SECTION: Cover green

Guide to the Global Basic Observing Network

SECTION: TitlePage

Guide to the Global Basic Observing Network

SECTION: ISBN-Guides

SECTION: Revision\_table

PUBLICATION REVISION TRACK RECORD

TABLE: Revision table

|  |  |  |  |  |
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SECTION: Table\_of\_contents

SECTION: Pr-Preliminary\_pages

Chapter title in running head: INTRODUCTION

Introduction

General

This is the first edition of the Guide to the Global Basic Observing Network, a new Volume II of the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165). The Guide was developed following the decision of the eighteenth session of the World Meteorological Congress, [Resolution 34 (Cg-18)](https://library.wmo.int/doc_num.php?explnum_id=9827" \l "page=120) on Global Basic Observing Network, as well as the approval of the Global Basic Observing Network (GBON) Technical Regulations ([Resolution 2 (Cg‑Ext(2021)](https://library.wmo.int/doc_num.php?explnum_id=11113" \l "page=29)), section 3.2.2 of the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160), with the implementation taking effect from 1 January 2023, considering that the GBON implementation plan takes into account the individual capabilities of Members.

Members should commence their implementation of this network, including the necessary preparations for GBON station designation and GBON data exchange, if needed in a phased approach, as allowed by their individual capacities. Where applicable, implementation can be done with support from multilateral and bilateral development partners, and financial mechanisms such as the [Systematic Observations Financing Facility](https://alliancehydromet.org/soff/) (SOFF).

To complement these activities, the Congress in 2021 requested the Commission for Observation, Infrastructure and Information Systems (INFCOM) to develop the technical guidelines, processes and procedures needed to ensure the expedient and efficient implementation of GBON, and to prepare for the effective performance and compliance monitoring of GBON.

A set of guidelines incorporated in this version of the Guide will be progressively revised and enhanced through the GBON implementation, to complement the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160) and the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165) with the necessary guidance information and technical guidelines related to the GBON implementation.

Purpose and scope

The initial Guide aims to assist Members in complying with the GBON regulations that come into effect on 1 January 2023. It was developed by the Secretariat, in particular the Infrastructure Department, with input from technical experts of the Commission for Observation, Infrastructure and Information Systems (INFCOM).

Future versions of this Guide will provide detailed guidance and technical guidelines on how to establish, operate and manage GBON to make observations in compliance with the [Technical Regulations](https://library.wmo.int/index.php?lvl=notice_display&id=14073) (WMO‑No. 49), Volume I, Part I, and the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160). These versions will explain and describe GBON practices, procedures and specifications and will be aimed at assisting the technical and administrative staff of National Meteorological and Hydrological Services and other organizations responsible for the planning and management of networks of observing stations.

The Guide should be used in conjunction with the many other relevant WMO Guides, technical documents and related publications, mainly with the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165).

List of related publications

The development of this Guide takes a thin‑layer approach, meaning that it aims only to publish additional, new material that complements the material in the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165).

Publications related to this Guide are listed in the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165).

1. INTRODUCTION TO THE GLOBAL BASIC OBSERVING NETWORK

What is gbon

It is specified in the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160) that the GBON is a subset of the surface‑based subsystem of WMO Integrated Global Observing System (WIGOS), used in combination with the space‑based subsystem and other surface‑based observing systems of WIGOS, to contribute to meeting the requirements of Global Numerical Weather Prediction (NWP), including reanalysis in support of climate monitoring.

The GBON is a twenty-first century approach to ensuring consistent access to essential observations.

Real-time access to reliable data is critical to weather forecasts and climate analysis. GBON is a new set of global standards that will identify and address major observational data gaps, and so dramatically enhance the global real-time weather observing system.

Over the last several decades, NWP, the practice of computer-based model simulations of the atmosphere based on observational data, has emerged as the common foundation of all weather and climate services for nations big and small.

Thus, Members are increasingly depending on model data products provided by global and regional modelling and prediction centres. However, like an engine needs fuel, these centres and products are in turn completely reliant on a constant supply of reliable observations from all states to ensure accurate forecasts and climate products.

**What is the Problem**

Currently, vast gaps exist over land and sea where essential surface-based observations are missing. For instance, current gaps in surface-pressure observations available to NWP centres are shown here (see map, above) by black dots. Orange dots show where observations are available but are not currently all being shared internationally.

**What is the Solution**

In response, the GBON represents a new approach in which the basic surface-based observing network needed to feed the NWP models with input data is designed, defined and monitored at the global level.

Once fully implemented, GBON will significantly increase the availability of the most essential surface-based data. This will have a direct positive impact on the quality of weather forecasts and information and will enable all WMO Members to deliver better, more accurate and timely weather- and climate-related services to their constituencies.

The implementation of GBON will not only improve the timely and spatial availability of observational data, but it will also increase the functionality and application of satellite data which require in situ validation.

Reliable weather forecasts and climate analyses are essential for public services that help save lives, protect property and foster economic prosperity. This is all made possible by continued access to a wealth of real-time environmental observations from the entire globe.

**Conclusion**

With the implementation of GBON, WMO is poised to take an important step in improving observational support for critical global NWP and climate analysis systems. In large parts of the developed world, GBON requirements are already met, and in other parts they will be easy – or at least not overly onerous – to meet. However, in many developing countries they will be impossible to meet using current national resources alone. Fortunately, the international community is ready to help, as evidenced by the sheer number of currently ongoing or imminent development projects involving observing systems.

Many of these projects tend to be designed individually, without mutual coordination or a common strategy, even though meteorology by its very nature lends itself best to a global approach. If accepted in the development community, GBON could fill a void by helping to guide projects toward solutions that address both global and local needs.

