# WMO Regional Association VI (RA VI) - Regional Conference 2026

## EW4All in Region VI: Turning Ambition into Action with Innovation and Exchange

# RBON in RA VI

## *Addressing regional needs through enhanced data exchange*

(Krunoslav Premec, WMO Secretariat)

WORLD METEOROLOGICAL ORGANIZATION

*(Bucharest, Romania, 30 Sept – 1 Oct 2026)*

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# Regional Basic Observing Network (RBON)

(Approved by Decision 21 (EC-69) REGIONAL BASIC OBSERVING NETWORK, in 2017)

- 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.



# Early Warnings for All and RBON



## Disaster risk knowledge

Systematically collect data and undertake risk assessments

- Are the hazards and the vulnerabilities well known by the communities?
- What are the patterns and trends in these factors?
- Are risk maps and data widely available?



## Detection, observations, monitoring, analysis and forecasting of hazards

Develop hazard monitoring and early warning services

- Are the right parameters being monitored?
- Is there a sound scientific basis for making forecasts?
- Can accurate and timely warnings be generated?



## Preparedness and response capabilities

Build national and community response capabilities

- Are response plans up to date and tested?
- Are local capacities and knowledge made use of?
- Are people preapred and ready to react to warnings?



## Warning dissemination and communication

Communicate risk information and early warnings

- Do warnings reach all of those at risk?
- Are the risks and warnings understood?
- Is the warning information clear and usable?

**Work Plan for consideration of EW4All observational user requirements and gaps through RBON was approved at EC-78.**

# RBON

## Surface-based

- Surface
- Clim
- Upper … N, GRUAN)
- Wind profilers
- Weather radars
- Lightning detection systems
- Aircrafts
- Aeronautical stations
- Hydro
- At
air qua
- Cryosph … (GCW)
- Marine observations (drifters, floats, moorings, tide gauges, ships, gliders …)
- Terrestrial observations (GTOS)
- Surface-based space weather observations
- GNSS radio-occultation

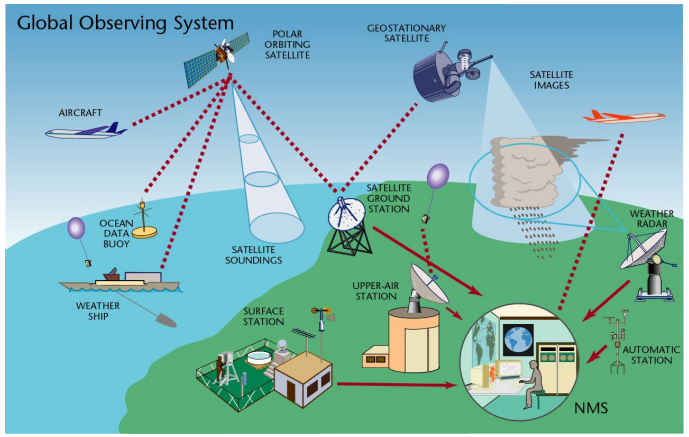
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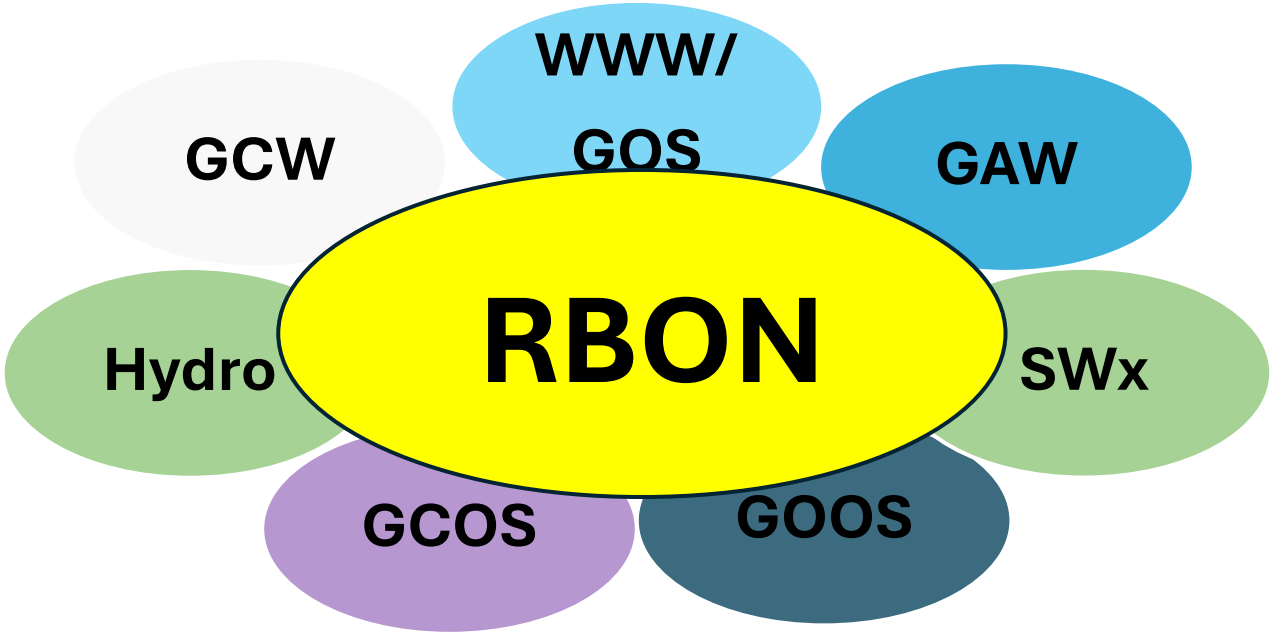
GBON

RBON

## Space-based

- Geostationary
- Polar orbiting LEO
- Eliptical orbit, ....



# Regional Basic Observing Network (RBON)

- **Decision 13 (RA II-16)** (Abu Dhabi, UAE, 12-16 Feb 2017) - Decides to establish a pilot RBON for RA II, comprised initially of the merging of all RBSN and RBCN stations of RA II.
- **Decision 21 (EC-69) REGIONAL BASIC OBSERVING NETWORK, (**Geneva, Switzerland, 10-17 May 2017**)**

The WMO Executive Council **recognized**:

- The need to integrate the RBSN, RBCN and AntON into RBON and,
- include additional observing stations/platforms into the RBON to reflect its multi-disciplinary nature in support of all WMO application areas,

**Requested** regional associations:

To establish, on the model of RA II, pilot RBON in each WMO Region, comprised initially of the merging of all RBSN, RBCN and AntON stations of that Region;

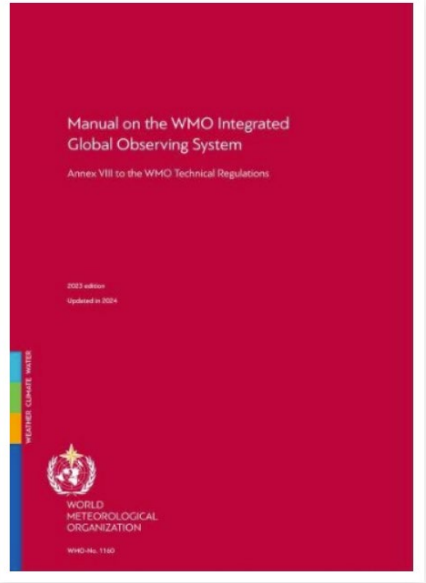
**Requested** Members:

To actively participate in the further development of the RBON Concept and propose inclusion of **additional surface-based observing stations, such as weather radars, wind profiler systems, lightning detection systems, data buoys, voluntary observing ships and aircraft,** in the Pilot RBON established by the regional association.

