



Global Ocean Observing System



# GOOS Observations Coordination Group & networks – working towards FAIR data flow

Emma Heslop, Programme Specialist - GOOS, IOC

Kevin O'Brien, OCG Vice Chair Data, NOAA

NFP Meeting

27 October 2025

# Agenda

- Roots of the Strategy in mapping data flow (Emma)
- OCG Data Strategy – principles & implementation (Kevin)
- Minimum Metadata OceanOPS Passport – principles & implementation (Kevin)
- IOC Data Architecture – (Emma)
- WMO Unified Data Policy / IOC Data Policy (Emma)
- Next Steps & Questions (Emma and Kevin)

# ROLE OF OCG

The Observation Coordination Group (OCG) works to efficiently **operate**, **maintain**, **coordinate** and integrate a comprehensive in-situ global ocean observing system

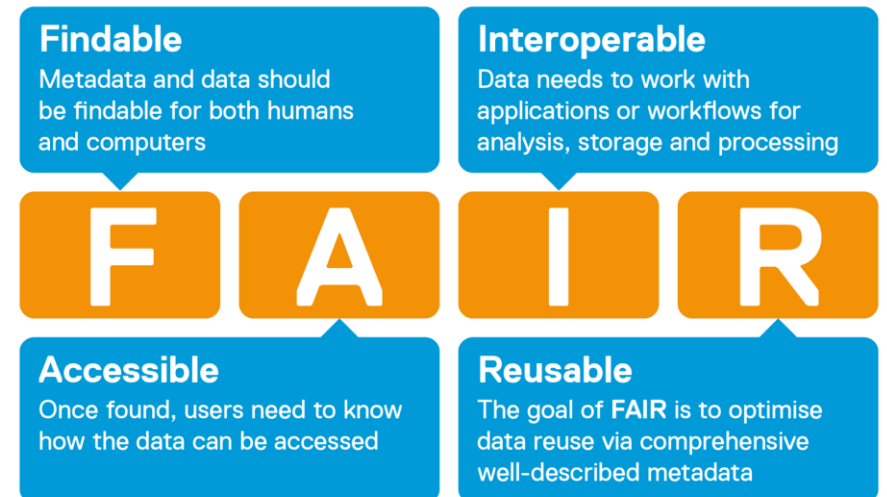
OCG targets **8 foci** for action across the 13 mature and 3 emerging Networks:

- Requirements
- Observing Advances
- Standards and Best Practices
- Data Management
- OceanOPS
- Metrics
- Environmental Stewardship
- Capacity Development



# OCG Data Goals

- FAIR compliance of metadata, data and data services across all OCG networks
- Federated end point of distributed services for OCG data
- Data/Metadata are discoverable and harvestable
- Data/Metadata are available through identified global repositories
- Data are fully documented and required metadata is available through OceanOPS
- Quality data are available in near real time from the GTS and/or other data access services
- Data/Metadata are properly archived and citable



# GOOS OCG Data Implementation Strategy - Roots

# Initial Activities – Mapping the Network data flows

## WHAT

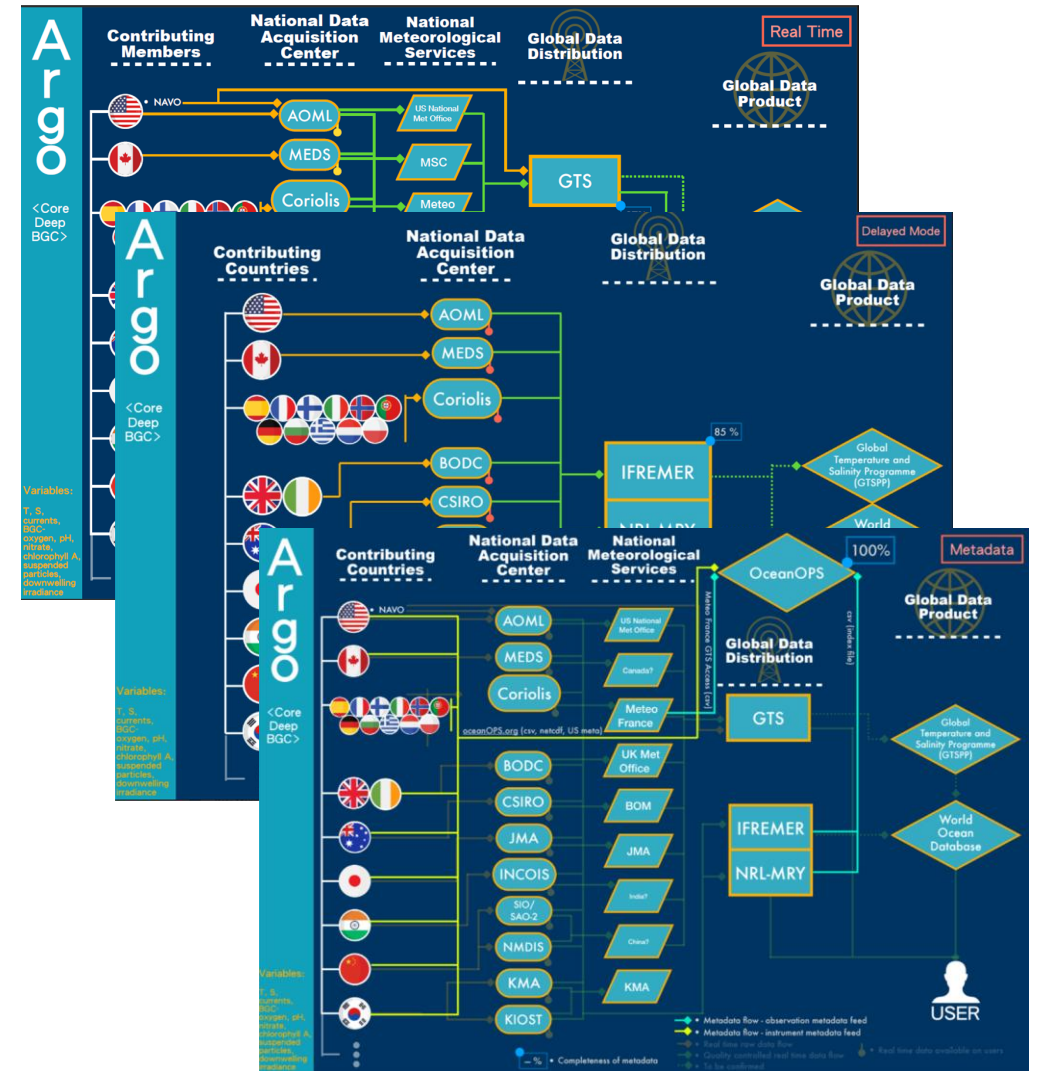
- near-real time, delayed mode and metadata
- by country for all the global in situ networks

