EuroGO-SHIP
Enhancing ocean observations

Report of EuroGO-SHIP data curation recommendations including GAP analysis

Deliverable 2.3

28 November / Version 1.0

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About this document

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1. Summary of Deliverable 2.3

The objective of WP item 2.2 and corresponding deliverable 2.3 was the analysis of existing data and metadata streams and formats for real-time and delayed mode submission methods from repeat hydrography cruises, with the aim to identify issues and gaps and eventually propose a data curation and preservation strategy that adheres to FAIR data principles.

2. Introduction

The motivation for a European infrastructure for hydrography was born out of the experience of existing international structures that coordinate hydrographic observations including International GO-SHIP and the ICES Working Group on Hydrography. Both International GO-SHIP and ICES, as well as those involved in the Black Sea observing system, have written white papers describing their activities (Sloyan et al., 2019, González-Pola et al., 2019, Palazov et al., 2019). These white papers identify several areas that we will improve and move beyond the state of the art within the EuroGO-SHIP initiative.

A large amount of valuable ocean observation data is gathered during research cruises. Physical properties such as temperature, currents and conductivity; chemical properties including salinity, dissolved oxygen, nutrients and tracers; and biological aspects including chlorophyll-a fluorescence. Some measurements are made by continuously running instruments, and others by laboratory analysis of bottle samples. There is a wide range of timescales upon which observations are considered 'final' and available for scientific research. Some temperature and salinity data are used within 12 hours of being observed, and some bottle samples may be stored for many months before being analysed in the laboratory back on shore. Observations may be suitable for applications such as ocean and weather forecasting in their 'raw' state, but the same observations undergo careful quality control before being suitable for research and climate studies.

Delayed-mode data submission procedures, formats and repositories from the World Ocean Circulation Experiment (WOCE) as origin of repeat hydrography are nowadays at least partially still in place, but not always applicable for hydrography cruises at broader scale (ie non-GO-SHIP). Advancements in best practices and technology (including real-time data submission), changes in national data policies, and the development of the European data aggregation landscape have led to a situation where it is very difficult to follow research cruises and their emerging data, which often flow in different versions and formats to different repositories and into different products. We developed a methodology to analyse the present situation, noting that data producers are sometimes unaware of how and where their data are eventually available at international scale, or missing at key repositories, and in many cases difficult to identify. Hydrography cruises also play an important role in the implementation of autonomous observing networks (eg Argo), both as deployment and cal/val opportunity; often set up as piggy-back

operation, the contribution of the hydrography cruises are often not properly recognized, and effects like carbon footprint not appropriately shared.

3. Methodology

The methodology we used was as follows:

- 3.1: Implementation of persistent and full lifecycle Cruise-ID scheme by OceanOPS
- 3.2: Seek input from key stakeholders in hydrographic data production and management
- 3.3: Spin up / visualize draft (meta-) data landscape
- 3.4: Run (meta-) data survey at global scale to identify national data best practices
- 3.5: Based on survey, make a data format recommendation for (at least) CTD and bottle data
- 3.6: Select a representative set of sample cruises and analyse delayed-mode data availability at different repositories
- 3.7: Analyse real-time data availability of CTD data (milestone)
- 3.8 Develop and test a SeaDataNet-compliant ADCP dataformat (milestone)

3.1. Implementation of persistent and full lifecycle Cruise-ID scheme by OceanOPS

OceanOPS implemented a capacity for allocation of persistent, unique cruise identifiers: 10 random characters without further semantic, in principle rolling out the ID allocation principles and procedures already in place for floats, buoys, etc, for which OceanOPS has delegated allocation authority from WMO members. Users with an OceanOPS user profile can register cruises on GO-SHIP- or other recognized reference lines through a simple GUI by submitting the line name with other core cruise metadata, in particular anticipated dates, and will instantly receive a cruise-ID. For cruises which are not performed on reference lines, users can submit the cruise geography through a drawing tool which returns the geography as WKT and also features great-circle routing if required (Figures 1-4). The allocation of identifiers is also possible through the OceanOPS API and machine-to-machine metadata exchange with OceanOPS will be of growing importance in the future. Cruise metadata should become richer during the cruise lifecycle (precise dates, parameters, ship, contacts, stations, deployments etc). It should be noted that through the EU AMRIT project, OceanOPS will act as Coordination and Monitoring Centre for EOOS, with particular focus on cruise management.

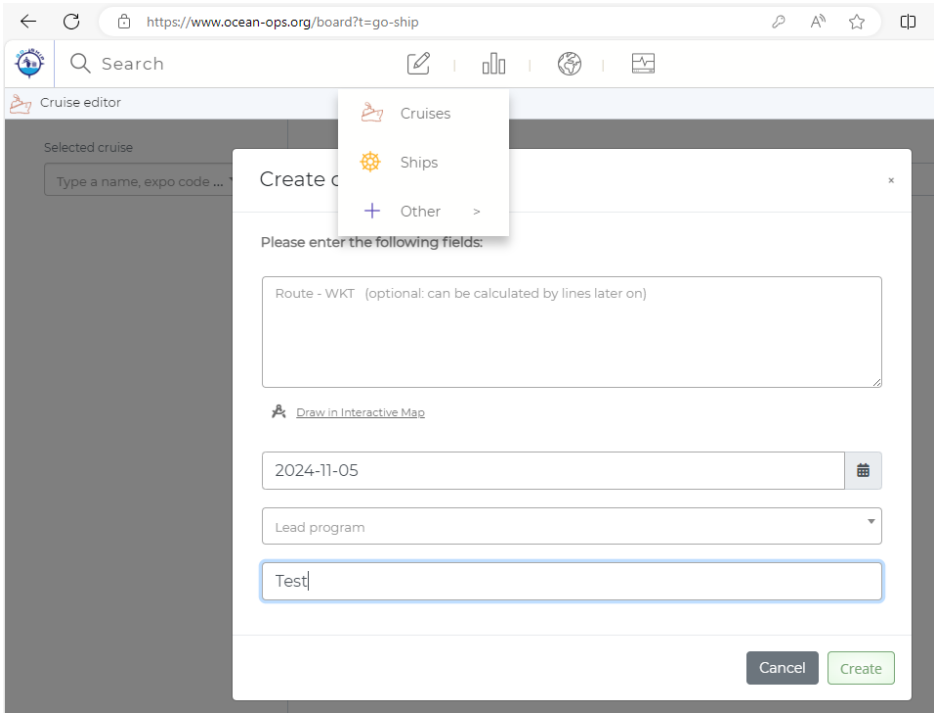

Figure 1: From the OceanOPS dashboard (ocean-ops.org), authorized (logged) users can easily submit and updated cruise metadata with a graphical user interface (GUI)

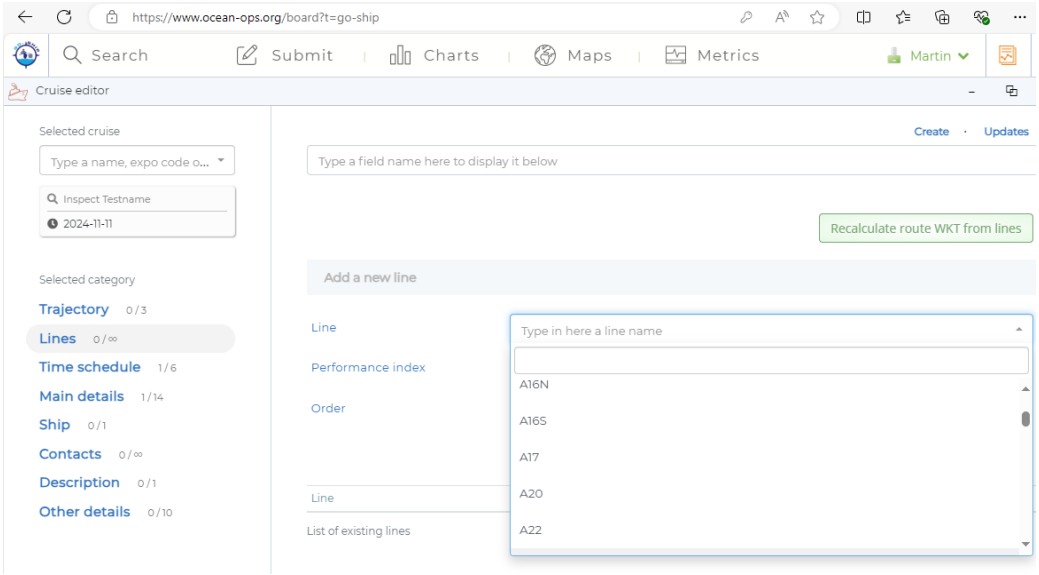

Figure 2: Where cruises take place on reference lines, the cruise geometry can be easily submitted by referencing the line name (reference table). Other fields query contact, ship information etc.

