OCG data flow mapping

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Introduction

As part of the Observations Coordination Group (OCG) Data Strategy, and Metadata harmonization efforts, and in line with a request from the tenth GOOS Steering Committee meeting in September 2020, GOOS initiated a Data and Metadata mapping project to clearly map out the data and metadata flows for both real-time and delayed mode data, across all the recognized OCG global networks: Argo, OceanGliders, Data Buoy Cooperation Panel (DBCP), Ship Observations Team (Voluntary Observing Ships (VOS), Ships of Opportunity Program (SOOP), Automated Shipboard Aerological Programme (ASAP)), the Global Ocean Ship-Based Hydrographic Investigations Program (GO-SHIP), OceanSITES, Global Sea Level Observing System (GLOSS), Animal Borne Ocean Sensors (AniBOS), and High Frequency (HF) Radar.

Our aims for this mapping exercise are to: 1) enable those outside the networks to better understand how network data moves through the global and national data management systems; 2) enable us in identifying gaps and areas where we can potentially improve or better support data and metadata access; 3) ensure that the required metadata is accessible and flowing into the OceanOPS monitoring system, 4) use as a base for a cross-network data strategy, ensuring that the data from global networks reaches existing and future global access points for both operational real-time and quality controlled delayed mode data. This is a focused effort to increase value and visibility of OCG network data by improving its interoperability and ensuring that OCG data meets its critical role as an integral part of the global ocean information digital ecosystem.

The information and insight from this data mapping will inform and guide the development of an OCG Data Implementation Strategy, to better support observational network development in these areas, and recommend best practices to the community. Understanding these data and metadata flows and identifying areas of enhancement are crucial in order to increase FAIR compliance of OCG network data and compliance with the WMO Unified Data Policy.

The data mapping contains data structures, QC elements, and key performance indicators such as data availability, timeliness, and completeness of metadata, to identify the current state of data and metadata flows for the networks. With this picture of the data flows within the different networks, we can also work with WMO and IODE to integrate this information into their data mapping efforts to extend mapping beyond the scope of just OCG and its networks.

Beyond the work of the GOOS OCG the data maps provided here are useful for global, national and regional observing and data management systems, GOOS partners and others that want to understand the existing data pathways.

Description of the mapping

For each OCG global network, the data mappings consist of three parts: real-time data, delayed mode data and metadata. The mappings illustrate the pathway of 1) real-time data to availability on the WMO GTS and/or through non-GTS services (e.g. GDACs), 2) delayed mode data from network specific repositories, and 3) metadata flow from networks to be available in the OceanOPS monitoring system, and from endpoint locations to OceanOPS to verify for example metadata quality, data arrival and timeliness.

The mapping effort is an on-going work as the OCG networks evolve in partners, EOVs/ECVs, and data pathways. While the initial effort concentrated on the delivery of individual observations or primary data, it will continue to map the products (gridded e.g.) made available, where possible.
Variables:
- T, S, currents
- BGC: oxygen, pH, nitrate, chlorophyll A, suspended particles, downwelling irradiance

Contributing Members:
- USA
- Canada
- France
- Germany
- Italy
- Japan
- South Korea
- Spain
- Brazil
- China
- India
- Indonesia
- South Africa
- Australia
- New Zealand
- UK
- China
- India
- Japan
- South Korea
- South Africa
- Australia
- New Zealand

National Data Acquisition Center:
- AOML
- MEDS
- Coriolis
- BODC
- CSIRO
- JMA
- INCOIS
- SIO/SAO-2
- NMDIS
- KIOST
- KMA

Global Data Distribution:
- IFREMER
- NRL-MRY

Global Data Product:
- Global Temperature and Salinity Programme (GTSPP)
- World Ocean Database

Delayed Mode:
- Delayed mode raw data flow
- Quality controlled delayed mode data flow
- To be confirmed

Data distributed within 12 months
- Delayed mode data available on users
Real Time

Variables:
SST, Sea level atmospheric pressure, Wind vector, Salinity, Waves, Air temperature, Relative Humidity

Contributing Members

National Data Acquisition Center

National Meteorological Services

Global Data Distribution

DB real time raw data flow

DB quality controlled real time data flow

Real time data available to users

To be confirmed

Developing GDAC

Drifting Buoy (DB)