## WHY

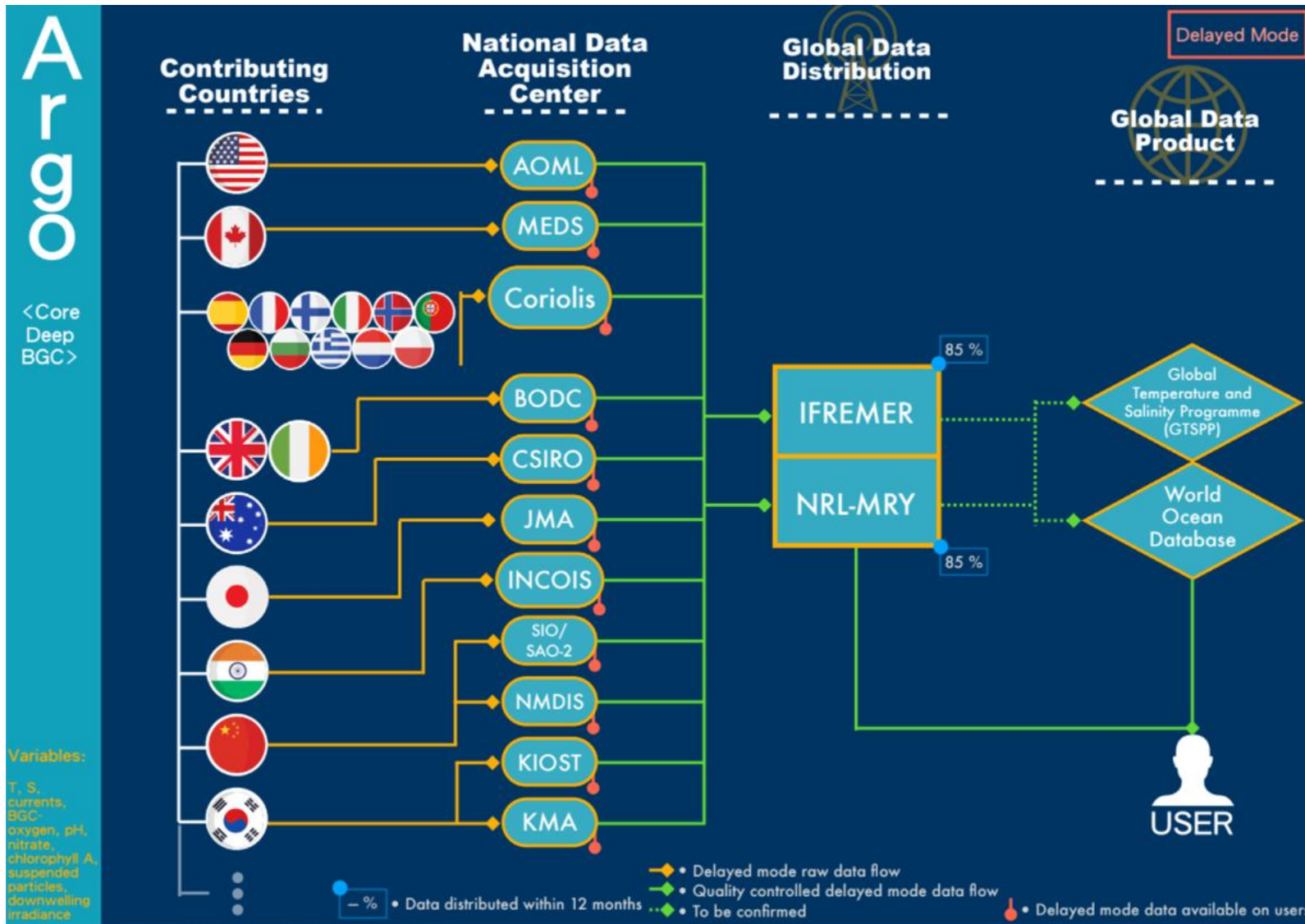
- Identify gaps and enhancements towards network data and metadata services FAIR compliance