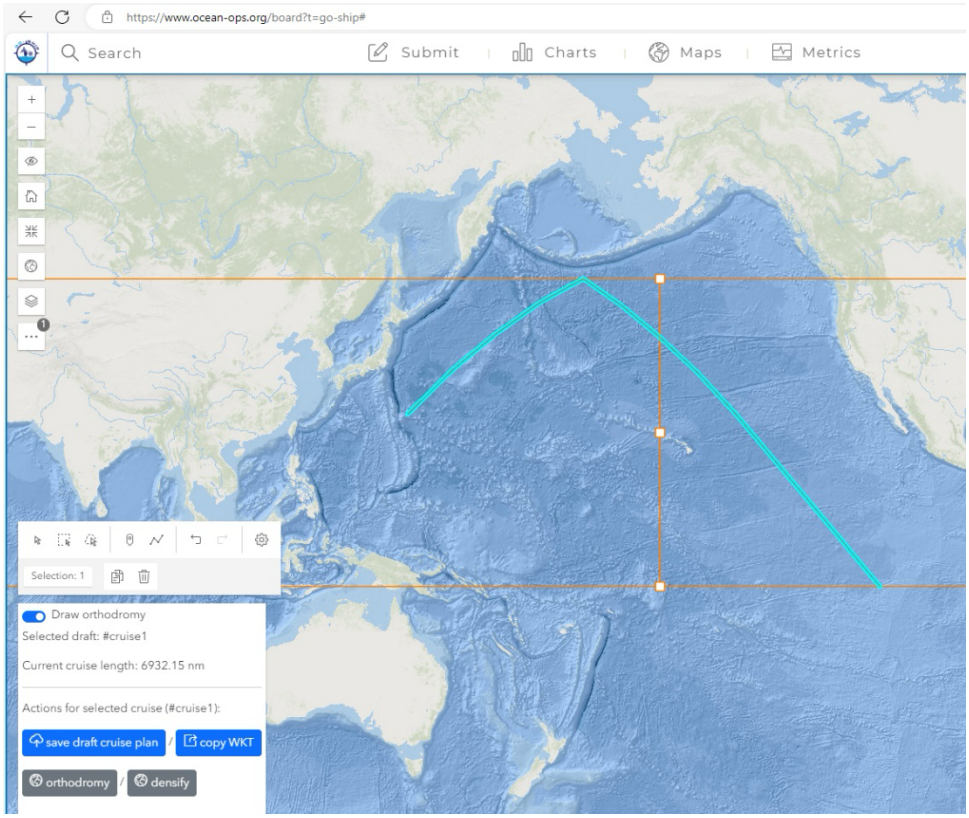

Figure 3: Where cruises do NOT take place on reference lines, or where eg transit details should be included, a drawing tool of the OceanOPS dashboard permits the creation of geometry information as WKT

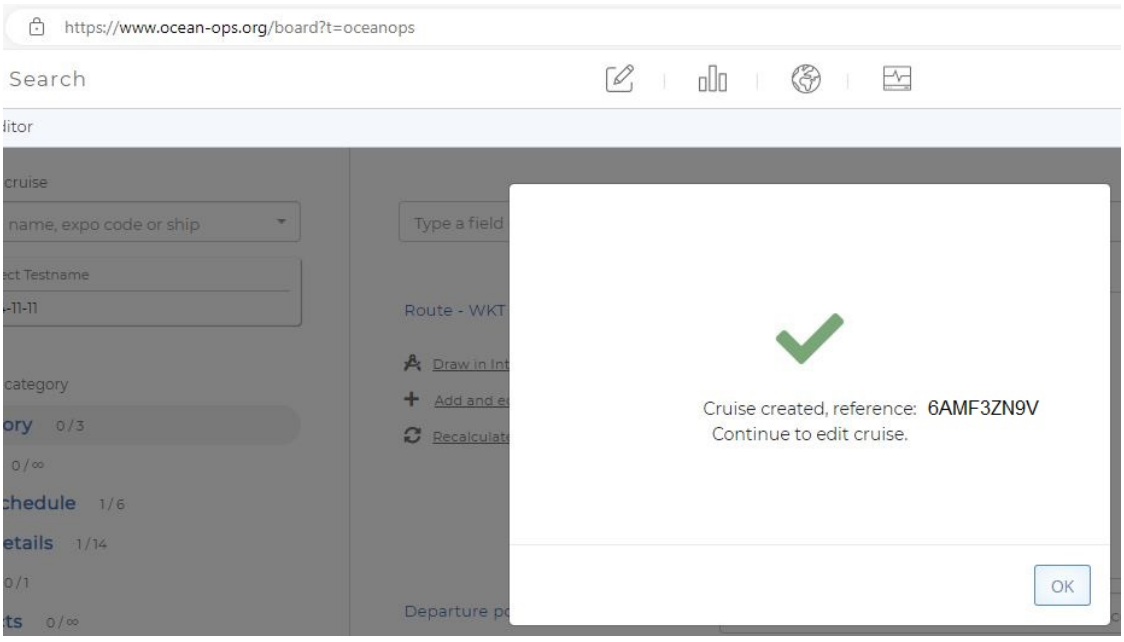

Figure 4: Upon submission of above (at least basic) cruise metadata, the systems immediately returns a persistent identifier (PID): The OceanOPS Cruise ID

3.2. Seek input from key stakeholders in hydrographic data

Data management practices were discussed with representatives of the following entities, mostly per request of the EuroGO-SHIP WP2 Team to participate in meetings of these groups; the scope of WP2 item 3 on data curation was presented and feedback collected, with the aim of setting the scene and spin up the (draft) landscape in the follow-up item 3.3:

- Eurofleets data management work package and external advisory board
- EuroSea work package 3 (data)
- EMODnet Physics
- GO-SHIP Data Management Team and Steering Committee
- Principle Investigators and Chief Scientists of GO-SHIP cruises
- GOSUD Steering Committee
- GLODAP Steering Committee
- Observations Coordination Group (OCG) Data Team of GOOS
- SeaDataNet Office Team for Cruise Summary Reports (CSR)
- French NODC and Coriolis Team
- World Ocean Database (WOD) Team

3.3. Spin up / visualize draft (meta-) data landscape

For a sample cruise (French A25/Ovide GO-SHIP cruise on RV Thalassa from 11 June 2018 to 15 July 2018) we searched for data and metadata.

- At OceanOPS, (ID: Q35XOJO3EY, allocated by OceanOPS per above new allocation scheme) the available metadata was very limited and incorrect in terms of departure (expected 1 June) and arrival (30 June) dates. The anticipated Expocode (35HT20180601: ICES ship code (35HT for new Thalassa) and anticipated departure date 1 June 2018) was thus wrong (correct would be: 35HT20180611) and could not be used for data tracking purposes (and thereby finding richer metadata and data). Autonomous instruments (eg float 6902806) with deployment report for Thalassa in the 1 to 30 June time range were allocated to this cruise.
- For said float, at the Euro-Argo monitoring facility, a persistent identifier for the deploying cruise was not available.
- In the SeaDataNet Cruise Summary Report (CSR) catalog, the cruise was found with ID 20185720 (CSR-ID allocated by SeaDataNet). Metadata in this CSR are rich and available as XML, with measured parameters and data references in SeadataNet, and French Research Fleet (Cruise-DOI 10.17600/18000510 allocated by Ifremer)
- From the CSR, 239 datasets were linked in SeaDataNet (CTD, bottles, XBTs)
- From the French Research Fleet website (Cruise-DOI see above), links are available for published data (Seanoe-ID: https://www.seanoe.org/data/00762/87394/); DOI:

10.17882/87394), and (raw/less QC'ed) data stored at the French NODC SISMER (provided by ship operator GENAVIR)

- At the GO-SHIP GDAC (CCHDO), data could be found with an Expocode (35HT20180611) for which the departure date is correct (20180611), but the ship code (35TH"old" Thalassa, 35HT "new" Thalassa) created issues. the cruise was properly tagged as A25/GO-SHIP.

At this stage of this analysis, RT data was not tracked. At a later stage, we identified such data submitted to Coriolis (using ship call-sign as ID) and from there to GTS and CMEMS (again using call-sign, not WIGOS/WMO-IDs)

Figure 5 shows how OceanOPS (Coordination/Planning and Monitoring Centre) allocates IDs for cruises and platforms, eg Argo floats: the latter are easily traceable (green) because these IDs are used in all data submissions, it is thus easy to monitor the data flow and instrument status, and find additional metadata if required (from Argo GDAC, using again that same ID). The float deployment is often performed by hydrographic cruises but only properly traceable (and thus accountable) if i) the float deployment report references a unique ship-ID (IMO or ICES) and ii) cruise dates in OceanOPS are up-to-date (ideally by machine-to-machine metadata exchange).

The efficient tracking of cruises (and emerging data) by OceanOPS requires that the allocated unique ID follows the cruise and data along the lifecycle, which is presently not (yet/sufficiently) the case (red); data which are already submitted in real-time are in general still using the radio call-sign of the ship, not a WIGOS/WMO-ID allocated by OceanOPS; proper accounting as contribution from a particular cruise is still possible if i) the cruise dates are up-to-date and ii) the call sign is registered in OceanOPS as ship metadata. Without this information, a connection between data submitted in real-time, and at later stage (most likely QC'ed) to the GDAC cannot be made.

The use of the Expocode is an issue for all cruise-related activities taking place ahead of the departure, and even then, ship code and dates have repeatedly led to inconsistencies.

Matching real-time data submitted to the GTS with delayed-mode data (QC'ed) available at later stage at the GDAC or other archives does not, or only very scarcely, take place.

While using other identifiers, data and metadata from the selected cruise were properly submitted to, and available from, SeaDataNet CSR/CDI.

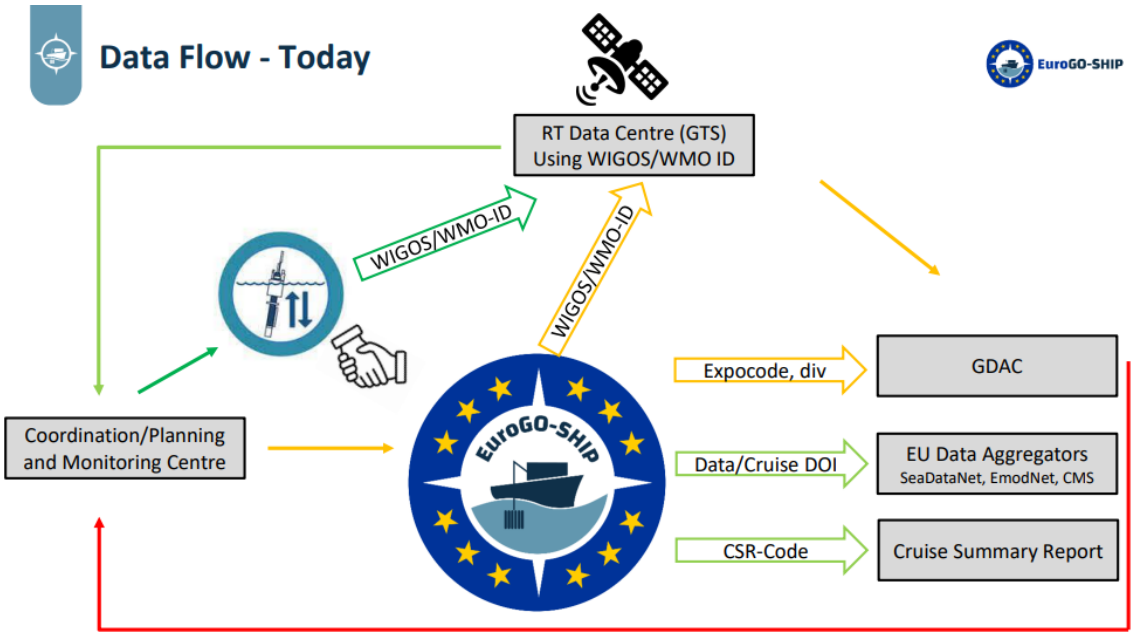

Figure 5: Tracking of cruises and instruments with a variety of mostly unmapped identifiers, traffic light coded.