# Regulatory and Guidance material

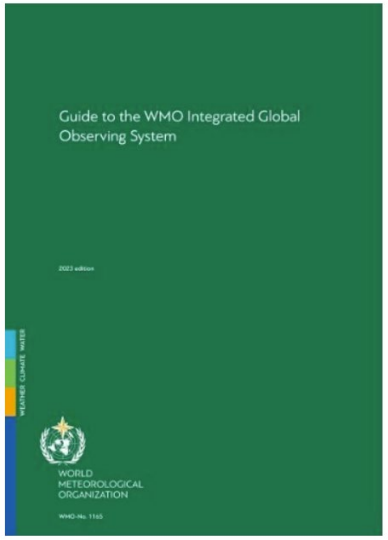
Members' duties regarding GBON and RBON are defined through the provisions in:

- Manual on the WMO Integrated Global Observing System (WMO-No. 1160), Section 3.2.2. GBON, 3.2.3 RBON
  - (2023 edition, **updated in 2024**; approved by EC-78 in June 2024, is available via WMO Library).

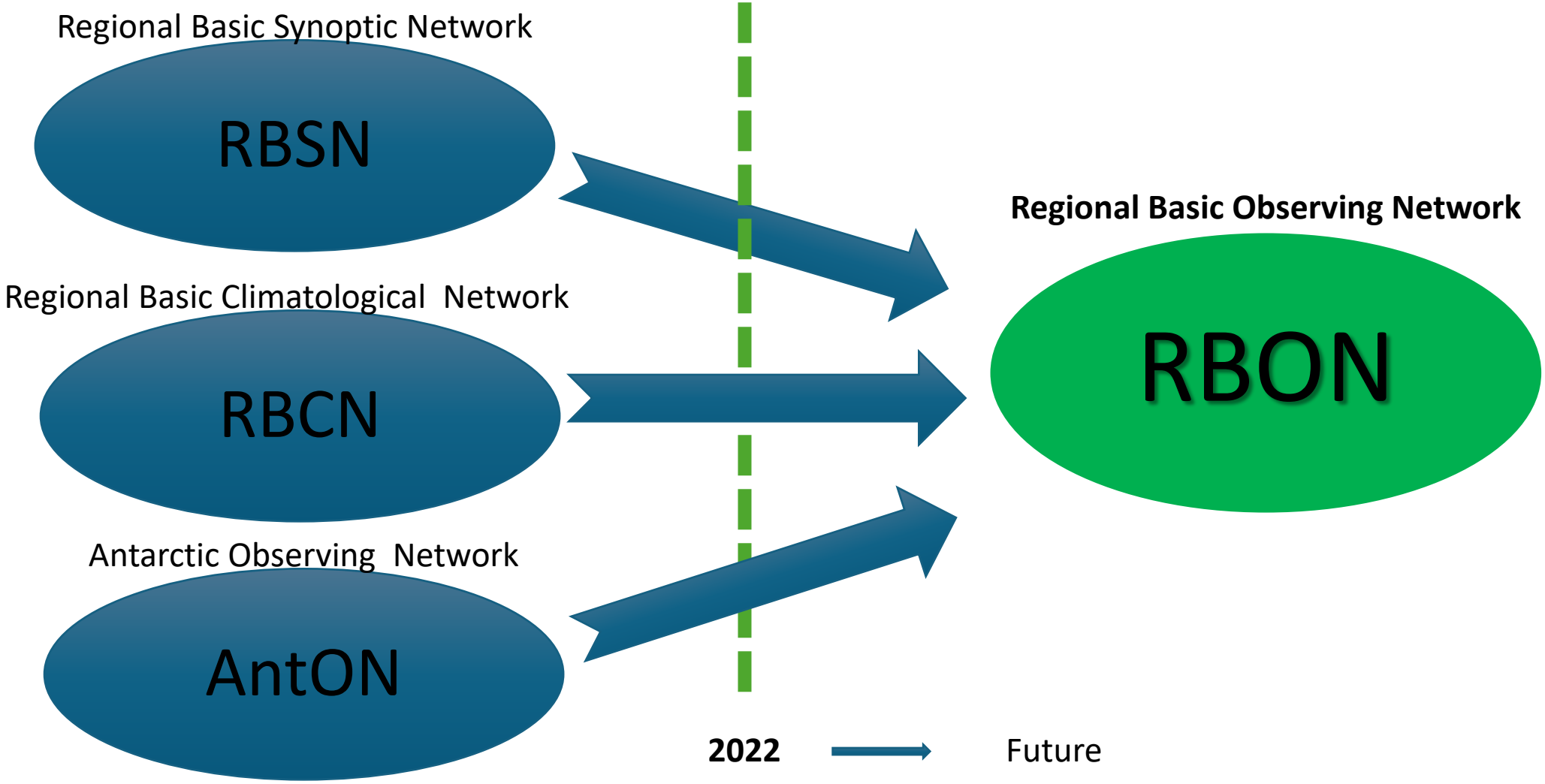



Guidelines on how to address the provisions and design GBON and RBON are described in:

- Guide to the WMO Integrated Global Observing System (WMO-No. 1165), Chapter 10 – GBON, 11 – RBON.
  - (**2024 edition**, approved by INFCOM-3 in April 2024, is available via WMO Library).



# Initial RBON



# Progress with RBON design – Global level

Despite its complexity, as multiple stakeholders are involved, there is significant progress with RBON design in all Regions, in particular, in RA II, V and VI:

- key challenges identified and phased approach developed,
- variables and requirements under finalisation, or approved (RA II – approved as guidelines, RA V – approved, RA VI – to be approved on 1 Oct),
- Workshops/webinars being organised in all Rs (RA VI - June and November 2025 with PRs, HAs and WIGOS NFPs),
- guidance material being developed.

