WIGOS Networks

Pre INFCOM-3 Information Session
(25 March – 5 April 2024)

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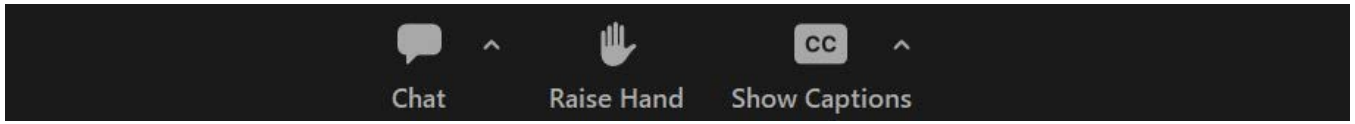
25 & 27 March 2024

WORLD
METEOROLOGICAL
ORGANIZATION

General remarks

1. There will be 2 identical sessions:
    - 25 March (16:00 - 18:00 UTC) - Western Hemisphere
    - 27 March (6:30 - 8:30 UTC) - Eastern Hemisphere
2. The sessions will be recorded, and the recordings will be available on the INFCOM-3 website.
3. **Second part of the session will be dedicated to your questions, please:**
    - raise your hand,
    - use the chat, or
    - send an email (in any WMO language) to: kpremec@wmo.int.



4. The working language is English, but we may try to address the questions in Spanish or French.
5. INFCOM-3 documents: INFCOM-3 - Session Information (wmo.int)

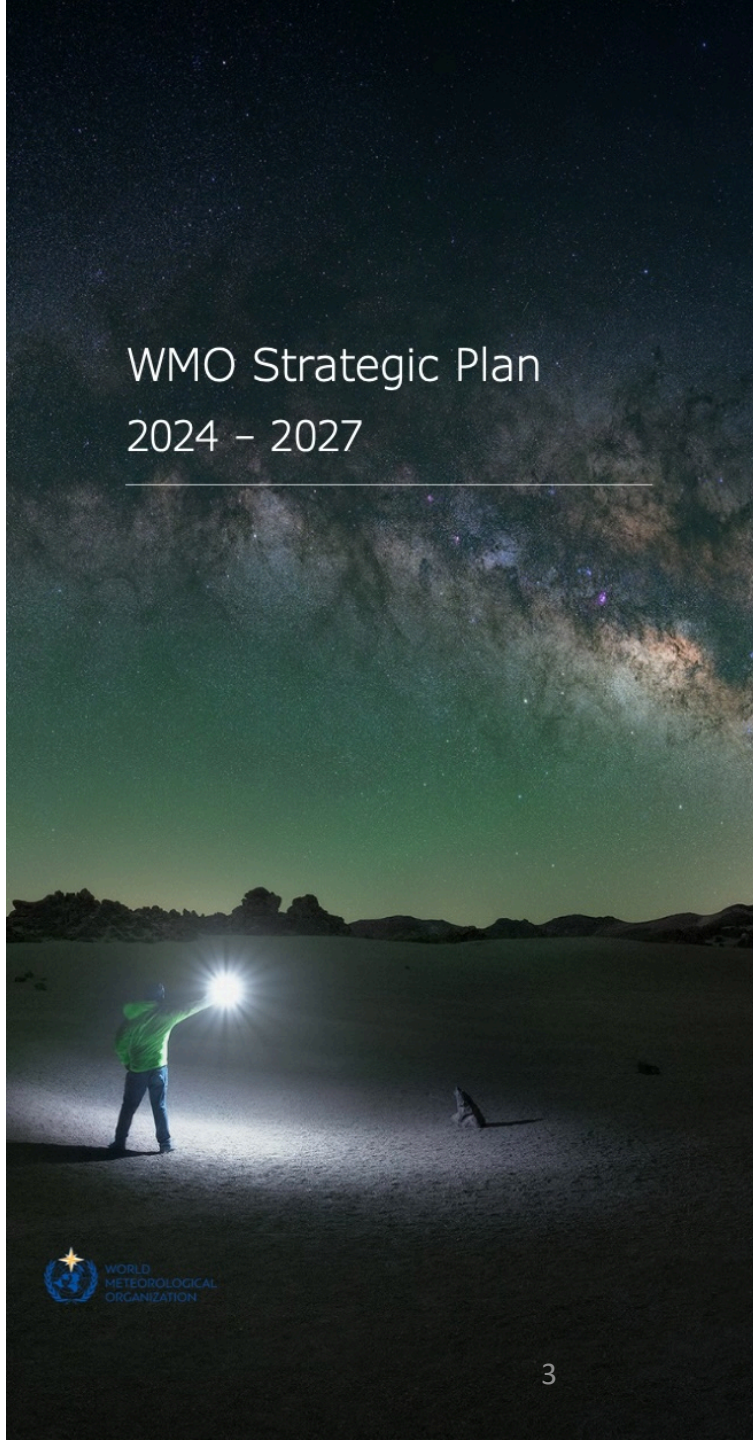
WORLD METEOROLOGICAL ORGANIZATION

WIGOS in WMO's Strategic Plan 2024-2027

Objective 2.1: **"*Optimize the acquisition of Earth System observation data through WIGOS*"**

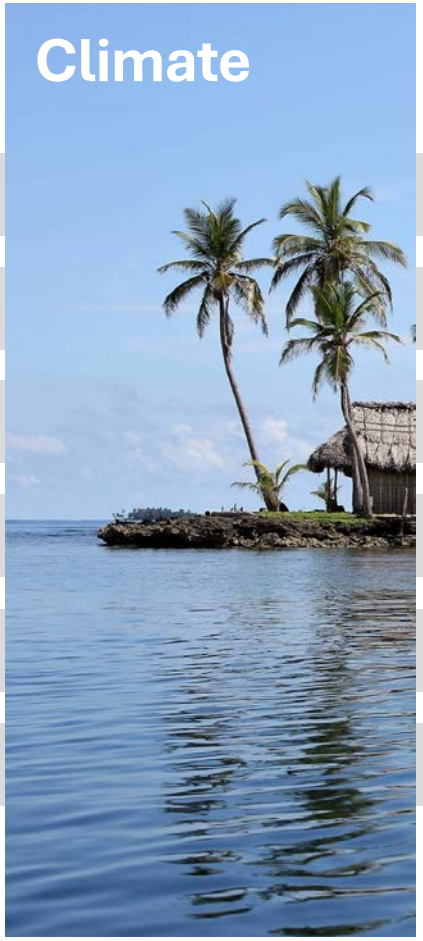
Focus in 2024–2027:

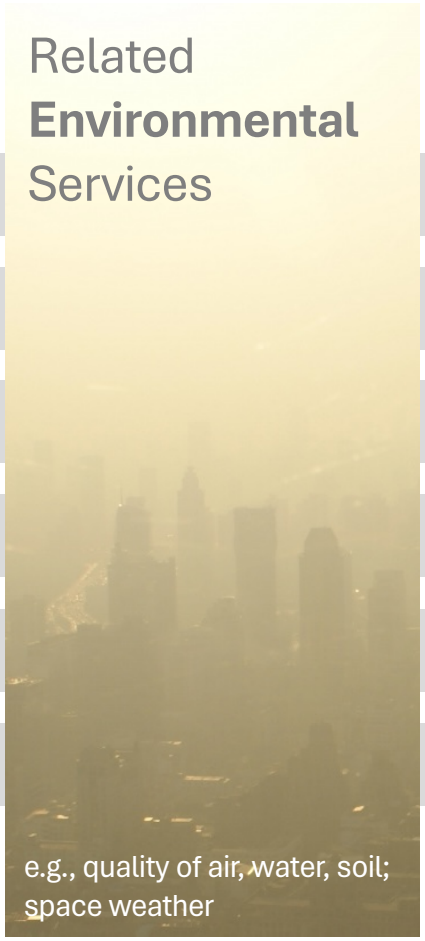
- The availability and scope of observational data increased.
- Observations across domains into WIGOS integrated.
- Observations to support climate adaptation and mitigation coordinated.
- New technologies brought into operations.
- Environmentally sustainable design of WMO observing programmes ensured.



