurskey welcomed the suggestion and confirmed the TT’s intent to publish the document. Mr. Kramp mentioned the potential expansion of the VOS scheme, which may have implications for the guidance document and the TT’s future activities. He also encouraged members of the panel interested in deeper involvement to consider taking on the role of Vice-Chair. Mr. Figurskey strongly supported this idea, emphasizing the Task Team’s desire to enhance both geographic and gender diversity

within its membership and welcoming anyone willing to contribute even a small amount of their time.

Further discussion focused on clarifying the level of involvement expected from Task Team (TT) members. Ms. Gallage proposed that each TT's Terms of Reference (ToR) should include a brief description outlining the anticipated frequency of meetings and a summary of ongoing or planned activities. This, she suggested, would help potential members better understand the nature of the work involved and the expected level of commitment before joining a Task Team.

12.7. Plenary Discussion including Recommendations from Task Teams

WMO Secretariat thanked the TT-RPT for their efforts on capacity development including the 7th Port Meteorological Officers workshop and the GOOS webinar on Data Quality for VOS and DBCP platforms. These initiatives were very well received and have had high levels of participation. The TT-RPT Chair would like to upload a FAQ document to the GOOS webinar page to provide answers to questions raised by webinar participants.

Mr. Martin Kramp highlighted that the TT Metadata has an important, on-going role within SOT and recommended that all SOT networks should be represented within the TT membership.

Action 12.1/1: *TT-RPT to re-write the IMO MSC Circular 1293 for review by the SOT-EC (TT-RPT, Mar 2026)*

Action 12.1/2: *TT-RPT to re-write the relevant sections of the Marine Observer's Handbook as PDF files for use in Turbowin Help files (TT-RPT, Oct 2025)*

Action 12.1/3: *TT-RPT Chair to follow up with VOS Donation recipients for status updates on implementation (TT-RPT Chair, Jun 2025)*

Action 12.1/4: *TT-RPT Chair to update content of the VOS website including link to new VOS brochure (TT-RPT, Jun 2025)*

***Action* 12.2/1** — TT-Metadata to prepare instructions for how users can request to add a new sensor to OceanOPS reference tables (December 2025)

***Action* 12.2/2** - TT-Metadata to produce a user guide for how to use the OceanOPS system to extract/export metadata (December 2025)

***Action* 12.2/3** – TT-Metadata to regularly review the OceanOPS SOT Github repository for updating metadata reference table values and issues regarding the OceanOPS tool (Ongoing)

***Action* 12.2/4** – TT-Metadata to arrange further training webinars for the wider SOT community (with TT-RPT)

***Action* 12.2/5** – TT-Metadata to retire the OceanOps to Pub.47 export, working with members to ensure the smooth migration to the new SOT Metadata format (end 2026)

***Action* 12.2/6** – TT-Metadata to establish if there are any remaining users of Pub47 exports (Phase 2 end)

***Action* 12.2/7** – TT-Metadata to work through the list of sensors in the OceanOps interface and ensure that all parameters are available to record against the sensor model capabilities

Action 12.4/1 Verify, review and expand expertise of TT-KPI membership to include chair and co-chair, noting the requirement for expertise across the SOT panels and with the MetoFrance QC tools. (TT-KPI; by June 2025)

Action 12.4/2: TT-KPI to review existing indicators and maps for the SOT and make recommendations to the EC for re-design or new products if required (and potentially parameter-based beyond SOT) (TT-KPI; by Dec 2025)

Action 12.4/3: Further develop metrics on spatiotemporal coverage, relating those metrics to the requirements as specified in the WMOs RRR (in coordination with the GOOS OCG/networks, GCOS AOPC and OOPC, and other relevant groups). (TT-KPI; by SOT-14) [preliminary findings to EB by end 2025]

Action 12.4/4: Further enhance metrics on:

- data flow (to include monitoring the use of the latest BUFR sequences for marine data);
- quality of observations (particularly linking to the MeteoFrance QC tools, blacklisting and error statistics -mean error and RMSE);
- and the percentage of VOS in a particular class reporting the parameters required to meet that classification.

(TT-KPI; by SOT-14) [preliminary findings to EB by end 2025]

Action 12.4/5: Review monthly-OceanOPS products, including static maps, in liaison with the TT- KPI and adjust those as necessary. (SOT-TC, TT-KPI; by Dec 2025)

Action 12.4/6: Review monthly-OceanOPS products, including static maps, in liaison with the TT- KPI and adjust those as necessary. (SOT-TC, TT-KPI; by Dec 2025)

Action 12.4/7: Contribute to the OCG TT Metrics & Maturity Phase 2 to establish robust metrics for the maturity and health of the SOT networks. (SOT-EB?; by March 2026)

Recommendation 12.2/1 – all users to have migrated to using the new SOT format and submitting their metadata via the OceanOPS interface by the end of (the extended) migration phase 2, noting that the OceanOPS to Pub47 export will end by this date (December 2025)

Recommendation 12.2/2 – The Task Team Metadata encourages members to submit nominations for the roles of Task Team Chair and Vice Chair. Nominations should be submitted to sot-tt-meta@groups.wmo.int

Decision 12.2/1: The Task Team decided that all subsurface SOT sensors should be recorded in the OceanOps database as sensor height and entered with a negative value; and that any references to sensor depth should therefore be removed to avoid confusion for users.

13. DATA SESSION

13.1. OCG Data Task Team

Mr. Kevin O'Brien presented as GOOS OCG Vice-chair for data latest topics from the OCG Data Task Team. He introduced the OCG cross-network data implementation strategy and outlined the requirements, and activities as well as the SOT representatives. The objective is to ensure that the data is relevant and useful. During the first year, the focus is on metadata. There are also thoughts about getting stakeholders and customers involved. As far as DMD is concerned, the idea is to get as much data as possible.
Then Mr. O'Brien introduced the OceanOPS metadata 'Passport' and explained the development of a Cross-IOC data architecture and how stakeholders get involved. A minimum set of metadata is required for WIGOS ID. Further, the data survey comprises a series of 12 questions to make sure the OCG cross-network is understood. The aim here is to raise availability and visibility for stakeholders. It is important to handle the original data for different systems, make it available for different stages, and avoid copying.
Regarding the development architecture the goal is to build a cross IOC implementation team. A pilot project is planned to exchange data via WIS2.0.

13.2. About Coriolis and its role as GDAC for various networks

Mr. Ludovic Drouineau presented the CDS Coriolis data. Coriolis is part of the operational oceanography program for in-situ observations in France. Six institutions as well as stakeholders are involved. The program has a strong focus on operational oceanography. Coriolis is involved in GDAC, GOSUD and IODE-28, and acts as a leader of Copernicus Marine Service In-Situ TAC.
The national and European landscape as well as the Coriolis and OCG networks are introduced and explored before the speaker addresses GDAC activities, the Coriolis visualization tools, the work related to ARGO data services and network. The wide range of data processing including metadata, quality control, monitoring, and data distribution is demonstrated. Finally, the next steps were outlined.

13.3. Transition to WIS2.0

Mr. David Berry (WMO) gave a presentation on the transition to the WMO Information System v2 (WIS 2.0). The key differences between the existing WMO Global Telecommunication System, (GTS) and the WIS 2.0 were described, notably the move from a closed point to point message switching system to a more open system based on modern web technologies and built using open standards and open software. Dr Berry then gave a brief description of the requirements for both publishing observations on the WIS2.0 and for subscribing to and downloading from the WIS2.0. Most of the requirements described were technical but Dr Berry also noted that approval is required to publish data on the WIS2.0, either as a National Centre (NC) with approval from a WMO Members Permanent Representative (PR) or as a recognized Data Collection and Processing Centre (DCPC) within a WMO program or network. Data Assembly Centres (DACs) and Global Data Assembly Centres (GDACs) from the Marine Climate Data System were given as

examples of DCPCs within the WIS 2.0. Dr Berry then finished by outlining the current status and timeline for the transition to WIS 2.0, noting that the process was already underway, with a target of 90 % of WMO Members and data to be migrated by 2030, followed by the termination of the GTS by 2033.

13.4. Assessing XBT data assimilation in models

Mr. Shane Keating talked about Assessing XBT data assimilation in models. The East Australian Current (EAC) was the focus of a recent publication which looked at observation impacts assessment with the South-Eastern Australia Coastal Ocean Forecast System (SEA-COFS), in particular the impact of XBT data. Mr. Keating went on to discuss Observing System Simulation Experiments (OSSE) to analyse the effect of changing the temporal frequncy of XBT sampling in the EAC, the vertical structure of mesoscale eddies with surface observations only versus surface observations and XBT observations. Next Mr. Keating discussed Observing System Experiments (OSE) using real data as the source of truth rather than simulating this with a model. A study which looked at spatial resolution dependence across the EAC which showed that higher resolution XBT sampling helped to better identify where the ocean currents are. This is of direct benefit to shipping, helping with ship route optimisation and improved fuel efficiency.

