WEATHER CLIMATE WATER
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WMO Rolling Review of Requirements process: the Ocean perspective

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WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

Outlines

- What are the WMO High-Level Guidance (HLG) Document and RRR process?
- How are the ocean topics reflected in the HLG Document?
- The WMO Global Basic Observing Network (GBON)

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The High-Level Guidance Document

High Level Guidance on the evolution of global observing systems during the period 2023-2027 in response to the Vision for WIGOS (i.e. WMO Integrated Global Observing System) in 2040

- Submitted to INFCOM-II, October 2022.
- Drafted and compiled by the JET-EOSDE Working Group
- Supported by a consultant and experts from WMO and GCOS Secretariat, SC-MINT, GAW, SG-GBON and OceanPredict Evaluation Task Team.

Purpose and scope of the document

- **Target audience:** WMO Members' observation network operators and managers
- **Purpose:** To clearly state the principles that should be considered for the development of national WIGOS implementation.
- **Scope:** In situ and space based observing systems in all Earth system domains, in supporting WMO's activities and priorities.
- **Identifies:** urgent specific actions that arise in response to the priorities of WIGOS, WMO programmes, and our knowledge of current data gaps.

The Rolling Requirements Review (RRR)

- The HLG-document relies on information gathered through the RRR.
- The RRR is the process used by WMO to collect, vet and record user requirements for all WMO application areas and match them against observational capabilities:
  - Observation requirements stored in Requirements data base (OSCAR)
  - Knowledge on observation impact gathered at WMO workshops dedicated to this topic, every 4 years.
  - “Statements of Guidance” (SoGs) prepared by experts for each WMO Application Area to consider the extent to which the capabilities meet the requirements and to produce a Gap analyses.

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WMO Application Areas supported by WIGOS and listed in the RRR

1. Global numerical weather prediction
2. High-resolution numerical weather prediction
3. Nowcasting and very short range forecasting
4. Seasonal and inter-annual forecasting
5. Aeronautical meteorology
6. Forecasting atmospheric composition
7. Monitoring atmospheric composition
8. Atmospheric composition for urban applications
9. Ocean applications
10. Agricultural meteorology
11. Hydrology
12. Climate monitoring *(currently under revision by GCOS and WCRP)*
13. Climate applications *(currently under revision by GCOS and WCRP)*
14. Space weather

WMO Application Areas supported by WIGOS and listed in the RRR

1. Global numerical weather prediction (and its interface with the ocean)
2. High-resolution numerical weather prediction
3. Nowcasting and very short range forecasting
4. Seasonal and inter-annual forecasting
5. Aeronautical meteorology
6. Forecasting atmospheric composition
7. Monitoring atmospheric composition
8. Atmospheric composition for urban applications
9. Ocean applications
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14. Space weather

The ocean community has to be in the driving seat, when it comes to "Marine Applications", and potentially the sub-applications to be defined within the Marine Applications.

Integration of the Ocean in the HLG Document

- A SoGs for Ocean Applications was produced in 2016 by the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) based on the JCOMM User Requirement Document.
- On May 26th 2021, the SoGs (2016) was sent to the Ocean Predict OS-Eval Task Team for circulation among the group (chairs Yosuke Fujii and Elisabeth Remy).
- On June 15th, a revised version of the SoGs was sent back by OS-Eval Task Team.
- The requirements listed in the SoGs for ocean applications have been synthesized in section 2.1 of the HLG-document focusing on data requirements at the interfaces.
- July/August 2021: SC-ON and its Expert Teams
- - September/October 2021: INFCOM SCs and relevant SGs (e.g. SG-OOIS)
- - November/December 2021: SERCOM, Research Board, GCOS, GOOS, HPC
- - January 2022: consolidation of feedback
- - February 2022: Final INFCOM MG review
- - March 2022: Final meeting of the WG-HLG

How are the Ocean topics reflected in the HLG-document?

Ocean in the HLG-document

- Section 2.1 on: Synthesis of key observational **gaps** from Statements of Guidance with some recommendations, 2.1.7 Ocean Applications
- Section on **observation impact results**: Summary of results for the Ocean Domain from the Earth System Prediction Scoping Workshop in Dec 2019
- The SoG for Ocean Applications is a few years old but arrangements to obtain updates have been taken.