Weather, climate, water applications

Drivers of an Earth System approach





space-based

- *Atmosphere*
- *Hydrology*
- *Cryosphere*
- *Ocean*
- *Terrestrial*
- *Space weather*

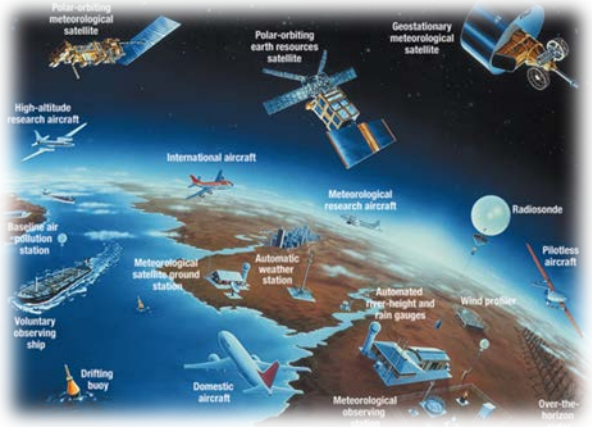
surface-based

Photos: Various authors, WMO Calendar Competition 2024, cc

The Scope of WIGOS networks

WIGOS

WMO Integrated Global observing System



Measurements (SC-MINT) &

Networks (SC-ON)

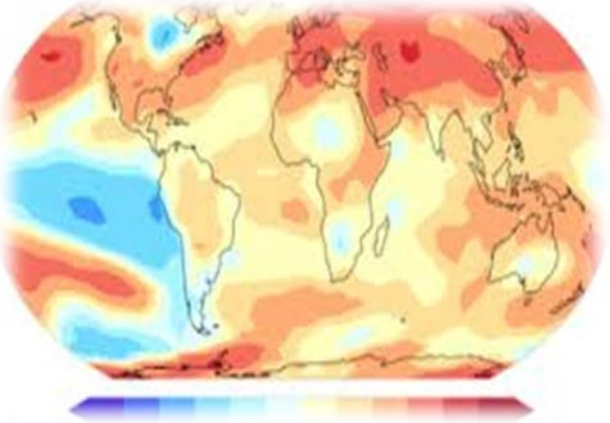
WIS

WMO Information System

Data exchange (SC-IMT)