## OUTCOMES

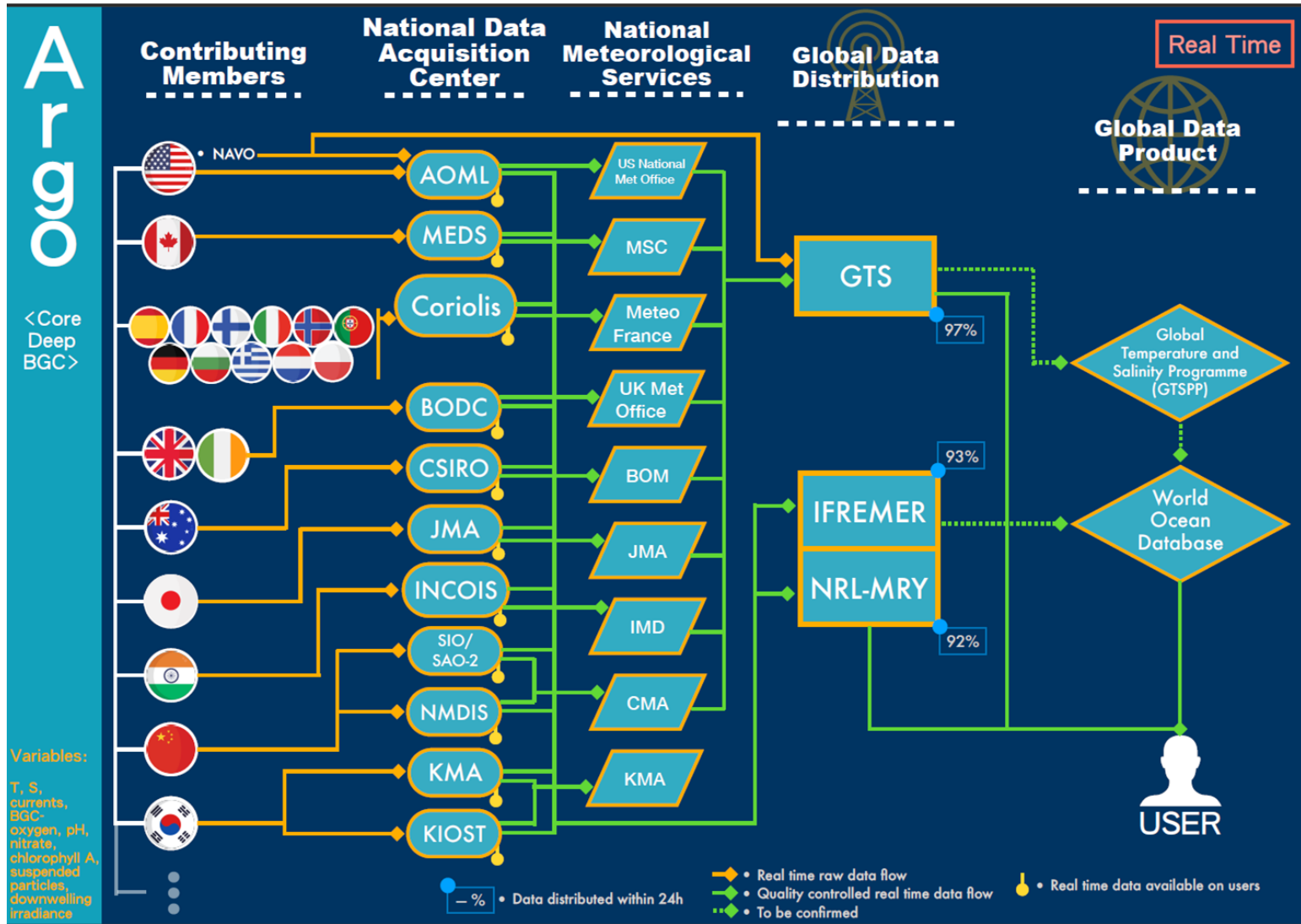
- Complex landscape - number of Global Data Assembly Centres (GDACs) identified
- Clear understanding of metadata flow and harvesting for services
- formation of OCG Data Strategy



OCG Data Mapping - GOOS-278



- Pathways are different for Real time and delayed mode data
- Pathways different for different countries
- Data available at at many points (Unique identifiers vital)
- Global Data Distribution centres or GDACs are vital - resilience, access, tracking



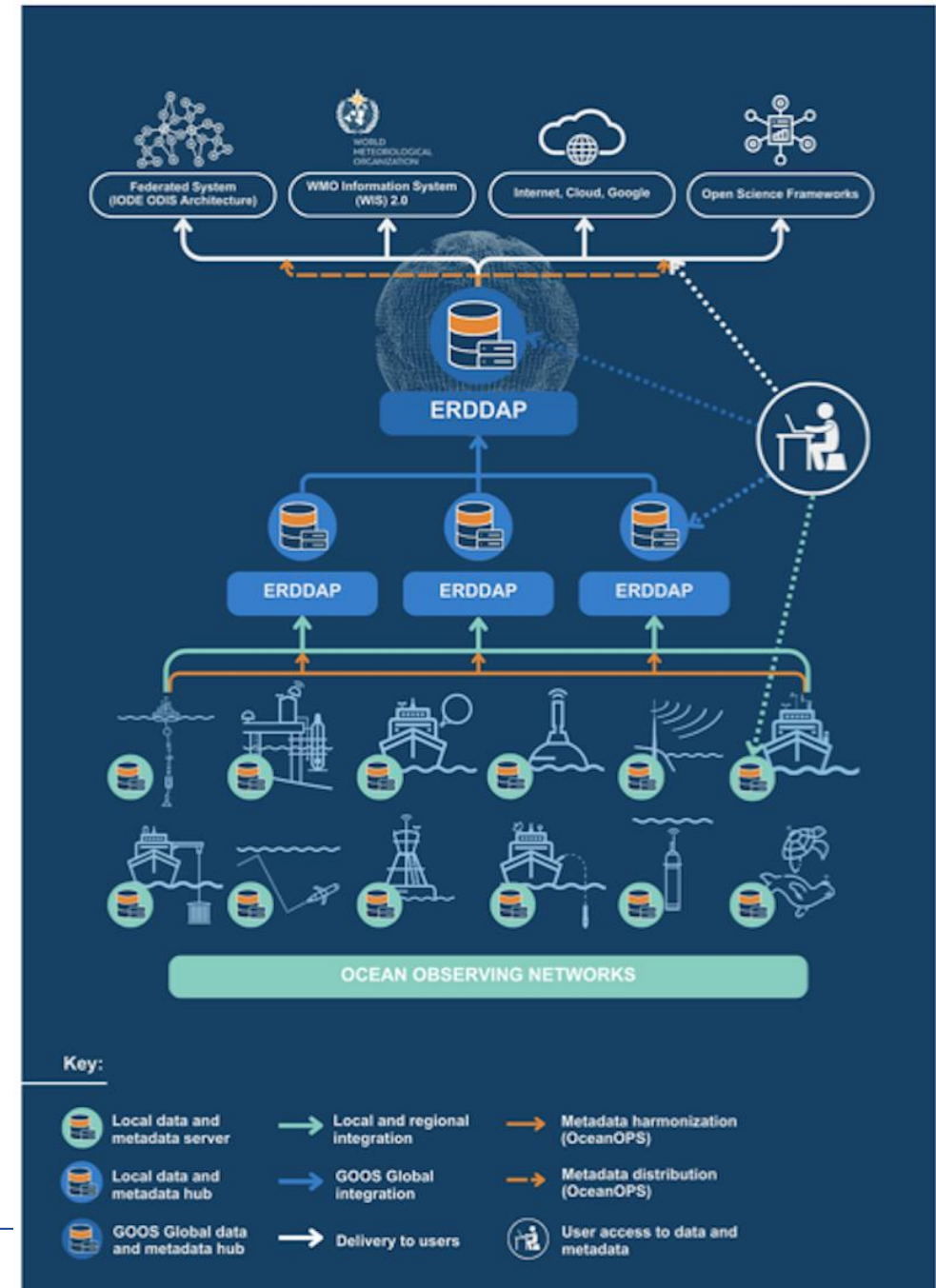
- Data reaches WMO GTS (soon WIS2) and other Global data Distribution centres for operational system access
- Pathways different for different countries