BOM

MSC

MNR/HKO

MF

Coriolis

OGS

SAWS

UKMO

AOML

SIO

BOM

MSC

CMA/HKO

Meteo France

Coriolis

ITAF-REMET

SAWS

UKMO

NDBC

NWS

GTS

AOML

ICOADS

Coriolis

MEDS

For DB, 100% are in BUFR format

* Data distributed within 1 hr

97%

Global Data Product
Delayed Mode

- Data distributed within ??
- Completeness of meta data

Variables:
- SST, Sea level
- Atmospheric pressure
- Wind vector
- Salinity
- Waves
- Air temperature
- Relative Humidity

Coriolis

MEDS

Developing GDAC

Countries

NDBC

AOML

SAWS

UKMO

OGS

Coriolis

Coriolis

E-SURFMAR

Countries

MNR/HKO

MF

MSC

BOM
Real Time—%

• Data distribution within 1hr

• MB real time raw data flow

• MB quality controlled real time data flow

• Real time data available to users

BOM

MSC

CMA

SHOA

MF

NDBC

BSH

HNMS

NOIT

IMI

JMA

KMA

IH

IEO

NDWC

UKMO

BOM

MSC

CMA

SHOA

Meteor France

NDBC

DWD

HNMS

IMD

IMI

JMA

KMA

IPMA

AEMET

NDWC

UKMO

Contributing Members

National Data Acquisition Center

Global Data Distribution

GTS

97 %

USER

For MB, 65% are in BUFR format

Variables:

SST, Sea level atmospheric pressure, Wind vector, Waves, Air temperature, Relative Humidity

Moored Buoy (MB)
Variables:
- SST, Sea level atmospheric pressure, Wind vector, Salinity, Waves, Air temperature, Relative Humidity

- Data distribution within ??
- Completeness of meta data
- MB delayed mode raw data flow
- MB quality controlled delayed mode data flow
- Delayed mode data available to users
Variables:
- SST, Sea level
- Atmospheric pressure
- Wind vector
- Salinity
- Waves
- Air temperature
- Relative Humidity

Contributing Members:
- Australia (BOM)
- Chile (SHOA, Meteo Chile)
- Colombia (CCO, INAMHI)
- India (INOCAR, IMD)
- Indonesia (INCOIS, JMA)
- Japan (JMA)
- New Zealand (MSNZ, INAMHI)
- Peru (FERHR)
- Russia (NDWC)
- United States (NDBC)

National Data Acquisition Center:
- BOM
- SHOA
- CCO
- INOCAR
- INCOIS
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

National Meteorological Services:
- BOM
- SHOA
- Meteo Chile
- CCO
- INAMHI
- INCOIS
- IMD
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

Global Data Distribution:
- GTS
- 77% Tsunameter

For Tsunameter, none of them are in BUFR format

Developing GDAC

Data distribution within 1hr
- Tsunameter real time raw data flow
- Tsunameter quality controlled real time data flow
- Real time data available to users

Real Time

USER
Data distribution within ??
Completeness of meta data
Tsunameter delayed mode raw data flow
Tsunameter quality controlled delayed mode data flow
Delayed mode data available to users
Developing GDAC

Variables:
- SST, Sea level atmospheric pressure, Wind vector, Salinity, Waves, Air temperature, Relative Humidity

Contributing Members
- BOM
- SHOA
- CCO
- INOCAR
- INCOIS
- JMA
- MSNZ
- NDWC
- NDBC

National Data Acquisition Center

Global Data Distribution

NDBC

USER
**Variables:**
- SST, Sea level
- atmospheric pressure
- Wind vector
- Salinity
- Waves
- Air temperature
- Relative Humidity

**OceanOPS**

**Contributing Members**
- BOM
- SHOA
- CCO
- INOCAR
- INCOIS
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

**National Data Acquisition Center**
- BOM
- Meteo Chile
- IDEAM
- INAMHI
- IMD
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

**National Meteorological Services**
- GTS

**Global Data Distribution**

**Metadata**
- Tsunameter real time raw data flow
- Tsunameter quality controlled real time data flow
- Real time data available to users
- Metadata

**Monitoring data flow**
- Manually harvested metadata (csv or website)

**Tsunameter**
- For Tsunameter, none of them are in BUFR format

**OSMC Open-GTS Access Node**

**Contributing Members**
- NDBC
- BOM
- SHOA
- CCO
- INOCAR
- INCOIS
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