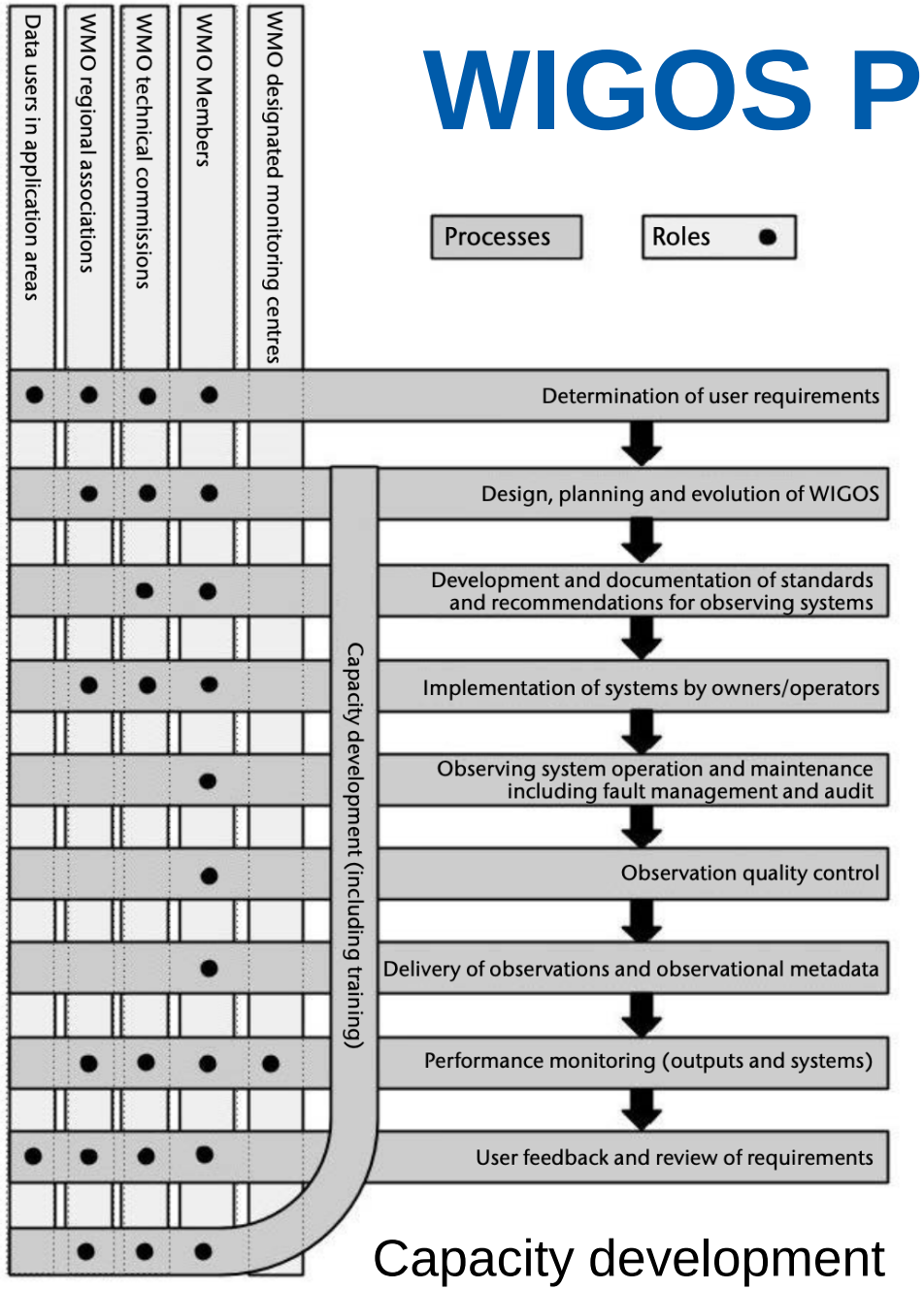
WIPPS

WMO Integrated Processing and Prediction System

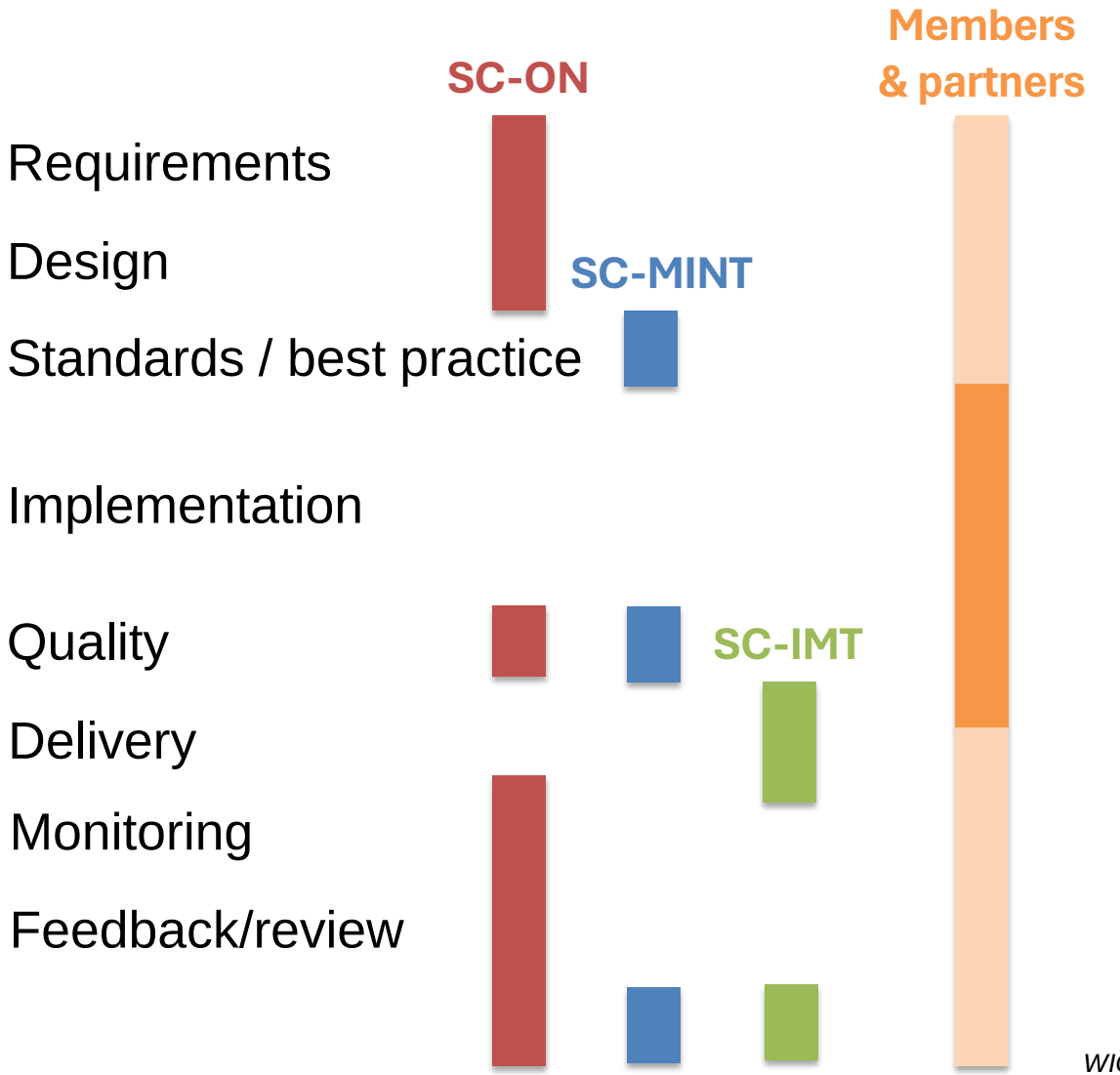


Data Processing & Modelling (SC-ESMP)

WIGOS Processes and Roles



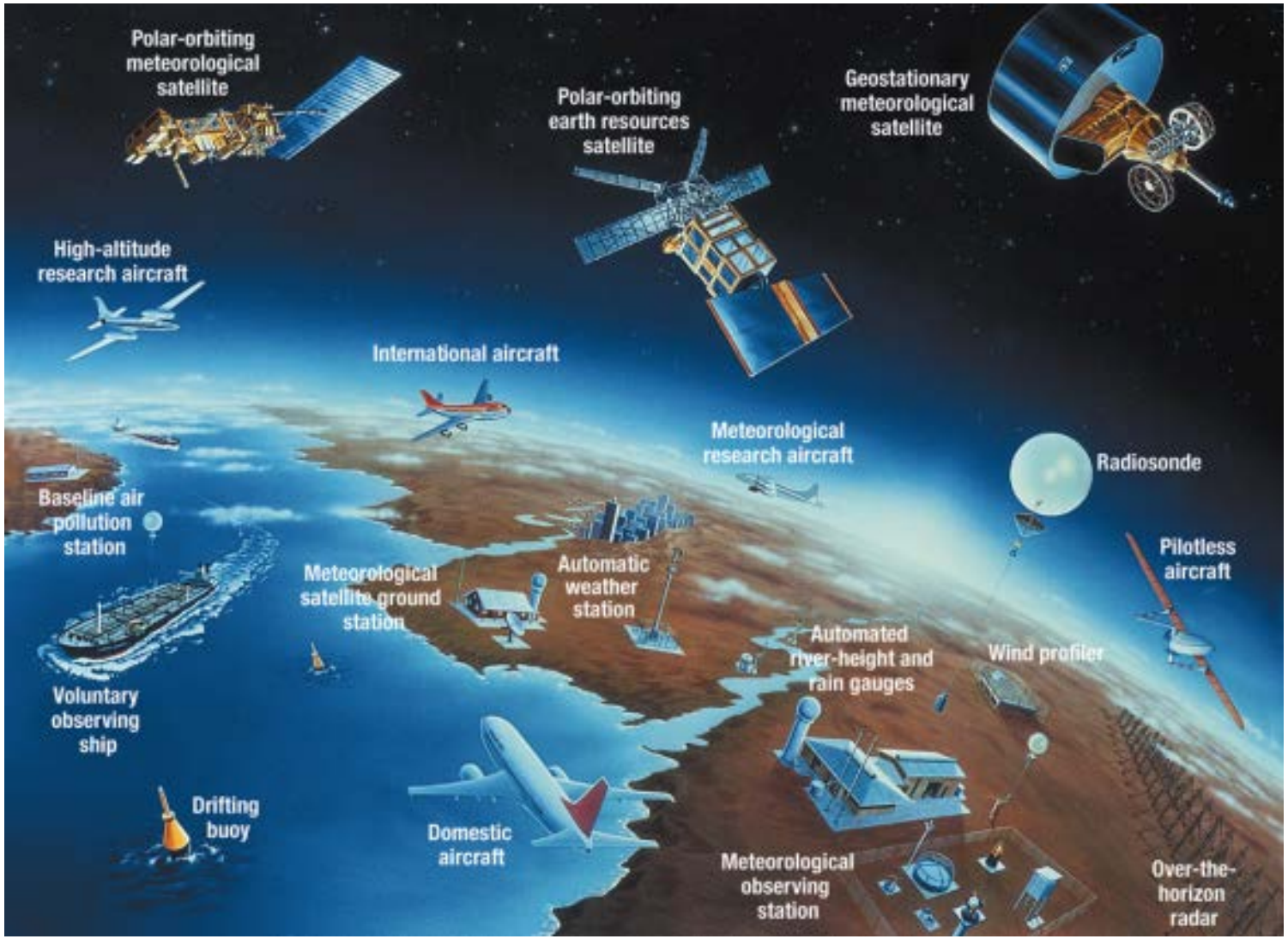
Capacity development



WIGOS Manual (WMO No.-1160)

Topics of WIGOS Network (SC-ON)