# OCG Data Implementation Strategy - Today

# Cross-Network Data Implementation Strategy

The Implementation Plan defines specific and actionable ways OCG observing networks can move towards FAIR compliance:

- Work of 2 years - international leading edge concepts (federation/ERDDAAP) and dialogue with networks
- Aim to improve:
  - (meta)data discovery, exchange, accessibility and usability for all stakeholders
  - access to distributed (meta) data endpoints through federated nodes
  - uniform data services across networks and EOVs
  - traceability



# Setting Requirements

Set of recommendations to achieve

OCG works with networks on an individual basis



## GOOS OCG Data Implementation Requirements

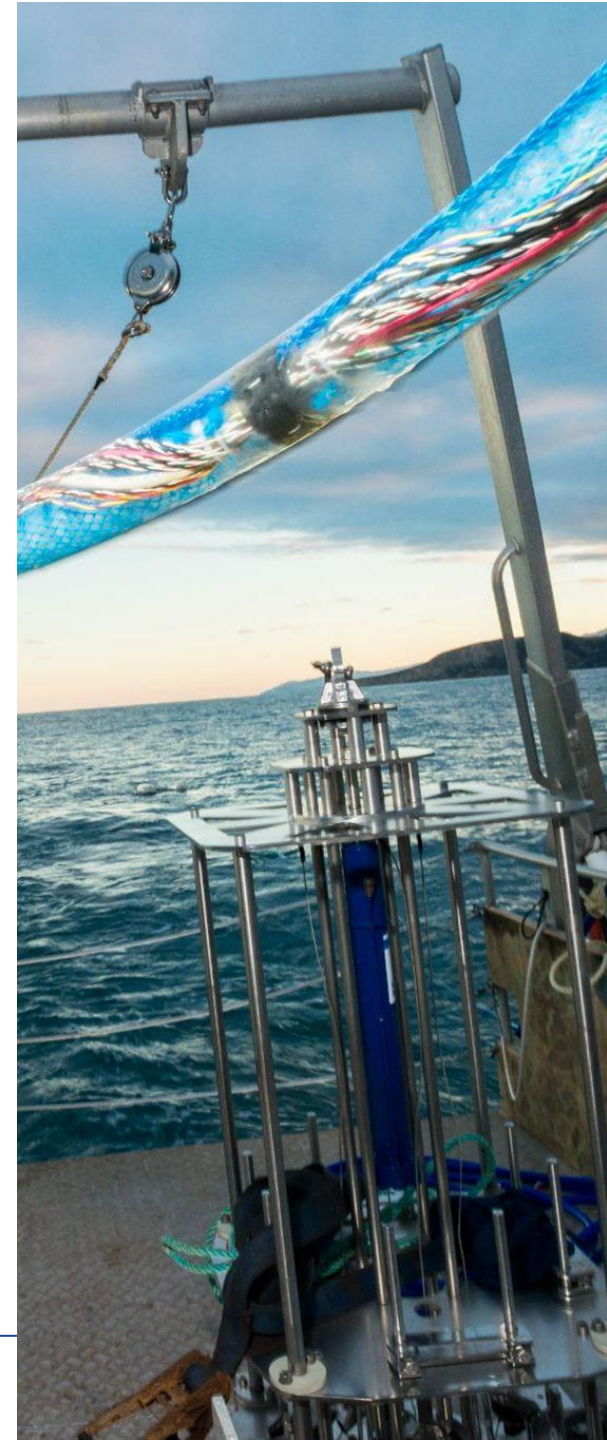
Real Time Data		Metadata	
OCG-R1	Data shall be exchanged in real time (with minimum delay) via the WIS/GTS of the WMO in approved formats/templates.	OCG-R7	Networks shall have a defined uniform metadata content that includes at least the minimum OceanOPS requirements, thereby ensuring that they are compliant with the WIGOS metadata requirements. Note that OceanOPS is the authoritative source through which WIGOS metadata are submitted to OSCAR for all oceanographic and marine meteorological platforms.
OCG-R2	Data shall be available in real time or near-real time on the Internet through interoperable services (preferably ERDDAP) freely and without any restriction. Community agreed quality control procedures shall be applied in real-time and adjusted values made available when possible.	OCG-R8	Discovery and Use metadata shall be based upon a well-documented community standard, including a persistent and unique WMO/WIGOS identifier allocated by OceanOPS and use controlled vocabularies.
		OCG-R9	Platform and Discovery metadata shall be exchanged with OceanOPS utilizing machine-2-machine services.
Delayed Mode Data		Best Practices	
OCG-R3	Each network shall have at least one identified Global Data Repository. This Global Data Repository may be one or multiple (mirrored) repositories, or they may be data endpoints that can be federated into a virtual global repository.	OCG-R10	Each network should have an active data team.
OCG-R4	Data and data products shall be available through publicly accessible ERDDAP services. These distributed ERDDAP services will be federated under a single OCG ERDDAP focal point.	OCG-R11	Each network should have identified best practices on data infrastructure and workflows and data Q.C.
OCG-R5	NetCDF is the preferred data file format, though ERDDAP services can act as a data format translator if needed.	OCG-R12	Raw/real-time data, delayed mode data and data products should be archived and have unique identifiers created (i.e., Digital Object Identifier (DOI)) for citation and reuse.
OCG-R6	Additional platform metadata should be available through the Global Data Repository and harvestable by machine-2-machine services.		