13.5. The impact of SOT data

Ms. Sharon Jewell presented a report on the use and impact of SOT data at the UK Met Office. Specifically focused on NWP models. She provided an overview of Forecast Sensitivity to Observations Impact (FSOI) analysis, global distribution of ship data and its impact on global NWP model forecasts, and a case study exploring the impact of ship observations in the Arctic.
FSOI provides a method for quantifying the impact of observations assimilated into global NWP model on forecast error. Impacts can be calculated in near real-time. Data from about 1000 ships are assimilated daily into the UK Met Office Global NWP. Most observations are from the northern hemisphere. Generally, most data close to the coast or around small islands are less beneficial. Pressure and Relative Humidity (particularly around the equator) from ship observations have the greatest impact, followed by temperature and wind.
Observations at high latitudes are essential for modelling climate systems, monitoring the coverage of the polar ice sheet and bespoke atmospheric and marine forecasts for aircraft and ships operating in these areas. Most high latitude observations are from research vessels. Met Office have hopes to recruit additional ships from polar expedition cruises to increase in-situ observations in the Arctic. More manual observations result in a higher impact from this network compared to AWS.

13.6. Discussion

Ludovic Drouineau from Ifremer asked Kevin O'Brien what to do to put the data to ODIS. Mr. O'Brien invites anyone interested to contact him.

Jean-Baptiste Cohuet from Meteo-France asked how new stations can be accepted in GTS and how this can be controlled. Mr. Berry replied that new stations have to be agreed on WMO.

A further question came from Kevin O'Brien from University of Washington. He is interested in the consolidation of different types of metadata sources. Mr. Berry informed

that there is a Task Team on Delate Mode Data (TT DMD). The various metadata are treated and processed individually. We need to have a guide.

Action 13.4/1*: Include the observations impact information into a brochure, website etc for ship companies and other stakeholders (TT-KPI/RPT, midterm review)*

14. BREAKOUT GROUPS (PARALLEL SESSIONS)

14.1. VOS Breakout Session

14.1.2. Review and approve Terms of Reference and membership

Mr. Joel Cabrie led the discussion on the review of the Voluntary Observing Ships (VOS) Terms of Reference. The updated Terms of Reference is provided in the Annex 2.

14.2. SOOP Breakout Session (Rebecca Cowley)

14.2.1. XBT Science Team report

The presentation was not given, due to a lack of time. However, an overview of the current science using XBTs (eXpendable BathyThermographs) was presented. Recent publications include:

- Using XBTs to determine seabed physical characteristics using temperature decay after the probe hits the bottom (Hornbach et al, 2024 https://doi.org/10.1029/2023EA003441).
- Reprocessing of XBT data from the Medditerreanean with addition of metadata Simoncelli et al, 2024, https://doi.org/10.5194/essd-16-5531-2024)
- Processing of 20 years of XBT data along the PX36 line (New Zealand to Antarctica), Aulicino et al, 2024, https://doi.org/10.519)
- Twenty years of monitoring the Brazil Current along AX97, Ferreira et al, 2025, https://doi.org/10.5670/oceanog.2025e113)
- Marine Heat Wave studies using XBTs along the Kurushio Current (Chandler et al, 2024)
- 25 years of XBT data along the IX28 line from Tasmania to Antarctica (SURVOSTRAL). Auger et al, 2021, https://doi.org/10.1038/s41467-020-20781-1)
- Atlantic Meridional Overturning Circulation (AMOC) studies, Pita et al (2024), Pujiana et al (2024), Foody et al (2024).

Action 14.1/1: *The XBT Science Team is re-incorporated into the SOOPIP to ensure that the impact of XBTs is adequately addressed at each SOT meeting and scientific guidance is given to the XBT Network operators on organization of the network.*

14.2.2. XBT database and standardization

The formation of the XBT Data Management Team during the Joint IQuOD/GTSPP/SOOPIP/XBT Science meeting in Italy, 2024, was presented. The goals of the XBT Data Team are to:

- Create a coordinated global repository for all XBT SOOP data
- All data to be in a single format

- Products to be created include a 'clean' data product, and a gridded data product along each transect
- Software tools for users to enable them to access and plot the data as well as create the gridded product on the fly
- Publications to present the dataset and the products and discuss the science outcomes from selected transects along Western Boundary Current regions.

14.2.3. Discussion of SOOP membership groups

The members of the Ship Of Opportunity Programme Implementation Panel (SOOPIP) decided to eliminate general references to SOOP networks and refocus the panel exclusively on Expendable Bathythermograph (XBT) activities. Other SOOP networks are encouraged to establish their own coordination structures, similar to the XBT Network, either within the Ship Observations Team (SOT) or directly under the Observing Coordination Group (OCG). Previous efforts to coordinate other networks under SOOPIP have faced challenges due to limited engagement from members of those networks.

The pCO2 group has formalized its coordination through the Surface Ocean CO2 Observing Network (SOCONET), while the Continuous Plankton Recorder (CPR) network maintains a less formal structure, potentially aligning with bio-observation groups. The Thermosalinograph (TSG) data network is recommended to formalize its operations, possibly through the International Repeat Ship Observations (IRSO) group. Discussions explored how the TSG network could formalize its structure, suggesting that coordination with the SOCONET group may be beneficial.

The SOOPIP recommends changing its name to "XBT SOOP" to clearly reflect its focus on XBT activities, prioritizing "XBT" in the name while retaining "SOOP" for funding purposes and brand recognition.

The XBT SOOP will continue to engage with and support emerging networks in areas such as ship recruitment, data management, and best practices.

The XBT Data Team, comprising Ms. Rebecca Cowley (Lead), Ms. Lisa Krummel, Ms. Simona Simoncelli, Mr. Ludovic, Mr. Joaquin Triananes, Ms. Naomi Krauzig, Mr. Ash Parker, and Ms. Rebecca Hudak, was established. The data team is tasked with setting goals related to data formats, Global Data Assembly Center (GDAC) operations, real-time quality control (RTQC), and ERDDAP delivery. Existing formats, including the SEADATAnet format, Australian format, and CORIOLIS formats, require coordination. The team noted that the GDAC could harmonize these formats. The use of ERDDAP was proposed to standardize data delivery, eliminating the need for a uniform data submission format.

A working group for XBT SOOP website content was formed, led by Ms. Justine Parks, with members including Ms. Ash Parker, Ms. Simona Simoncelli, Ms. Rebecca Cowley, Ms. Lisa Krummel, and Mr. Zach Barton.

Decision:
The Coriolis data center agreed to serve as the XBT-SOOP Global Data Assembly Center (GDAC).

Action 14.3/1 That the name of the SOOPIP organization be rebranded to XBT SOOP under the SOT. The TOR and OceanOps to be updated accordingly. (SOOPIP Exec, TC, April, 2025)

Action 14.3/2 Create an XBT data management team focused on the goals of unifying the XBT data from the different operational programs. (Rebecca Cowley, April, 2025)

Action 14.3/3 Allocate funds from the SOT budget to refresh the website for the 3 networks and funds to pay yearly domain name purchase. (SOT EB, May, 2025)

Action 14.3/4 Identify an individual from one of the operational programs to create the new website. Network to form internal TT to create the content (Justine Parks, May 2025)

Action 14.3/5 Use Australia case study to track down sources of reporting discrepancies and share results with XBT SOOP. (SOOPIP, TC, Dec 2025)

Action 14.3/6 Amend the SOOPIP mailing list to reflect the change to XBT SOOP naming and constitution

Recommendation 14.3/1 TSG operational groups are recommended to self-organize, explore engaging with IRSO, (SAMOS?), R/V technicians, and to engage more closely with GOSUD. (SOOP-TSG/Zach Barton, TC, begin April 2025)

Recommendation 14.3/2 pCO2 groups participating in SOOP-pCO2 to shift their work to participate in SOCONET and no longer in SOOP. (SOOP-pCO2, pCO2/SOCONET, Next SOT)

Recommendation 14.3/3 FerryBox and other operational groups investigate how to self-organize and explore the best route of engagement with the OCG. (FerryBox/Other networks, next SOT)

14.2.4. Review and approve Terms of Reference

New terms of Reference for the XBT SOOP were approved:

XBT-SOOP Terms Of Reference
The eXpendable BathyThermograph-Ship of Opportunity Program (XBT-SOOP) shall:

1. Coordinate activities of participating agencies that implement and maintain XBT equipment and measurements on Ships of Opportunity (SOOP) including resources and their availability. Resources can be instrumentation, software packages, vessels, data management and dissemination systems, and other related components.
2. Create, exchange, and update recommended and/or best practices and technical and developmental information for XBT instrumentation.
3. Promote the maintenance of metadata in OceanOps to participating agencies.

4. Promote the transmission of XBT data to the Global Telecommunication System (GTS)/WIS2.0 and relevant data centres according to operational and scientific requirements.

5. Provide guidance and assistance to the Ship Observations Team (SOT) chairperson and Technical Coordinator to produce monitoring reports and analyses, performance indicators, implementation plans and information exchange facilities.

6. Regularly review the impact of XBT observations and XBT-SOOP network design by engaging and collaborating with the scientific community.

7. Engage with, support, and facilitate partnerships with other ocean observing networks.

8. Quarterly online meetings are recommended during the SOT intersessional period.

15. QUESTIONS AND DISCUSSION ARISING FROM ALL FORMER ITEMS

Summary

16. SOT ADMINISTRATION

16.1. Financial report

Ms. Champika Gallage from WMO Secretariat presented the financial report. She reported that SOT activities are primarily funded through extrabudgetary funds and managed in the DBCP Trust Fund, which has been renamed the Ocean Observing Networks Trust Fund (OON TF) since November 2024. The terms of reference (ToR) of the OON TF has not changed.

All OceanOPS technical coordinators' salaries and travel are paid through extrabudgetary funds received by the OceanOPS. All extrabudgetary contributions received by oceanOPS including funds from European Union Projects and funds from NOAA/WHOI are managed in a single trust fund named OceanOPS Trust Fund (OOP TF) since November 2024. OOP TF includes all contributions received from multiple sources, including the WHOI/NOAA funds.