- Observation network design
- Rolling Review of Requirements
- Surface & Space based observations
- Aircraft-based observations
- Integration of various Earth System domains
- WIGOS Tools: OSCAR/Surface, Space, Requirements WDQMS



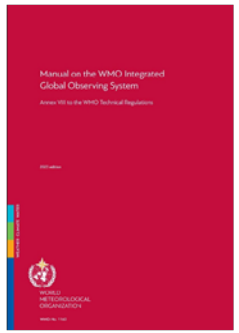
- Regional WIGOS Centers
- GBON & RBON
- Compliance Monitoring
- Tiered networks
- Radio Frequency Coordination
- Collaboration with GCOS, GOOS, GCW, G3W
- Capacity development
- Data Policy

Documents submitted to INFCOM-3

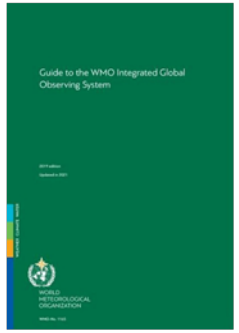
Following documents are part of the WIGOS network session at INFCOM-3:
(in blue: to debate; in grey: approve without debate)

- **8.1(1)** Amendments to **WIGOS Manual** (WMO-No. 1160)
- **8.1(2)** Update of **WIGOS Guide** (WMO No. 1165), including the Technical Guidelines for RWCs on WDQMS (WMO-No. 1224)
- **8.1(3)** Plan for update of the **WIGOS Vision 2040** (WMO-No. 1243) and the **High-level Guidance** on the Evolution of GOSs during 2023–2027 (WMO-No. 1334)
- **8.1(4) GBON**: implementation and expansion including SOFF, metadata and tools
- **8.1(5) Update of the Guidelines on Best Practices for Achieving User Readiness for new meteorological Satellites (WMO-NO. 1187)**
- **8.1(6) Hydrological Data Centres**

Significance of Manual on and Guide to WIGOS



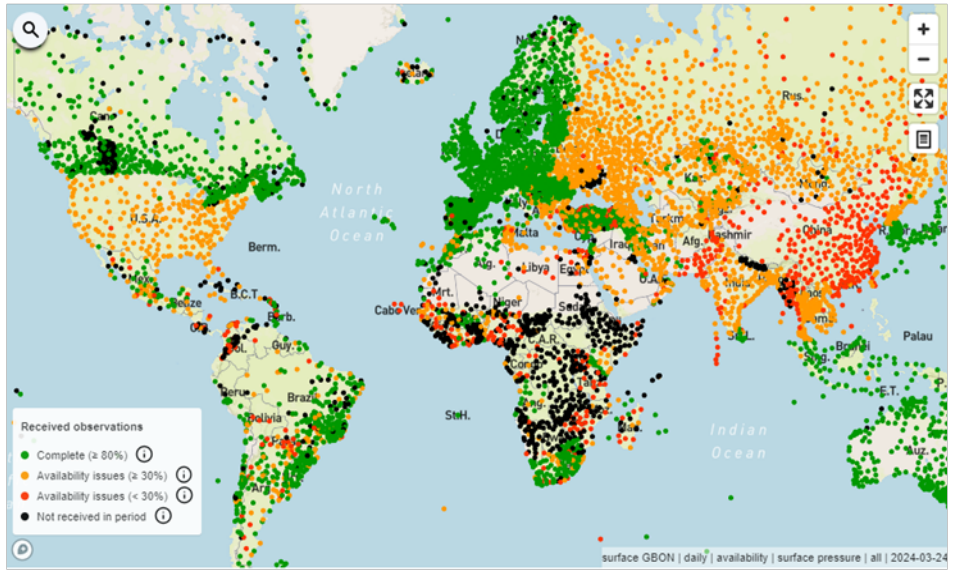
Manual → specifies the obligations of Members



Guide → provides guidance material to regulations

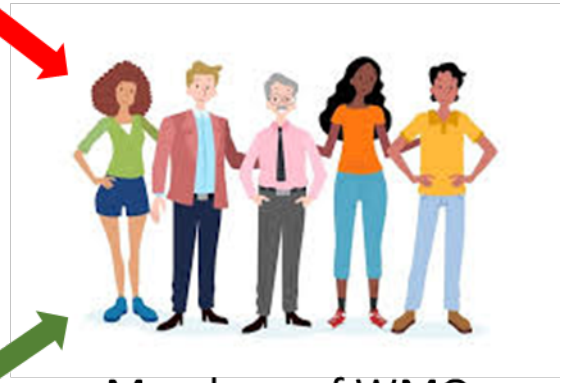
Manual on WIGOS

a) specifies the implementation and operation of WIGOS;
b) facilitates cooperation in observations among Members;
c) ensures adequate uniformity and standardization in a & b



Guide to WIGOS explains and describes WIGOS practices, procedures and specifications and aims to assist the technical and administrative staff

Need to be compliant
→ SHALL
→ SHOULD



Members of WMO

provides assistance to be compliance

Amendments to the Manual on WIGOS (WMO-No. 1160)

↳ Doc. 8.1(1)

1 Recommendation for INFCOM-3 and 1 annex with the Resolution for EC-78.

Key topics included in the proposed amendments:

- **Observing component for Space Weather** → integration into WIGOS (explained on specific slides)
- **Radio frequency (RF) matters** → concept of National FP (explained on specific slides)
- An update of the **GCOS Climate Monitoring Principles** (Appendix 2.2)
- **GBON & RBON** → several topics (explained on specific slides)
- **Space observations** → Issuers of WSIs, WMO core and recommended satellite data → explained on slides
- Added Chapter (5/5.15) on **DAYCLI reporting practice** → explained on specific slide
- Definition added for **Environmental Sustainability** - (Under Definitions)
- Clarifications on the **state of the ground, snow depth, sea ice and rate of ice accretion**

Update of Guide on WIGOS (WMO No. 1165)

↳ Doc. 8.1(2)

2 resolutions: Update of the WIGOS Guide and update of including the Technical Guidelines for RWCs on WDQMS (WMO-No. 1224)

Key topics included in the proposed updates:

- Relevant updates made to chapter 1 at the **end of WIGOS Initial Operational Phase** (2020-2023)
- **Observing component for Space Weather** → integration into WIGOS (explained on slides 15 and 16)
- Advancing **Environmental Sustainability** - guidance on this new Observing Network Design Principle
- **Radio frequency (RF) matters** – new section and Terms of Reference on National Focal Points for RF matters
- **Regional WIGOS Centres** → additional guidance on RWC's role, technical infrastructure and staff competences added
- **GBON** → several topics (explained on slides 20 - 23)
- **RBON** → alignment with GBON design process, and reflection of the UN Early Warning for All initiative

8.1(2)/2 – Update of the Technical Guidelines for RWCs on WDQMS

There is a significant update of this publication that includes:

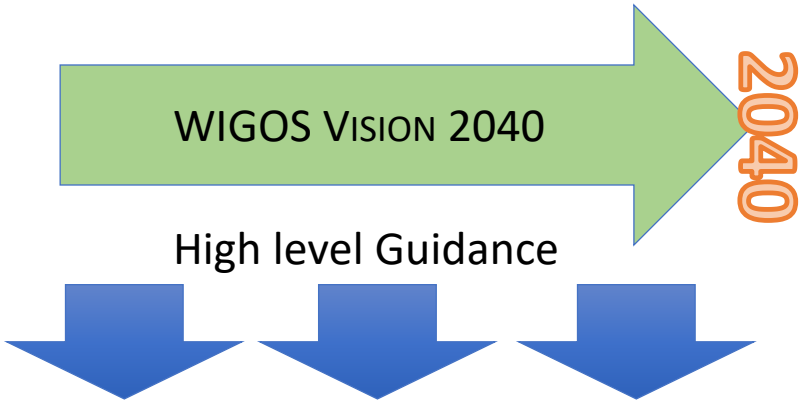
- activities related to GBON compliance monitoring,
- metadata management,
- extraction of relevant parts on RWC's role, technical infrastructure and staff competences and their inclusion in the WIGOS Guide,
- updated guidance related to WIGOS Tools, particularly WDQMS and Incident Management System webtools
- deletion of annexes 1, 5, 6, 7.