3.4. Run (meta-) data survey at global scale to identify national data best practices

A survey (Repeat Hydrography Data Pathways Questionnaire) was then created by the WP contributors. It contained the following sections:

- General information about the participant
- Metadata/Identifiers
- Near-real-time data (with subsections surface/profile)
- Delayed mode data
- Other comments

The draft survey was reviewed in a EuroGO-SHIP teleconference, then presented/finalized at the 7th meeting of the international GO-SHIP Steering Committee (New Orleans, February 2024) and implemented through the EU survey tool. It was promoted through mailing lists of GO-SHIP and EuroGO-SHIP, and social media/EuroGO-SHIP website and newsletter. National representatives were directly requested to support/coordinate the collection of information at national level. In Annex 1 is a copy of the questionnaire, which will remain available online until the end of the project.

We received 18 answers from 12 different countries, visualized in Figure 6. What EU data aggregators do and if/how data flow to/between SeaDataNet, Copernicus Marine Environment Monitoring Service (CMEMS) and European Marine Observation and Data Network (EMODnet) was unclear to contributors outside, but also inside of Europe. Through section 3.6 we found out

that some contributors believed their data were not available in this EU structure, while in reality they are.

As shown in Figure 6, additional key findings of the survey regarding metadata include:

- Cruise Summary Reports (CSR, former ROSCOPs) are submitted by most Chief Scientists within Europe shortly after the cruise, and a few countries outside Europe also use this system, which provides GUI and machine-readable XML versions of the CSR.
- DOIs are used for datasets by just over half of the participating countries, and even less less so in terms of cruise DOIs. Various other identifier schemes (eg Expocode, radio call sign) are used in data submissions.
- The submission of (near-) real time data is already in place or planned by around half of the survey contributors.
- While most of the participants are aware of the GO-SHIP Data Policy, around half of them report that they face compliance issues.
- Data formats mostly mentioned in real-time submission are table-driven codes of the WMO; for delayed mode data, WOCE, ICES, SeaDataNet and netCDF were reported.
- A clearer picture than the OCG Data Flow Mapping for GO-SHIP (as initially targeted) could not be created based on the survey results and led to the decision of analyzing data availability at key data repositories for a representative set of sample cruises in section 3.7.

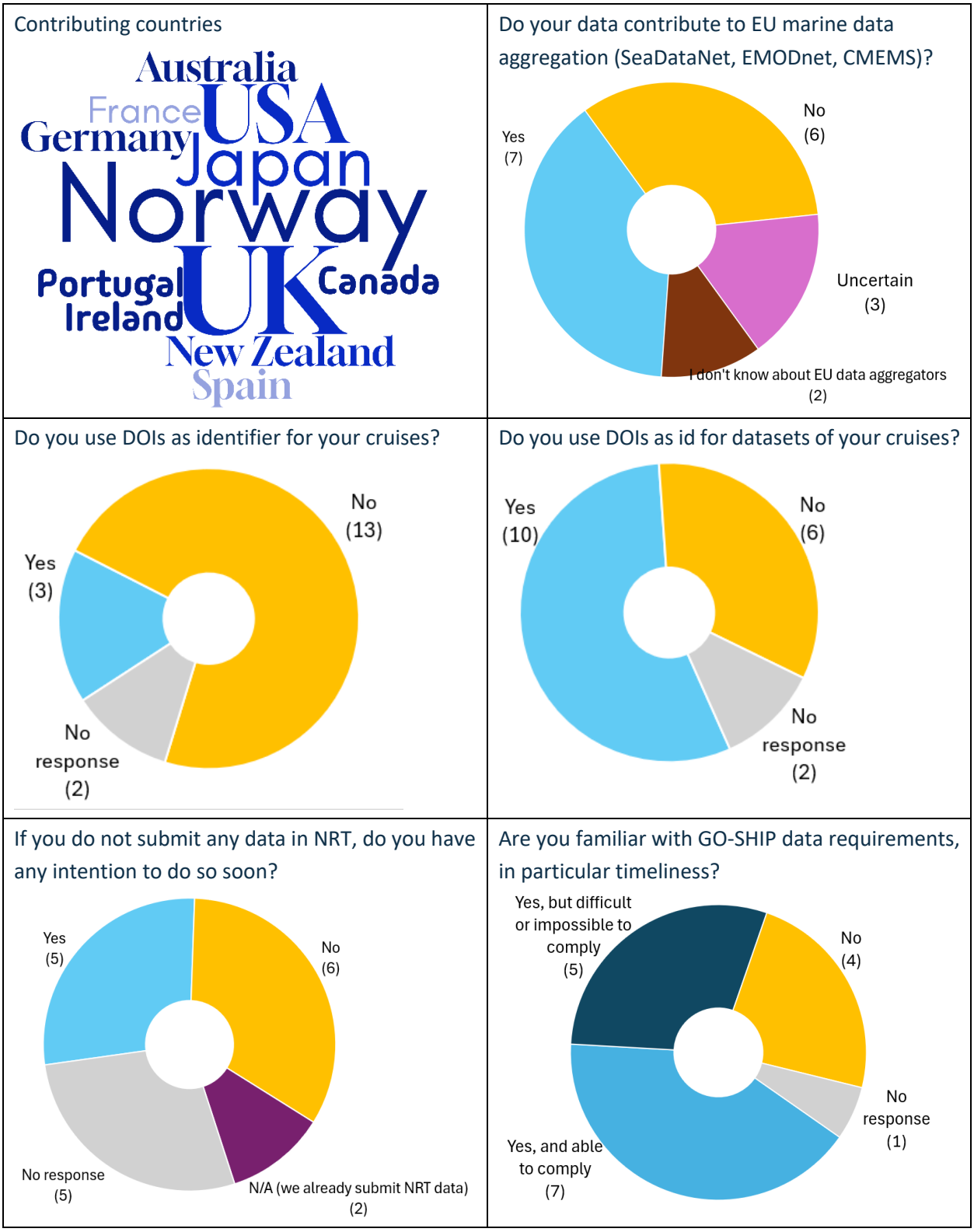

Figure 6: Pie-charts and country cloud resulting from Data Pathway questionnaire

3.5. Data format recommendation for (at least) CTD and bottle data

EuroGO-SHIP data must be preserved and distributed with a high level of FAIR data principles:

- A NetCDF format containing data, metadata, and quality control (QC) flags.
- Vocabularies described in vocabulary servers, interoperable with the SeaDataNet vocabulary server (https://vocab.nerc.ac.uk).
- Persistent identifiers (DOI, PID) for datasets, producers, institutions, people, projects, and infrastructures.
- A detailed description (online format manual, regularly updated).
- Content validated by a format checker.

For CTD, bottle, and other physical and biogeochemical data, the Copernicus Marine in situ NetCDF format should be recommended:

- *Copernicus Marine In Situ TAC NetCDF format manual https://doi.org/10.13155/59938*
- *Copernicus Marine In Situ NetCDF file format checker https://doi.org/10.17882/45538*

The generation of CTD and bottle data files in Copernicus Marine NetCDF format has been supported by CMEMS marine service since 2019 and continues; the Copernicus Marine service is permanently funded by the European Commission.

For ADCP data, the SeaDataNet NetCDF ADCP format will be preferred.

- *SeaDataNet. Datafile formats. ODV, MEDATLAS, NETCDF https://doi.org/10.13155/56547*
- *Fichaut Michele, Gatti Julie, Lherminier Pascale, Odaka Tina, Franc Lea, Crouzille Sébastien (2024). SADCP data format converter and viewer, from oceanSITES to SeaDataNet TrajectoryProfile. https://archimer.ifremer.fr/doc/00924/103579*

Both formats conform to the NetCDF-CF standard accepted by CCHDO, the global GO-SHIP data center. This facilitates the circulation of data to CCHDO.

3.6. Analysis of delayed-mode data availability at different repositories based on representative set of sample cruises

With limited success from the survey in 3.4 regarding the mapping of data flows, a direct analysis of data availability at key repositories was performed with the following set of sample cruises: For the 2017-2024 time range, the last performed GO-SHIP cruise was selected for a country, and if that cruise was not (yet) available at the GO-SHIP GDAC (CCHDO), in addition also the last cruise from such a country available at the GDAC. As repositories were selected the corresponding NODC as reported by the country, data publishers if applicable, within SeaDataNet the CSR and Common Data Index (CDI), CMEMS, EasyOcean and World Ocean Database (WOD). The dataflow from CMEMS into EMODnet was reported properly in place and EMODnet was thus not further investigated. The repositories are linked in the Table 1 below for further information.

Table 1: Availability of data from selected cruises at key data repositories/products (status Nov 2024); X=available, (X)=partly available, U=underway data (TSG), C=CTD, B=Bottles. For GDAC, CSR and WOD the identifiers used by those entities are listed.