Six member countries (Australia, Canada, Germany, India, New Zealand, and South Africa) and E-SURFMAR make annual contributions to the OON TF. Over the years these regular contributors decided the fraction of funds they would like to provide for SOT, DBCP and OceanOPS. The latest agreed distribution of funds for 2025 are provided in Table 1 and 2.

Table 1: Distribution of funds from Members (2025) in %

Contributor	Contribution	In US$ (20/03/2025)	OceanOPS	DBCP	SOT
E-SURFMAR	€ 51’700	$56’008	70%	15%	15%
Meteorological Services of New Zealand	€1,800	$1’950	61%	31%	8%
Environment and Climate Change Canada	CAD 30,000	$20’850	25%	50%	25%
Bureau of Meteorology, Australia	15’500 CHF	$17’541	70%	15%	15%
National Institute of Ocean Technology, India	$5’000	$5’000	61%	31%	8%

BSH, Germany	€3,600	$3’900		100%	
South African Weather Service, South Africa	2’500 CHF	$2’829	65%	20%	15%
Bureau of Meteorology, Australia (TURBOWIN)	15’500 CHF	$17’541			100%
Total		$125’618			

Table 2 Distribution of funds from Members (2025) in US$

Contributor	In Currency of Payment	In US$(20 March2025)	WMO/DBCP TF in US$		
			Ocean OPS	DBCP	SOT
E-SURFMAR	€ 51’700	$56’008	$39’205	$8’401	$8’401
Meteorological Services of New Zealand	€1,800	$1’950	$1’189	$604	$156
Environment and Climate Change Canada	CAD 30,000	$20850	$5’212	$10’425	$5’212
Bureau of Meteorology, Australia	15’500 CHF	$17’541	$12’278	$2’631	$2’631
National Institute of Ocean Technology, India	$5’000	$5’000	$3’050	$1’550	$400
BSH, Germany	€3,600	$3’900		$3’900	
South African Weather Service, South Africa	2’500 CHF	$2’829	$1’839	$566	$424
Bureau of Meteorology, Australia (TURBOWIN)	15’500 CHF	$17’541			$17’541
Total		$125’618	$62’775	$28’077	$34’766

Table 3 provide the summary of expenses in 2023, which includes expenses for VOS donation project and the travel of SOT personnel. The 2023 Financial report of the trust funds is provided in Annex 4.

Table 3: Status of the SOT budget in 2023

Description	Amount in US$
Balance Brought Forward from previous year (2022)	$59’444.00
National Contributions	$14’964.92
Funds Available for 2023	$74’408.92
SOT other expenses	($6’030.00)
SOT Chair and other travel	($3’634.00)
Direct & Indirect costs	($289.92)
Balance as of 31 Dec 2023	$64’455.00

All regular contributions were received for 2024. Additionally, a contribution from the Bureau of Meteorology, Australia, towards Turbowin activities increased the total contributions to the SOT in 2024. Table 4 summarizes transactions in 2024, and Annex 4 provides the trust fund's financial report.

Table 4: Status of budget in 2024

Description	**Amount in US$**
Balance Brought Forward from previous year (2023)	$64’455.00
National Contributions	$46’536.86
Funds Available for 2024	$110’991.86
SOT chair and other travel	($7’841.00)
TURBOWIN funds	($2’321.00)
Direct & Indirect costs	($304.86)
Balance as of 31 Dec 2024	$100’525.00

Anticipated contributions and expenses for 2025-26 is provided in Table 5, and SOT is requested to review and approve these expenses.

Table 5: Anticipated budget for SOT in 2025-26

Description	**Amount in US$**
Balance as of 31 December 2024	$100’525
Expected income in 2025	$34’766
Funds Available for 2025	**$135’291**
SOT chair and other travel	($10’000)
Turbowin	($15,000)
Other activities	($15,000)
Expenses (Direct & Indirect costs)	($1,200)
Carry forward to 2026	$94,091
Expected income in 2026	$17’000
Funds Available for 2026	**$111’091**
SOT Chair and other travel	($15,000)
Other SOT expenses	($35,000)
Expenses (Direct & Indirect costs)	**($1,500)**
Carryforward balance to 2027	**$59’591**

SOT operates with a small budget with contributions from a small number of countries. SOT members are requested to consider financial contributions towards SOT activities.

Decision: SOT approved the budget in Table 5 for the next intercessional period of 2025 and 2026

16.2. SOT executive board membership

SOT Executive board membership is renewed at every SOT session. Accordingly, a call-out letter went out seeking nominations for a number of SOT executive board membership

positions. Nominations were received for almost all positions except the ASAP vice-chair position, which the SOT agreed to fill during the intercessional period. The following members were elected by the SOT for Executive board.

SOT Chairperson	: Mr. Joel Cabrie (Australia)
SOT Vice Chairperson	: Mr. Sun Yhaobin (China)
VOS Co-Chairperson	: Ms. Jacqueline Sugier (UK)
VOS Co-Chiarperson	: Mr. Henry Kleta (Germany)
VOS Co-Vice Chaiperson	: Ms. Elizabeth Kent (UK)
VOS Co-Vice Chairperson	: Mr. OlivierDesprez de Gesincourt (France)
XBT SOOP Co Chairperson	: Ms. Justine Parks (USA)
XBT SOOP Co Chairperson	: Ms. Tammy Morrison (South Africa)
XBT Vice Chairperson	: Ms. Ashley Parker (Australia)
ASAP Chairperson	: Mr. Rudolf Krockauer (Germany)
ASAP Vice Chairperson	:Vacant and to be filled during the intercessional period

SOT reviewed and updated the SOT Executive Board Terms of Reference (ToR) to align with organizational changes and instructions from OCG. Updated version of the Executive Board ToR is provided in Annex 3 and cleaned version of the revised and SOT approved ToR's of the Task Teams are available from OceanOPS website here.

Decisions:

1. SOT agreed to have Two chairpersons and two vice chairpersons for the VOS panel. This was justified with the amount of priority works to complete during the next intercessional period.

16.3. Next SOT session (SOT-14)

There were number of unconfirmed offers (New Caledonia, Chile, Ecuador, Colombia, Peru, China) received to host the SOT-14 session in 2027. The executive board will discuss this, make a final decision and notify the panel with suggested dates of the meeting.

17. ACTIONS REVIEWS

Actions and recommendations are provided in Annex 5.

18. CLOSURE OF THE SESSION

SOT Chair, Mr Cabrie, thanked the participants and closed the meeting on April 04th 2025 at 16:30 local time.

Annex 1: Agenda/Timetable

Preceding Side meetings on Monday 31 March 2025		
Time: CEST (UTC+2)	**Item**	**Moderator*** (Rapporteur)**
08:00-09:00	Registration/Administration	
09:00-10:00	SOT Executive Committee (Members only)	Joel Cabrie
10:00-10:30	Coffee Break	
10:30-11:30	Exec meeting (ctd.) with OceanOPS SLA overview	Martin Kramp
11:30-12:00	Coffee Break	
12:00-13:00	SOT Metadata Task Team (TT) Meeting	Emma Steventon
13:00-14:00	Lunch Break	
14:00-15:15	Turbowin Working Groups Meeting (PB, NG)	Jean-B.Cohuet
15:15-15:45	Coffee Break	
15:45-17:00	TT for Recruiting Promotion and Training Meeting	Joel Cabrie

Day 1: Tuesday 1 April 2025		
Time: CEST (UTC+2)	**Item**	**Moderator*** (Rapporteur)**
08:00-09:00	Registration/Administration/Coffee	
09:00-09:40	1. **Opening SOT-13** 1.1. Ifremer welcome (*Ifremer tbd, 5 min*) 1.2. WMO (*Nir Stav, 10 min*) 1.3. IOC (*Vidar Helgesen, 10 min*) 1.4. SOT Chair (*Elizabeth Kent, 5 min*) 1.5. Adoption of the Agenda (*Session Chair, 5 min*) 1.6. Housekeeping instructions (*Martin Kramp, 5 min*)	Mathieu Belbeoch (Emma Steventon)
09:40-11:00	2. **Setting the Scene: Introduction of ship-based Observing Networks/Projects (Flashtalks)** 2.1. SOT: VOS, SOOP, ASAP (*Joel Cabrie, 10 min*) 2.2. Repeat Hydrography: (Euro-) GO-SHIP (*Elaine McDonagh, 5 min*)	Martin Kramp (Justine Parks)