Note: this publication provides complementary guidance to the WIGOS Guide, in particular chapters 7 and 8.

WIGOS Vision 2040 & High-level Guidance

- WIGOS Vision 2040 (WMO-No. 1243):

  - likely scenario of evolvement of user requirements for observational data until 2040,
  - ambitious, but technically and economically feasible vision for an integrated observing system that will meet them.



- High-level Guidance in response to the Vision:

  (WMO-No. 1334)

  - provides guidance to the WMO Members for key activities and actions to be implemented within the next five years,
  - Consists of principles of a general nature and identifies urgent specific actions.

Manual on WIGOS

Plan for update of WIGOS Vision 2040 (WMO-No. 1243) and the High-level Guidance on the Evolution of GOSs during 2023–2027 (WMO-No. 1334)

↳ Doc. **8.1(3)**

1 Decision for INFCOM-3 regarding the Update of the WIGOS Vision 2040 and the High-Level Guidance

- **New technologies** (e.g. AI) emerge, observation systems & requirements evolve → need for an update process
- Both documents comprise all Earth System domains (Atmosphere, Hydrology, Cryosphere, Climate, Atmospheric composition, Ocean and Space Weather) and Surface as well as Space observations. Therefore, many **stakeholders** need to be engaged in this update process.

Content of the Decision doc:

- updates of both publications should be initiated in the next intersessional period,
- proposed updates should be presented to INFCOM-4 for endorsement and then to Cg-20 for approval,
- SC-ON should lead the updates, ensuring wide consultations among broad community of stakeholders, such as NMHSs, space agencies, relevant international organizations and programmes, observing system developers, and other private and academic sectors.

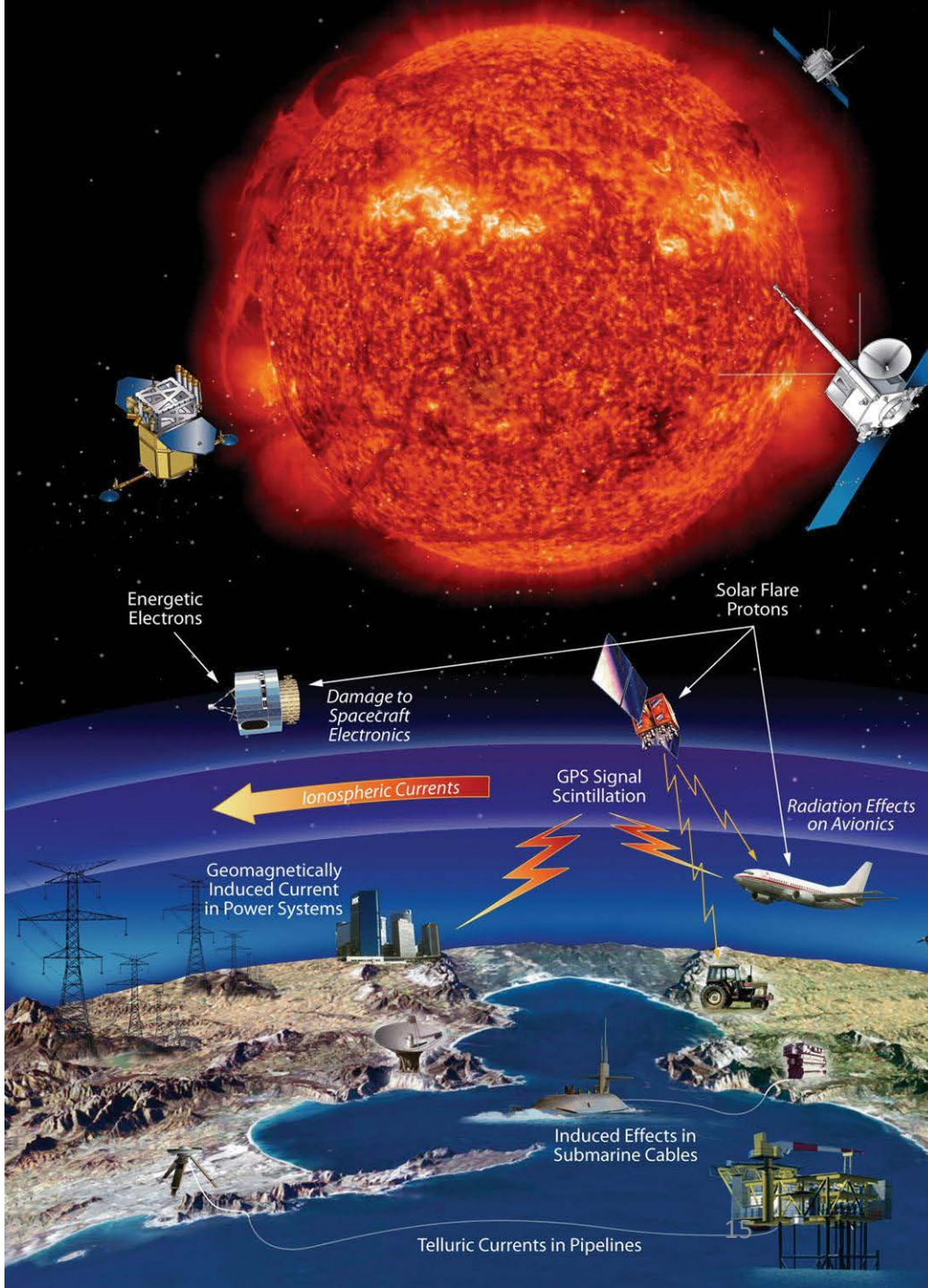
Space Weather

Space Weather: phenomena that impact systems and technologies in orbit and on Earth.
Space weather can occur anywhere
from the surface of the sun to the surface of Earth

Two topics related to Space Weather at INFCOM-3:

- Amendment of the **Manual** and **Guide** to **WIGOS:**
  Inclusion of chapter 1.2.5:
  Observing system for Space Weather
  → attributes still need to be developed

- **4-year plan** of
  WMO activities related to Space Weather (8.5(2))



Inclusion in the Manual on WIGOS

↳ Doc. 8.1(1)

- Inclusion of the observation component of Space Weather into WIGOS → New Chapter 1.2.5
- More detailed attributes need to be added

1.2.5 The observing system for Space Weather

1.2.5.1. The observing system for Space Weather shall be a coordinated system of observing networks, methods, techniques, facilities and arrangements encompassing the monitoring of the solar activity, as well as its impacts on geospace, atmosphere and the Earth surface.

1.2.5.2 The purpose of the observing system for Space Weather shall be to provide the necessary observations from all parts of the globe that are required by Members for their operational Space Weather services.