							SeaDataNet				
Country	**Year**	**Month**	**Line**	**GDAC**	**NODC**	**Publisher**	**CSR**	**CDI**	**CMEMS**	**EasyOcean**	**WOD**
USA	2024	February	I8S	325020240221	CCHDO						US -56077
AU	2024	January	I9S		NCMI				U		AU-7207
	2018	January	SR3	096U20180111	NCMI		20206458		U / C / B	X	AU-6194
JP	2023	October	P14N	49NZ20231006					C	X	JP-48306
Spain	2023	June	A25		CSIC		21030273	(X)	C		ES-1718
	2019	April	A17	29HE20190406	CSIC		20195584	(X)	C		ES-1669
Norway	2022	May	A29/75N		NMDC		21026742				
	2016	August	A29/75N	58GS20160802			20163145		C / B	X	NO-5577
Germany	2022	February	A12/SR4		Marine-Data.de	PANGAEA	21030431				
	2018	March	MED01	06M220180302		PANGAEA	20180026		C		DE-12877
UK	2022		(AR28)	740H20220712	BODC						GB-13645
	2021	February	A23/SR1	740H20210202	BODC		21030846		C	X	GB-13601
France	2018	June	A25	35HT20180611	SISMER	SEANOE	20185720	X	U / C / B	X	FR-16646
Ireland	2017	April	A2	45CE20170427	MI		20185522	X	C / B	X	IE-7316

This analysis was much more difficult than expected in a FAIR data environment. It is often unclear where to query what exactly to find the data, and it became clear that different repositories potentially host different versions of the datasets; this comes from data which the ship operators must submit to the NODC, while a further QC'ed dataset is sometimes made available by the scientists through a data publisher. The scientist must in addition send the dataset to the GDAC, which means that any update of the originating dataset would also require re-submission to the GDAC. While for most of the (at least EU-) cruises the CSR was identified, the CDI-link from there to the datasets within SeaDataNet often does not exist, or the data are incomplete there (e.g., only underway data). In CMEMS, again often only data subsets (underway and/or CTDs and/or bottles) were available. Availability in the EasyOcean or WOD products comes in general from availability at the GDAC.

Gaps in the Table 1 do not necessarily mean that data were not there – it just means that we were unable to find it. This is mostly related with a missing identifier that follows cruise, data and emerging data along the full lifecycle. For the same cruises and datasets, presently a few different identifiers are used without clear mapping. With reference to section 3.5, the (manual) creation

of expocodes can fail because of typos (TH inversed for Thalassa at GDAC) or unclear departure dates (ships returned back to port shortly after departure for a short period, eg medical evacuation or technical issues before “real” departure).

It should also be noted that some data were apparently only available at the GDAC because they were pro-actively pulled there by CCHDO from other archives instead of being submitted by the data producer.

3.7. Analysis of real-time data availability of CTD data (milestone)

The path of real-time CTD profile and underway data

The main focus of this section of the report is on (near) real-time data, comprising profiles of temperature and salinity gathered from research vessel’s CTD instrument, hereafter referred to as ‘CTD data’. The secondary focus is on (near) real-time data from underway systems (‘UW data’). The results, tables and maps reported here are the same as those presented in the M2.2 report (submitted at M12).

The precise path of real-time CTD and underway (UW) data from ship to user has not been documented for all nations or all research vessels. Below are presented examples from two countries, explaining how real-time data transfer from research vessels is achieved.

UK CTD data:

- After a CTD cast is performed and the rosette has returned to deck, the ship’s computer system runs software that subsamples the raw descending CTD profile.
- The subsampled data is sent in text format by ship’s email system to ocean.data@metoffice.gov.uk
- Every hour, the Met Office data processing system looks for new data. If any is found, it is automatically QC’d using the Argo real-time QC procedure, reformatted into WMO BUFR format and issued to the GTS under header “IOXX01 EGRR”. It is also stored in the Met Office’s internal database, where it is available for assimilation into short range forecasts such as global and regional 7-day ocean forecasts, and the coupled ocean-atmosphere numerical weather prediction system (‘the weather forecast’).
- See Carse et al., (2015) and Tim Smyth’s report for Milestone 4.5.

UK underway data:

- This is not presently distributed in real-time.

French CTD data:

- The PSO or scientist responsible for the CTD manually validates the raw CTD data and sends it to shore, where it is received by colleagues at Ifremer
- At Ifremer, a semi-manual QC process takes place, and the data is issued to the GTS in BUFR format under header “IOSX01 LFVX”.

French underway data:

- The TECHSAS acquisition system installed on French R/V vessels sends an email each day with position, weather data, and thermosalinometer data to Coriolis. Each observation is sampled at 5 min, an email contains one day. The data is then available in Coriolis disseminated to GOSUD and Copernicus Marine Service. The data is issued to the GTS in ASCII format using TRACKOB (SOVF93 LFVX).

Methods

This report presents the results of investigations of three main systems where users may seek to discover real-time CTD profiles and underway data. Data has been collected from each portal from the users' perspective, for a five-month period from 1st May to 30th September 2023:

1. The World Meteorological Organization's Global Telecommunications System, referred to as WMO GTS. Data is circulated globally in WMO data formats, usually BUFR but occasionally the legacy formats called TESAC or TRACKOB. The BUFR template for CTD profiles is called TM 3-15-007. This is accessed by national Met Services around the world who use the data to initialise short-range forecasts, both ocean forecasts and coupled ocean-atmosphere numerical weather prediction systems ('the weather forecast').
2. The Copernicus Marine Environment Monitoring Service's global in-situ quality-controlled observations product[1] INSITU_GLO_PHYBGCWAV_DISCRETE_MYNRT_013_030. Data are collected through global networks such as Argo, and also by harvesting the GTS. Data are in netCDF files, updated hourly. Files named "*_PR_CT_*.nc" and "*_TS_TS_*.nc" were gathered to study CTD and UW data, respectively. This product is used for assimilation into operational forecast models by users who perhaps do not have access to the WMO GTS, or who may simply prefer the CMEMS system and its data format.
3. EMODnet-Physics. This is the destination for real-time data from the EARS systems, installed on 10 or more European research vessels during the recent EuroFLEETS+ project. It is also fed by the CMEMS real-time data. To complete the feedback loop, the EARS data arrives at Coriolis via EMODnet (Thierry Carval, pers. comm.).

Figure 7 shows the research cruises known to the OceanOPS system with a departure data during the study period. This map can be used to give an indication of where research vessels were operating during the study period, and hence where we might expect to see real-time CTD and underway data. However, it is imperfect because some of these cruises may not have been GO-SHIP, and some may not have been making CTD or UW measurements due to the science plan of the cruise. During the study period, there were 59 cruises, by 20 different vessels.

[1] Citation for this CMEMS data product is https://doi.org/10.48670/moi-00036

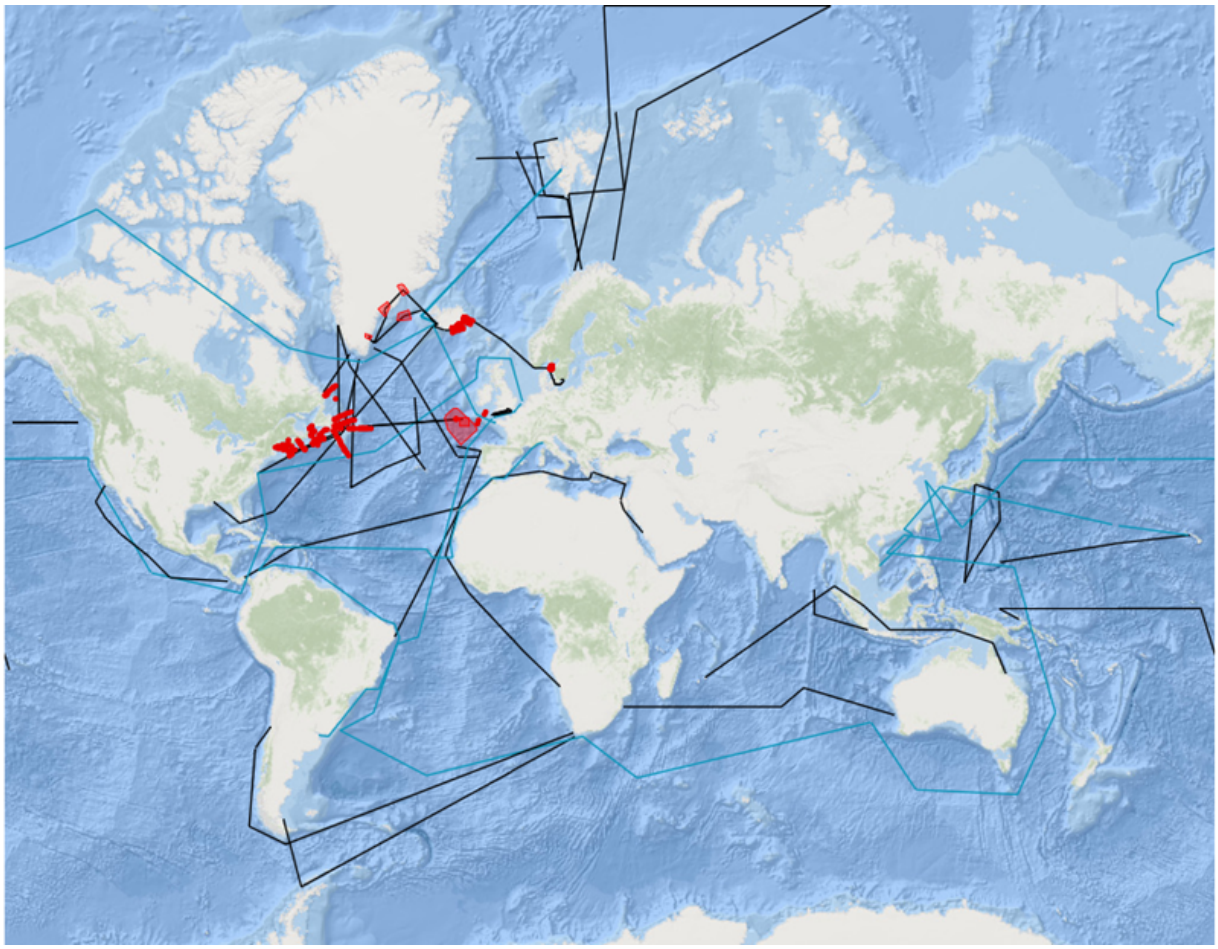

Figure 7: OceanOPS cruise map for cruises departing between 01/05/23 and 30/09/23. Source: https://www.ocean-ops.org/board?t=argo with Argo locations switched off and cruise layer showing, filtered by departure dates within the study period.