**RBON Promotional video: Arabic, Chinese, English, French, Spanish and Russian.**

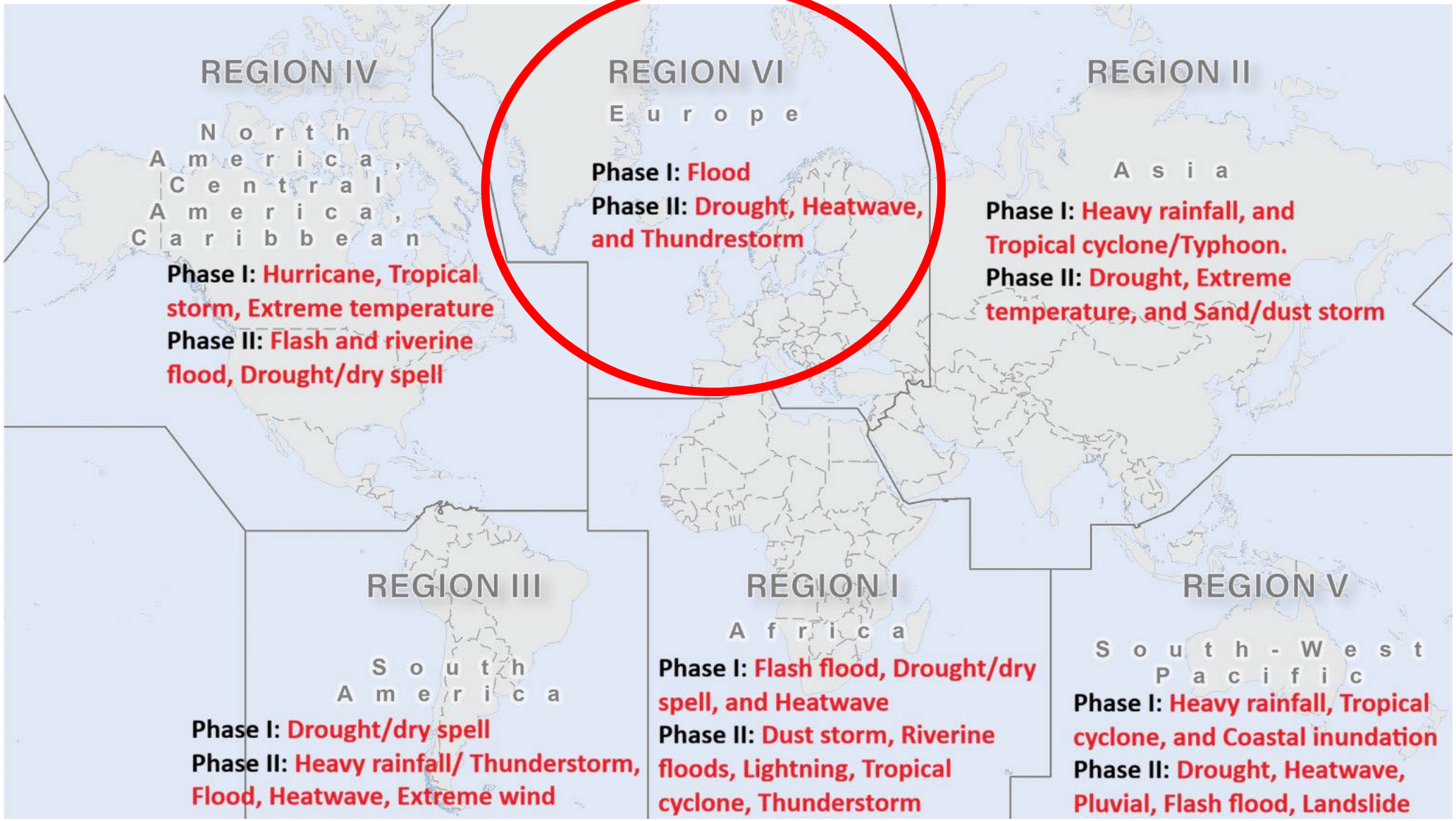
**RBON Piloting**: volunteers: Zambia, Hong Kong, China, Indonesia,

- Test of station de-assignment and re-affiliation in OSCAR/Surface (RA V)

- Pilot implementation - data sharing via WIS2.0 - RA II and V

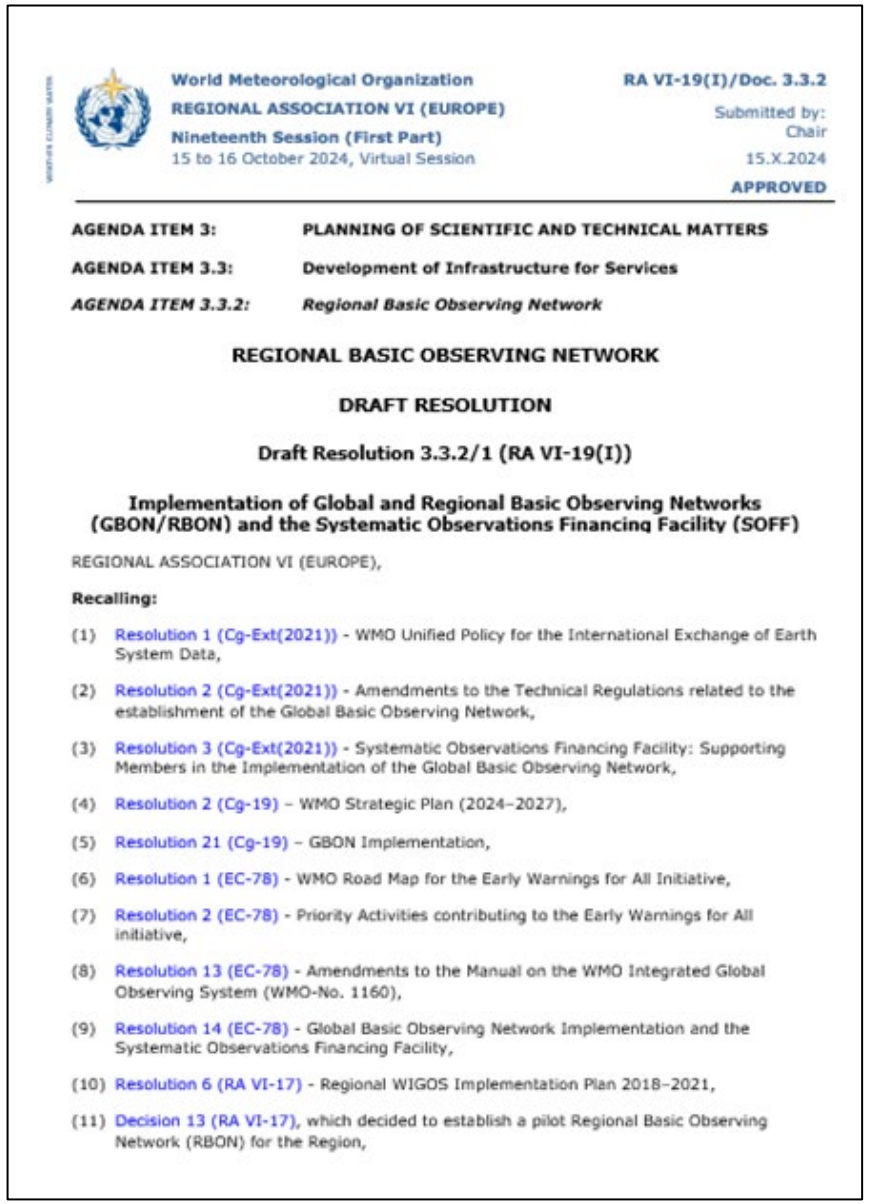
# RBON – Key challenges per RAs

- The phenomena to be addressed in order to bring substantial socioeconomic benefits.