Keywords: Mesoscale-coastal, interface data, sea-ice dynamics, satellite-in-situ, physics-wave-biogeochemistry, extreme events, climate monitoring.

The ocean surface

Integrating satellite and in-situ

- **Synergetic use of data from satellite missions and surface-based** platforms is highly needed in order to develop accurate ocean products. Measurements from drifters and tidal gauges, sea surface salinity, temperature and radiometric data are needed to support the development of high-quality altimeter, ocean colour and salinity ocean products. **This coordination is still insufficient. This is particularly critical in some regions like coastal areas and the polar ocean**.

- **Mesoscale** features are derived from satellite at global scale with an always increasing resolution. For satellite altimetry, to obtain a satisfactory spatial resolution (i.e. <100 km and even less for coastal areas) a combination of several instruments is required. Still **the resolution for altimetry products in the coastal regions is too coarse.** Next generation altimetry based on wide swath observation (e.g., SWOT) is promising for these purposes and will provide **observation at higher resolution (<50 km).**

- 6-hourly sampling of Scatterometer measurements for surface wind.

Sea-ice

- Assimilation of **sea ice concentration** observed by satellite microwave radiometers such as SSMI/SSMIS or AMSRE/AMSR2, etc. is often conducted in sub-seasonal to longer term prediction systems, and it has a crucial impact on accurate estimates of initial sea ice state. The current observation capacity during the freezing season is sufficient if the current quality of sub-seasonal to longer prediction systems is considered. Some research indicates that assimilation of sea ice thickness is effective to improve predictions of the sea ice extent in ice-melting seasons.

The river-ocean interface

- The dynamics of the coastal ocean is strongly governed by its lateral boundaries. The quality of ocean predictions can be adversely affected by a too coarse-resolution forcing. A high-resolution information on the heat, water, nutrients fluxes from the atmosphere and land would improve the performances of coastal forecasting systems.

The sub-surface ocean

- The quality of the sea surface ocean prediction improves if ocean models assimilate surface and sub-surface data. The advent of autonomous platforms like Argos, gliders, buoys and moorings has improved the quality of ocean forecasts delivering observations in (N)RT mode. In particular, autonomous platforms with sea ice detection are particularly useful in the polar ocean where the observational gap (in real-time) hinders the reliability of sea ice forecasts with impact on NWP.

The green ocean

- During the next decade, a boom of (sub-)surface-based (e.g. BGC Argos, gliders) and satellite biogeochemical observation is expected, enhancing the forecasting capabilities of the “green ocean” (biochemistry and ecosystem).

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The HLG document and SoGs are living documents and will be regularly updated based on exchanges with OCG, GOOS, OceanPredict, …

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Key characteristics of Global Basic Observing Network (GBON)

as it currently exists, per Res. 2/Cg-Ext(2021)

- Prescribed variables to be observed;
- Well-defined observing remit for each WMO Member;
- Prescribed network density;
- Prescribed temporal density (reporting frequency) of observations;
- Mandatory international exchange of observations;

Suggested GOOS (initial) contribution to GBON (This does not preclude other GOOS observations and/or networks becoming part of GBON in the future).

- **Air pressure and SST** measurements from drifting buoys.
- Surface meteorological observations from Voluntary Observing Ships (VOS).
- Upper ocean **temperature and salinity** data from the global array of **Argo floats**.
- Surface meteorological observations and, where available, upper ocean temperature (and salinity) data from moored data buoys.

GOOS SC-10 Part 2: Suggestions for the GOOS Steering Committee on an initial GOOS contribution to the WMO Global Basic Observing Network (GBON) Background Information

Prepared by Jon Turton, David Legler and Emma Heslop, with input from the Observations Coordination Group Exec.

Engagement of the ocean community is crucial for working on:

- Principles' for GBON expansion
- The extension of the RRR to marine applications (to be defined)
- The coordination of observation evaluation activities
- The contribution to a workshop on Numerical Prediction of the Earth system (May 2024, exact dates and title to be confirmed).

Thank You

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