# OceanOPS Passport Concept

- **Small subset** of critical metadata based on controlled vocabularies and PIDs
- Evolution not revolution - networks already submit most/all metadata - set standard
- OceanOPS will certify completeness
- Crosswalk with BioEco metadata
  - **Ensure traceability** of platform activity from deployment to retrieval.
  - **Track GOOS contributions**, including agencies, nations, and infrastructure.
  - **Monitor observing capacity** by tracking active/past deployments and scientific payload.
  - **Validate metadata** and integrate into WMO, IOC, and GOOS databases.
  - **Support coordination** for planning, status updates, and gap response.
  - **Improve data discoverability** by linking missions to observations???
  - **Visualiation and system analysis**



**Defining the minimum metadata required for unique ID (WIGOS ID), support user access & interoperability, enable tracking**




# “Passport” metadata components

Mandatory  
 Computed  
 Nice to have

(\*) Reference  
 table  
 [...]array

**Identification**  
 WIGOS ID  
 Platform description (\*)  
 [EOV/ECV] (\*)




**Affiliation**  
 Program (\*)  
 Country (\*)  
 Organization (lead) (\*)  
 [GOOS Observing Network] (\*)  
 [Observatories] (\*) (if applicable)  
 [Tags] (\*)

**Data**  
 [Data Assembly Centre] (\*)  
 [Global Data Node] (\*)  
 [data identifier]

**Operations**  
 Deployment date  
 Deployment latitude  
 Deployment longitude  
 Deployment ship (\*) (if applicable)  
 Deployment cruise (\*)

Ending date Ending  
 latitude Ending  
 longitude Ending  
 cause (\*) Recovery  
 ship (\*) Recovery  
 cruise (\*)

**Hardware**  
 Platform model  
 (\*) Manufacturer  
 (\*)  
 Serial number  
 [Telecommunication]

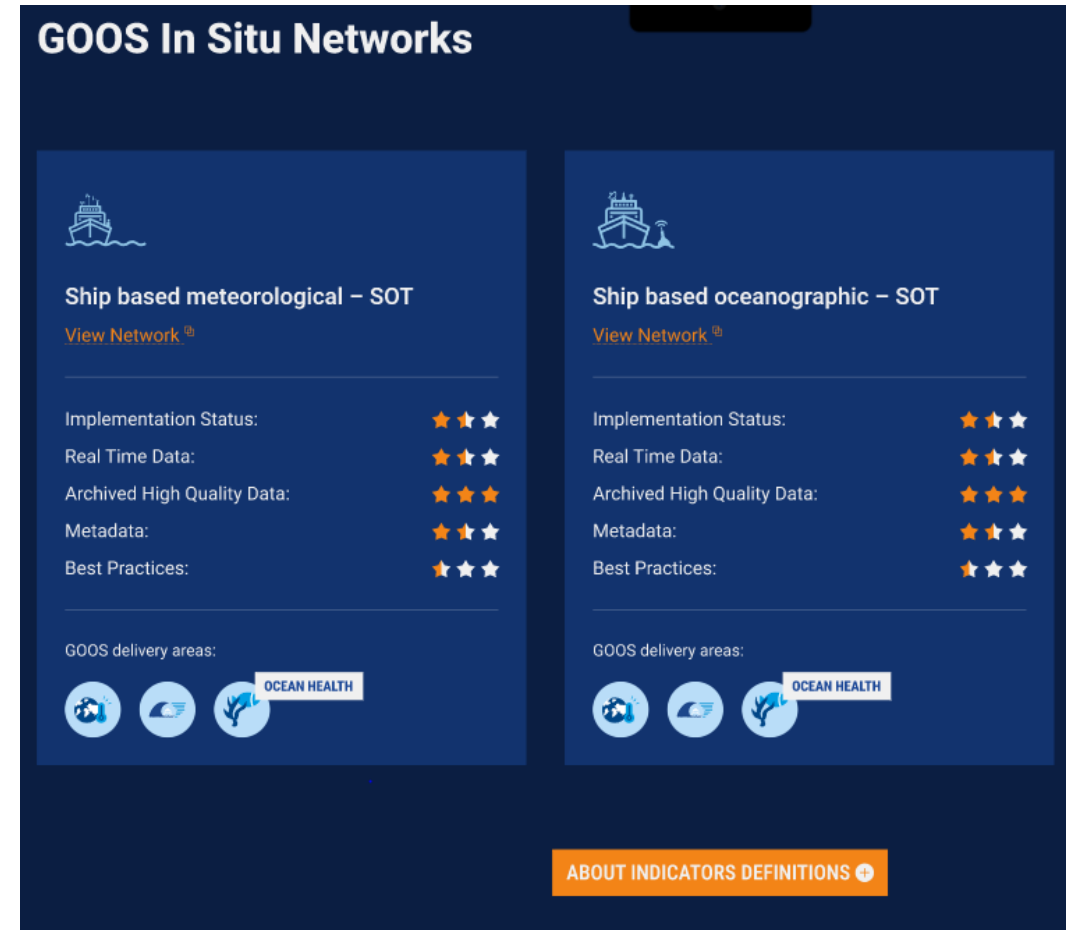
[Sensors] (\*)  
 Model  
 Manufacturer  
 (\*)  
 [Sub Variables] (\*)  
 Serial number  
 Sensor height (if applicable)  
 Start date  
 End date  
 Providers (\*) (if applicable)

**Status**  
 Status (\*)  
 Latest observation date  
 Latest observation latitude  
 Latest observation longitude

**Update**  
 Passport Delivery Date  
 Latest Update Date

# Use of metadata in Ocean Observing Status Report

- Single-card assessment per network
- Next year a Passport score will be introduced