As a component of WIGOS, GBON comes with robust technical monitoring and management systems and tools, which could be used to track the impact of individual projects. Shifting project design and evaluation metrics from “number of observing stations purchased and installed” to “number of observations delivered in real-time to global NWP” may have its challenges; but to do so could well turn out to be truly transformational not just for the WIGOS but for all stakeholders in the Global Weather Enterprise.

2. GBON RATIONALE

benefits of gbon

Improvements from GBON in the international exchange of observational data will flow through the weather value chain to deliver benefits of over US$ 5 billion annually. The benefits of increasing surfaced-based observations through GBON will be felt most in regions that are most vulnerable to climate change and its impacts including Africa, South America, South-West Pacific and parts of Asia. However, given the global nature of weather and climate, benefits of GBON will be realized both in the countries where the improvements are made and across the globe.

In order to achieve these benefits, additional investment and capacity development will be needed for many developing countries. WMO is working closely with the international development and climate finance communities to facilitate this, including by establishing the [SOFF](https://alliancehydromet.org/soff/). More information on how SOFF can help close the GBON gap can be found [here](https://library.wmo.int/index.php?lvl=notice_display&id=21771" \l ".YcNfohOZPX3" \t "_blank).

Details on GBON benefits are provided in [The value of Surface-Based Meteorological Observation Data: Costs and benefits of the Global Basic Observing Network](https://library.wmo.int/index.php?lvl=notice_display&id=21770" \l ".YcM1KxOZPX1" \t "_blank).

3. GBON REQUIREMENTS

3.1 GENERAL REQUIREMENTS

Reliable weather forecasts and climate analyses are essential for public services that help save lives, protect property and foster economic prosperity. This is all made possible by continued access to a wealth of real-time environmental observations from the entire globe.

Whilst many regions provide a reliable feed of observational data, some areas under-report or have a suboptimal observing network density. Recognizing the essential role played by these observations, the WMO has recently (June 2018) decided to proceed with the design of a GBON, to be proposed to its Members for approval at the eighteenth World Meteorological Congress in 2019. This rapid development cycle is testament both to the importance and to the urgency of resolving these issues.

The provisions within the GBON design are based on up‑to-date observational requirements for global NWP as defined by technical experts working under the WMO Commission for Basic Systems and the Global Climate Observing System. Drawing on 20 years of NWP observational data impact studies coordinated by WMO, the provisions specify – in clear, quantitative terms – the obligations of WMO Members to acquire and exchange these critically needed observations: which parameters to measure, how often, at what horizontal and vertical resolution, and which measurement techniques to use.

3.1.1 Requirements of Global NWP, including reanalysis in support of climate monitoring

Since the early 1960s, WMO has coordinated the acquisition and international exchange of meteorological observations in support of weather and climate services worldwide via the Global Observing System of its World Weather Watch Programme.[[1]](#footnote-1)

Since that time, the advent of high performance computing and other advanced technologies has transformed weather forecasting from a manual, local task into a globally connected, quantitative process. Complex computer simulations are now routinely fed with millions of measurements provided by a plethora of instruments in space, in the air, based on land, or on in the ocean.

All of today’s quantitative weather forecast and climate analysis products – even down to the finest local scales and immediate “nowcasting” time ranges – ultimately rely on global-scale NWP. This therefore acts as a backbone for everything that a modern weather and climate service does.

Global NWP systems are large-scale undertakings: millions of lines of computer code running on some of the fastest supercomputers available, ingesting tens of millions of observations every day. They require gigabit communication lines and petabytes of storage capacity, and typically have hundreds of staff developing, testing, running and diagnosing them. Reliable, real-time access to observational data from the entire globe is critical to the quality of the output from these systems.

Satellites provide global coverage and can measure parameters for both atmosphere and surface, and satellite data make a very substantial contribution to forecast skill. However, global NWP systems still have a critical reliance on surface-based observations for certain key parameters that cannot yet be reliably measured from space: in particular atmospheric surface pressure, the vertical distribution of winds and subsurface ocean parameters. Surface-based observations are essential over land, over snow and ice surfaces, and they continue to play important roles for calibration and validation of space-based data.

Whilst space agencies provide millions of observations daily to global NWP, substantially improving forecast skill, this is no excuse for WMO Members to neglect their responsibilities for operating and exchanging data from surface-based observing networks. Any lack of observations over one area is known to negatively impact the quality of the forecast and analysis products, not only in the area of missing data but elsewhere on the globe as well. Missing or non-reporting stations, glitches in telecommunication, or excessively restrictive national data policies thus all have an adverse impact both locally and globally. Such gaps in coverage amount to lost opportunities for National Meteorological and Hydrological Services (NMHSs) to deliver the best possible warning and monitoring information to their constituencies.

3.1.2 Current status

The international exchange of observations in meteorology has a long history and has evolved significantly over time. The most frequently cited articulation of WMO policy on this is found in [Resolution 40 (Cg-XII)](https://community.wmo.int/resolution-40), adopted by the eleventh World Meteorological Congress in 1995, and codified in the *[Technical Regulations](https://library.wmo.int/index.php?lvl=notice_display&id=14073)* (WMO-No. 49), Volume I. However, both [Resolution 40  (Cg-XII)](https://community.wmo.int/resolution-40) and the *Technical Regulations* arguably fall short of their intended goal by not specifying “hard numbers” for Members to comply with.

This problem has been further exacerbated by the lack of sustained real-time monitoring of data delivery, and by the decision of WMO to leave it to its six Regions – and thus ultimately to individual Members – to specify their requirements and design and implement their own networks accordingly. The lack of a clearly articulated global design and the absence of global compliance monitoring have led to an unrealistic, inflated perception of compliance among the WMO Members, and it has allowed persistent inhomogeneity across in the globe in the volume of observations internationally exchanged.