	2.3. Underway CO2: SOCONET and TRICUSO (*Tobias Steinhoff, 5 min*) 2.4. Shaping an Ocean Of Possibilities: The "German SOOP" (*Tobias Steinhoff, 5 min)* 2.5. FerryBox (*Anna Willstrand Wranne, 5 min*) 2.6. GACS CPR Survey (*Clare Ostle, 5 min)* 2.7. Plankton Planet (*Colomban de Vargas, 5 min*) 2.8. RV underway data project of DAM (*Gauvain Wiemer, 5 min*) 2.9. Global Ocean Surface Underway Data: GOSUD (*Ludovic Drouineau, 5 min*) 2.10. AU FishSOOP (*Véronique Lago, 5 min*) 2.11. SEAMAP : Targeted underway bathymetry (*Lars Rüpke, 5 min*) 2.12. SPC FishSOOP 2.13. FVON (*Cooper van Vranken, 5 min*) 2.14. SAMOS (*Shawn Smith, 5 min*) 2.15. ScienceRoCS (*Shawn Smith, 5 min)*	
11:00-11:30	Coffee Break	
11:30-12:00	2. **Setting the Scene (cont.): Introduction of ship-based Observing Networks/Projects (Flashtalks)** 2.13 Discussion (30 min)	Martin Kramp (Justine Parks)
12:00-13:15	3. **Ocean Observing under UN umbrella** 3.1. Crowdsourced bathymetry: Experience from IHO (*Sam Harper, 15min, recorded*) 3.2. Role / needs of IMO; 2024 IMO-WMO symposium on extreme weather (*Osamu Marumoto, 10 min*) 3.3. From AIS to VDES (*Hideki Noguchi, 5 min*) 3.4. EW4All, G3W: Leadership of the WMO (*Nir Stav, 10min*) 3.5. GOOS and IOC activities (*Joanna Post, 10min*) 3.6. The Ocean Decade "Odyssey" project and related UNOC activities (*Mathieu Belbeoch, 10min*) 3.7. Discussion (*25 min*)	Emma Heslop (Rebecca Cowley)
13:15-14:15	Lunch Break	
14:15-15:15	4. **Evolving Partnerships with Shipping Industry** 4.1. Introduction (*Mathieu Belbeoch, 5 min*) 4.2. Partner presentation: Brittany Ferries (*Erwann Gabriel, 10 min*) 4.3. Partner presentation: Kongsberg (*Peer Fietzek, 10 min*) 4.4. Partner presentation: OceansX (*Berend van de Kraats, 10 min*)	Joanna Post (Axel Anderson)

	4.5. Discussion (*15 min*)	
15:15-15:45	Coffee Break	
15:45-17:15	5. **Partner Programs** 5.1. Other GOOS networks which require assistance from ships (*Martin Kramp, 10 min*) 5.2. The EU-AMRIT Project (*Laurent Mortier, Mathieu Belbeoch, 10 min*) 5.3. IRSO, ERVO and Eurofleets: Role and organization of research vessels (*Giuseppe Magnifico, 10 min*) 5.4. The IOC-IMOCA and recent Vendée Globe Race partnership (*Claire Vayer, 10 min*) 5.5. Operational challenges with underway Data from sailing yachts (*Stefan Raimund, 10 min*) 5.6. Innovative ship, innovative instrumentation with Monaco Explorations: MODX70 and SailBox (*Orens Pasqueron de Fommervault, Stephan Deschner, 10 min*) 5.7. Research Vessel + Ocean Racer = Research Racer: About Team Malizia (*Boris Herrmann, 10 min*) 5.8. Discussion time (*10 min*)	Martin Kramp (Joel Cabrie)
18:00-20:00	**Ice breaker**	

Day 2: Wednesday 2 April 2025		
Time: CEST (UTC+2)	**Item**	**Moderator*** (Rapporteur)**
08:00-09:00	Registration/Administration/Coffee	
09:00-10:20	6. **TURBOWIN** 6.1. Report from Turbowin Partnerboard Chairperson (*Jean-Baptiste Cohuet, 15min*) 6.2. Developing a way forward for collecting data from VOS post June 2026 (*Jaqueline Sugier, 10min*) 6.3. Report on the market analysis for developing a system to replace Turbowin (*Louisa Bloomer, 15min*)	Joel Cabrie (Steffen Steinmoeller)

	6.4. Discussion (*40min*)	
10:20-11:00	7. **OceanOPS** 7.1. Report from Technical Coordinator (*Martin Kramp, 20 min*) 7.2. OceanOPS update and Service Level Agreement with SOT (*Mathieu Belbeoch, 20 min*)	Joel Cabrie (Steffen Steinmoeller)
11:00-11:30	Coffee Break	
11:30-13:15	7.3 Discussions continued (*40 min*) 8. **FOURTEENTH SESSION OF THE VOS PANEL (VOSP-14)** 8.1. Report by the VOSP Chairperson (*Joel Cabrie, 15 min*) 8.2. E-SURFMAR Expert Team on VOS status report (*Olivier Desprez, 10 min*) 8.3. Report from VOS GDAC (*Callum Stone, 10 min*) 8.4. Report from US VOS (*Michael Potochney, 5 min*) 8.5. Opportunities and Challenges with bathymetry data (*Sam Harper, 5 min*) 8.6. Discussions, Q/A (*30* min)	Emma Steventon (Jean-Baptiste Cohuet)
13:15-14:15	Lunch Break	
14:15-15:15	9. **SEVENTEENTH SESSION OF THE SOOP IMPLEMENTATION PANEL (SOOPIP-17)** 9.1. Report from the SOOPIP Chairperson *(Justine Parks, 10 min*) 9.2. Report from 2024 joint GOSUD/GTSPP/IQUOD/SOOP meeting (*Simona Simoncelli, 10 min)* 9.3. XBT Data flow and transmission (*Joaquin Trinanes, 10 min*) 9.4. Field Personnel Solutions (*Avery Snyder, 10 min*) 9.5. Underway CO2 data from US program (*Denis Pierrot, 10 min*) 9.6. Discussions, Q/A	Ash Parker (Rebecca Cowley)
15:15-15:45	Coffee Break	
15:45-17:30	Discussions, Q/A (cont.) (*15 min*) 10. **Second Session of the ASAP Panel (ASAP-2)** 10.1. Report by the ASAP Chairperson (*Rudolf Krockauer*)	Jean Baptise Cohuet (Joel Cabrie)

	10.2. Data issues and developments (*Rudolf Krockauer*) 10.3. Review and approval of ASAP Terms of Reference (*Rudolf Krockauer*) 10.4. Discussion, Q&A 11. **Strategic direction from Secretariat (WMO/IOC)** 11.1. OCG (*David Legler/Ann Zinkann, 15min*) 11.2. GOOS/IOC (*Joanna Post, 15min)* 11.3. WMO (*Champika Gallage, 15min*) 11.4. Discussion (*15 min*)	

Day 3: Thursday 3 April 2025		
Time: CEST (UTC+2)	**Item**	**Moderator*** (Rapporteur)**
08:00-09:00	Registration/Administration/Coffee	
09:00-11:00	12. **REPORTS FROM THE TASK TEAMS** 12.1. Task Team on Recruitment, Promotion and Training (TT-RPT, *Steffen Steinmoeller, 10min*) 12.2. Task Team on Metadata (TT-Metadata, *Emma Steventon, 10min*) 12.3. Task Team on Instrument Standards and SatComm Systems (TT-ISSC, *Jean-Baptiste Cohuet, 10min*) 12.4. Task Team on Key Performance Indicators (TT-KPI, *Elizabeth Kent, 10min*) 12.5. Task Team on VOS Delayed Mode data (TT-VOS-DMD, *Axel Andersson, 10min*) 12.6. Task Team on the Expansion of Independent Class Observations (*TT-EICO, Darin Figurskey, 10min*) 12.7. Plenary Discussion including Recommendations from Task Teams (*60 min*)	Olivier Desprez (Joel Cabrie)
11:00-11:30	Coffee Break	
11:30-13:15	13. **DATA SESSION** 13.1. OCG Data Task Team (*Kevin O'Brien, 10min*)	Axel Andersson (Tina Leiding)

	13.2. About Coriolis and its role as GDAC for various networks (*Ludovic Drouineau, 10 min*) 13.3. Transition to WIS2.0 (*David Berry, 10min*) 13.4. Assessing XBT data assimilation in models (*Shane Keating, 10min)* 13.5. The impact of SOT data (*Sharon Jewell, 10min)* 13.6. Discussion (*40 min*) ▪ Do we need a Data Task team for SOT? ▪ Interaction with ODIS	
13:15-14:15	Lunch Break	
14:15-15:15	14. **BREAKOUT GROUPS (Parallel sessions)**	
	14.1. VOS Breakout Session: 14.1.1. Discussion 14.1.2. Review and approve Terms of Reference and membership (*Joel Cabrie*) 14.1.3. IMO Circular 1293 revision 2 (*Joel Cabrie*) 14.1.4. Marine Observer's Handbook update (*Joel Cabrie*)	Joel Cabrie (Steffen Steinmoeller)
	14.2. SOOP Breakout Session: 14.2.1. XBT Science Team report (*Lisa Krummel*) 14.2.2. XBT database and standardization (*Rebecca Cowley*) 14.2.3. Discussion of SOOP membership groups (*Justine Parks*) 14.2.4. Review and approve Terms of Reference (*Justine Parks*)	Justine Parks (Rebecca Cowley)
15:15-15:45	Coffee Break	
15:45-17:00	**Ifremer Visit (followed by social dinner)**	

Day 4: Friday 4 April 2025		
Time: CEST (UTC+2)	**Item**	**Moderator*** (Rapporteur)**
08:00-09:00	Registration/Administration/Coffee	
09:00-10:00	15. **QUESTIONS AND DISCUSSION ARISING FROM ALL FORMER ITEMS**	Steffen Steinmoeller (Olivier Desprez)

11:00-11:30	Coffee Break	
11:30-12:30	16. **SOT Admin** 16.1. Financial report (*Champika Gallage*) 16.2. SOT executive board membership (*Champika Gallage*) 16.3. Next SOT session (SOT-14) (*Champika Gallage*)	Elisabeth Kent (Axel Andersson)
12:30-13:15	17. **Actions Review**	Martin Kramp (Champika Gallage)
13:15-14:15	Lunch Break	
14:15-15:15	**Actions Review continued**	
15:15-15:45	Coffee Break	
15:45-17:00	18. **Closure of the Session (SOT-Chair, 5 min)**	SOT Vice-Chair (SOT TC)

Annex 2: VOS Terms of Reference

VOS Terms of Reference (approved at the SOT-13)

The Voluntary Observing Ship (VOS) Panel shall:

b) Review, recommend and coordinate the implementation of new and improved specialized shipboard meteorological instrumentation, siting and observing practices, as well as of associated software;
c) Support the development and maintenance of new pilot projects;
d) Oversee and encourage members to upgrade their VOS to report according to standards meeting climate user requirements, including reporting the required climate and ship parameters in both real time (GTS) and in delayed mode (via VOS GDAC);
e) Develop and implement activities to optimize ship inspections and recruitment, including promotional material;
f) Prepare annually a report on the status of VOS operations, data availability and data quality.