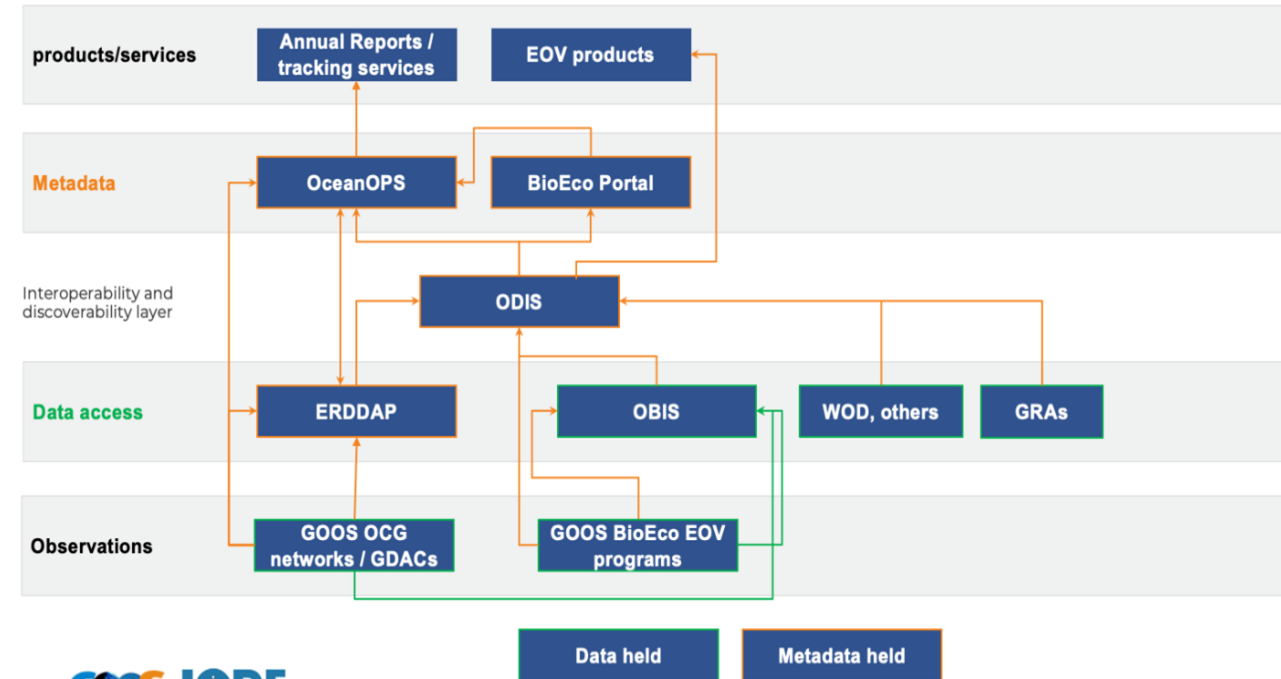
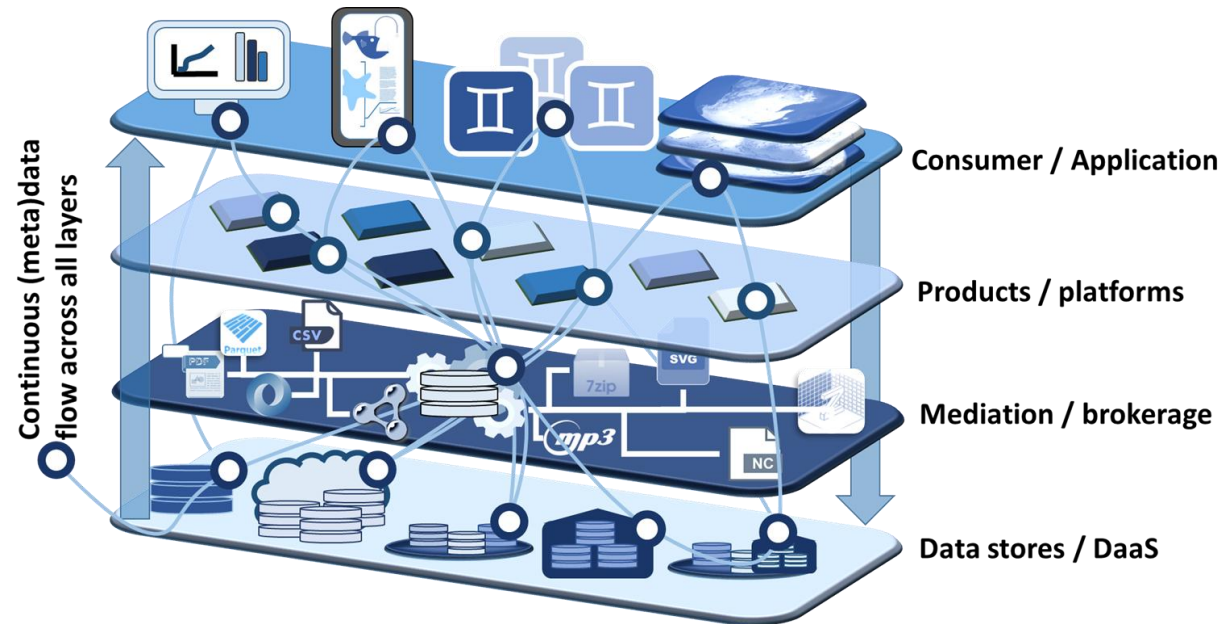
# Progress, status and next steps

- OceanOPS Passport
  - endorsed by OCG Networks through Annual Meeting 2026
  - provide guidelines for network members implementation 2025, majority of networks already submit required passport info (more or less)
  - OceanOPS developing automated tracking - e.g. Report Card
- implementing machine-to-machine metadata exchange between OceanOPS and networks necessary to scale and provide support for new GOOS OCG networks
- Supporting networks to have resilience through Global Data Distribution/Assembly Centres
- Federating ERDDAP Nodes / EOVS data
  - several networks have implemented ERDDAP at one or more data endpoint
  - federated into proto GOOS data node and being harvested by ODIS
- Additional standards work to assess metadata for provenance, uncertainty, citation, licencing 2026

# IOC Data Architecture Future developments

# Work on the concept

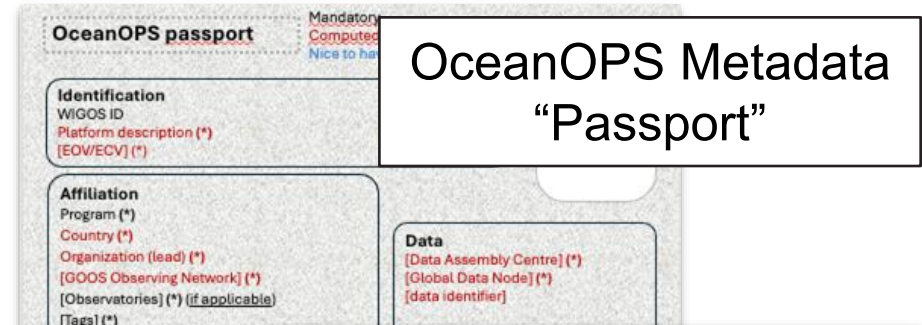
Vision: A harmonised and tightly coordinated suite of IOC data systems delivering open, actionable, and freely available data for the ocean's digital ecosystem.