GBON addresses such gaps, and for the time being, addresses the requirements of Global NWP and Climate Data Reanalysis, focusing on specific observing types and variables as described in paragraph 3.2.1. Together with the Regional Basic Observing Network (RBON), GBON builds from existing infrastructure and the former Regional Basic Synoptic and Climatological Networks (RBSN and RBCN), with financial support also being gradually provided to some Least Developed Countries and the Small Island Developing States (SIDS) through the SOFF.

WMO Members can be divided into three broad categories, in terms of expected compliance with GBON and its impact on national observing and data sharing practices:

**1. Those already compliant with the proposed GBON provisions.** This group is estimated to include roughly 20–25% of the Members. There is no significant impact to those Members, other than the positive of receiving more observations and better products.

**2. Those currently not in full compliance but who already have data that** – if internationally exchanged – would make them compliant with GBON. This group of countries is estimated to include 25–30% of the Members. However, since

some of the largest countries in the world fall in this group, it represents a much larger proportion in terms of land area. The main impact on this group is likely to be either on data policy or on telecommunication, depending on the country in question, and is expected to be mostly minor.

**3. Those currently not in a position to comply with GBON due to lack of resources.** This group includes many developing countries, perhaps half of all WMO Members. In order for GBON to be successful, these Members will need international assistance, in some cases on an interim basis, while in other cases semi-permanent mechanisms will need to be developed.

The WIGOS has recently developed a Data Quality Monitoring System ([WDQMS](https://wdqms.wmo.int)), by which data delivery to four global NWP centres is now monitored around the clock, in near-real time. The inhomogeneity across the globe in both network density and reporting practice is striking, and the large data voids (areas without any dots on the map), and the prevalence of dots shown in colours other than green both amount to significant lost opportunities to provide better services.

The Infrastructure Commission is exploring if GBON requirements could be expanded to other domains. For example, through [Decision 6 (EC-75)](https://library.wmo.int/doc_num.php?explnum_id=11331" \l "page=65), the Executive Council has approved a concept note on the potential integration of additional hydrological and cryosphere variables into the GBON and requested the president of INFCOM to conduct a study based on the concept note. Study will address questions such as:

(1) What is the main driver behind the need to incorporate additional hydrological and cryosphere variables in GBON? Is it within the scope of the current purpose of GBON as approved by Cg-Ext(2021), or will it require an extension of the scope1?

(2) Will the proposed additional GBON variables be supplying necessary input data for global NWP and climate reanalysis? If yes, has it been documented via the RRR, or is there a likelihood that it can be?

(3) Is there sufficient clarity on the observing remit of the WMO Members for the variables in question?

(4) Is there a sufficient level of common understanding and agreement about the data requirements to specify detailed network characteristics?

(5) Is there a broadly understood and agreed requirement among the vast majority of the WMO Members for mandatory global exchange of hydrological and cryosphere data? The further expansion of GBON in other domains, for example in the oceans or for Green House Gases monitoring, may then be further explored on the basis of lessons learned from GBON expansion in hydrology and cryosphere.

3.1.3 National impact of GBON and role of international development efforts

Overall, the most significant impact of GBON is expected to be a major strengthening of global observational data availability, with all that will follow in terms of availability of better products and services at global, regional, national and local levels. However, it must also be acknowledged that with GBON come new, or at least more clearly articulated obligations that will require additional effort by some Members.

Most, if not all, of the countries belonging to the third group shown above are either current or potential targets for various types of internationally funded development projects, either of a bilateral nature or through multilateral finance mechanisms. If designed and implemented appropriately, these projects could contribute substantially to the GBON implementation. This would be especially valuable in data-sparse areas where the additional observations would make a marked impact on global NWP, and therefore on forecast quality.

Many internationally funded, observations-related development projects are “country-driven”. They are based on national weather and climate risks, observing capabilities and national desires to improve them, and the unique capabilities and needs of individual NMHSs. To some extent this approach is politically driven, and therefore it may not be easy to change. However, it risks ignoring the inherently trans-boundary nature of weather and climate, both in their manifestations and in the activities we as humans need to undertake when trying to understand and predict them. Many of the obstacles to effective weather and climate information service provision – especially in relation to observations – are characterized far less by national uniqueness than they are by global commonality.

Access to high-quality NWP products and reliable climate analyses is foundational to any modern weather or climate service, and ensuring that the NWP systems are fed by comprehensive sets of reliable observations is therefore in the self-interest of these same services. However, since the link between local observations and the local quality of NWP outputs is often poorly understood, especially in NMHSs in some developing countries, data delivery from these countries often falls short. When designing projects, it should therefore be the responsibility of the international development community – and certainly of WMO whenever it is involved – to ensure that the requirements for global NWP are addressed, alongside any local requirements of the countries concerned. At the same time, the NMHS should be supported to identify and, if possible, quantify the national benefits of international data exchange, in terms of both improved services and increased economic productivity.

In terms of staff, the WMO Secretariat is a relatively small organization, so it is unrealistic to expect that it can be directly involved in all capacity development projects with observing components. However, where possible, the Organization should seek to implement framework agreements with the major funding agencies and implementing partners, under which the GBON regulatory material would be used in project design, implementation and evaluation.

Many projects struggle to clearly demonstrate their impact, and often this is directly tied to a lack of helpful metrics defined at the outset and incorporated in project results frameworks. However, since WMO will monitor GBON data delivery 24/7, incorporating GBON standards into projects offers the opportunity to define simple, quantitative metrics of success that are directly linked to end user benefits. Monitoring will include overall "colour of the dots on the map", along with performance by station, by station type, by country, including averages, trends, etc. So a very simple measure of the impact of a given project could be, for instance, a "before and after" map display of GBON data delivery.

3.2 SPACE AND TIME REQUIREMENTS

3.2.1 Compliance criteria (deliverable 2.2)

The definition of GBON compliance criteria includes the aggregation of metrics, spatially and temporally, for surface and upper-air stations/networks (coverage, uptime, data delivery) and will accommodate mobile or mixed networks as needed.