**National Data Acquisition Center**
- BOM
- Meteo Chile
- IDEAM
- INAMHI
- IMD
- JMA
- MSNZ
- FERHR
- NDWC
- NDBC

**National Meteorological Services**
- GTS

**Global Data Distribution**

**Metadata**
- Tsunameter real time raw data flow
- Tsunameter quality controlled real time data flow
- Real time data available to users
- Developing GDAC

**Monitoring data flow**
- Manually harvested metadata (csv or website)
Variables:
- SST, Sea level atmospheric pressure, Wind vector, Waves, Air temperature, Relative Humidity

Contributing Members
- Polar Buoy
- E-SURFMAR Countries

National Data Acquisition Center
- BOM
- MSC
- Coriolis
- MF
- OGS
- SIO/AOML

National Meteorological Services
- BOM
- MSC
- Coriolis
- Meteo France
- ITAF-REMET
- NDBC

Global Data Distribution
- GTS
- MEDS
- Coriolis

Real Time
- PB real time raw data flow
- PB quality controlled real time data flow
- Real time data available to users

*For Polar buoy, 100% are in BUFR format

Countries
- Australian
- Canada
- France
- Italy
- USA

To be confirmed
- Developing GDAC

Data distributed within 1hr
- Data distributed within 1hr
- PB delayed mode data flow
- PB quality controlled delayed mode data flow
- Delayed mode data available to users
- Developing GDAC

Variables:
SST, Sea level atmospheric pressure, Wind vector, Salinity, Waves, Air temperature, Relative Humidity

Contributing Members
- BOM (Australia)
- MSC (Canada)
- E-SURFMAR (Countries)
- MF (France)
- OGS (Italy)
- SIO/AOML (USA)

National Data Acquisition Center
- Coriolis

Global Data Distribution
- MEDS

USER
OceanOPS

UserController

Variables:
- SST, Sea level atmospheric pressure,
- Wind vector,
- Waves, Air temperature,
- Relative Humidity

Contributing Members
- E-SURFMAR Countries
- Countries

National Data Acquisition Center
- BOM
- MSC
- Coriolis
- MF
- OGS
- SIO/AOML

National Meteorological Services
- BOM
- MSC
- Coriolis
- Meteo France
- ITAF-REMET
- NDBC

Global Data Distribution
- GTS
- Coriolis
- MEDS

Metadata

- Monitoring data flow
- Manually harvested metadata (csv, website)
- Automated metadata harvesting
- To be confirmed
- Developing GDAC

Completeness of metadata
- PB real time raw data flow
- PB quality controlled real time data flow
- Real time data available to users

For Polar buoy, 100% are in BUFR format
Variables:
- SST, Sea level atmospheric pressure,
- Surface wind speed and direction,
- Significant wave height,
- Air temperature,
- Relative Humidity

Contributing Members:
- BOM
- CWAO
- KNMI
- NOAA
- DWD
- AEMET
- MF
- UK Met office
- NOAA/NWSTG
- Met Eireann
- Washington?
- IMD
- JMA
- SMHI
- Hongkong observatory
- Code41
- Other operators

National Data Acquisition Center

Global Data Distribution
- UK
- Germany

Global Data Product

ICOADS

User

Delayed Mode

• Not known or unconfirmed
• Delayed mode raw data flow
• Quality controlled delayed mode data flow
• Delayed mode data available to users
AOML

CSIRO

BOM

RAN

SIO

Variables:

T

NCEI

GTS

Global Data Product

WOD

GTSSPP

IQUOD

Real Time

Real time raw data flow

Quality controlled real time data flow

Real time data available to users

Contributing Members

National Data Acquisition Center

National Meteorological Services

Global Data Distribution

Global Data Product

User
Delayed Mode

• Delayed mode raw data flow
• Quality controlled delayed mode data flow
• Delayed mode data available to users
Variables:

- **Real time raw data flow**: Data distributed within 24h
- **Quality controlled real time data flow**: Not known or unconfirmed
- **Real time data available to users**: Not known or unconfirmed

**Contributing Countries**
- USA
- France
- Spain
- Germany
- Denmark
- Japan
- South Korea

**National Data Acquisition Centers**
- US Met Office (Washington)
- MF
- AEMET (Madrid)
- DWD (Offenbach)
- DMI
- JMA
- KMA (Seoul)