# RBON design in RA VI

- RA VI decided in 2018 to establish pilot RBON for RA VI, initially comprising of RBSN and RBCN stations (Decision 13 (RA VI-17)).
- Resolution 5 (RA VI-19) - Implementation of Global and Regional Basic Observing Networks (GBON/RBON) and the Systematic Observations Financing Facility (SOFF).
- Establishment of RBON Focus Group within the Working Group for Observation, Infrastructure and Information Systems in order to foster the RBON design and implementation in the Region.
- Development of Action Plan for RBON design in RA VI.



World Meteorological Organization
REGIONAL ASSOCIATION VI (EUROPE)
Nineteenth Session (First Part)
15 to 16 October 2024, Virtual Session

RA VI-19(I)/Doc. 3.3.2
Submitted by: Chair
15.X.2024
APPROVED

**AGENDA ITEM 3:** PLANNING OF SCIENTIFIC AND TECHNICAL MATTERS
**AGENDA ITEM 3.3:** Development of Infrastructure for Services
***AGENDA ITEM 3.3.2:*** ***Regional Basic Observing Network***

**REGIONAL BASIC OBSERVING NETWORK**

**DRAFT RESOLUTION**

**Draft Resolution 3.3.2/1 (RA VI-19(I))**

**Implementation of Global and Regional Basic Observing Networks (GBON/RBON) and the Systematic Observations Financing Facility (SOFF)**

REGIONAL ASSOCIATION VI (EUROPE),

**Recalling:**

(1) Resolution 1 (Cg-Ext(2021)) - WMO Unified Policy for the International Exchange of Earth System Data,

(2) Resolution 2 (Cg-Ext(2021)) - Amendments to the Technical Regulations related to the establishment of the Global Basic Observing Network,

(3) Resolution 3 (Cg-Ext(2021)) - Systematic Observations Financing Facility: Supporting Members in the Implementation of the Global Basic Observing Network,

(4) Resolution 2 (Cg-19) – WMO Strategic Plan (2024–2027),

(5) Resolution 21 (Cg-19) – GBON Implementation,

(6) Resolution 1 (EC-78) - WMO Road Map for the Early Warnings for All Initiative,

(7) Resolution 2 (EC-78) - Priority Activities contributing to the Early Warnings for All initiative,

(8) Resolution 13 (EC-78) - Amendments to the Manual on the WMO Integrated Global Observing System (WMO-No. 1160),

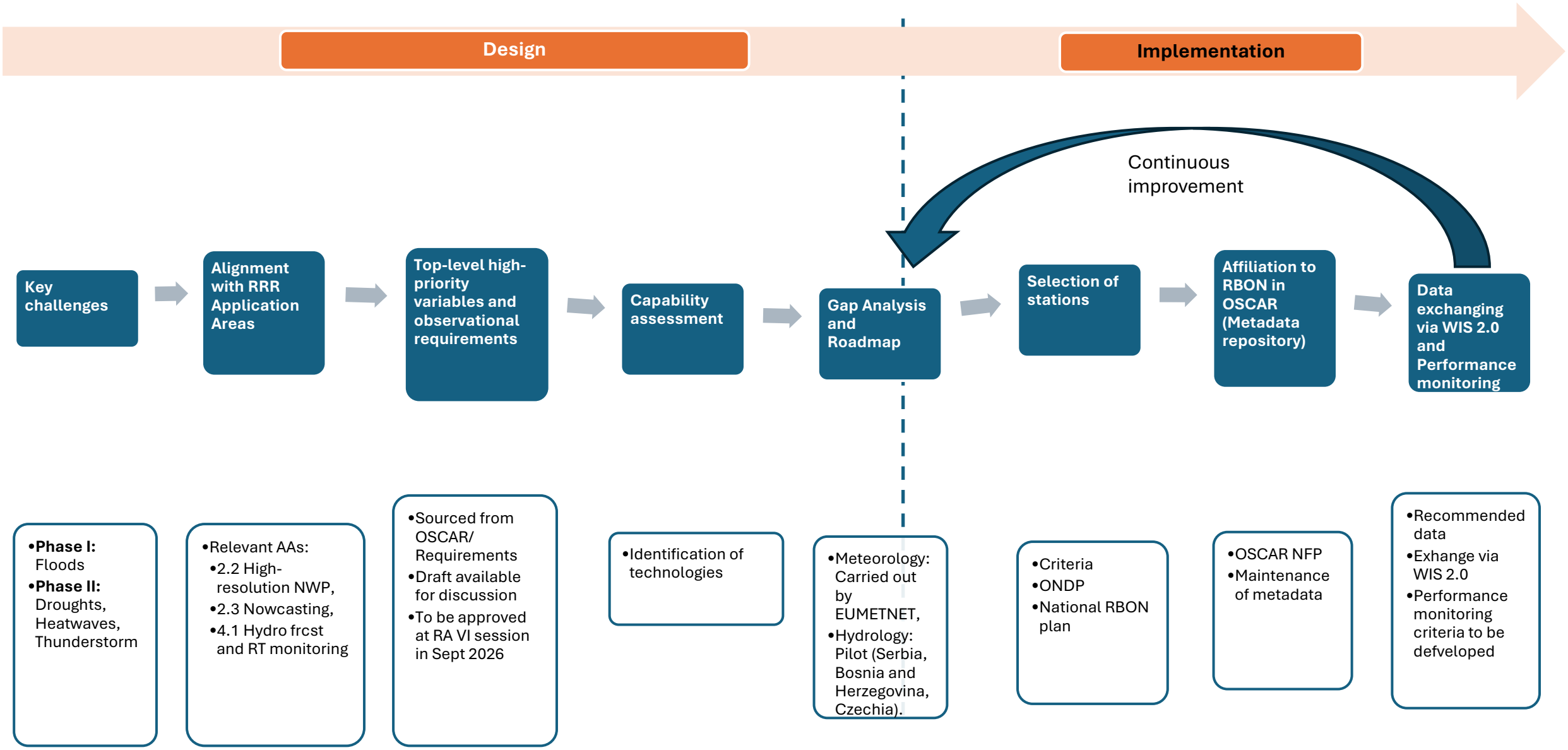
(9) Resolution 14 (EC-78) - Global Basic Observing Network Implementation and the Systematic Observations Financing Facility,

(10) Resolution 6 (RA VI-17) - Regional WIGOS Implementation Plan 2018–2021,

(11) Decision 13 (RA VI-17), which decided to establish a pilot Regional Basic Observing Network (RBON) for the Region,