GBON Regulations

The full set of GBON provisions is specified in the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160), section 3.2.2.

Table 1 below provides a summary of GBON requirements for different types of observing stations in terms of space and time requirements according to the “shall” (bold) and “should” provisions of GBON.

**Table 1. Summary of GBON requirements for different types of observing stations, ‘shall’ provisions in bold type.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***HR*** | ***VR*** | ***Obs cycle*** | ***Variables*** | ***Other requirements*** |
| ***Surface land stations*** | **200km** 100km[[2]](#footnote-2) | n/a | **1h** | **SLP, T, U, Wind, precipitation hourly cumul, snow depth** | **Exchanged in real time through WIS2** |
| ***Upper-air stations operated from land*** | **500km** 200km2 | **100m** | **2/24h** | **T, U, wind** | **Up to 30 hPa, exchanged in real time through WIS-2** |
| ***Subset of upper-air stations*** | 1000km[[3]](#footnote-3) | 100m | 24h | T, U, wind | Up to 10hPa, Exchanged in real time through WIS2 |
| ***Surface marine stations in EEZs*** | **500km** | n/a | **1h** | **SLP, SST** | **Exchanged in real time through WIS2** |
| ***Upper-air stations operated in EEZs*** | **1000km** | **100m** | **2/24h** | **T, U, wind** | **Up to 30 hPa, exchanged in real time through WIS2** |
| ***Aircraft data*** | 100km at flight level | 300m for profiles | 1h | T, U, wind | Data exchange per licensing agreement |
| ***Remote sensing profiler observations*** | Where available | 100m | 1h | T, U, wind | n/a |

**GBON Compliance Criteria**

**Designation of stations and initial seeding**

Relevant governance points, for reference to GBON compliance, are as follows:

 Only Members have the authority to nominate stations in GBON, either on the basis of the global gap analysis or one performed by them.

 The decision on the composition of GBON is made by Congress on the basis of INFCOM recommendation. Small changes to the composition of GBON can be decided by the President of WMO on the basis of Members proposed commitment.

 All existing surface and upper-air stations (including RBSN/RBON stations) which are either already meeting the GBON requirements, or are considered to be technically capable of meeting them, and are operating and reporting (i.e. stations displayed in green or orange stations in the WDQMS data availability charts) will be proposed to be included in GBON, with possible subsequent adjustments (or objections) by Members. The Secretariat will therefore write to Members to seek their consent, or appropriate action (e.g. to upgrade stations to meeting GBON requirements), giving them sufficient time to respond (no reply will be regarded as consent).

 An updated Gap analysis will identify areas where additional efforts will be needed for more stations to be eventually committed into GBON.

 This process will provide the following station lists; GBON-Surface-Land(Initial); GBON-Surface Marine(Initial); GBON-Upper-Air-Land(Initial); and GBON‑Upper‑Air‑Marine(Initial).

 Further Gap analysis will be required to support the effort to implement a full GBON.

**GBON Station Compliance Criteria**

(1) All GBON stations, for the initial seeding, shall be registered in OSCAR/Surface and include the network affiliation to GBON. If any GBON station does not meet this requirement, the responsible country will be assessed as non-compliant.

(2) GBON-Surface-Land Station (Initial)

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C |  |
| Monthly Availability (%) (Reported/Expected) | Monthly Timeliness (%) | Monthly Quality (%) | GBON Compliance |
| No. of monthly pressure reports[[4]](#footnote-4) / (Days per month \* 24) | No. of late SYNOP reports[[5]](#footnote-5) / (Days per month \* 24) | No. of rejected pressure reports[[6]](#footnote-6) / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Pressure Compliance) |
| No. of monthly temperature reports2 / (Days per month \* 24) | No. of late SYNOP reports3 / (Days per month \* 24) | No. of rejected temperature reports4 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Temperature Compliance) |
| No. of monthly humidity reports2 / (Days per month \* 24) | No. of late SYNOP reports3 / (Days per month \* 24) | No. of rejected humidity reports4 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Humidity Compliance) |
| No. of monthly wind reports2 / (Days per month \* 24) | No. of late SYNOP reports3 / (Days per month \* 24) | No. of rejected wind reports4 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Wind Compliance) |
| No. of monthly precipitation[[7]](#footnote-7) reports2 / (Days per month \* 24) | No. of late SYNOP reports3 / (Days per month \* 24) | No. of rejected precipitation reports4 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Precipitation Compliance) |
| No. of monthly snow depth5 reports2 / (Days per month \* 24) | No. of late SYNOP reports3 / (Days per month \* 24) | No. of rejected snow depth reports4 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Snow depth Compliance) |
|  |  |  | GBON surface-land station compliance will be decided on all, or a subset, of above (to be decided) |

(3) GBON-Surface Marine (Initial)

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C |  |
| Monthly Availability (%) (Reported/Expected) | Monthly Timeliness (%) | Monthly Quality (%) | GBON Compliance |
| No. of monthly pressure reports[[8]](#footnote-8) / (Days per month \* 24) | No. of late SYNOP reports[[9]](#footnote-9) / (Days per month \* 24) | No. of rejected pressure reports[[10]](#footnote-10) / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Pressure Compliance) |
| No. of monthly sea-surface temperature reports5 / (Days per month \* 24) | No. of late SYNOP reports6 / (Days per month \* 24) | No. of rejected sea-surface temperature reports7 / (Days per month \* 24) | If (A) > 80% -AND – (B) < 5% -AND – (C) < 5%  (Sea-Surface Temperature Compliance) |
|  |  |  | GBON surface marine platform compliance will be decided on all, or a subset, of above (to be decided) |