**National Meteorological Services**
- KWBC (Washington)
- LFPW (Toulouse)
- LEMM (Madrid)
- EDZW (Offenbach)
- BOM
- JMA
- KMA

**Global Data Distribution**
- GTS
- ??
- ??

**Global Data Product**
- Real Time
Contributing Countries:
- JMA
- KMA
- DWD
- DMI
- AEMET
- MF
- US Met Office
- MF

National Data Acquisition Center:
- JMA
- KMA
- DWD
- DMI
- AEMET
- MF
- US Met Office

National Meteorological Services:
- JMA
- KMA
- LFPW (Toulouse)
- LEMM (Madrid)
- EDZW (Offenbach)

Global Data Distribution:
- KMA
- JMA
- LFPW (Toulouse)
- LEMM (Madrid)

Variables:
- Not known or unconfirmed
- Data distributed within 24h
- Delayed mode raw data flow
- Quality controlled delayed mode data flow
- Delayed mode data available to users

Contributing Countries:
- Japan
- Korea
- Germany
- Denmark
- Spain
- France
- USA

Global Data Product:
- User
- Delayed Mode
Variables: surface currents, wave height, wave direction, wave period, wind direction

Real Time

• Real time raw data flow

• Quality controlled real time data flow
Variables:
surface currents, wave height, wave direction, wave period, wind direction

Delayed Mode raw data flow
Quality controlled delayed mode data flow
Variables:
T, P, S, Oxygen, Pressure, Fluorescence, Light

Contributing Members
- USA
- Australia
- Canada
- France
- Spain
- UK
- Japan

National Data Acquisition Center
- NOAA ATN
- ?
- ?
- Coriolis
- SOCIB
- UKMO
- JMA?

National Meteorological Services
- NDBC
- ?
- Coriolis
- ?
- UKMO
- JMA?

Global Data Distribution
- GTS

User

Real Time

Symbols:
- Orange dot with arrow: Real time raw data flow
- Green dot with arrow: Quality controlled real time data flow
- Yellow dot: Real time data available to users
- Blue dot with %: Data distributed within ???h
Variables:
- T, P, S, Oxygen, Pressure, Fluorescence, Light

- Not known or unconfirmed
- Data distributed within a year
- Delayed mode raw data flow
- Quality controlled delayed mode data flow
- Delayed mode data available to users
- Virtual GDAC
### Variables:
- T, P, S,
- Oxygen,
- Pressure,
- Fluorescence,
  - Light

### Contributing Members
- **US**
- **Australia**
- **Canada**
- **France**
- **Spain**
- **UK**
- **Japan**

### National Data Acquisition Center
- **Sensor Model, S/N, etc**
  - **NOAA ATN**
  - **IMOS**
  - **CIOOS**
  - **CIOOS ERDDAP**
  - **UKMO**
  - **??**

### Metadata
- **OceanOPS**
- **GTS**

### Global Data Distribution
- Data distributed within ??h
- Real time data available to users
- Metadata flow - observation metadata feed
- Metadata flow - instrument metadata feed

- • Not known or unconfirmed
Delayed Mode

Data distributed within 1yr

Variables:
T, P, S, Oxygen, Fluorescence, Turbidity, pH, Nitrates, water velocity

Contributing Members:
- Australia
- United States
- Canada
- United Kingdom
- Spain
- Norway
- Greece
- Sweden
- Netherlands
- Italy
- South Korea
- Japan
- Brazil
- China

National Data Acquisition Center:
- IMOS
- US IOOS
- MEDS
- BODC
- SOCIIB
- NMD

Global Data Distribution:
- Coriolis
  - Data Publishing Services (PANGAEA, SEANOE, others)

User

Individual PIs

Delayed mode raw data flow
- Not known or unconfirmed
- Data distributed within 1yr
- Quality controlled delayed mode data flow
- To be confirmed
Contribution Countries

National Data Acquisition Center

Global Data Distribution

Variables:
- T, P, S, Oxygen, Fluorescence, Turbidity, pH, Nitrates, water velocity

- Not known or unconfirmed
- Data distributed within 3-6 hr
- Real time raw data flow
- Quality controlled real time data flow
- Real time data available to users