World Meteorological Organisation's Global Telecommunications Service (WMO GTS)

CTD and underway (thermosalinograph) data that has been circulated on the GTS was extracted from NOAA's OSMC ERDDAP server. See Table 2 (CTD) and Table 3 (underway).

CTD data has been delivered to the GTS by 13 European research vessels during the period 01/05/23 to 30/09/23, comprising 6 UK, 3 German and 4 French vessels (Table 4). The ERRDAP server was queried for all European countries, to ensure no data submissions were missed. A total of 933 CTD profiles were available on the GTS during the study period.

The median time delay for CTD profiles is reported in hours, where available. This is the time between the profile being observed and becoming available on the GTS. For the UK, the typical delay is 2.4 to 12.0 hours, as seen for James Cook, Discovery and Scotia. Three of the UK vessels experienced longer delays due to these being new additions to the system during summer 2023, and there were some initial problems with the data flow set-up, which are now resolved. The

French vessel's delay of approximately 60 hours is as expected for a system with a manual component to the QC prior to data issue. The German vessels have delays of around 100 to 300 hours, which the author is not able to fully explain at present. It is understood that Germany has a protocol in place which can intentionally delay GTS transmission, but this is not used on all vessels (Martin Kramp, pers. comm.).

Underway data has been delivered to the GTS by 7 European research vessels during the period 01/05/23 to 30/09/23, comprising 3 German and 4 French vessels with a typical time frequency of between 2 and 10 minutes (Table 5). These are the same vessels that submitted CTD data to the GTS. The ERRDAP server was queried for all European countries, to ensure no data submissions were missed.

Methods of assessing timeliness for underway data were investigated but it has not been possible to complete this work to date.

Table 2: CTD (T and S profiles) available on GTS by country during period 01/05/23 to 30/09/23. All European nations were searched, only three nations returned data. Source ERDDAP server https://osmc.noaa.gov/erddap/tabledap/OSMC_flattened.html . Queries run on 11/10/23. For CTD, query with observation depth > 0.0 and profile salinity > 0.0. At present, timeliness delays are only available for data received from the GTS at the UK Met Office.

Country	Call Sign	Vessel Name	N_Profiles (Median_Delay)	Notes
UK	2FGX5	Discovery	99 (2.4 h)	
UK	GHRU	Corystes	172 (57 h)	Charter by Marine Scotland, includes oxygen
UK	MEEU8	Plymouth Quest	1 (415 h)	New during Sept '23, includes oxygen
UK	MLRM6	James Cook	13 (4.6 h)	
UK	MXHR6	Scotia	78 (12 h)	Includes oxygen
UK	ZDLQ3	Sir David Attenborough	11 (105 h)	New during July '23
Germany	DBBE	Sonne	11 (366 h)	
Germany	DBBH	Meteor	39 (94 h)	
Germany	DBBT	Maria S. Merian	25 (238 h)	
France	FGTO	Tethys II	1	
France	FMCY	Pourquoi Pas	126 (66 h)	

France	FNCM	Atalante	29
France	FNFP	Thalassa	328 (56 h)
SUM			**933**

Table 3: Underway data (SST and SSS) available on GTS by country during period 01/05/23 to 30/09/23. All European nations were searched, only 2 nations returned data. Source ERDDAP server https://osmc.noaa.gov/erddap/tabledap/OSMC_flattened.html . Queries run on 11/10/23. For Underway, query with surface salinity > 0.0.

Country	Call Sign	Vessel Name	Frequency
Germany	DBBE	Sonne	2 minutes
Germany	DBBH	Meteor	4 minutes
Germany	DBBT	Maria S. Merian	4 minutes
France	FGTO	Tethys II	1-5 mins
France	FMCY	Pourquoi Pas	1-5 mins
France	FNCM	Atalante	1-5 mins
France	FNFP	Thalassa	5-10 mins
COUNT	**7**		

Copernicus Marine Service INS-TAC

CTD and underway (thermosalinograph) data that is available in the Coriolis data base was extracted using the data selection tool https://dataselection.coriolis.eu.org/ for the period 01/05/2023 to 30/09/2023. This website accesses real-time data in the global INS-TAC product INSITU_GLO_PHYBGCWAV_DISCRETE_MYNRT_013_030, referred to as CMEMS INSTAC.

There is CTD data available at the Coriolis database for 51 unique vessels during the study period, comprising 27 Japanese, 6 Canadian and 17 European vessels (Figure 8). This report will focus on the 17 European vessels. The 17 European vessels comprise 6 UK, 3 German, 4 French, 3 Norwegian and 1 Spanish vessels (Table 4). A total of 1,133 CTD profiles were available at Coriolis during the study period.

There is UW data available at the Coriolis database for 65 unique vessels during the study period (Figure 9). These are a mixture of cargo, research and passenger vessels. A total of 30 research vessels contributed, 13 of which are European (plus 11 from USA, 3 Australia, 2 Japan, 1 New Zealand). The 14 European RV contributors comprise 10 French, 3 German and 1 Belgian vessels (Table 5).

The same three German vessels submit CTD and UW data to Coriolis. For France, the four RVs that submit CTD data also submit UW data, and there are an additional 6 vessels contributing UW data only. The Belgica submitted UW data but not CTD data to Coriolis. The UK does not submit UW data to Coriolis (or to the WMO GTS) at present.

Methods of assessing timeliness for both CTD and underway data are being investigated with Coriolis but have not yet been finalised.

Table 4: CTD (T and S profiles) and available from European research vessels in the Coriolis database by country during period 01/05/23 to 30/09/23. Source: downloaded csv data files from https://dataselection.coriolis.eu.org/ on 24/10/2023, having selected type CTD and parameter salinity for the specified date range. Note that 61 CTDs showed up under call sign DFCG, this was the old Sonne (Germany) which has been sold to Argentina according to vesseltracker.com. Hence removed from these counts.

Country	Call Sign	Vessel Name	N_Profiles	Notes
UK	2FGX5	Discovery	96	
UK	GHRU	Corystes	172	
UK	MEEU8	Plymouth Quest	2	
UK	MLRM6	James Cook	13	
UK	MXHR6	Scotia	74	
UK	ZDLQ3	Sir David Attenborough	11	
Germany	DBBE	Sonne	22	
Germany	DBBH	Meteor	39	
Germany	DBBT	Maria S. Merian	25	
France	FGTO	Tethys II	1	Includes oxygen
France	FMCY	Pourquoi Pas	126	Includes oxygen
France	FNCM	Atalante	29	Includes oxygen
France	FNFP	Thalassa	337	Includes oxygen
Norway	LDGJ	Johan Hjort	113	
Norway	LGWS	Kristine Bonnevie	79	
Norway	LMEL	G.O. Sars	96	

Spain	EAKF	Sarmiento de Gamboa	98	Includes oxygen[2]
SUM			**1333**	**(incl. 288 Norway)**

Table 5: Underway data (SST and SSS) from European research vessels available in the Coriolis database by country during period 01/05/23 to 30/09/23. Source: downloaded csv data files from https://dataselection.coriolis.eu.org/ on 24/10/2023, having selected data type thermosalinograph and parameters sea temperature and salinity. NB sampling frequency quoted is the median frequency during the study period.

Country	Call Sign	Vessel Name	# Obs	Sampling frequency
France	FAC8862	Sagitta II	6335	2.0 minutes
France	FGA3812	Nereis II	1311	2.0 minutes
France	FGG8669	Albert Lucas	7285	2.0 minutes
France	FGTO	Tethys II	5902	2.7 minutes
France	FKJB	L'Europe	13582	4.5 minutes
France	FMCY	Pourquoi Pas	51320	2.1 minutes
France	FMNB	Le Commandant Charcot	1103	60 minutes
France	FNCM	Atalante	30545	2.0 minutes
France	FNFP	Thalassa	33838	4.5 minutes
France	FQBE	Cotes de la Manche	13969	2.0 minutes
Germany	DBBE	Sonne	55573	2.0 minutes
Germany	DBBH	Meteor	76607	2.0 minutes
Germany	DBBT	Maria S. Merian	72341	2.0 minutes
Belgium	ORCO	Belgica	4635	10 minutes
COUNT	**14**			

[2] This is BOCATS cruise along the OVIDE-A25 section, CTD dates are 09/06/23 to 05/07/23. The CTD data were sent manually by Pascale Lherminier within three weeks of acquisition, and were uploaded to the doi within five weeks, https://doi.org/10.17882/95607.

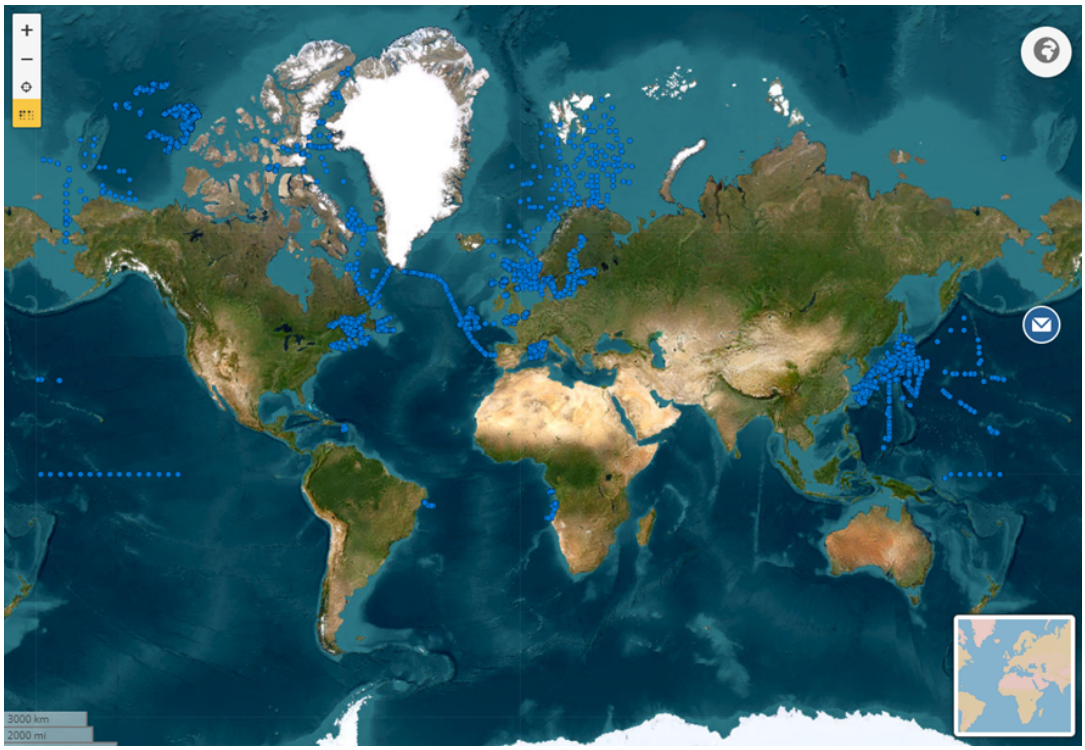

Figure 8: CTD data in Coriolis database from 01/05/2023 to 30/09/2023 (n=10,315).