(4) GBON-Upper-Air-Land (Initial) and GBON-Upper-Air-Marine (Initial)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D |  |
| Monthly Availability (%) (Reported/Expected) | Resolution (100m) | Monthly Timeliness (%) | Monthly Quality (%) | GBON Compliance |
| No. of monthly temperature profile (to 30hPa) reports[[11]](#footnote-11) / (Days per month \* 2) | Yes or No[[12]](#footnote-12) | No. of late BUFR-TEMP reports[[13]](#footnote-13) / (Days per month \* 2) | No. of rejected temperature profile reports[[14]](#footnote-14) / (Days per month \* 2) | If (A) > 80% -AND – (B)=Yes – AND – (C) < 5%  -AND – (D) < 5%  (UA Temperature Compliance) |
| No. of monthly humidity profile (to 30hPa) reports8 / (Days per month \* 2) | Yes or No9 | No. of late BUFR-TEMP reports10/ (Days per month \* 2) | No. of rejected humidity profile reports11/ (Days per month \* 2) | If (A) > 80% -AND – (B)=Yes – AND – (C) < 5%  -AND – (D) < 5%  (UA Humidity Compliance) |
| No. of monthly wind profile (to 30hPa) reports8 / (Days per month \* 2) | Yes or No9 | No. of late BUFR-TEMP reports10/ (Days per month \* 2) | No. of rejected wind profile reports11/ (Days per month \* 2) | If (A) > 80% -AND – (B)=Yes – AND – (C) < 5%  -AND – (D) < 5%  (UA Wind Compliance) |
|  |  |  |  | GBON Upper-Air station/platform compliance will be decided on all, or a subset, of above (to be decided) |

**Initial GBON station compliance assessment**

It was agreed that for the initial phase of GBON a subset of the compliance criteria in the above section would be used to assess station compliance.

**Assessment S1 (GBON affiliation)**

To enable compliance assessment a GBON station must be registered in OSCAR/Surface and include the network affiliation to GBON. If any GBON station does not meet this requirement, the station will be assessed as non-compliant.

**Assessment S2** (GBON Surface Land Station performance)

|  |  |
| --- | --- |
| Monthly Availability (%)  (Reported/Expected) | GBON Compliance |
| No. of received pressure reports[[15]](#footnote-15) / (Days per month \* 24[[16]](#footnote-16)) | ≥ 80% |

**Assessment S3** (GBON Upper-Air-Land Station performance)

|  |  |
| --- | --- |
| Monthly Availability (%)  (Reported/Expected) | GBON Compliance |
| No. of received radiosonde profile reports (to 30hPa)[[17]](#footnote-17) / (Days per month \* 2[[18]](#footnote-18)) | ≥ 80% |

Whilst the above assessments are undertaken and recorded on a monthly basis, it is recommended that Member countries should review these assessments on a quarterly basis and a GBON assessment report should be produced annually.

**Initial GBON country compliance assessment**

It is recommended that the monthly assessments C1-C3 are recorded against each Member country on a quarterly basis.

The monthly country compliance assessment should be as follows:

Assessment C1: Member country nominated GBON stations (Agreed initial seeding) are registered in OSCAR/Surface and are affiliated to GBON.

Compliant 100% Non-compliant < 100%

Assessment C2: Compliant if number of Surface Land GBON compliant stations (S2 above) is greater than, or equal to, required number of Surface-Land GBON stations from GBON global gap analysis.

Assessment 3: Compliant if number of Upper-Air-Land GBON compliant stations (S3 above) is greater than, or equal to, required number of Upper-Air-Land GBON stations from GBON global gap analysis.

It is recommended that each Member country is assessed against the quarterly reports on an annual basis.

3.2.2 Compliance status (deliverable 2.3)

Compliance of GBON at both, a station and Member level will be routinely assessed and made publicly available, using dedicated tools such as the WDQMS. The Regional WIGOS Centres will also assist in this regard by alerting Members on non-compliance issues and discovered incidents. Members are invited to be aware of their compliance status and undertake their own compliance monitoring with the goal to evolve their observing networks towards full GBON compliance if this is not already the case.

3.3 EXEMPTION PER ARTICLE 9 OF WMO CONVENTION

3.3.1 Compliance status of Members invoking Article 9 of the WMO Convention (deliverable 2.3)

Article 9(b) of the WMO Convention published in the *[Basic documents No. 1](https://library.wmo.int/index.php?lvl=notice_display&id=14206" \l ".Y0gbdXZBw2w)* (WMO-No. 15) states that “*If … any Member finds it impracticable to give effect to some requirement in a technical resolution adopted by Congress, such Member shall inform the Secretary-General of the Organization whether its inability to give effect to it is provisional or final, and state its reasons therefor”*.

The *[Technical Regulations](https://library.wmo.int/index.php?lvl=notice_display&id=14073)* (WMO‑No. 49), Volume I, General Provisions, paragraph 6 states that *in accordance with the above definitions, Members shall do their utmost to implement the standard practices and procedures. In accordance with Article 9 (b) of the Convention and in conformity with Regulation 101 of the General Regulations, Members shall formally notify the Secretary-General, in writing, of their intention to apply the standard practices and procedures of the Technical Regulations, except those for which they have lodged a specific deviation. Members shall also inform the Secretary-General, at least three months in advance, of any change in the degree of their implementation of a standard practice or procedure as previously notified and the effective date of the change.*

Accordingly, the following conditions, criteria and implications on compliance status of a Member invoking Article 9(b) concerning their contribution to GBON are as followed:

Concerning the horizontal resolution requirement, a Member invoking Article [Australia] 9(b) concerning their commitment to GBON should clearly indicate the reasons, for what part of their territory they are seeking exemption to meeting GBON requirements, their level of commitment to meeting GBON horizontal resolution requirement for the rest of their territory, the period during which they believe such part of their territory would be exempted, and whether they have any plan to improve the situation.

Concerning the temporal resolution requirement, a Member invoking Article [Australia] 9(b) concerning their commitment to GBON should clearly indicate what subset of their GBON observing stations will not be meeting the temporal resolution requirements, the reasons why the requirement cannot be met, the period during which they believe such subset of stations would be exempted, and whether they have any plan to improve the situation.