Contributing Countries:
- National Data Acquisition Center:
  - IOC/SLSMF
  - UHSLC
  - SONEL
  - JRC
  - EMODnet

GTS

Not known or unconfirmed
Variables:
- T, P, S, Oxygen, Fluorescence, Turbidity, pH, Nitrates, water velocity

Contributing Countries

National Data Acquisition Center

Global Data Distribution

- Not known or unconfirmed
- Completeness of metadata
- Delayed mode raw data flow
- Quality controlled delayed mode data flow
- Delayed mode data available to users
• AEMET - State Meteorological Agency
• AODN - Australian Ocean Data Network
• AOML - Atlantic Oceanographic and Meteorological Laboratory
• AWI - Alfred Wegener Institute
• BIOS - Bermuda Institute of Ocean Sciences
• BODC - British Oceanographic Data Centre
• BOM - Bureau of Meteorology
• BSH - Federal Maritime and Hydrographic Agency of Germany
• CCHDO - CLIVAR and Carbon Hydrographic Data Office
• CCO - Colombian Ocean Commission
• CIOOS - Canadian Integrated Ocean Observing System
• CMA - China Meteorological Administration
• CNR - National Research Council
• CNRS - National Center for Scientific Research
• CSIRO - Commonwealth Scientific and Industrial Research Organization
• DFO - Fisheries and Oceans Canada
• DMI - German Maritime Institute
• DML -
• DWD - Germany’s National Meteorological Service
• ECCC - Environment and Climate Change Canada
• FERHR -
• FMRI - Faroe Marine Research Institute
• GEOMAR - Helmholtz Centre for Ocean Research Kiel
• GISC - Geographic Information Science
• GLODAP - Global Ocean Data Analysis Project
• GTS - Global Telecommunication System
• HCMR - Hellenic Centre for Marine Research
• HKO - Hong Kong Observatory
• HNMS - Hellenic National Meteorological Service
• IEO - Spanish Institute of Oceanography
• IFREMER - French Research Institute for Exploitation of the Sea
• IH - Hydrographic Institute
• IMD - India Meteorological Department
• IMI - Marine Data Center
• IMOS - Integrated Marine Observing System
• IMR - Institute of Marine Research
• IMRPE - Marine Institute of Peru
• INAMHI - Ecuadorian Institute for Meteorology and Hydrology
• INCOIS - Indian National Centre for Ocean Information Service
• INOCAR - Oceanographic Institution of the Navy
• IOOS - Integrated Ocean Observing System
• IPMA - Portuguese Institute for Ocean and Atmosphere
• IQUOD - International Quality-Controlled Ocean Database
• ITAF-REMET - Italian Airforce - Operational Forces Command - Department for Meteorology
• JAMSTEC - Japan Agency for Marine-Earth Science and Technology
• JMA - Japan Meteorological Agency
• KIOST - Korea Institute of Ocean Science and Technology
• KNMI - Royal Netherlands Meteorological Institute
• MEDS - Marine Environmental Data Service
• MEOP - Marine Mammals Exploring the Oceans Pole to Pole
• MF - Meteo France
• MNR - Ministry of Natural Resources
• MSNZ - Marine Services New Zealand
• NCEI - National Centers for Environmental Information
• NDBC - National Data Buoy Center
• NIO - National Institute of Oceanography
• NIOZ - Royal Netherlands Institute for Sea Research
• NOIT - National Institute of Ocean Technology
• NOC - National Oceanography Centre
• NRC - National Research Council
• NSWC - National Science Foundation
• NWS - National Weather Service
• NWSTG - National Weather Service Telecommunication Gateway
• OGS - National Institute of Oceanography and Experimental Geophysics
• PMEL - Pacific Marine Environmental Laboratory
• RAN - Royal Australian Navy
• SAM - Southwest Atlantic Meridional Overturning Circulation
• SAWSS - South African Weather Service
• SHOA - Spanish for Hydrographic and Oceanographic Service of the Chilean Navy
• SIO - Second Institute of Oceanography
• SMHI - Swedish Meteorological and Hydrological Institute
• SNU - Seoul National University
• SOCIB - Balearic Islands Coastal Observing and Forecasting System
• TTU - Tallinn University of Technology
• UKMO - UK Met Office
• USP - University of Sao Paulo
• WHOI - Woods Hole Oceanographic Institution
• WOD - World Ocean Database
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