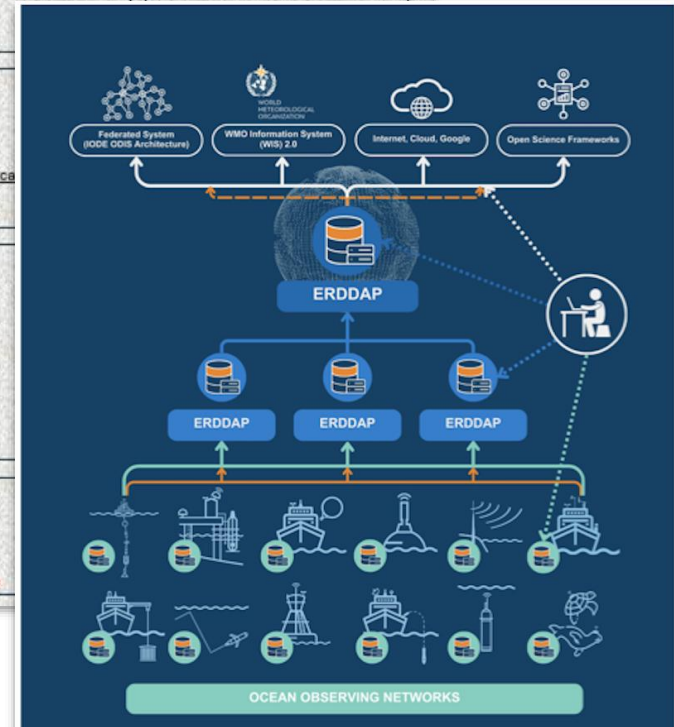
[IOC Data Architecture Concept Proposal](#) (IOC A33)

# Building blocks

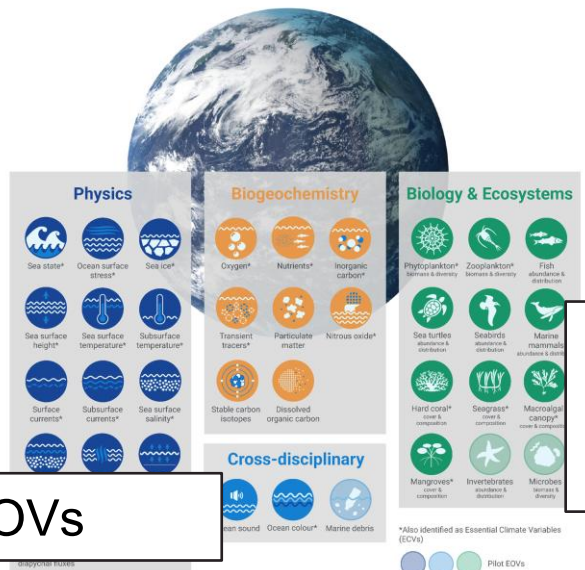
- GOOS and IODE
- Federated governance ODIS, federated systems GOOS ERDDAPs, OBIS nodes, OceanOPS, etc
- EOVs - harvest across federated system
- Minimum metadata - unique identifiers
- OceanOPS tracking/visualisation
- Provenance, uncertainty, licencing
- GOOS metadata 'tag' - quality



OceanOPS Metadata "Passport"



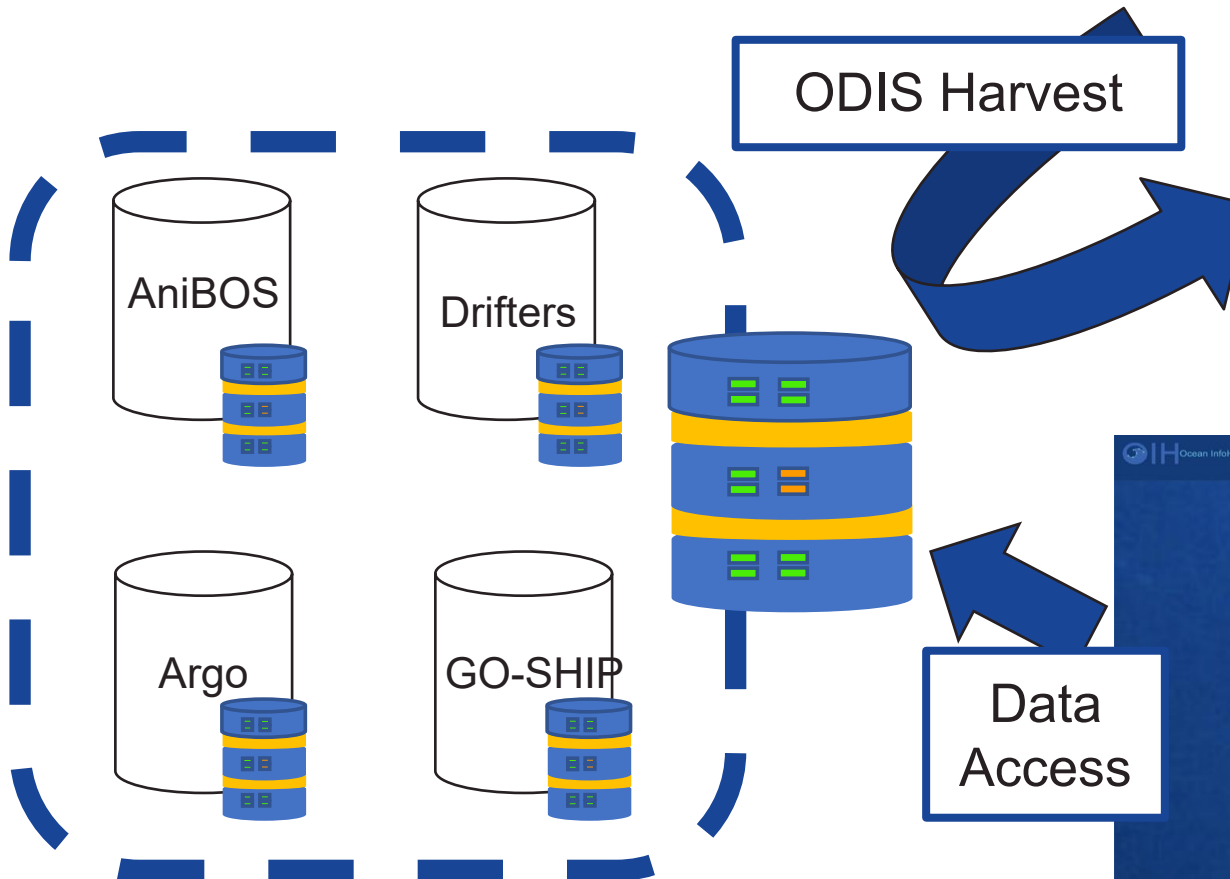
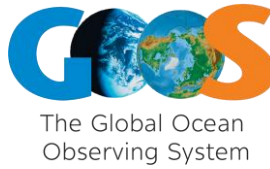
OCG Federated Network