An independent committee of experts designated by the INFCOM president in consultation with the INFCOM management group will assess whether a Member claiming Article 9(b) should be regarded as GBON compliant on the basis of the following criteria:

(1) the reasons stated by the Member are regarded as legitimate,

(2) there is substantial part of the Member territory compliant to GBON horizontal requirements (for small countries, if the horizontal requirement for GBON is met thanks to commitment of surrounding countries to GBON, the country may still be regarded as GBON compliant if it is at least committing one observing station to GBON);

(3) there is substantial number of GBON stations committed by the Member that comply with GBON temporal resolution requirements.

If the independent committee of experts considers that the Member is GBON compliant, such status will be reflected in the overall compliance status of all Members. In the contrary, the Member will be informed about its non-compliance status by the Secretary-General, and be urged to take steps to become compliant. The INFCOM president will inform the Executive Council about the independent committee decision.

4. MANAGEMENT OF GBON

**4.1 ROLES AND RESPONSIBILITIES**

Under the TT-GBON Operating Plan Activity Area #1, the table below clarifies the roles and responsibilities of main stakeholders concerning the process for establishing the initial composition of GBON. Responsibilities of national focal points are detailed in the [Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026) (WMO‑No. 1165), Chapter 6, Annex 1.

**Table X: Roles and responsibilities of main stakeholders in establishing initial composition (January 2023) of GBON**

| ***Stakeholder or group*** | ***Role*** |
| --- | --- |
| Members |  Nominate WIGOS National Focal Points and brief them on their role in support of GBON implementation; make sure they will get appropriate support from their management to undertake their role.   Consider GBON requirements, identify opportunities for committing GBON stations and filling identified gaps, implement GBON requirements, and take action as needed for complying with them:   Consider the proposal from the Secretariat on the initial seeding of GBON stations based on existing capabilities (green and orange stations in WDQMS data availability map), e.g. existing RBSN and upper-air stations, possibly to be upgraded; and respond to Secretariat in case they want to object (no response is regarded as consent).   Nominate additional GBON stations, including for example existing stations not currently reporting internationally or those from partner organizations for which MoU at national level could be negotiated and established to commit their stations to GBON.   Least developed and SIDS to apply for SOFF funding.   Other Developing Countries to make use of capacity development opportunities, including SOFF technical support when applicable. |
| WIGOS National Focal Points |  Contribute, to the design of GBON and identify the existing or new GBON stations to be committed by their Country/Territory and promote or coordinate the necessary actions nationally to reach such commitment.   Complete a National GBON Gap Analysis and liaise with the Secretariat and inform them on Country/Territory capabilities and possible non-achievable requirements.   Negotiate with partner organizations & encourage non-NMHS observing stations to be made available when their meet GBON requirements. |
| OSCAR/Surface National Focal Points |  Make sure that candidate GBON stations WIGOS metadata are recorded in OSCAR/Surface |
| WDQMS National Focal Points |  Check and monitor compliance of candidate GBON stations nationally, using the specific GBON view on WDQMS Webtool once it becomes available, and address any incident that may have been reported by the Regional WIGOS Centre. |
| Regional WIGOS Centres (RWCs) |  Monitor compliance of GBON observing stations with GBON requirements, and alert Members via their WDQMS NFSs about identified incidents.  *(Comment: At the RWCs Global Workshop (July 2022) they agreed that GBON stations should be a priority in their operations, but there is no regulatory nor guidance material on that yet – a recommendation has been made to update the existing technical guidance on WDQMS for RWCs, e.g. to cover GBON, among other things, although this is not started)* |
| Regional associations working groups on Infrastructure |  Promote regional cooperation and exchange of data across political boundaries – share benefits, share space, propose prioritization mechanism(s) for such cooperation e.g. in support of disaster risk reduction; facilitate processing of GBON data and the use of existing global and regional infrastructure (e.g. WIS centres, WIS 2.0 in a box). |
| WMO Secretariat |  Provide technical support to TT-GBON for the design of the initial GBON composition, including:   Liaison with WIGOS NFPs to get information on Members’ capabilities, and what candidate observing stations they wish to commit to GBON.   Perform global gap analysis and make proposal on the initial seeding of GBON.   Drafts guidance material on GBON as needed.   Look at how to make the best use of WIGOS tools (WDQMS, OSCAR/Surface), and assist ET-WT on how these tools should evolve or be used for GBON.   Assist TT-GBON and INFCOM teams on other remaining tasks as defined in the annex of the TT-GBON Terms of Reference. |
| SOFF Secretariat |  Coordinate the implementation of SOFF according to the SOFF Secretariat Terms of Reference.   Provide support to Members concerning the understanding of SOFF operational elements in support of GBON implementation to fill the gaps.   Collaborate with WMO Secretariat and the TT-GBON to develop and provide specific guidance and training for SOFF peer advisors.   Collaborate with WMO Secretariat and the TT-GBON in identifying GBON country opportunities for SOFF programming decision making.   Collaborate with WMO Secretariat and TT-GBON in establishing the WMO functions as SOFF Technical Authority.   Collaborate with WMO Secretariat and the TT-GBON in developing specific WDQMS reports, or OSCAR/Surface features for SOFF. |
| INFCOM Management Group |  Reviews the recommend list of GBON stations to be included in the network initial composition. |
| TT-GBON |  Develop technical guidelines, processes and procedures needed to ensure expedient and efficient implementation of GBON, and to prepare for effective performance and compliance monitoring of GBON. |
| INFCOM |  Recommends to Congress adoption of the list of GBON stations to be included in the network initial composition. |
| Congress |  Adopts the list of GBON stations to be included in the network initial composition. |

**4.2 PROCESS FOR THE DESIGNATION OF STATIONS (DELIVERABLE 7.2)**

The process to be followed by all stakeholder for the designation of GBON stations is regulated according to Appendix 3.1 of the Manual on the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160).