1.2.5.3 The observing system for Space Weather shall consist of surfacebased systems as well as spacebased systems.

1.2.5.4 The observation system for Space Weather should lead to standardization and coordination of Space Weather observations across existing programmes and networks.

Radio Frequency Coordination

The weather, water, and climate community relies on the radio frequency spectrum for two vital functions:

(1) to observe the earth (e.g., with satellites, weather radars, and wind profilers) and

(2) to transmit data about the earth system to meteorologists, hydrologists, emergency managers, and other scientists

- Access to the radio-frequency spectrum is **critical** to the operation of WMO global infrastructure → it underpins the service delivery of all Members.
- The radio-frequency spectrum is a physically limited and increasingly **contested** resource, with emerging technologies continually raising demand.

Need for Radio Frequency coordination

To safeguard the availability of the radio-frequency spectrum for meteorological and related environmental operations and research, it is of prime interest for Members

- to **engage** with their respective **National Regulatory Authorities** (NRA) and
- to **actively contribute** to any matters related to the radio-frequency spectrum at the national, regional or international level, in particular regarding preparation for the International Telecommunication Union (ITU) World Radiocommunication Conference (WRC).

→ Establishment of a WMO network of national focal points for radiofrequency matters

Radio Frequency Coordination

Amendment to the **Manual** on WIGOS regarding Radio Frequency Coordination:

- new provisions on compliance with regulations for the use of radio frequencies
- designation of the National Focal Points for RF matters

Amendment to the **Guide** on WIGOS regarding Radio Frequency Coordination:

- Radio frequency (RF) matters – a new section developed and Terms of Reference on National Focal Points for RF matters included (Chapter 6)

As of 25 March: 94 focal points from 74 countries nominated

(see: National Focal Points on Radio Frequency matters | World Meteorological Organization (wmo.int)

a)	Region I:	25	focal points from 18 countries
b)	Region II:	33	focal points from 23 countries
c)	Region III:	4	focal points from 3 countries
d)	Region IV:	15	focal points from 13 countries
e)	Region V:	6	focal points from 5 countries
f)	Region VI:	15	focal points from 15 countries

Important that each Member nominates Focal Point for Radio Frequency matters

--> all Focal Points will receive training.

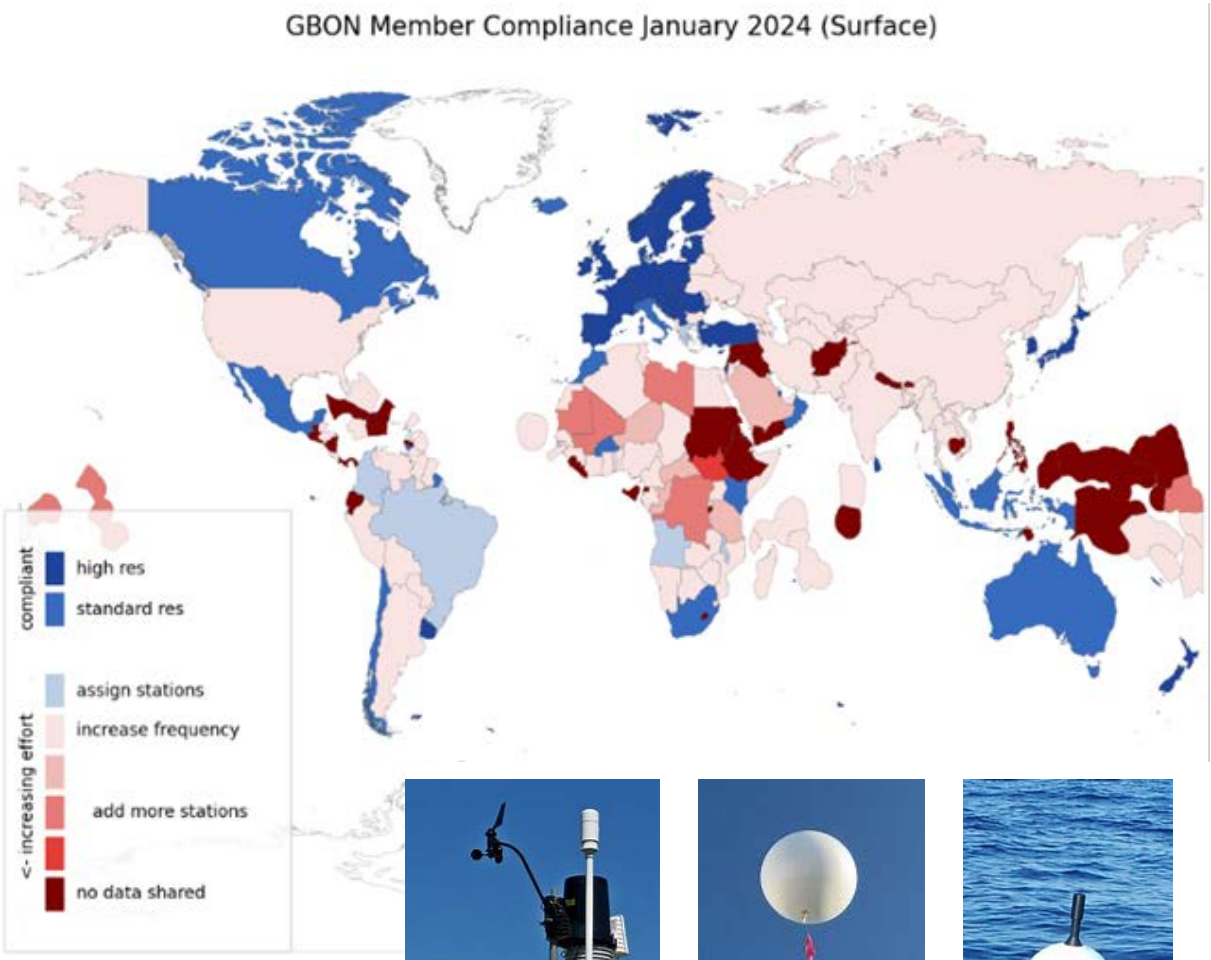
Global Basic Observing Network (GBON)

A global public good for improved weather prediction and climate reanalysis

- Worsening gaps in the basic surface-based observations that keep weather predictions on track - full implementation estimated to bring USD 5 billion in annual benefits