Annex 3: Ship Observation Team (SOT) Executive Board (EB) Terms of Reference

(SOT-13- Review)

The Terms of Reference of the SOT EB shall be:

(a) To seek guidance from the SOT at its regular sessions regarding specific issues to be addressed by the SOT EB and task teams during the intersessional period;
(b) To act promptly to deal with any SOT-related administrative, financial, and planning issues and opportunities that might arise, within the guidelines established and reviewed regularly by the team;
(c) To authorize the chairperson or the vice-chairperson as delegated, to commit any expenditure necessary for the resolution of these issues and the promotion of the team's aims and objectives, up to the maximum amounts that might be agreed in advance by the SOT EB, by the SOT at regular session, or by the availability of funds;
(d) To assist the chairperson with regard to continuing the arrangements, including financial arrangements, to secure the services of a technical coordinator;
(e) To set working priorities according to the SOT requirements at its regular sessions, and provide further guidance to the networks during the intersessional period
(f) Negotiate activities for OceanOPS according to SOT priorities within the framework of the OceanOPS SLA;
(g) Confer by electronic mail, with a minimum of four EB teleconferences held annually, and at least two of those including the Chairs and vice-Chairs of the SOT Task Teams or their representatives;
(h) To exploit opportunities to confer at other meetings face-to-face;
(i) To conduct regular SOT session biennially, following an agenda developed by the SOT EB;
(j) To conduct a mid-term video conference to track and review action items, budget, annual workplan and the OceanOPS Service Level Agreement;
(k) To consult with SOT members, task team chairpersons, OceanOPS and secretariats during the intersessional period as required; and,
(l) To report its activities to the SOT at its regular session, and throughout the intersessional period as appropriate.

Membership

The membership of SOT EB shall be constituted by:

(a) The SOT Chair(s), vice-Chair(s);
(b) The VOS Chair(s), vice-Chair(s);
(c) The XBT SOOP Chair(s), vice-Chair(s);
(d) The ASAP Chair(s), vice-Chair(s);
(e) The OceanOPS focal point (ex officio);
(f) A representative from the IOC Secretariat (ex officio); and,
(g) A representative from the WMO Secretariat (ex officio).

Working procedures

(a) A quorum of the SOT EB will be at least three members, including the SOT Chair or his or her designee, VOS Panel Chair or his or her designee, and XBT SOOP Chair or his or her designee and ASAP chair or his or her designee.
(b) Any SOT member can attend SOT EB meetings as an observer, subject to availability of virtual or actual meeting room space. If required, the chairperson will make a final decision as to which observers may attend. The chairperson may also invite other persons to attend at his or her discretion.

(c) The term of SOT EB members is two years, equal to the intersessional period between SOT meetings. They shall be eligible for re-election in their respective capacities, but would serve in principle for no more than three consecutive terms (in principle six years) in that capacity. Elections will be decided by a simple majority if a quorum of SOT members is present during the regular biennial meeting. Nominations for vacant positions on the EB will be made prior to, or at, the meeting so that a vote can be taken at the end of the meeting.

(d) A quorum of a biennial meeting will consist of at least seven SOT members, with one member per WMO Member State/Territory or IOC Member State represented. If more than one member representing one WMO and/or IOC Member State/Territory is attending, the representatives from that particular State/Territory have to decide whose vote shall be counted. If a quorum is not present at the meeting, elections shall be by unanimous vote. If a unanimous vote cannot be achieved, membership shall be determined by the Secretariats.

(e) In principle, EB membership should assure regional and gender balance as far as possible.

(f) The SOT EB may establish time-bound substructures for the discharge of specific tasks during an intersessional period. The cost shall not exceed the availability of funds. Such temporary substructures shall be discontinued at the end of every intersessional period unless agreed to continue by the SOT members at the biennial meeting.

Annex 4: Financial statements

(link to the Financial report)

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

Secrétariat
7 bis, avenue de la Paix – Case postale 2300
CH 1211 Genève 2 – Suisse
Tél.: +41 (0) 22 730 81 11
Fax: +41 (0) 22 730 81 81
wmo@wmo.int – public.wmo.int

Ocean Observing Networks Trust Fund
Trust Fund 421309
Statement of income and expenditure
For the period 1 January to 31 December 2024
Amounts in United States dollars

1. Balance brought forward , 1 January 2024				244,375
2. Income				
2.1 Contributions a/				150,839
2.2 Transfer of balances of to OceanOPS (JCOMMOPS, EuroSea and GROOM) b/				(72,260)
2.3 Gain in exchange currency				18,594
3. Total available funds during reporting period				341,548
4. Expenditure				
4.1 Direct project costs				
4.1.1 DBCP				
4.1.1.1 DBCP Capacity Building	28,820			
4.1.1.2 DBCP Chair Travel	9,977			
4.1.1.3 DBCP Total		38,797		
4.1.2 SOT				
4.1.2.1 SOT Chair and Other Travel	7,841			
4.1.2.2 TURBOWIN Funds	2,321			
4.1.2.3 SOT Total		10,162		
4.1.3 WMO				
4.1.3.1 WMO Travel	4,616			
4.1.3.2 WMO Total		4,616		
4.1.4 OceanOPS - GROOM				
4.1.4.1 OceanOPS Network Focal Point	18,103			
4.1.4.2 OceanOPS Staff Direct Personnel Costs	1,876			
4.1.4.3 OceanOPS - GROOM Total		19,979		
4.1.5 Argo				
4.1.5.1 Travel	3,184			
4.1.5.2 Argo Total		3,184		
4.1.6 Total direct costs		76,738		
4.2 Indirect project costs				
4.2.1 Support costs at 3%	2,302			
4.2.2 Bank charges	501			
4.2.3 Total indirect costs		2,803		
4.3 Total project expenditure				79,541
5. Balance of fund at 31 December 2024				**262,007**
6. Balance comprised of the following projects:				
6.1 DBCP				129,326
6.2 SOT				100,525
6.3 WMO				14,911
6.4 Argo				17,245
6.5 Total				**262,007**

v Contributions	
Bureau of Meteorology (EUR 3,510, CHF 20,150 and AUD 20,000)	39,534
GEOMAR, Germany (EUR 25,717.56)	28,227
CSIRO, Australia (AUD 30,000)	19,764
European Commission (release of deferred income)	29,238
Météo France (EUR 15,510)	16,804
The Agency for Meteorology, Climatology and Geophysics (USD 10,000)	10,000
BSH, Germany (EUR 3,600)	3,818
National Institute of Ocean Technology (USD 1,866.36)	1,866
Meteorological Services of New Zealand (CHF 1,404)	1,588
Total contributions	**150,839**

v *Transfer of balance of JCOMMOPS, EuroSea and GROOM Projects to OceanOPS Trust Fund*

The financial statement has been prepared on the accrual basis of accounting in accordance with the International Public Sector Accounting Standards (IPSAS). Therefore, the amount of contributions shown above excludes those that are deferred in accordance with IPSAS.

Certified correct:
Krishnavarahan Adhivarahan
Chief, Finance Division
12 March 2025

Certified correct:
Albert Fischer
Director, WIGOS Division
12 March 2025

Annex 5: Actions and Recommendations

SOT-13 Actions and Recommendations

Agenda item	Description	Responsibility	Timeline
6	Provide evidance of Turbowin use to the partner board	Panel members	Dec-25
6	Do a survey with ship operators to find their requirements	Turbowin partnerboard	Dec-25
6.1	Members operating Turbowin software to consider joining the Turbowin Partnerboard (Members, SOT14)	TBW partnerboard	
7.1	OceanOPS to foster Sailing4Science Initiatives in remote areas (ong.) (recommendation=)		
7.1	TT meta to contact SOT operators to improve metadata quality in OceanOPS		
7.1	TT Chairs to provide updated ToRs and member lists to OceanOPS (30 April 2025) and OceanOPS to update User Groups (31 May 2025)		30 April/31 May
7.1	Operators to exploit OceanOPS computed Status Reports to identify gaps and make updates (metadata, contacts, etc)		
7.1	SOT-EB to work with IRSO, to recruit full int RV fleet for SOT (ongoing		
7.1	Populate OceanOPS system with cruise information where possible (SOT members, through NFPs and Operators, ongoing BP)		
7.1	SOT-EB to investigate how recently reduced TC support/SLA could be increased to former level (ongoin, BP, include NFPs)		
7.1	Increase Capacity Development activities with other GOOS networks (RPT TT, SOT14)		SOT14
7.1	OceanOPS to continue highlevel discussion with shipping industry, and UNOC activities to foster industry engagement with SOT (recomm.)		
7.1	OceanOPS to extend data tracking to WIS and Coriolis if SLA permits (recomm)		
7			
8.1	All VOS operators to review and update their VOS metadata in the OceanOps metadata database (VOS operators, July 2025)	TT RPT	
8.1	All VOS operators are requested to provide quarterly delayed mode data to the VOS GDACs in IMMT format (VOS operators, quarterly)	TT RPT	
8.1	All VOS operators to encourage visual observations from participating vessels where possible (VOS operators, ongoing)	TT RPT	
8.1	VOS operators to encourage a target of one observation per watch (every 4 hours) from manual observing ships (VOS operators, ongoing)	TT RPT	