# RBON Design and Implementation process (in RA VI)

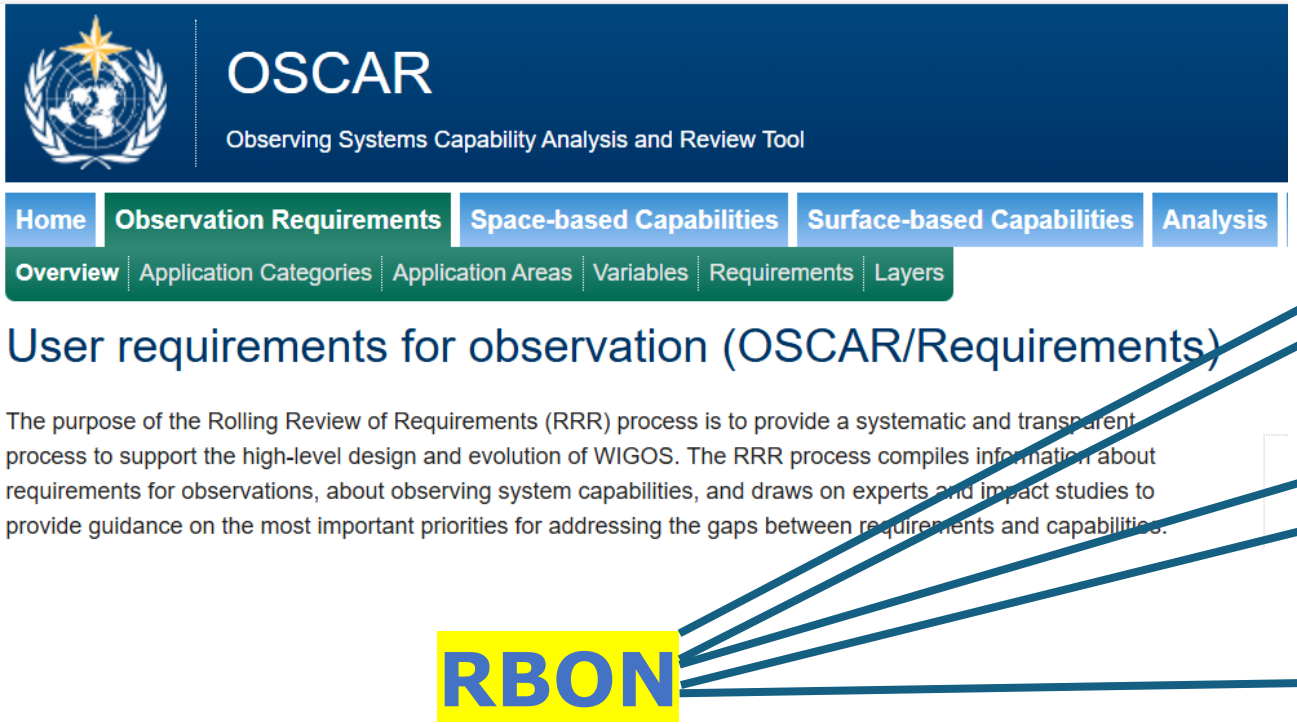
## WIGOS Guide (WMO-No. 1165), Chapter 11



# OSCAR/Requirements

**GBON**

**RBON**




| ESAC | Application areas |
|---|---|
| 1. Space Weather Applications | 1.1 Sun, Heliosphere and Solar Wind Forecasting and Monitoring<br>1.2 Energetic Particle and Magnetosphere Forecasting and Monitoring<br>1.3 Ionosphere, Thermosphere and Geomagnetic Field Forecasting and Monitoring |
| 2. Atmospheric Applications | 2.1 Global Numerical Weather Prediction and Real-time Monitoring<br>2.2 High-Resolution Numerical Weather Prediction<br>2.3 Nowcasting / Very Short-Range Forecasting<br>2.8 Aeronautical Meteorology<br>2.9 Agricultural Meteorology<br>2.6 Atmospheric Composition Forecasting and Monitoring<br>2.7 Atmospheric Composition Information Services in Urban and Populated Areas<br>2.4 Sub-Seasonal to Longer Predictions<br>2.5 Atmospheric Climate Monitoring |
| 3. Oceanic Applications | 3.1 Ocean Forecasting and Real-Time Monitoring<br>3.2 Coastal Forecasting<br>3.3 Oceanic Climate Monitoring and Services<br>3.4 Tsunami Monitoring and Detection<br>3.5 Marine Environmental Emergency Response<br>3.6 Maritime Safety (ports to open ocean)<br>3.7 Ocean Biogeochemical Cycles |
| 4. Hydrological and Terrestrial Applications | 4.1 Hydrological Forecasting and Real-time Monitoring<br>4.2 Hydrological and Terrestrial Climate Monitoring |
| 5. Cryospheric Applications | 5.1 Terrestrial Cryosphere Forecasting and Monitoring<br>5.2 Sea-Ice Forecasting and Monitoring<br>5.3 Cryospheric Climate Monitoring |
| 6. Integrated Earth System Applications | 6.1 Earth System Forecasting and Monitoring<br>6.2 Understanding Earth System Processes |

# RBON design – Role of Members

- **Establish and manage RBON** in their Region (RAs) and the Antarctic (EC).
- **Propose and commit existing stations** (consider national partnerships and upgrading stations to meet RBON requirements if needed).
- **Ensure** the observations are available **for international exchange in real or near-real time.**
- **Commit to operate** the stations for **at least four years, (10 years preferred).**
- **Review** regularly **RBON composition and monitor its performance.**
- **Continue to operate the former RBCN stations** as RBON stations addressing climate monitoring requirements.
- **Nominate National Focal Point** on WIGOS, OSCAR/Surface and WDQMS.
- **Record station metadata** in Metadata Repository (OSCAR/Surface).



# OSCAR/Surface – RA VI

Program/Network affiliation/WIGOS/GOS/GOS surface networks (as of 28 September 2026):