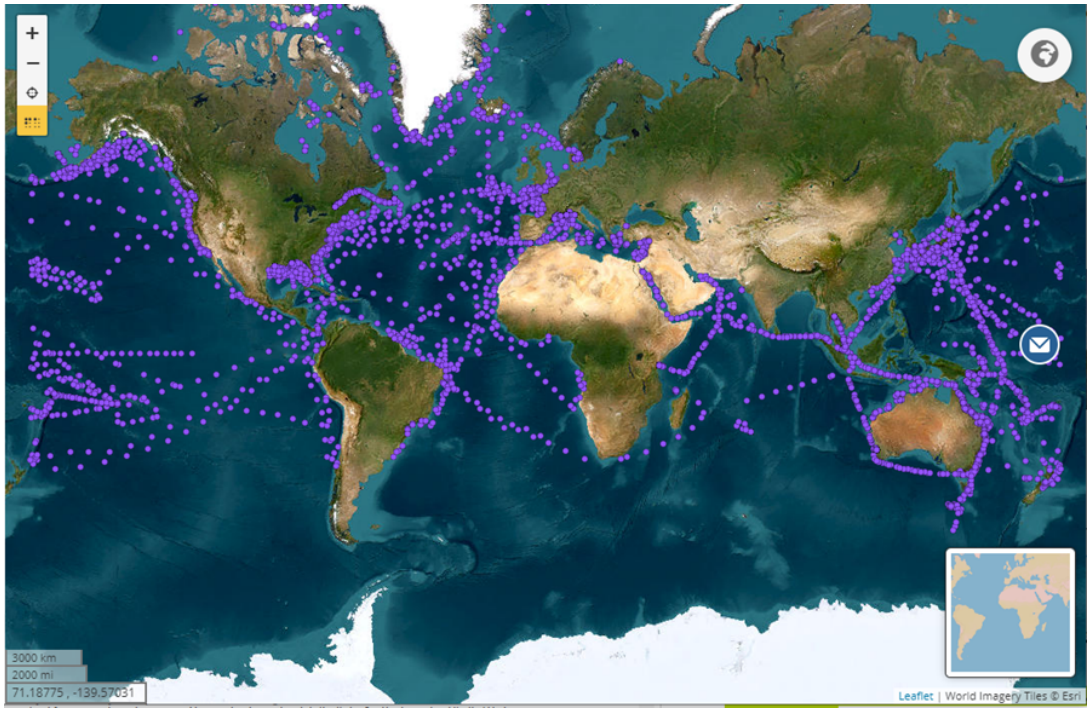

Figure 9: Thermosalinograph (T and S, underway) data in Coriolis database from 01/05/2023 to 30/09/2023 (n=4,859. Includes all vessel types: cargo, passenger, fisheries and research vessels).

The EARS system and EMODnet

During the EuroFleets+ project (recently ended), the EARS system was set up on around 10 research vessels within the European research fleet, to deliver near real-time data from research vessels to the Eurofleet Dashboard and to EMODnet.

Since the project has ended, only the Spanish RVs retain the system for operational use. The data is delivered via CSIC to EMODnet, but they are not incorporated into EMODnet in real time. It is understood that plans are underway for EARS to be a sustained platform, perhaps via an ERIC or Belgian NGO.

Figure 10 shows the CTD data available on EMODnet-Physics, for the last year. The author found that the data search tool is not as easy to use as Coriolis. It was not possible to specify a precise date range, nor to receive summary data such as count of CTD profiles returned by the search.

The CTDs from the BOCATS-OVIDE cruise on Samiento De Gamboa (call sign EAKF) during summer 2023 were available (see Figure 10, the line from Spain to Greenland). It is not clear whether these arrived at EMODnet via the EARS system or via the Ifremer/Coriolis pathway. It is also not possible to say how quickly these observations arrived in EMODnet – only that they were available after 5 months.

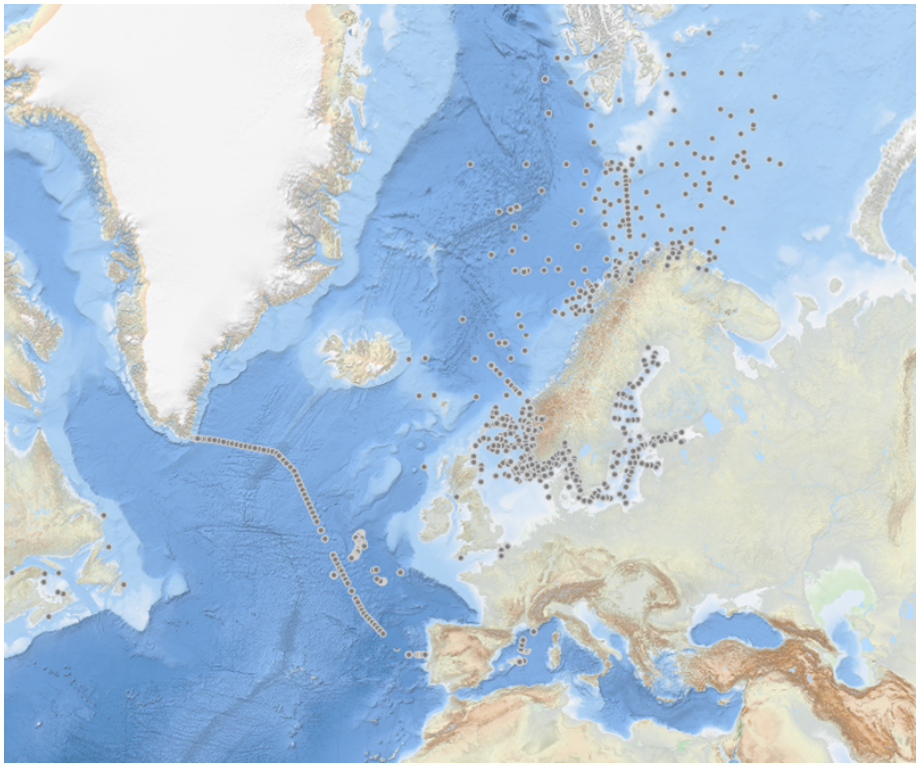

Figure 10 : EMODnet map of CTD profiles available in near-real time. Source: https://emodnet.ec.europa.eu/geoviewer/#!/ with platform set to CTD and time range set to one year. Query run on 21/11/23, for the period 21/11/22 to 20/11/23. It was not possible to focus on specific dates in this query.

Summary of real-time data study

1. The study period was five months in duration, 01/05/2023 to 30/09/2023.
2. Five countries released real-time data from their research vessels during the study period: Belgium, France, Germany, Norway and UK.
    a. Norway has CTD data available on CMEMS INSTAC.
    b. Belgium has UW data available on CMEMS INSTAC.
    c. France and Germany had CTD and UW data available on GTS and CMEMS INSTAC
    d. UK had CTD data available on GTS and CMEMS INSTAC
    e. Spain's EAKF (Sarmiento de Gamboa) did not come up in a GTS search for data by country, using the ERRDAP system mentioned above. This data was present in the CMEMS INSTAC. A later search for the vessel's call sign EAKF showed the data did reach the GTS, with country "UNKNOWN" – perhaps because this was a cruise led by Fiz Perez (Spain, CSIC) but data sent by Pascale Lherminier from Ifremer to the French data system. Most likely, the data was issued via France/Ifremer, instead of CSIC (which does not provide this service).
3. For the vessels belonging to UK, France and Germany, the amount of CTD profiles reaching the GTS and the CMEMS INSTAC product are quite equal (Tables 2 and 4). The map of real time CTD data available at the CMEMS INSTAC matches fairly well to the cruise tracks known to the OceanOPS system in Europe and the Nordic Seas (Figures 7 and 8). This suggests that most of the research cruises operating during the study period released data in real time.
4. Concerning dissolved oxygen profiles: the French vessels' CTD data available on CMEMS INSTAC includes oxygen profiles. These oxygen profiles do not appear in the GTS version of the data. The author knows that three UK vessels (Corystes, Scotia and Plymouth Quest) have oxygen included in their BUFR message when issued to the GTS. The oxygen profiles are not picked up and carried through into the CMEMS INSTAC files. Both of these points should be investigated in future.
5. Quite a lot of underway (UW) data is available via Coriolis in the CMEMS INSTAC product that is not available on the GTS. Only 7 research vessels from 2 countries contribute UW data to the GTS, whereas 14 research vessels from 3 countries contribute to the CMEMS INSTAC product.
6. The main gap found in this study is that it appears that, aside from the 5 countries listed above, all the other European countries did not release any RT data during the study period.
7. It has not yet been possible to compare time delay statistics between the GTS and Coriolis CTD data availability. Having this information will make it possible to construct a recommendation to users about which data source might be best to fulfil their real time data requirements.