8.2	E-Surfmar recommends that a financial commitment be made to ensure the sustainability of Turbowin beyond mid-2026. (VOS operators, 2026)	VOS operators	
8.2	E-Surfmar recommends QC-TOOLS for VOS fleet management. (VOS operators, ongoing) ,BP	VOS operators	
8.2	E-Surfmar to continue to support OceanOPS for Metadata management. (recomm).	Eumetnet	
8.3	Members are encouraged to provide feedback and user requirements for an updated or replaced format for the IMMT code. (VOS operators and data users)	VOS operators	midterm review
8.3	Observations submitted to a VOS GDAC should contain the same identifier as on the GTS, i.e., the SOT-ID should be used as identifier also in IMMT if it is used for GTS real time data.	VOS operators	Best practice
12.1	TT-RPT to re-write the IMO MSC Circular 1293 for review by the SOT-EC.	TT-RPT	Mar-26
12.1	TT-RPT to re-write the relevant sections of the Marine Observer's Handbook as PDF files for use in Turbowin Help files.	TT-RPT	Dec-25
12.1	TT-RPT Chair to follow up with VOS Donation recipients for status updates on implementation.	TT-RPT	Jun-25
12.1	TT-RPT Chair to update content of the VOS website including link to new VOS brochure.	TT-RPT	Jun-25
12.2	TT-Metadata to prepare instructions for how users can request to add a new sensor to OceanOPS reference tables (December 2025)	TT-Metadata	Dec-25
12.2	TT-Metadata to regularly review the OceanOPS SOT Github repository for updating metadata reference table values and issues regarding the OceanOPS tool (Ongoing)	TT-Metadata	ongoing
12.2	Arrange further metadata training webinars for the wider SOT community (with TT-RPT)	TT-Metadata / TT-RPT	SOT-14
12.2	Retire the OceanOps to Pub.47 export, working with members to ensure the smooth migration to the new SOT Metadata format (December 2025)	TT-Metadata	Dec-25
12.2	Investigate capabilities of the next generation AIS system, VHF data exchange system (VDES) for SOT purposes	TT-ISSC	midterm review
12.2	TT-Metadata to work through the list of sensors in the OceanOps interface and ensure that all parameters are available to record against the sensor model capabilities	TT-Metadata	Dec-25
12.3	Members to update their metadata in OceanOPS database and clean inconsistencies (Members, ASAP)	TT-ISSC	BP
12.3	Centers that are sending both TAC and BUFR are asked to stop TAC diffusion, operational WMO newsletter. (Members, ASAP)	TT-ISSC, WMO	

12.4	Review existing indicators and maps for the SOT and make recommendations to the EC for re-design or new products if required (and potentially parameter-based beyond SOT)	SOT networks	Dec-25
12.4	Further develop metrics on spatiotemporal coverage, relating those metrics to the requirements as specified in the WMOs RRR (in coordination with the GOOS OCG/networks, GCOS AOPC and OOPC, and other relevant groups	TT-KPI	preliminary findings end 2025, finalised by SOT-14
12.4	Further enhance metrics on: data flow (to include monitoring the use of the latest BUFR sequences for marine data); quality of observations (particularly linking to the MeteoFrance QC tools, blacklisting and error statistics -mean error and RMSE); and the percentage of VOS in a particular class reporting the parameters required to meet that classification.	TT-KPI	preliminary findings end 2025, finalised by SOT-14
12.4	Contribute to the OCG TT Metrics & Maturity Phase 2 to establish robust metrics for the maturity and health of the SOT networks.	SOT-EB	Mar-26
12.5	Complete the review of IMMT including metadata requirements.	TT-VOS-DMD	SOT14
12.5	Propose a mechanism to ensure VOS metadata history is regularly archived	TT-VOS-DMD	midterm review
13.4	Include the observations impact information into a brochure, website etc for ship companies and other stakeholders	TT KPI/RPT	midterm review
14.3	Re-focus the SOOP network on XBTs [CTD] only and rebrand the network name to be XBT SOOP. Rewrite the ToRs accordingly.	XBT SOOP, TC in Ocean-Ops	SOOPIP Apr-205 TC?
14.3	Create an XBT data management team focused on the goals of unifying the XBT data from the different operational programs	XBT SOOP, TC in Ocean-Ops	Apr-25
14.3	Use Australia case study to track down sources of reporting discrepancies and share results with XBT SOOP	XBT SOOP, TC	Dec-25
14.3	Amend the SOOPIP mailing list to reflect the change to XBT SOOP naming and constitution	XBT SOOP, TC	25-Jun
4.5	Actio 4.5/1 ScienceRoCS to investigate how to ingest data into GTS or WIS 2.0 and to seek collaboration with appropriate partners for this task (recomm; Shawn)		
15.1	Action 15/1: Form working group to address the UNOC Brochure. Membership to include Justine Parks, Joel Cabrie, Mathieu Belbeoch, Shane Keating, Darin Figurskey, Martin Kramp and Jean-Baptiste Cohuet.	Mathieu Belbeoch	Apr-25
15.1	Action 15/2: Call to SOT community for interested persons to contact the TT-KPI Chair to participate in a review of the TT membership, strucure and ToRs.	TT KPI	Apr-25

15.1	Action 15/3: Add a data quality metric and status update of WIS2.0 migration to the national report template. Addition of QC blacklist to be added to auto-generated NR.	SOT-EB	SOT-14
15.1	Action 15/7: Draft a proposal to IMO MSC for member states to push for standards relating to onboard sensors for all new ship builds (i.e. barometer, anemometer, SST sensor, etc)	VOS Chair	Oct-25
15.1	Action 15/4: Establish network -specific content review teams for the new SOT website(s)	XBT SOOP, VOS & ASAP Chairs	Jul-25
15.1	Action 15/8: Investigate alternative Action Item tracking tools for intersessional period	TC	Dec-25
15.1	Action 15/9: Communicate OceanOPS SLAs targets to OCG	SOT Chair	OCG-16
15.1	Action 15/10: TT-RPT to formalise existing best practice documents through GOOS framework to improve VOS health index for BPs	TT-RPT	SOT-14
	All recommendations identified as best practices to be incorporated into GOOS endoresed best practices for SOT	TT-RPT	SOT-14

Agenda Item	Recommendations	To whom	Follow up by
2	TT to work on synergies between different initiatives presented at SOT-13(Agenda 2) to see how best some of them come under GOOS umbrella	OCG	SOT Exb
7	Assist SOT to develop a unified policy on how to deal with non-met variables measured from VOS (e.g. CO2, Depth)	OCG	SOT Exb
9.1	Letter supporting SOT activities to the ships signed by WMO/IOCand IMO	OCG	SOT Exb
9	GOOS write a letter to IRSO requesting all suitable research ships to have atmospheric, CO2 and underway measurements and share data as appropriate/feasible	GOOS	SOT Exb
12.2	All users to have migrated to using the new SOT format and submitting their metadata via the OceanOPS interface by the end of (the extended) migration phase 2, noting that the OceanOPS to Pub47 export will end by this date	TT-Metadata	Dec-25
12.2	The Task Team Metadata encourages SOT members to submit nominations for the role of a Co- Chair (focus VOS). Nominations should be submitted to sot-tt-meta@groups.wmo.int	TT-Metadata	Jun-25
14.3	pCO2 groups participating in SOOP-pCO2 to shift their work to organize within SOCONET and no longer within SOOP.	SOOP-pCO2 & SOCONET	
14.3	TSG operational groups are recommended to self-organize, explore engaging with IRSO, SAMOS, R/V technicians, and to engage more closely with GOSUD and no longer within SOOP.	SOOP-TSG & GOSUD	

14.3	CPR operational groups are recommended to continue their efforts at self-organization within GACS and no longer within SOOP.	SOOP-CPR & GACS	
14.3	FerryBox and other operational SOOP groups not already mentioned, investigate how to self-organize and explore the best route of engagement with the OCG.	FerryBox, other networks	