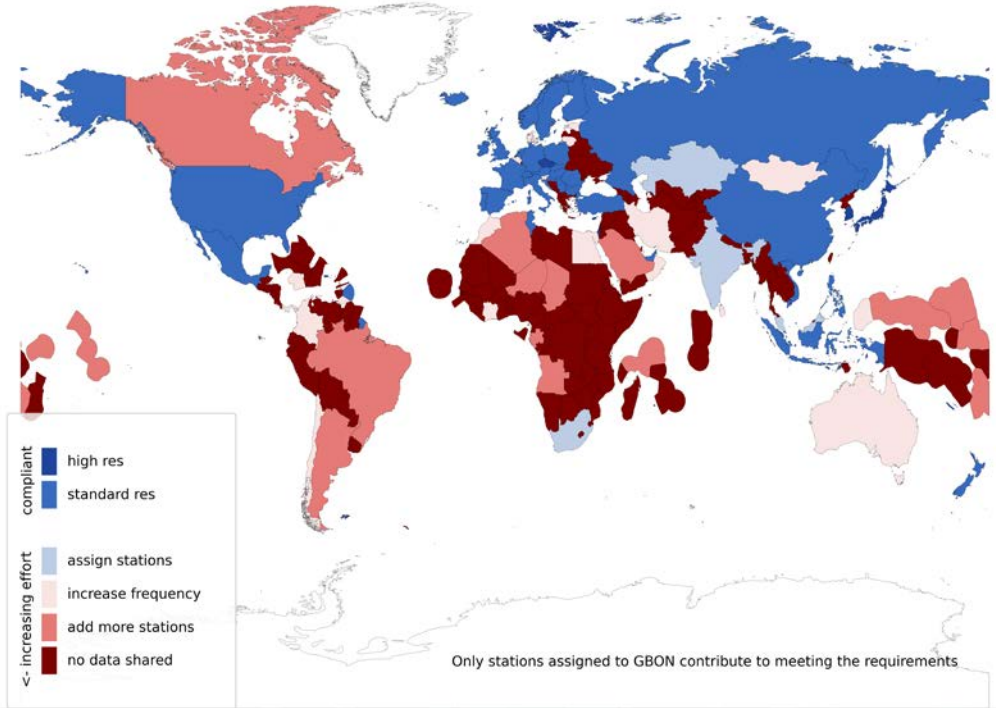
- Members in 2021 accepted **obligation to take and share** GBON observations at **minimum horizontal and time resolution**
  - Surface land at 200 km, hourly
  - Upper air over land at 500 km, 2x daily
  - Surface marine in EEZ at 500 km, hourly

- WMO co-created the **Systematic Observations Financing Facility (SOFF)** to help Members meet that GBON obligation, with priority on support to LDCs and SIDS



The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

GBON Member Compliance January 2024 (Upper-air)



- SOFF provides **long-term technical and grant-based financial assistance** to enable countries to acquire and internationally exchange GBON observations
- It focuses on the **sustainability of investments** by providing **open-ended result-based finance** upon verification of data sharing through WDQMS
- SOFF prioritizes **Small Island Developing States (SIDS) and Least Developed Countries (LDCs)** to close the largest data gaps

- 62 countries programmed in the **Readiness phase**, 60 approved for funding, 13 fully completed
- 11 countries approved for the **Investment phase**
- 101 countries have requested SOFF support: funding gap to deliver work program by 2025

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

GBON in the WIGOS Manual and Guide

1. **Manual on WIGOS (WMO-No. 1160), GBON - relevant section 3.2.2**
    - Clarification on horizontal resolution requirement for Members whose surface area of EEZ is significantly larger than the land surface (3.2.2.7),
    - non-binding **voluntary operation of GBON in areas of global commons**, to allow further development of monitoring and targets for the High Seas and Antarctica (new provision 3.2.22bis),
    - Alignment of the GBON design process as per Resolution 21 (Cg-19) (Appendix 3.1).
2. **Guide to WIGOS (WMO-No. 1165), Chapter 11 - GBON**
    - interpretation of the horizontal resolution requirements,
    - **calculation of GBON targets for EEZs,**
    - **compliance monitoring for GBON marine stations,**
    - GBON design process (according to Resolution 21 (Cg-19)),
    - role of ad-hoc committee for claims invoking Article 9(b).

8.1(4) GBON: implementation and expansion including SOFF, metadata and tools

This document includes one recommendation and two decisions

1. EC recommendation:
   - Encouraging Member compliance,
   - Urging Members to consider of financial contributions to SOFF,
   - Invitation to SOFF Steering Committee to consider expansion to marine GBON in EEZ,
   - Invitation to SOFF SC to develop mechanism for Member feedback jointly to INFCOM & SOFF.
2. GBON Expansion
   - Continued work on hydrological variables,
   - Within present scope of GBON for different domains and in cooperation with GCOS / climate reanalysis,
   - Considering climate monitoring application areas, in cooperation with Global Greenhouse Gas Watch.
3. GBON metadata
   - Request SC-ON to examine WIGOS Metadata Standard and WIGOS Information Resource tools based on Member needs and feedback,
   - Report back to INFCOM-4 on implications and costs of associated changes.

Regional Basic Observing Network (RBON)

- network of surface-based meteorological, hydrological and related observing stations/platforms to address the **key regional weather, water, climate and other environmental challenges**.
- leads to **improved services** by delivering more and enhanced observations to stakeholders.
- enables the **full benefit of regional and national observing capabilities** to be realized.
- consider **EW4All** observational user requirements and gaps through RBON.
- is defined and adopted by the relevant **WMO Regional Association**, or the Executive Council or the World Meteorological Congress for the Antarctic.

GBON vs RBON

RBON

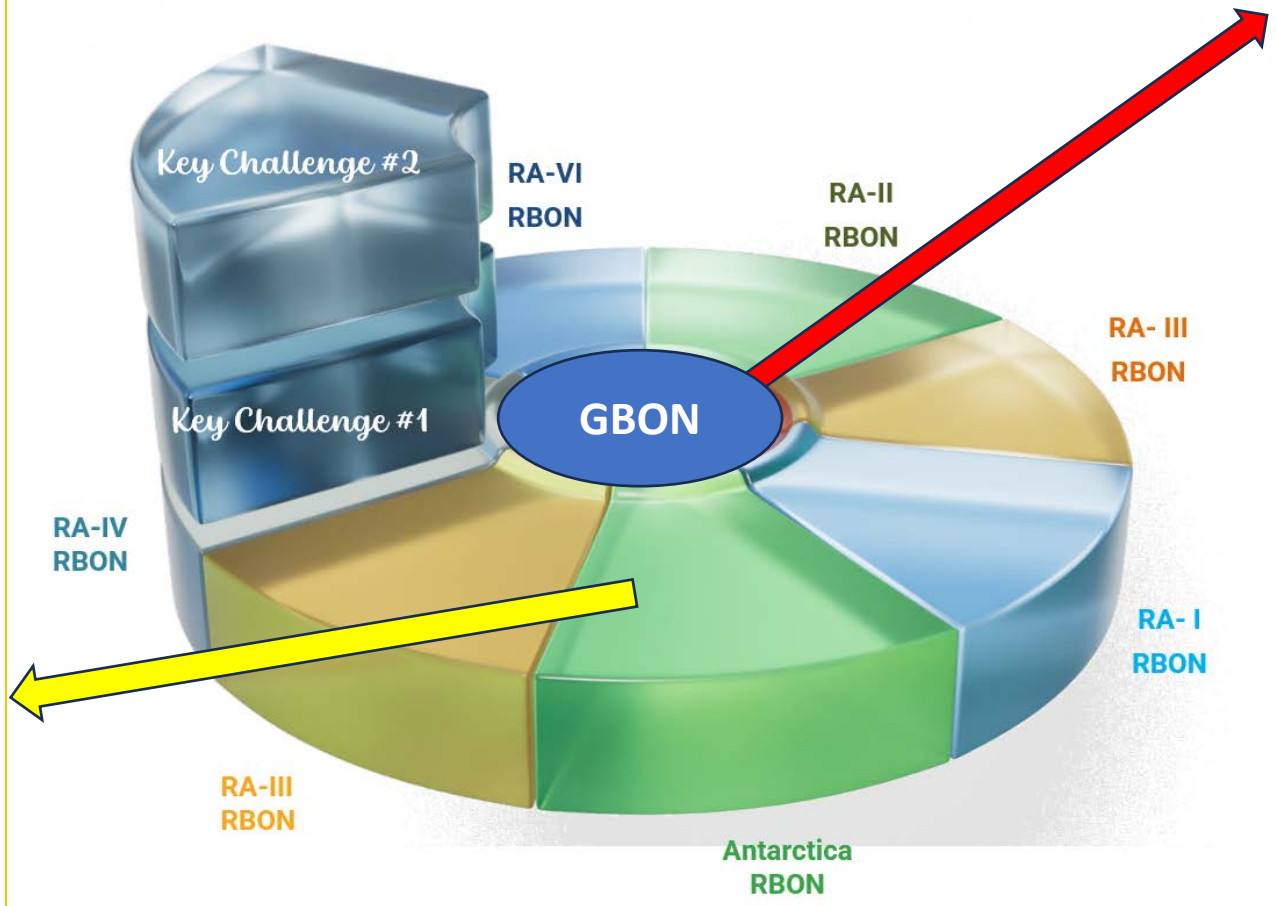
Purpose
- regional requirements,
- key regional challenges (e.g., floods, droughts, tropical cyclones, thunderstorms, heat waves)