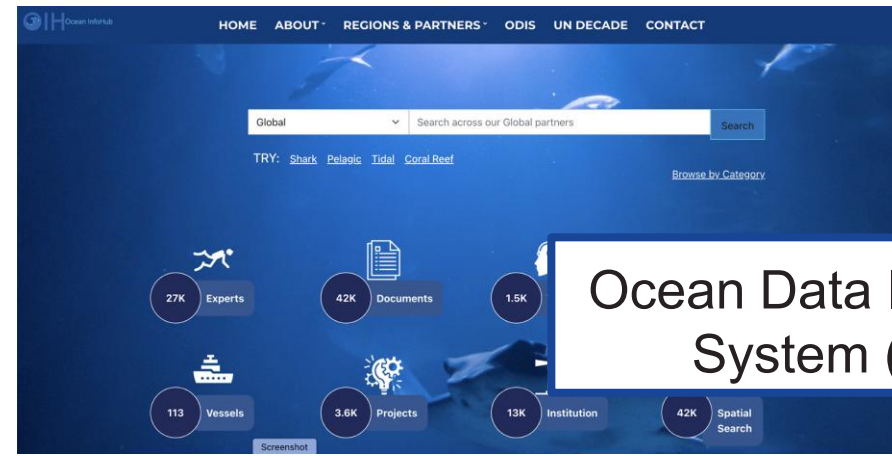
EOVs



# GOOS OCG Data Hypernode - Connection to ODIS and IOC Architecture



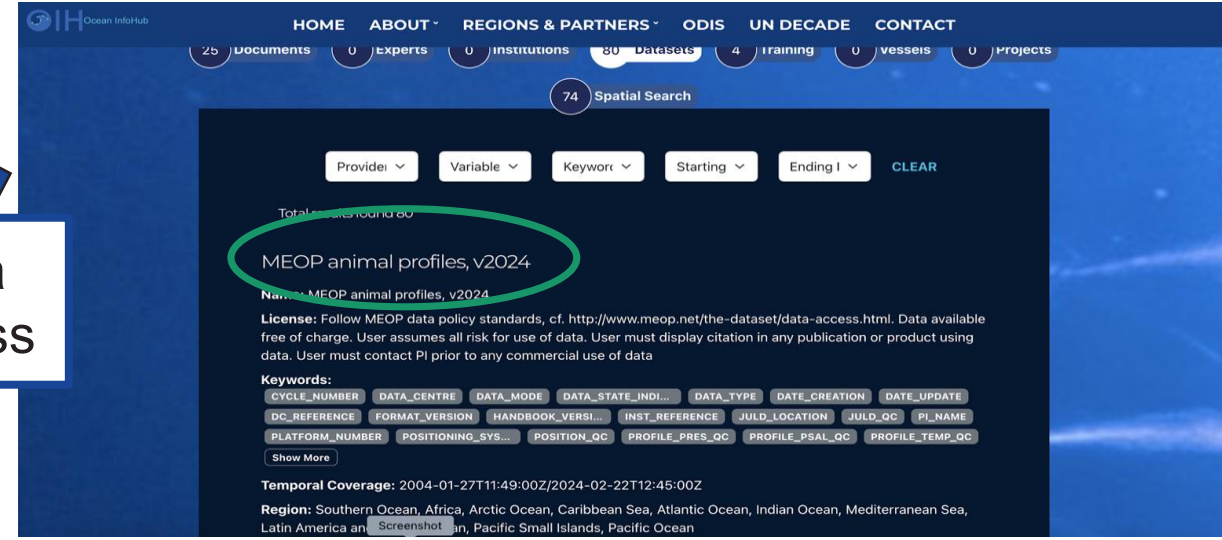
GOOS Federated Data (aka Hypernode)



Ocean Data Information System (ODIS)



User query



# WMO Unified Data Policy

*relevance to ocean*

# WMO Unified Policy for the International Exchange of Earth System Data (Resolution 42)

Single 'unified' data policy across multiple domains: Weather, Climate, Hydrology, Atmospheric Composition, Cryosphere, Oceans and Space Weather that aims to broaden and enhance the free and unrestricted international exchange of Earth system data

**For oceans - covers in situ and remotely sensed observational data both in and above the ocean and at the sea-surface, from the open ocean to the coast, along with other data that provide necessary input to ocean monitoring and prediction and for a variety of other Earth system applications**

**Acknowledges the right of governments, based on their national laws and policies, to choose the manner by, and the extent to which, they make data available domestically or for international exchange – so does not override national data policies**

Core data (shall be exchanged on a free and unrestricted basis)	Recommended data (should be exchanged)
Marine meteorological and oceanographic observations, as defined in the WIGOS Manual (WMO-No. 1160)	Physical GCOS ECV and GOOS EOVS observations that have been collected outside of designated GOOS activities
All other physical GOOS EOVS and GCOS ECVs collected as part of a GOOS observational network, programme or project consistent with the IOC Oceanographic Data Exchange Policy (IOC Resolution XXVI 8)	All other observed biogeochemical and biological/ecosystems GCOS ECVs and GOOS EOVS;
Ocean analysis and prediction fields provided by global NWP systems operating under the auspices of the GDPFS, as defined in the Manual on the Global Data-processing and Forecasting System (WMO-No. 485);	Observations of pH, chlorophyll-A, suspended particles and downwelling irradiance which are fundamental to address significant scientific and societal ocean/climate-related issues
All ocean reanalysis fields provided by the Global Processing Centres of the GDPFS;	
All watches, warnings, advisories and alerts for public safety (protection of life and property) issued by Members' designated warning and alerting authorities according to WMO Technical Regulations	

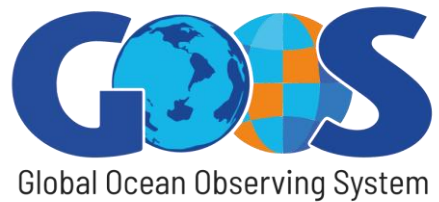
Approved by WMO Extraordinary Congress 2021 (Res. 1) - [link to policy](#)



# NFPs action?

# Questions, feedback, thoughts

- A lot of information presented - do you have any questions!
- Is this information useful to NFPs?
- What is important for you?
- Do you see a role for NFP in supporting this work?
- Do you want updates? More or less information?



# Thank you

[goosocean.org](http://goosocean.org)