Annex 6: Participants List

ATTENDANCE	LAST NAME	FIRST NAME	AFFILIATION (COUNTRY)
Online	AARDEMA	HEDY MARIA	MPI (GERMANY)
Online	ABBA	AMAZIA	NDM (CAMEROUN)
Online	ACCENSI	MICKAEL	IFREMER (FRANCE)
Online	ACHARYA	RAJA	IMD (INDIA)
Online	ADHIKARY	SOURAV	IMD (INDIA)
Online	ALABI	KOREDE ISAIAH	FCF (NIGERIA)
Online	AL-HARTHI	SAUD	NCM (SAUDI ARABIA)
In Person	ALORY	GAEL	LEGOS (FRANCE)
Online	AMARENDRA	PAMARTHI	AMARA (INDIA)
In Person	AMRINA	DAVA	BMKG (INDONESIA)
In Person	ANDERSSON	AXEL	DWD (GERMANY)
Online	ARBAOUI	FELLA	UST (ALGERIA)
Online	ARCE	JULIETA	SHN (ARGENTINA)
In Person	ARCENE	MOHAMED	ANACM (COMORES)
In Person	AUCAN	JEROME	SPC (NEW CALEDONIA)
Online	AULICINO	GIUSEPPE	UNP (ITALY)
In Person	BARTON	ZACHARY	UM (USA)
Online	BELAL	MAHMOUD	LFRPDA (EGYPT)
In Person	BELBEOCH	MATHIEU	OCEANOPS / WMO
Online	BEN ISMAIL	SANA	INSTM (TUNESIA)
Online	BHUKYA	BHASKAR	CIFE (INDIA)
In Person	BILLON	CHRISTOPHE	METEO-FRANCE (FRANCE)
Online	BISWAS	HABIBUR RAHAMAN	IMD (INDIA)
Online	BLOOMER	LOUISA	STANTEC (NEW ZEALAND)
In Person	BOSSER	PIERRE	ENSTA (FRANCE)
Online	BOUKSIM	HASSAN	GDM (MOROCCO)
Online	BRAVO	BENJAMIN	ARMADA (CHILE)
Online	BUSUMPRAH	PETER TEYE	MFA (GHANA)
In Person	CABRIE	JOEL	BOM (AUSTRALIA)
In Person	CARRACEDO	LIDIA	IFREMER (FRANCE)
In Person	CARVAL	THIERRY	IFREMER (FRANCE)
Online	CARVALHO	ANABELA	IPMA (PORTUGAL)
Online	CHAUDHARY	REHAN	HEREON (GERMANY)
In Person	CHENGWE	REFILWE DESIREE'	SAWS (SOUTH AFRICA)
In Person	CHEUNG	WING KAI	HKO (CHINA)
In Person	COATANOAN	CHRISTINE	IFREMER (FRANCE)
In Person	COCQUEMPOT	LUCIE	IFREMER (FRANCE)
In Person	COHUET	JEAN-BAPTISTE	METEO-FRANCE (FRANCE)
In Person	COLLARD	FABRICE	OCEANDATALAB (France)
Online	CONTE	AUGUSTO	NAVY (SPAIN)
Online	CORNES	RICHARD	NOC (UK)
Online	COTRONEO	YURI	UNP (ITALY)
In Person	COWLEY	REBECCA	CSIRO (AUSTRALIA)
Online	CROCHERON	MS MAGGIE ANN	(USA)
Online	CUNNINGHAM	FRASER	METOFFICE (UK)
Online	DAMASKE	DANIEL	PANGAEA (GERMANY)

Online	DAS	ANANDA	IMD (INDIA)
Online	DAS	MOHAN KUMAR	NOAMI (BANGLADESH)
Online	DE LA MAZA	ALEJANDRO	CNWS (CHILE)
In Person	DE VARGAS	COLOMBAN	CNRS (FRANCE)
Online	DEL AMO	YOLANDA	UB (FRANCE)
Online	DESBRUYÈRES	DAMIEN	IFREMER (FRANCE)
Online	DESCHNER	STEPHAN	HEREON (GERMANY)
In Person	DESPREZ DE GÉSINCOURT	OLIVIER	METEO-FRANCE (FRANCE)
Online	DEZA	ROSARIO	DHN (PERU)
Online	DIABY	ALMAMY	IFAN-CAD (SENEGAL)
Online	DIEDHIOU	TIDIANE	ANACIM (SENEGAL)
Online	DONG	SHENFU	NOAA (USA)
In Person	DROUINEAU	LUDOVIC	IFREMER (FRANCE)
Online	DUONG NGOC	TIEN	VMHA (VIETNAM)
Online	ELEGBEDE	ISA	SAEIO (USA)
Online	EMENYONU	UCHENNA	CBERD (NIGERIA)
In Person	EPINOUX	ALEXANDRE	CNRS (FRANCE)
Online	FEROLA	ANTONINO IAN	ESA
In Person	FIETZEK	PEER HOLGER	KONGSBERG DISCOVERY (NORWAY)
Online	FIGURSKEY	DARIN	NOAA (USA)
Online	FLEURY	ÉLODIE	IFREMER (FRANCE)
Online	FORBES	CRISTINA	USCG (USA)
Online	FRANGOULIS	CONSTANTIN	HCMR (GREECE)
Online	FRATIANNI	CLAUDIA	INGV (ITALY)
In Person	GABRIEL	ERWANN	BRITTANY FERRIES (FRANCE)
In Person	GALLAGE DONA	CHAMPIKA	WMO
In Person	GAUTIER	PHILIPPE	METEO-FRANCE (FRANCE)
Online	GAZYETOV	YEVGEN	BASZH (UKRAINE)
Online	GLUŠAUSKAITE	ISABELLA	WOC (USA)
Online	GOPAL	NEETHA	IMD (INDIA)
Online	GUEVARA PIMIENTO	EDINSON ANDRÉS	DIMAR (COLOMBIA)
In Person	GUILLERM	CHRISTOPHE	METEO-FRANCE (FRANCE)
Online	HELGESEN	VIDAR	IOC-UNESCO
Online	HERRMANN	BORIS	MALIZIA (GERMANY)
In Person	HESLOP	EMMA	IOC-UNESCO
Online	HUANG	FEILONG	GPMB (CHINA)
Online	HUDAK	REBECCA	WHOI (USA)
Online	HUISSIER MULLER	BRIGITTE	(FRANCE)
Online	ILLSLEY	HANNAH	METOFFICE (UK)
Online	INAL	AHMED	NCRDFA (ALGERIA)
Online	JEWELL	SHARON	METOFFICE (UK)
Online	JONAS	MATHIAS	IHO
Online	JORQUERA	RANDOLFO	ARMADA (CHILE)
Online	JUAN	MORENO	DIMAR (COLOMBIA)
Online	KA	MOUHAMADOU BAMBA	APRPE (CANADA)
Online	KEATING	SHANE	UNSW (AUSTRALIA)
Online	KENT	ELIZABETH	NOC (UK)
Online	KHEDIM	AMINE	NCM (ALGERIA)
Online	KHOTIMAH	MIA KHUSNUL	WMO

Online	KIM	CHANGSOO	(KOREA)
Online	KING	ANDREW	NIWR (NORWAY)
In Person	KLETA	HENRY	DWD (GERMANY)
Online	KOBASHIGAWA	YUTAKA	JMA (JAPAN)
In Person	KOTTA	DIONYSIA	HNMS (GREECE)
In Person	KRAMP	MARTIN	OCEANOPS / WMO
Online	KRAUZIG	NAOMI	UPM (ITALY)
In Person	KRIEGER	MAGALI	OCEANOPS / WMO
In Person	KROCKAUER	RUDOLF	DWD (GERMANY)
Online	KRUMMEL	LISA	BOM (AUSTRALIA)
Online	LAGO	VÉRONIQUE	UNSW (AUSTRALIA)
Online	LAHENS	OLIVIA	CMDLM (FRANCE)
Online	LANGOUL	ULRICH	PAD (CAMEROUN)
In Person	LEIDING	TINA	DWD (GERMANY)
Online	LHERMINIER	PASCALE	IFREMER (FRANCE)
Online	LIU	CHUNYING	NOAA (USA)
In Person	LIU	FEI	SMB (CHINA)
Online	LOGARZO	JULIETA	OGS (ITALY)
Online	MAASSEN	LANCE	CSUDN (USA)
Online	MACKENZIE	BEV	BIMCO
In Person	MAES	CHRISTOPHE	IRD (FRANCE)
Online	MAGNIFICO	GIUSEPPE	CNR (ITALY)
Online	MARASCO	MATTEO	IIEPP (ITALY)
Online	MARKI	ALEXANDRA	BSH (GERMANY)
Online	MARQUET	CHRISTOPHE	STERELA (FRANCE)
Online	MARUMOTO	OSAMU	IMO
Online	MCDONAGH	ELAINE	NORCE (NORWAY)
Online	MCMAHON	AIDAN	BOM (AUSTRALIA)
Online	MELNIKOV	VASILY	OCEAN (RUSSIA)
Online	MFOULA NKOLO	FRÉDÉRIC	APCAM (CAMEROON)
Online	MIMFE'E MBA	ARHEL EULOGE	PAK (CAMEROUN)
Online	MMUOMAIHE	JAMES ONYEBUCHI	IOMA (NIGERIA)
Online	MOHAMED	AHMED	MFBE (SOMALIA)
Online	MOHAMED	HASSAN AHMED	KMD (KENYA)
Online	MÖLLER	KLAS OVE	HEREON (GERMANY)
Online	MORRIS	TIM	ARUP (UK)
In Person	MORTIER	LAURENT	ENSTA (FRANCE)
Online	NANGLE	JOHN	NOAA (USA)
In Person	NARROS	JULIEN	IOC-UNESCO
In Person	NATH	DR SANKAR	IMD (INDIA)
Online	NAVRIA	KAVITA	IMD (INDIA)
Online	NEVEROVSKYI	IGOR	BASZH (UKRAINE)
Online	NOGUCHI	HIDEKI	(JAPAN)
In Person	O'BRIEN	KEVIN	UW (USA)
Online	OELKER	JULIA	ICBN (GERMANY)
Online	ONGOLO MAYAM	CYRILLE PIERRE	PAK (CAMEROUN)
Online	OSTLE	CLARE	MBA (UK)
In Person	PARKER	ASHLEY	CSIRO (AUSTRALIA)
In Person	PARKS	JUSTINE	SIO (USA)