Successes for real time data sharing during EuroGO-SHIP

It is an aspiration of EuroGO-SHIP to increase the number of vessels that transmit real-time CTD profiles to shore during cruises. Since the start of the project in December 2022, four research vessels started sending CTD data in real time (UK: Sir David Attenborough and Plymouth Quest; Ireland: Celtic Explorer and Tom Crean), with strong interest and engagement with Italy to trial the system on Gaia Blu during spring 2025. It is also an aspiration to provide shared software and training to assist new vessels in sharing their real time CTD data. Shared software is already available in GitHub https://github.com/timjsmyth/MetOffice_CTD_send .

After project members from WP2 & WP4 joined Baltic Operational Oceanography Service (BOOS) meetings to talk about real time data under EuroGO-SHIP, we learned in May 2024 that BOOS is now delivering CTD data from the RVs of Finland, Estonia and Sweden to CMEMS and EMODnet, with Poland, Denmark and Germany expected to join soon.

Plans for future work on real-time data

It is an aspiration of EuroGO-SHIP to increase the number of vessels that transmit real-time underway data to shore during cruises. Parameters measured are temperature and salinity, with possible additions of biogeochemical parameters such as dissolved oxygen, chlorophyll-a fluorescence and turbidity. Going forwards, Tim Smyth and Fiona Carse are already working with UK research vessel operators to get a pilot system working as soon as possible. In the UK we hope to be able to develop and share some code in the near future (UW2MET, which is likely to be similar to the UK's CTD2MET code).

Real-time sharing of horizontal current profile data from ship-mounted ADCP instruments is a future ambition of the EuroGO-SHIP project. Data users are very keen to have real time current data from research vessels. This has been investigated during the project (see WP4 D4.4 report, due M24), but it has not been possible to achieve this yet. Going forwards, Tim Smyth and Fiona Carse are already working with UK research vessel operators to get a pilot system working as soon as possible, noting that this task is likely to require considerable human expertise and time, as well as high quality computing systems on board the RV. Fiona Carse will also work with Johanna Linders (BOOS) to share BOOS CTD data on the GTS (in addition to CMEMS).

Work towards including the unique IDs assigned by OceanOPS in the real time data stream, to avoid confusion for data users – being able to tell the difference between real time and 'best quality' data in future data archives is important for users.

Assess and better define timeliness of the following data streams, to improve how we inform data users:

- underway data delivery to the GTS
- data becoming available at Coriolis (both CTD and underway)
- discover user requirements on timeliness (this is linked to WP4, see D4.4 report, due M24).

- Note that, until recently, it was true that only Met Services / Operational Centres had access to GTS data. But now, there are portals (ERDDAPs, DWD, etc) where anyone can access real-time GTS data. It is still useful to know which data source is the fastest, but hopefully it is now easier for users to adapt or access new data sources.

Create a graphic summarising the parameters and real time data pathways for CTD and underway data by country (flow chart or table).

Understand more about the destination of oxygen profile data, specifically: UK oxygen profiles are not showing in the Copernicus INS-TAC but are on the GTS; French oxygen profiles are available at Copernicus INS-TAC but not on the GTS.

Carry out case studies to show data pathways using real cruise examples, to illustrate and understand the full range of data destinations from a GO-SHIP cruise. Some possible cruises to focus on:

- May 2023 RRS James Cook cruise, NE Atlantic
- June – July 2023 OVIDE cruise, North Atlantic
- An older cruise, ~ 2019, that has delayed-mode QC'd data lodged and also had RT data available – perhaps a Drake Passage / Yvonne Firing cruise or an Ellett Line North Atlantic cruise.

3.8. Develop and test a SeaDataNet-compliant ADCP data format (milestone)

Ship-mounted acoustic Doppler current profilers (SADCP) have been used for over 25 years and have been available on most research ships for much of that time. They are relatively easy to operate on a routine basis, permitting nearly continuous monitoring of the upper ocean current structure beneath each ship. However, despite current data measured by SADCP are labelled level 1 variable in GO-SHIP, we identified a major gap in the availability of those data concerning European GO-SHIP cruises, in part because the data processing is not homogeneous and because the format of the qualified data is not FAIR.

To remedy this situation, in close partnership with SeaDataNet, following FAIR principles and proper vocabulary, we created a format suitable for SADCP data. This format includes compulsory variables and metadata (such as position, current speed, ship speed and associated QC), as well as optional ones (such as bottom depth, tide). The particularity of SADCP data is that the measurements are done along the trajectory of the ship in a water layer (from depth *x* to depth *y*). In netCDF it means that the geophysical variables have another dimension (Depth) in addition

to the Time dimension: that is the reason for the name of trajectoryProfile of the SeaDataNet netCDF format[3].

SeaDataNet uses a software called Octopus[4] to reformat and check all kind of data before integrating it into the international infrastructure. In the frame of this project, an extension of Octopus was written to transform existing (and future) SADCP data so that they can be ingested in the international SeaDataNet infrastructure. At first, we focused on data qualified by CASCADE software[5], then extended this to data qualified by CODAS software. By focusing on those two data processing toolboxes, we potentially cover about 80% of acquired data. Note that Octopus can run an any computer, so that PIs can potentially submit SADCP data in the recommended format for SeaDataNet, without relying on data centres to do it.

The specificity of SeaDataNet is that data need to be submitted by the countries that ran the cruises on research vessels, to be properly associated with the corresponding datasets. As a demonstrator, a first subset of 5 French cruises is already available in SeaDataNet. To find them on https://cdi.seadatanet.org/search, search criteria are as follows: P02 = ”Horizontal velocity of the water column”; Measuring area type = ”curve”; Free search = “GO-SHIP”. Seven more SADCP datasets of international cruises are already converted and ready to go.

To increase the end user uptake, we developed a web application called SADCP Viewer[6]. SADCP Viewer is a reproducible web application based on pangeo environment and help users to better discover SADCP data on a web interface without manually downloading SADCP data stored in SeaDataNet. The full flow is visible in Figure 11.

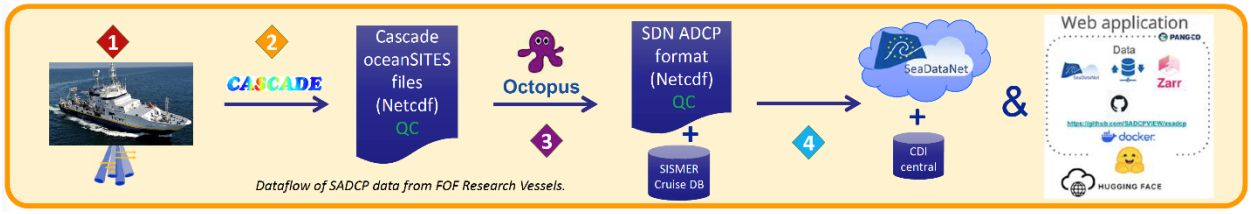

Figure 11: Data flow of SADCP data from Research Vessels to Visualisation

[3] Lowry Roy, Fichaut Michele, Schlitzer Reiner, Maudire Gilbert, Bregent Sophie, Gatti Julie (2024) - **SeaDataNet Datafile formats: ODV, MEDATLAS, netCDF**. Deliverable D8.5, 69 p. https://doi.org/10.13155/56547

[4] S. Brégent, M. Fichaut, S. Crouzille (2016) – **Octopus user manual**, 15 p. https://www.seadatanet.org/content/download/698/file/SDN_OCTOPUS_UserManual.pdf

[5] Kermabon Catherine, Lherminier Pascale, Le Bot Philippe (2023). **CASCADE V7.2: Software for processing, qualifying and visualizing SADCP data. User's guide**. https://doi.org/10.13155/100082

[6] Tina Odaka, Pascale Lherminier, Léa Franc (2024): SADCP Viewer. https://doi.org/10.5281/zenodo.11071218, https://huggingface.co/spaces/SADCPVIEW/SADCP_VIEWER

4. Results/Conclusion

The end-to-end data flow / data curation from research cruises is not in a good state at the present time (!). We have increased our understanding of the main gaps and weaknesses (listed below) and will use this as a basis for our future work.

- There are differences in participation in research cruise data submission, at all timescales, both between nations and within nations
- Data providers / cruise PIs sometimes do not know the destination(s) of their cruise's datasets
- It can be difficult for data users to attribute datasets to a particular research cruise
- It can be difficult to know which is the 'best' or 'final' version of a dataset (eg real-time CTD profile vs 'final' CTD profile)
- We have made good progress with SADCP data curation, which will be highly valued by data users, including a new SeaDataNet-compliant data format
- We have made a harmonized netCDF data format recommendation
- We have increased the amount of near real time CTD data available to forecasting centres
- We propose a solution to facilitate FAIR data and metadata flows in future, via a full lifecycle Cruise-ID allocated by OceanOPS.

The unique cruise identifier is allocated by OceanOPS (Figure 12, Coordination Centre) based on basic metadata (who/where/when, estimated) as soon as the idea of a cruise emerges, ie potentially before a national planning and funding agency takes any action. For international coordination of the GOOS, such early cruise information can be of high value.

When the cruise is confirmed and eventually goes to sea, real-time data should be submitted with WIGOS/WMO-IDs which are also allocated for ship-stations by OceanOPS; presently used radio call signs of ships should be outphased, as not in line with WMO-WIGOS requirements for unique IDs.

Delayed-mode data from a cruise (and any updates) should be submitted in the recommended harmonized data formats (including national IDs if required, but always including the unique cruise-ID allocated by OceanOPS) to a single (national) data centre, from where these data flow to EU data aggregators, but also to the GDAC and into GDAC-based products. Multiple submission of datasets is no longer required.

In the CSR format, a field already exists for alternative IDs which could be used in general for the OceanOPS Cruise-ID (tbc). As soon as the CSR is submitted shortly after the cruise, OceanOPS could identify and exploit automatically the corresponding machine-readable XML format and gain access to the full set of cruise metadata with all dates, stations, parameters etc.