**RBCN (deprecated) – 945 stations**

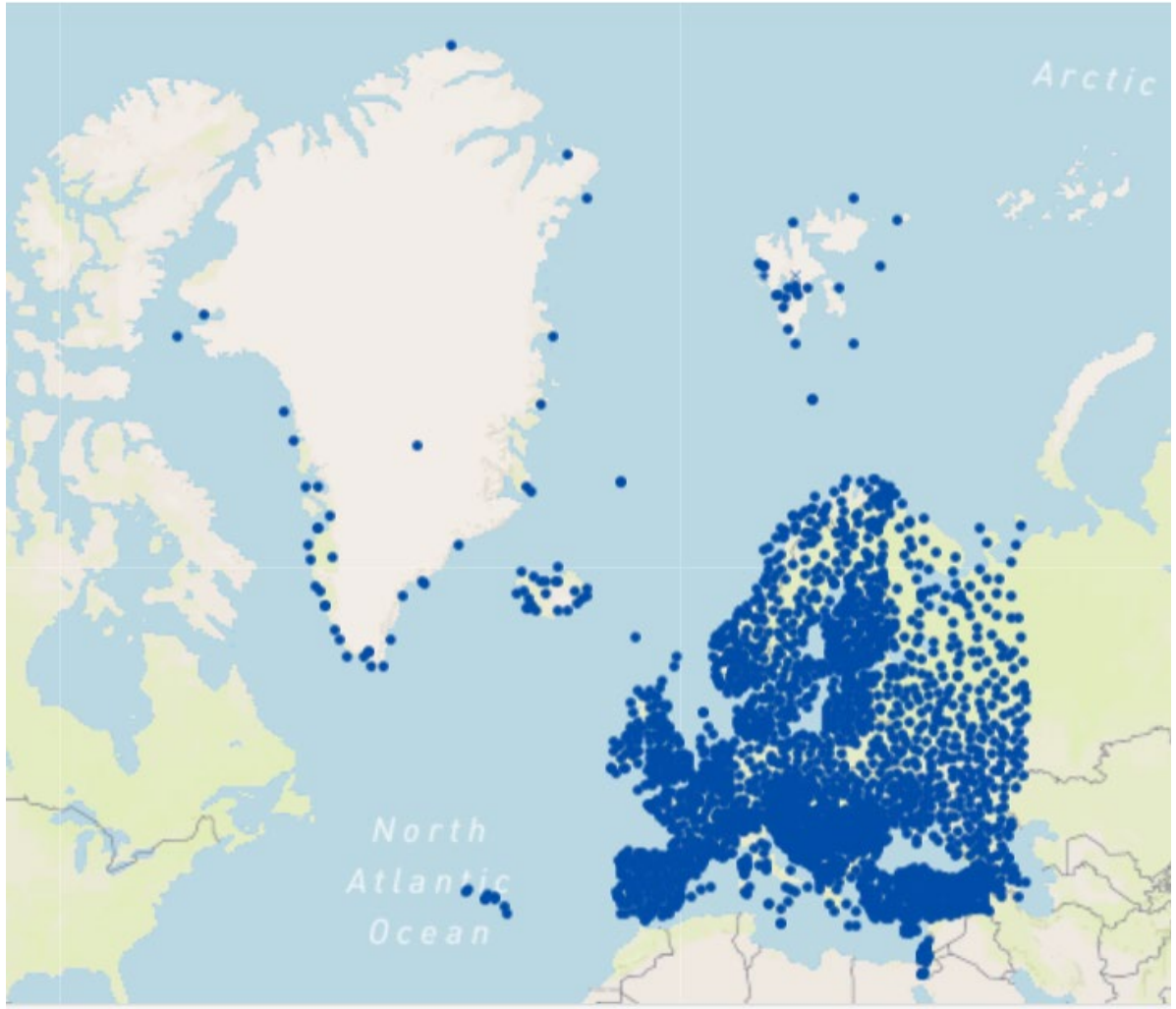
**RBSN (deprecated) – 1151 stations**

**Total: 2096 stations**

**RBCN&RBSN (deprecated) – 1557 stations**

**GBON – 2828 stations**

**RBON – 1706 stations**



# GBON requirements summary
## (mandatory in bold)

| | HR | VR | Obs cycle | Variables | Other requirements |
|---|---|---|---|---|---|
| **Surface land stations** | **200 km**<br>100 km[1] | n/a | **1 h** | **SLP, T, U, Wind, precip. (hourly cumul), snow depth** | **Exchanged in real time through WIS2** |
| **Upper air stations operated from land** | **500 km**<br>200 km[1] | **100 m** | **2/24 h** | **T, U, wind** | **Up to 30 hPa, exchanged in real time through WIS-2** |
| **Subset of upper air stations up to 10hPa** | 1000 km[2] | 100 m | 24 h | T, U, wind | Up to 10hPa, Exchanged in real time through WIS2 |
| **Surface marine stations in EEZs** | **500 km** | n/a | **1 h** | **SLP, SST** | **Exchanged in real time through WIS2** |
| **Upper air stations operated in EEZs** | **1000 km** | **100 m** | **2/24 h** | **T, U, wind** | **Up to 30 hPa, exchanged in real time through WIS2** |
| **Aircraft data** | 100 km at flight level | 300 m for profiles | 1h | T, U, wind | Data exchange per licensing agreement |
| **Remote sensing profiler observations** | Where available | 100 m | 1h | T, U, wind | n/a |

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1: High density requirement is mandatory for data exchange where capability exists

2: Requirement is mandatory for data exchange where capability exists

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

# Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

Notes:

1. **Values for horizontal resolution, observing cycle and latency are according to the most stringent value** defined for individual hazards. Hazard-specific requirements are included in the RA VI-19/INF. 3.1(2).
2. **The variables marked with two asterisks (**) are considered as high-priority variables**, to be addressed promptly by Members during the Regional Basic Observing Network (RBON) implementation process.
3. The variables marked with one asterisk (*) are considered as lower priority, and in the case of a lack of capabilities, can be implemented with less urgency.
4. **The requirements** in this table usually correspond to the threshold or breakthrough requirements in the WIGOS Rolling Review of Requirements (RRR) process. They **should be met by a combination of different available technologies**.
5. Members should **specify the geographical regions/areas where they could meet the stated requirements**.
6. **All observational data should be exchanged through WIS 2.0**, in accordance with the Manual on the WMO Integrated Global Observing System (WMO-No. 1160), Manual on the WMO Information System (WMO-No. 1060), Volume I, and Manual on Codes (WMO-No. 306), Volume I.2. For hydrological datasets, where exchange through WIS 2.0 is not yet implemented or applicable, data should be shared through the WMO Hydrological Observing System (WHOS).

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

## Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

| Category | Key variable | Target Horizontal resolution [km] | Target Observing cycle [h] | Target Latency [h] | Available technologies (non-exhaustive list) |
|---|---|---|---|---|---|
| **3D Atmosphere (profile)** | Atmospheric temperature, specific humidity, wind (horizontal and vertical) | 200 | 1 | 30 min | Radiosonde[c], aircraft-based observation (ABO), uncrewed aerial system (UAS), microwave radiometer (MWR), ground-based Global Navigation Satellite System (GNSS) stations, differential absorption lidar, Raman lidar, weather radar, Sodar wind profiler, radar wind profiler, Doppler wind lidar |

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

## Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

| Category | Key variable | Target Horizontal resolution [km] | Target Observing cycle [h] | Target Latency [h] | Available technologies (non-exhaustive list) |
|---|---|---|---|---|---|
| Atmosphere/ (near) surface | Cloud cover | 200 | 3 | 2 | Ceilometer, infrared camera |
| | Accumulated precipitation (liquid and solid) | 30 | 10 min | 5 min | Precipitation gauge, weather radar |
| | Air temperature | 30 | 10 min | 5 min | Automatic weather station, staffed weather station, aviation meteorological system, black bulb thermometer |
| | Dew point temperature | | | | |
| | Air specific humidity | | | | |
| | Wind speed | | | | |
| | Wind gust speed | | | | |
| | Atmospheric pressure | | | | |
| | Downward and upward short-wave irradiance at Earth surface | 150 | 1 | 24 | Pyranometer |
| | Downward and upward long-wave irradiance at Earth surface | | | | Pyrgeometer |
| | Lightning | 15[d] | 5 min | 5 min | Ground-based real-time lightning detection system |
| | Precipitation intensity (liquid and solid) | 2[e] | 10 min | 20 min | Precipitation gauge, weather radar (see also radar variables) |