Online	PASQUERON DE FOMMERVAULT	ORENS	OCEANOPS / IOC-UNESCO
Online	PATRO	BAGATI SUDARSAN	IMD (INDIA)
Online	PATTANAIK	DUSHMANTA RANJAN	IMD (INDIA)
Online	PERONTO	JAMES	NOAA (USA)
In Person	PETIT DE LA VILLÉON	LOÏC	(FRANCE)
Online	PIERROT	DENIS	NOAA (USA)
Online	PINCHEIRA	CLAUDIA	ARMADA (CHILE)
Online	POLEZHAIEV	YEVHENII	BASZH (UKRAINE)
Online	POPOV	YURIY	BASZH (UKRAINE)
In Person	POST	JOANNA	IOC-UNESCO
Online	POTOCHNEY	MICHAEL	NOAA (USA)
In Person	PRATAMA	BAYU EDO	BMKG (INDONESIA)
Online	PRATAMA	KHAFID RIZKI	BMKG (INDONESIA)
In Person	PRAVEEN KUMAR	BALAN PILLAI	INCOIS (INDIA)
Online	PUTRI	ARDILIA O Y	BMKG (INDONESIA)
Online	QUISPE SALAZAR	ELMER OVIDIO	UPCH (PERU)
In Person	RAIMUND	STEFAN	TOR (SPAIN)
Online	RASTGOO	ZAHRA	IRIMO (IRAN)
Online	RESEGHETTI	FRANCO	INGV (ITALY)
Online	REYNAUD	THIERRY	IFREMER (FRANCE)
Online	RIMMELIN-MAURY	PEGGY	CNRS (FRANCE)
Online	ROBERTS	ALEXIS	NOAA (USA)
Online	RODRIGUEZ	JULIAN	BOM (AUSTRALIA)
Online	RÜPKE	LARS	GEOMAR (GERMANY)
In Person	RUSCIANO	EMANUELA	OCEANOPS / IOC-UNESCO
Online	RUSTY	ALBARAL	NOAA (USA)
Online	SALEH	SAHAR	IRIMO (IRAN)
Online	SANA	AHMAD	MEC (OMAN)
Online	SANDAMAL	RAVINDU	NHO (SRI LANKA)
Online	SANS	MILAN	ARMADA (CHILE)
Online	SAWATDIRAKSA	SOROT	TMD (THAILAND)
Online	SCHLUNDT	MICHAEL	GEOMAR (GERMANY)
Online	SCHROEDER	KATRIN	CNR (ITALY)
Online	SEARS	IAN	NOAA (USA)
In Person	SEBASTIAO NETO	FRANCISCO OSVALDO	INAMET (ANGOLA)
Online	SEDANO ARAUJO	ELIANA NICOOL	DHN (PERU)
Online	SHARMA	MONICA	IMD (INDIA)
Online	SHENDE	UDAY	IMD (INDIA)
Online	SIMONCELLI	SIMONA	INGV (FRANCE)
Online	SIRITHANYARAT	ANAN	TMD (THAILAND)
Online	SMITH	SHAWN	COAPS (USA)
Online	SNYDER	AVERY	OTC (USA)
Online	SODIENYE	NOBLE	STP (NIGERIA)
In Person	SOMORIN	IFEOLUWA	PIL (NIGERIA)
Online	STAV	NIR	WMO
In Person	STEINHOFF	TOBIAS	GEOMAR (GERMANY)
In Person	STEINMÖLLER	STEFFEN	DWD (GERMANY)
Online	STENSTRÖM	MIKAEL	SMHI (SWEDEN)
In Person	STEVENTON	EMMA MARGARET	METOFFICE (UK)

Online	STONE	CALLUM	METOFFICE (UK)
In Person	SUGIER	JACQUELINE	EUMETNET
In Person	SUN	ZHAOBIN	CMA (CHINA)
Online	SUNJAY	SUNJAY	BHU (INDIA)
Online	THONGBAI	CHARKRIT	TMD (THAILAND)
In Person	TRIÑANES	JOAQUIN	USC (SPAIN)
In Person	TURPIN	VICTOR	OCEANOPS / WMO
In Person	UNGER	VINCIANE	METEO-FRANCE (FRANCE)
In Person	VAN DE KRAATS	BEREND	OCEANSX (NETHERLANDS)
In Person	VAN DE VEGTE	JOHN	KNMI (NETHERLANDS)
In Person	VAN VRANKEN	COOPER	ODN (USA)
In Person	VAYER	CLAIRE	IMOCA (FRANCE)
Online	VILELA-SILVA	FELIPE	IFREMER (FRANCE)
Online	VOSS	DANIELA	ICBME (GERMANY)
Online	WEISBROD	ROBERTA	WFSA (USA)
Online	WIEMER	GAUVAIN	DAM (GERMANY)
Online	WILLRUTH	JAN	DWD (GERMANY)
Online	WILLSTRAND WRANNE	ANNA	VOTO (SWEDEN)
Online	WUT YEE	HNIN	DMH (MYANMAR)
Online	XU	HAITONG	IST (CHINA)
Online	YAMAMOTO	MAYU	JMA (JAPAN)
Online	YELTAY	AIZAT	KAZHYDROMET (KAZAKHSTAN)
Online	ZACHARIA	SHIJO	IMD (INDIA)
Online	ZENG	LI	DOF (CHINA)
In Person	ZHOU	QINQIANG	GMDC (CHINA)
Online	ZINKANN	ANN-CHRISTINE	UCAR (USA)
Online	ZULAS	OLEKSANDR	BAH (UKRAINE)

Annex 7: List of Acronyms

ADCP	Acoustic Doppler Current Profilers
AET	Australian Eastern Time
AG-Ocean	Advisory Group on Ocean
AOPC	Atmospheric Observation Panel for Climate
ASAP	Automated Shipboard Aerological Programme
ASV	Automated Surface Vehicle
ASV	Automated Surface Vehicles
AWS	Automatic Weather Station
CMEMS	Copernicus Marine Environment Monitoring Service
CPR	Continuous Plankton Recorder
CSB	Crowd-Sourced Bathymetry
CTD	conductivity, temperature, and depth
DACs	Data Aquisition Centers
DBCP	Data Buoy Cooperation Panel
DMD	Delayed Mode Data
E-ASAP	European Automated Shipboard Aerological Programme
EB	Executive Board
ECVs	Essential Climate Variables
EEZ	Exclusive Economic Zones
EOVs	Essential Ocean Variables
E-Surfmar	Surface Marine programme of the Network of European Meteorological Services
ETRP	Education and Training Programme
EUCAWS	European Common AWS
EUMETNET	a grouping of 31 European National Meteorological Services
EW4All	Early Warning for All
FSU	Florida State University
GBON	Global Basic Observing Network
GCOS	Global Climate Observing System
GDACs	Global Data Assembly Centers
GHG	GreenHouse Gas
GHRSST	Group for High-Resolution SST
GLODAP	GLobal Ocean Data Analysis Project
GOOS SC	GOOS Steering Committee
GOSUD	Global Ocean Surface Underway Data
GTS	Global Telecommunication System
GTSPP	Global Temperature and Salinity Profile Programme
ICES	International Council for the Exploration of the Sea
ID	Identification
IHO	International Hydrographic Organization
IMMT	International Maritime Meteorological Tape
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange
IQuOD	International Quality-controlled Ocean Database
IRSO	International Research Ship Operators
KNMI	The Royal Netherlands Meteorological Institute
KPIs	Key Performance Indicators
LCDs	Least Developed Countries
MCDS	Marine Climate Data System
MFP	Marine Facility Planning

MQCS	Minimum Quality Control System
MSR	Marine Scientific Research
NCEI	National Centers for Environmental Information
NGO	Non-Governmental Organization
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration
NRT	Near Real Time
OCG	Observation Coordination Group
OOPC	Ocean Observations Physics and Climate
OSCAR	Observing Systems Capability Analysis and Review
PIs	Programme Investigators
PMOs	Port Meteorological Officers
QC	Quality Control
RoCS	Research on Commercial Ships
RRR	Rolling Review of Requirements
RTC	Regional Training Center
RVs	Research Vessels
SAMOS	Shipboard Automated Meteorological and Oceanographic System
SG-OOIS	Study Group on Ocean Observations and Infrastructure
SIDs	Small Island Developing States
SLP	Sea Level Pressure
SOCAt	Surface Ocean CO_2 Atlas
SOCONET	Surface Ocean CO_2 Reference Observing Network
SOFF	Systematic Observations Financing facility
SOI	Schmidt Ocean Institute
SOO	Ship of Opportunity
SOT	Ship Observation Team
SPC	Pacific Community
SSS	Sea Surface Salinity
SST	Sea Surface Temperature
TC	Technical Coordinator
TF	Trust Fund
TOR	The Ocean Race
ToR	Terms of Reference
TSG	ThermoSalinoGraphs
TT	Task Team
TT-EICO	Expansion of Independent Class Observations
TT-ISSC	Task Team on Instrument Standards and Satellite Communications Systems
TT-KPI	Task Team on Key Performance Indicators
TT-RPT	Task Team on Recruitment, Promotion, and Training
UK	United Kingdom
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
USA	United States of America
VOS	Voluntary Observing Ships
WHOI	Woods Hole Oceanographic Institution
WIGOS	Integrated Global Observing System
WIS2.0	WMO Information System 2.0
WMO	World Meteorological Organization
XBT	Expendable BathyThermographs
XST	XBT Science Team