With this in place, the monitoring of data flows after submission of the CSR can be automated, at national, European and international scale; based on deployment reports (including date and unique ship ID) of autonomous instruments a coherent accounting is also enabled for such piggy-back projects of research cruises, or research ships in general (it is eg possible to query through OceanOPS how many autonomous instruments (including particular type, eg deep Argo) were deployed by which ships or fleets (eg all French RVs) as contribution to a particular project (eg EuroGO-SHIP) in a particular timeframe, and for providers of which country (eg Argo-US).

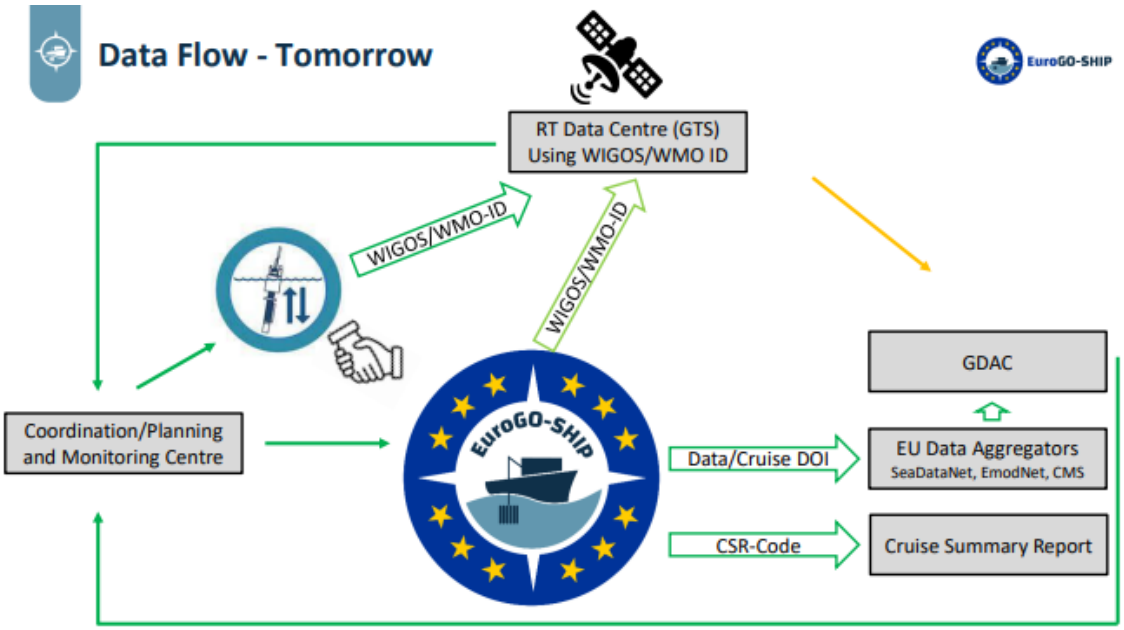

Figure 12: The monitoring of data flows is facilitated through the unique Cruise-ID which follows cruise and emerging data along the full lifecycle

Room for improvement remains regarding the matching of real-time data with delayed mode data of higher quality. Real-time data-based forecasts could be re-analysed once the higher quality delayed mode data become available and the here proposed way forward enables this matching in principle; for other observing networks which have fully implemented full lifecycle IDs allocated by OceanOPS (floats, drifters, moorings etc) this is already in place.

Lastly, with reference to the recently started EU AMRIT project, future work should also focus on automated exchange of metadata (including IDs) between cruise planning facilities (using eg MFP software) and OceanOPS as acting EOOS coordination centre.

5. Annex : Copy of Data Pathways Questionnaire

Repeat Hydrography Data Pathways Questionnaire

(Repeat) Hydrography Data Pathways Questionnaire

This questionnaire will be circulated within the European and international GO-SHIP and (repeat) hydrography communities during year 2 of the EuroGO-SHIP project (www.eurogo-ship.eu). The aim is getting a clearer picture what happens with data and how the situation could be improved following FAIR (Findable, Accessible, Interoperable, Reusable) principles.

We are not targeting any particular cruises you conducted, so do not hesitate to provide us with information on any data type from any cruise, and add any information of interest in the sections for free text. Most participants will not be able to answer all the questions, but only partially filled out surveys are still of high interest.

Beyond this project, the results of this survey will be very beneficial for international GO-SHIP and feed into the ongoing data tracking efforts of the GOOS Observations Coordination Group.

Please let the survey team (go-ship-eu@groups.wmo.int) know if you have any comments or questions, and invite others to participate. The survey is still open and first results will be presented late June during the 2024 annual EuroGO-SHIP meeting.

General

Your name

Martin

Your affiliation/organization

Country of your organization

Email

Your role (in this context)

If you do not manage your data during or after the cruise, who would be the best point of contact?

Do your data contribute to EU marine data aggregation (SeadataNet, EModenet, CMES)

- Yes
- No
- Uncertain
- I don't know about EU data aggregators

About metadata and IDs

Where are cruise metadata available before, during, after the cruise?

For EU cruises, are you aware of the Cruise Summary Report (CSR) and do you fill it as a PI/CS?

For non-EU cruises, is anything similar in place that shortly after the cruise provides a cruise summary? Machine-readable?

Who in your organization is in charge of submitting and updating the cruise metadata to OceanOPS before the cruise?

Are you aware of the OceanOPS Cruise ID Scheme and if yes, how do you implement it (where in your data files is this ID)?

Do you use DOIs as identifier for your cruises?

- Yes
- No

Do you use DOIs as identifiers for datasets of your cruises?

- Yes
- No

Do you use other identifier schemes for cruise and data and if yes, which (e.g. Expocode)?

Near real-time data

The following section and tables deals with near-real-time (NRT) data.

Please fill out the tables as much as you can, based on this example:

	Parameter	Timeliness	Identifier(s)	Data format(s)	Applied QC	Data destination(s)	GTS header	Data point of contact(s)	Any other info
1	SST	Less 5 min	Ship call sign	BUFR 308009	unknown	GTS, GOSUD	SOVX01 EGGR	Fred Sample Fred@me.co	

If you do not submit any data in NRT, do you have any intention to do so soon?

- Yes
- No
- Not applicable (we already submit NRT data)

Surface underway data (near-real-time)

	Timeliness: time delay between observation being made and arriving at data repository [e.g., 1 hour, 24 hours, 1 week, don't know]	Identifier(s) [e.g. call-sign, ICES code, SOT-ID]	Data format(s) [e.g., csv file, text file, netCDF file, WMO formatted message like BUFR or TESAC, don't know]n, ICES code, SOT-ID]	Applied QC [e.g., yes (include QC protocol name), no QC, don't know.]	Data destination(s) [e.g., WMO GTS, Coriolis, your institution's database, don't know]	If you issue data to WMO GTS, under what header do you send the message? [e.g., SOVX01 EGRR, don't know]	Data point of contact(s) [e.g., data manager, responsible person at your institute or national met service, don't know]	Any other info, including "not measured"
Surface dissolved oxygen								
Surface CO2 (pCO2)								
Sea surface temperature								
Sea surface salinity								
Chlorophyll fluorescence								
Meteorological Observations								

Any other underway data (near-real-time) – add below

	Parameter	Timeliness	Identifier(s)	Data format(s)	Applied QC	Data destination(s)	GTS header	Data point of contact (s)	Any other info
1									
2									
3									

Profile data (near-real-time)

	Timeliness	Identifier(s)	Data format(s)	Applied QC	Data destination(s)	GTS header	Data point of contact(s)	Any other info
CTD (temperature, salinity, depth)								
Dissolved oxygen								
Acoustic Doppler Current Profiles from ship-mounted instrument (sADCP)								

Any other profile data (near-real-time) – add below

	Parameter	Timeliness	Identifier(s)	Data format(s)	Applied QC	Data destination(s)	GTS header	Data point of contact (s)	Any other info
1									
2									
3									

Delayed mode data

This section deals with delayed mode data.

If you submitted (preliminary) data in near-real-time, is there any link to later submitted delayed mode data of higher quality (e.g. both submitted under same DOI)?

Are you familair with GO-SHIP data requirements, in particular timeliness?

- Yes, and able to comply
- Yes, but difficult or impossible to comply
- No

Please provide comments you may have regarding the GO-SHIP data requirements

With reference to the near-time-time tables and examples in the preceding section, please fill out this table as much as possible, including "unknown" or "not measured"

	Timeliness	Identifiers(s)	Data format(s)	Applied QC	Data destination(s)	Data point of contact(s)	Any other info
CTD including O2							
CTD without O2							
Bottles							
Nutrients							
Carbon: Total Alk							
Carbon: pH							
Carbon: CT (DIC)							
Carbon: DOC							
Transient Tracers: CFCs							
Transient Tracers: SF6							
Transient Tracers: 3H							
Transient Tracers: 3He							
Lowered ADCP							
Shipborne ADCP							
Underway data: Surface dissolved oxygen							
Underway data: Surface CO2 (pCO2)							
Underway data: Sea Surface Temperature							
Underway data: Sea surface salinity							
Underway data: Chlorophyll fluorescence							
Underway data: Meteorological observations							

Any other delayed mode data - add below

	Parameter	Timeliness	Identifier(s)	Data format(s)	Applied QC	Data destination(s)	Data point of contact(s)	Any other information
1								
2								
3								
4								
5								
6								

Please provide some links to data from your cruises

Any other comments?

By submitting this survey, you consent to providing personal information (full name, e-mail address, institution, country).

The lawful basis for processing your personal data in connection with participation in our survey is point (f) of GDPR article 6 (1), i.e., that the processing is necessary for the purposes of the legitimate interests pursued by the survey data controller. Personal data collected as part of this survey will not be shared with third parties and will be deleted as soon as found feasible, and no later than the end of the EuroGO-SHIP project, November 30th, 2025.

You may withdraw your consent at any time by emailing the data controller, Ryan Weber (NORCE): rywe@norceresearch.no. Withdrawing your consent will not affect the lawfulness of the processing of personal data that took place before you withdrew your consent.

Thank you very much!

Contact

mkramp@wmo.int