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

## Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

| Category | Key variable | Target Horizontal resolution [km] | Target Observing cycle [h] | Target Latency [h] | Available technologies (non-exhaustive list) |
|---|---|---|---|---|---|
| Terrestrial/ land surface | Snow depth | 50 | 1 | 1 | Manual graduated snow stake/ruler/rod, snow depth (laser, ultrasound) gauge |
| | Water equivalent of snow cover (SWE) | See footnote[f] | 1/month (when applicable) | 48 | Snow scale, snow pillow, manual snow survey, gamma radiation-based instrument |
| | Evapotranspiration | 200 | 1 | 1 | Evaporation pan, lysimeter, eddy covariance instrument |
| | Soil moisture at surface | 200 | 1 | 1 | Soil probe, cosmic-ray soil moisture instrument |
| | (Stream) Water level | See footnote[g] | 1 | 1 | Staff gauge, pressure-based sensor, float-operated gauge, acoustic and radar instrument |
| | Discharge | | | | Hydraulic structure or other appropriate techniques, can be derived from rating curves, index-velocity |
| | Lake/reservoir level | See footnote[h] | 1 | 1 | Staff gauge, pressure-based sensor, float-operated gauge, acoustic, and radar-based instrument |
| | Groundwater level | See footnote[i] | 1/week | 48 | Manual dip meter, electric tape, chalked steel tape, pressure transducer |

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

## Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

| Category | Key variable | Target Horizontal resolution [km] | Target Observing cycle [h] | Target Latency [h] | Available technologies (non-exhaustive list) |
|---|---|---|---|---|---|
| **Radar variables** | Doppler velocity | 1 | 15 min | 30 min | Weather radar |
| | Reflectivity | | | | |
| | Dual-pole parameter | | | | |

# Annex to draft Resolution 3.1/1 (RA VI-19(II))

# Draft list of key RBON variables and associated observational requirements for RBON implementation in RA VI

[a] In cases of manual observations, the observing cycle is longer.

[b] Available technologies refer to Members' surface-based observing capabilities. The list of available technologies is not exhaustive; Members are free to consider any other technologies that may contribute to meeting the requirements. Space-based (satellite) capabilities are not part of RBON but will be considered for the RBON gap analysis and in setting these requirements, as an RBON complementary data source.

[c] Time interval at which radiosonde soundings are made should ideally be adjusted to whether thunderstorms are deemed possible on a given day.

[d] Horizontal resolution describes uncertainty (accuracy) of the estimation of location of lightning detected.

[e] Horizontal resolution means data resolution.

[f] Each Member sharing a transboundary basin prone to snowmelt floods should have at least one water equivalent of snow cover (SWE) measurement site located in snow covered areas of that specific basin. According to the *Guide to Hydrological Practices* (WMO-No. 168), Volume I, one snow course for 2 000 to 3 000 $km^2$ is a reasonably good density for less homogeneous regions, and one course for 5 000 $km^2$ in homogeneous and plain areas. In the early stages of network development, snow cover surveys are usually made only once a year, near the expected time of maximum accumulation.

[g] Each Member sharing a transboundary basin should have at least one station monitoring stream water level and discharge located in that specific basin. According to the *Guide to Hydrological Practices* (WMO-No. 168), Volume I, the minimum density is one station per 1 000 $km^2$ (mountainous regions), 1 875 $km^2$ (interior plains and hilly regions), 2 750 $km^2$ (coastal regions), and 20 000 $km^2$ (polar and arid). Major rivers, immediately above the river mouths (usually above tidal influence), or where the rivers cross borders, below the points of entry of the major tributaries, at the outlets from lakes and reservoirs, and on flood-prone basins should have at least one measuring station.

[h] Each Member sharing a transboundary basin with lakes and reservoirs with surface areas greater than 100 $km^2$ should have at least one measuring station (*Guide to Hydrological Practices* (WMO-No. 168)), Volume I.

[i] Relevant for transboundary aquifers and groundwater systems in water-scarce areas where groundwater is a key freshwater resource and where notable abstractions should be monitored.

[j] The requirements on radar variables are the requirements on radar observational data and not on radars as observational sites.

# Draft Resolution 3.1/1 (RA VI-19(II))

## Design and implementation of Global and Regional Basic Observing Networks

**Acknowledging** the work conducted by the RBON Focus Group under the RA VI Working Group on Observations, Infrastructure and Information Systems (WG-I) in coordinating RBON design in Region VI, as presented in INF. 3.1(2),

**Recognizing** that RBON implementation by Members should consider their national circumstances, needs and capabilities, [Sweden]

**Approves** the **draft list of key RBON variables and associated observational requirements, as presented in the annex to the present Resolution** and authorizes the RA VI Management Group (MG) to make adjustments, if needed, following the RBON gap analysis and Members' needs and capabilities;

# Draft Resolution 3.1/1 (RA VI-19(II)) - ctd

## Design and implementation of Global and Regional Basic Observing Networks

**Requests** RA VI MG to:

(1) Keep under review the progress of RA VI in the implementation of RBON;

(2) Engage with regional/subregional partner organizations and programmes to promote relevant RBON implementation activities;

(3) Lead the analysis of the GBON implementation status in RA VI, considering in particular the overlap of coverage by stations operated by Members near borders, and report back to the next RA VI session on a possible optimization of regional or subregional GBON design;

(4) Foster the RBON design and implementation by facilitating the work of the RBON Focus Group;

(5) Promote involvement of the Regional WIGOS Centres in supporting Members in RBON implementation, according to their mandate; [Türkiye]

# Draft Resolution 3.1/1 (RA VI-19(II)) - ctd

## Design and implementation of Global and Regional Basic Observing Networks

**Urges** Members to contribute to the RBON design and implementation in Region VI by:

(1) Identifying stations/platforms that would contribute to meeting the agreed RBON requirements;

(2) Ensuring that all identified RBON stations/platforms are properly registered in the WIGOS metadata management tool (currently the Observing Systems Capability Analysis and Review Tool (OSCAR/Surface)), affiliated to RBON and that the metadata are kept up to date;

(3) Proceeding with the implementation of WIS 2.0 (*Manual on the WMO Information System* (WMO-No. 1060), Volume II, and *Guide to the WMO Information System* (WMO-No. 1061), Volume II [Secretariat]) as the principal framework for GBON and RBON data exchange;

(4) Providing capacity development and technical support, particularly by Members hosting Global Information System Centres (GISCs), to Members facing challenges in the transition to WIS 2.0; [Türkiye]

(4) Promoting the benefits of RBON for Region VI and inviting regional and national partner organizations and programmes to participate in relevant RBON implementation activities;

(5) Identifying financial mechanisms, other than Systematic Observations Financing Facility (SOFF), for RBON implementation, and sharing their experience with resource mobilization with others, in particular, low- and middle-income countries/economies;

(6) Designing and implementing RBON implementation pilot projects and/or impact studies;

(7) Designating missing WIGOS-related National Focal Points (NFPs) and maintaining all NFP contact details up to date;