Stations (shall)
- all surface-based observing stations as per requirements defined by Region

Stations (should)
- weather radars

In charge: RA

Note: **GBON is part of RBON**



GBON

Purpose
- global requirements,
- global NWP
- climate reanalysis

Stations (shall)
- surface land meteorological (SLP, T, H, W, P, SD)
- upper-air land meteorological (T, H, W)
- surface marine in EEZ (SLP, SST)
- upper-air marine in EEZ (T, H, W)

Stations (should)
- aircraft-based (T, H, W)
- remote sensing profilers (T, H, W)

In charge: INFCOM

RBON-related changes for INFCOM-3

Manual on WIGOS (WMO-No. 1160), RBON - relevant section 3.2.3

Adjustment of RBON provisions:

- to avoid duplication with GBON provisions,
- reflect the assignment process as per Resolution 21 (Cg-19).

Guide to WIGOS (WMO-No. 1165), *Chapter 12 - RBON*

- adjustment of the RBON design process to ensure consistency with GBON design process, and,
- reflection of the UN Early Warning for All initiative, per Resolution 4 (Cg-19).

Space-based observations

Topics to be discussed at INFCOM-3:

- WMO core and recommended satellite data in the Manual on WIGOS:
  - inclusion of initial sets of data to ensure the performance and quality of NWP output (Chapter 4/4.1.3, Attachment 4.2)),
  - Significant update (reduction) of CGMS baseline contribution to WIGOS (Attachment 4.1).
- Update of the Guidelines on Best Practices for Achieving User Readiness
- *(new authority in issuing WIGOS ID for satellites)*

15th Consultative Meetings on High-level Policy on Satellite Matters

6-7 February 2024

- INFCOM actions:
  - Work together to support the **regional needs** of Members in light of the **UN Early Warnings for All initiative**, by expediting expression of those needs and required approaches and by **supporting training** activities in cooperation with the Regional Associations;
  - Facilitate a dialogue with space agencies for **WIS 2.0 implementation**;
  - Support a three-way dialogue, with space agencies and the private sector, on **commercial sector engagement** related to space-based observing systems using the Open Consultative Platform;
  - Lead engagement with space agencies in updating the **WIGOS 2040 Vision.**

Other topics

- DAYCLI reporting practice:
  - Global exchange of **high-quality** and **quality-controlled** values and daily extremes of **air temperature, rain and snow**, including information about measurement quality and representativness,
  - Purpose
    - To better support climate services,
    - To support validation of modelling data,
  - Providing daily (DAYCLI), as well as monthly (CLIMAT), summaries on a monthly basis, in BUFR, via WIS 2.0,
  - The summaries should be accessible to all, in a database hosted by a centre (DWD, NOAA, ECMWF (TBD)),
  - Guidance will be available soon.

8.1(5) Update of the Guidelines on Best Practices for Achieving User Readiness for new meteorological Satellites (WMO-No. 1187)

1 Resolution 8.1(5) - Update of the Guidelines on Best Practices for Achieving User Readiness

The Best Practices provide **a typical breakdown of user readiness activities** and **a timeline of deliverables from satellite operators** to support user readiness. The Best Practices cover activities performed both by User Organizations and Satellite Operators.

The proposed updates to WMO-No. 1187 reflect:

- lessons learned from the satellite systems that have become operational over the last 5–10 years,
- novel types of LEO missions,
- the increasing role of commercial satellite data providers, and
- evolutions in user needs.

The title of the Guidelines has been changed from "**new meteorological satellites**" to "**new satellite systems**" to be applicable as broadly as possible, to be useful to new types of LEO satellites, commercial satellite operators, etc.).

8.1(6) Hydrological Data Centers

This document includes decision 8.1(6) about Hydrological Centers

WMO global hydrological Data Centres, only 3 so far, together with the GPCC (Global Precipitation Climatology Centre) are supporting WMO efforts in hydrological cycle observing systems.

- The decision calls for a development of a detailed workplan with the goal of defining a path for registering these centres as WMO centres,
- The workplan should also review the recommendation and proposed functionalities, assess their feasibility and the development of a unified process detailing how members may provide the data to the centres,
- The workplan should be submitted to INFCOM-4 for approval.

Highlights from the SC-ON workplan
(until INFCOM-4)

- Implementation of GBON, RBON and GCOS surface reference network in all regions.
- Development of the Roadmap for GBON expansion.
- Operationalisation of Regional WIGOS Centres.
- Evolution and improvement of the WIGOS tools (*OSCAR/Surface*, *WDQMS*).
- Possible update of the WIGOS Information Resource tools and the *WIGOS Metadata Standard*.
- Execution of the WIGOS Rolling Review of Requirements (RRR) process.
- Additional GBON and RBON observational requirements for ocean observations.
- Strengthening National WIGOS Implementation.
- Normative material for hydrological observations.
- Representation of cryosphere and polar and high mountain observations in OSCAR/Surface.
- Organization of the global Uncrewed Aircraft Systems (UAS) demonstration project.
- Update of aircraft-based observation publications and data availability, including Metadata repository.
- Preliminary WMO position paper on the 2027 World Radiocommunication Conference (WRC-27).
- Enhancement of the access and capacity of Members to use space-based systems data and products.
- Fostering capacity development and development of user-friendly outreach material.
- Organization of the 8th WMO Workshop on the Impact of Various Observing Systems on NWP and ESP (May 2024).
- Improving consistency and interoperability of WIGOS and WIS metadata.

Workplan for SC-ON until INFCOM-4

Specific topics:

- Respond to **EW4All** requirements for observations,
- Continue **further integration of the domains** into WIGOS,
- Implementation of Regional WIGOS Centre **Audit programme**,
- Contribute to **environmentally sustainable design** of the observing networks,
- Testing the **Tiered network concept** through pilot projects,
- Contribute to the **Global Greenhouse Gas Watch (G3W)** Implementation Plan.

Workplan for SC-ON until INFCOM-4

New initiatives:

- Facilitate WMO **pursuing closer links with the international satellite community**, starting with cryosphere and including communities of other domains, in collaboration with other relevant groups.

- Collaborate with other INFCOM subsidiary bodies (e.g., SC-ESMP) regarding the activities such as:
  - voluntary observations and crowd sourcing,
  - the Internet of Things,
  - Artificial Intelligence (AI), and
  - Exascale computing.

Please consider contributing to SC-ON work

Volunteer as an Expert (ensure database entry updated)
Ask for guidance on WIGOS

Thank you.

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