The list of GBON stations/platforms is elaborated in collaboration between the Members and INFCOM. It is essentially drawn from the list of all available stations/platforms in WIGOS as registered in [OSCAR/Surface](https://oscar.wmo.int/surface/" \l "/) by the Members, and monitored by the WDQMS for data quality. However, in the process, Members may also consider to install new observing stations or work with partner organizations at the national level in order to fill remaining gaps.

To assist Members in their efforts to contribute to GBON, INFCOM may provide Members with guidance on the number of additional surface stations and upper-air stations that are required for the Member to meet their obligations under 3.2.2.7–3.2.2.10 and 3.2.2.12–3.2.2.15. For each Member, INFCOM reviews their designated contribution as per 3.2.2.21 and assesses whether they meet the requirements specified in 3.2.2.7–3.2.2.10 and 3.2.2.12–3.2.2.15, and informs the Member in writing of its findings.

The composition of GBON, updated according to the proposals of Members with regard to the designation of GBON stations is regularly approved the Infrastructure Commission and Members are Members are urged to undertake the actions listed below:

(1) Ensure that a national focal point for OSCAR/Surface is nominated and has the authority to designate GBON stations (see the [list of designated national focal points](https://community.wmo.int/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-earth-observing-systems-and-monitoring-networks-sc/national-focal-points)).

(2) Regularly conduct a national gap analysis against GBON requirements (see guidelines and template in paragraph 4 on the management of GBON).

(3) Set and update their national targets for GBON and their National GBON Contribution Plan (see guidelines and template in section 4.4 and Annex 2).

(4) The designation or removal of GBON stations by Members is made and recorded in OSCAR/Surface by their National Focal Points for OSCAR/Surface. All designated GBON stations will then automatically appear on the dedicated [GBON webtool](https://community.wmo.int/global-basic-observing-network-gbon-station-designations-map). The stations designated by Members in OSCAR/Surface are recorded with “Pending Approval” status with regard to their GBON affiliation.

(5) Members may wish to remove stations from GBON for the following reasons: the station is no longer operational; the station was moved to another location and assigned a different WIGOS Station Identifier; the partner organization operating the station is no longer in capacity to operate the station according to GBON requirements; the station duplicates other GBON stations, etc. It is to be noted that in such case, the stations are not removed from OSCAR/Surface, and their assignment to GBON is neither deleted: the OSCAR/Surface NFP will only indicate in OSCAR/Surface the date at which GBON affiliation stops. Removal of stations is also subject to approval by INFCOM.

Following designation of GBON stations by Members, INFCOM, assisted by the Secretariat, reviews the designations and prepares the draft Resolution to INFCOM on the updated GBON composition. The updated GBON composition is made available through the dedicated [GBON web tool](https://community.wmo.int/global-basic-observing-network-gbon-station-designations-map) to all Members three months before INFCOM session. INFCOM then decides on the GBON composition on the basis of the list of designated GBON stations visible in the [GBON web tool](https://community.wmo.int/global-basic-observing-network-gbon-station-designations-map) at the time of its session. Adjustments are possible during the session after which the updated version of the GBON composition is approved by INFCOM. At this stage, the stations with “Pending Approval” status with regard to their GBON affiliation are turned to “Approved” status by the Secretariat on the basis of the actual INFCOM decision. The president of INFCOM is also authorized during the INFCOM intersessional period to approve small adjustments of the GBON composition on behalf of the Commission.

**4.3 NATIONAL GAP ANALYSIS (DELIVERABLE 1.3)**

To implement GBON at a national level, the Members are encouraged to complete the National GBON Gap Analysis for understanding the gap existing in the required observing networks and allow for identifying their national contributions to the composition of GBON for filling the identified gaps.

The gap analysis is the starting phase for implementing the GBON regulations. This section provides guidance to the WMO Members for the development of the GBON National Gap Analysis. The objective of the analysis is to define the gap between the GBON requirements and the existing surface, upper-air and marine observing networks. In other words, it serves as the basis for identifying the number of observing stations that need to be installed or improved to become compliant with the requirements of the GBON regulations.

The guidance provides a step-by-step process for defining the national GBON gap per GBON requirement. The results help the Members to assess whether their current network is meeting the requirements, plan actions to upgrade the observing networks as necessary and assign the first stations to the GBON network.

The completed National GBON Gap Analysis serves as the objective and quantitative basis for the preparation of the GBON National Contribution Plan, which considers the best approaches and activities for complying with the GBON regulations. Section 3.2.1 provides a summary of GBON regulations.

**GBON Gap Analysis steps**

The *global* gap analysis provides a quantitative estimate of the number of surface and upper‑air observing stations over land per country needed in order to meet the GBON requirements. The WMO Secretariat completes the global analysis on which stations are internationally sharing the data based on the information available through the WMO WIGOS Data Quality Monitoring System (WDQMS) tool. This serves as a baseline for the national assessment of existing observation networks against the target number of stations.

A template for completing the GBON National Gap Analysis Report is provided in Annex 1.

**Step 1 – Analysis of the GBON horizontal resolution requirements**

In this step, the country-specific GBON horizontal resolution requirements are analysed based on the global GBON gap analysis performed by the WMO Secretariat and the final adjustment by the Member. While the global gap analysis is a simplified analysis, the number of target GBON stations should be reviewed and adjustments done as needed by every Member. The global gap analysis does not include full investigation of Exclusive Economic Zone (EEZ), and therefore, no target number for marine observing stations are given. For Members having EEZ, the initial GBON target needs to be assessed in terms of surface marine observing network. Those Members who have territories in apart locations, should assess the GBON requirements for these territories individually.

Elements in Step 1:

(a) GBON horizontal resolution requirements: The GBON regulations as published in the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160).