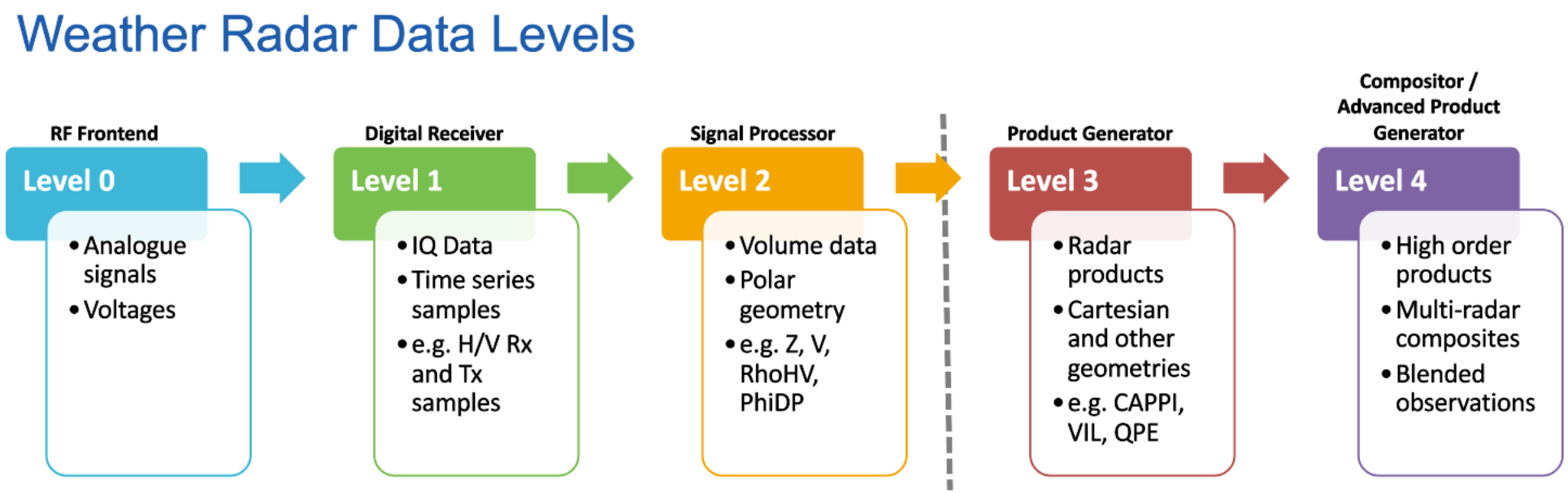
# Draft Resolution 3.1/1 (RA VI-19(II)) - ctd

## Design and implementation of Global and Regional Basic Observing Networks

**Encourages** Members having radar observational capabilities to:

1) Exchange Level 3 and 4 radar data, and strive to exchange Level 2 data over WIS 2.0 whenever Members' national data policies and capabilities allow for that;

2) Foster collaboration and coordination, including knowledge and experience sharing, of RA VI regional and subregional radar data exchange frameworks.



# GBON vs RBON

## RBON

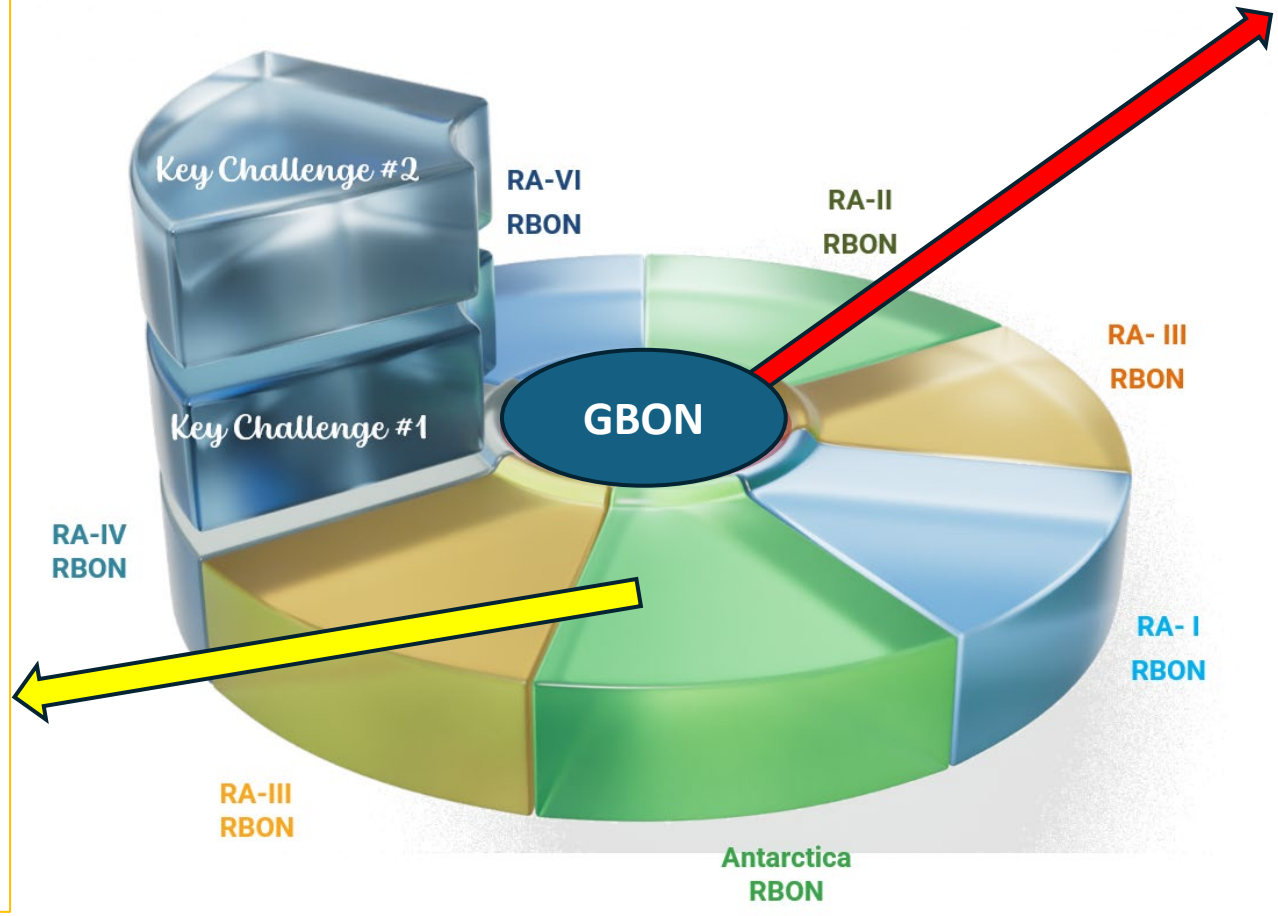
**Purpose**
- regional requirements,
- key regional challenges (e.g., floods, droughts, tropical cyclones, thunderstorms, heat waves)

**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

# Thank you to the Focus Group on RBON

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شكرًا لك

Mulțumesc

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