(b) GBON target: Number of surface and upper-air stations required based on the GBON global gap analysis completed by the WMO Secretariat and adjusted by the Member as necessary.

(c) Reporting: Number of surface, upper-air and marine stations reporting internationally to WMO Information System (WIS)

(d) Gap improve: Number of surface, upper-air and marine stations that could a priori be improved to meet GBON requirements, for example by increasing the number of shared observations (as default per the Global Gap Analysis).

(e) Gap new: Number of new surface, upper-air and marine stations need to be established and installed (as default per the Global Gap Analysis).

(f) Gap total: The total of how many stations need to, either be improved, or newly installed (as default per the Global Gap Analysis).

**Table 2. GBON network requirements as per the horizontal resolution**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GBON HORIZONTAL RESOLUTION REQUIREMENTS | GBON TARGET | REPORTING | GAP IMPROVE | GAP NEW | GAP TOTAL |
| SURFACE STATIONS   STANDARD DENSITY, 200km |  |  |  |  |  |
| SURFACE STATIONS   HIGH DENSITY, 100km |  |  |  |  |  |
| UPPER-AIR STATIONS   OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |  |
| MARINE STATIONS   500km |  |  |  |  |  |

Caveats of the global gap analysis results:

(1) The reporting threshold for GBON upper-air stations over land was one daily sounding, noting that the GBON requirement is two soundings per day.

(2) For SIDS, the EEZ area has been added to the total surface area which is the basis for the target number of stations.

(3) The surface area was computed based on a geographic information system model and may slightly deviate from official records.

**Step 2 – Analysis of existing GBON stations and their status against GBON requirements**

In step 2, the Member assesses the existing national observation networks and stations. This includes stations operated by the NMHS and other governmental agencies or private sector which could potentially be included to the national GBON network. Stations’ operational status is assessed along with the variables reported and maps provided to indicate the station distribution.

First, the assessment is done for observing networks operated by NMHS and the by third party operators at a network level. The networks are evaluated based on the mandatory GBON requirements as described in the left column of Table 1 in 3.2.1.

The elements to be analysed in step 2 are:

(1) **NMHS network:** Number of stations managed by the NMHS. The surface, upper-air and marine stations are assessed and categorized as reporting or to be improved.

(2) **Third party networks:** Number of surface, upper-air and marine stations operated by the third party which could contribute to or become GBON stations are assessed and categorized as reporting or to be improved. Not all third party networks are necessarily known, and this element should be assessed based on the best knowledge available.

(3) **Station information:** Name and owner of a station, andwhich variables a station is reporting and how regularly (table 4).

The status of existing stations is defined as follows:

 **Reporting:** Whether the operational station measures all GBON variables and exchanges the data to WIS in real-time.

 **Improve:** Whether the station exists but is not fully operational and can be improved to reporting internationally, e.g., the station is out of service, has broken instruments, reports on only some variables or none, or not as often as required. Actions for improvements are considered in the GBON National Contribution Plan.

**Table 3. Assessment of existent stations per their operational status and network ownership**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GBON  REQUIREMENTS | Existing observation stations (# of stations) | | | |
| NMHS network | | third party network | |
| Reporting | Improve | Reporting | Improve |
| SURFACE STATIONS   STANDARD DENSITY, 200km |  |  |  |  |
| SURFACE STATIONS   HIGH DENSITY, 100km |  |  |  |  |
| UPPER-AIR STATIONS   OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |
| MARINE STATIONS   500km |  |  |  |  |

*\*\*\* Placeholder for maps of existing surface and upper-air networks \*\*\**

Secondly, the status of the existing stations is analysed in terms of the GBON variables and international reporting cycle requirements (Table 1 in 3.2.1). The reporting cycle is assessed per station in respect to one-hour reporting frequency for surface and marine stations and twice a day for upper-air stations.

**Table 4. Assessment of existing GBON stations per variable and reporting cycle**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| STATION NAME | STATION TYPE (S/UA/M) | OWNER (NMHS/ 3RD PARTY) | GBON VARIABLE MEASURED | | | | | | REPORTING CYCLE | GBON COMPLIANT (Y/N) |
| AP | T | H | W | P | SD |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

*Station type: S: Surface, US: Upper-Air, M: Marine;* *Owner of the station: NMHS or which third party; Variables: AP: Atmospheric pressure; T: Temperature; H: Humidity; W: wind; P: Precipitation; SD: Snow depth; Reporting cycle: Number of observation reports exchanged internationally per day (0–24); summary whether the station is GBON compliant (Y/N)*

**Step 3 – GBON Gap Analysis results**

The results of steps 1 and 2 are summarized to Table 5: the number of stations required per GBON regulations (GBON target), number of existing stations compliant with the GBON requirements and new and improved GBON stations needed for surface, upper-air and marine networks are completed.

A map of existing stations is developed with the location of gaps indicated in circles of 200km (surface) and 500km (upper-air and marine) radius around the existing stations.

**Table 5. Results of the GBON National Gap Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GBON REQUIREMENTS | GBON TARGET | COMPLIANT STATIONS WITH GBON | STATIONS NEEDED AGAINST GBON REQUIREMENT | |
| NEW | IMPROVED |
| SURFACE STATIONS  STANDARD DENSITY, 200km |  |  |  |  |
| SURFACE STATIONS  HIGH DENSITY, 100km |  |  |  |  |
| UPPER-AIR STATIONS  OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |
| MARINE STATIONS  500km |  |  |  |  |

\*\*\* *A placeholder for maps of existing surface, upper-air and marine networks with gaps indicated* \*\*\*

As a summary, a list of surface, upper-air and marine stations which are compliant with the GBON regulations and recommended to designate to GBON.

**Table 6. Recommended existing surface, upper-air and marine stations to be designated to GBON.**

|  |  |
| --- | --- |
| STATION NAME | STATION TYPE (S/UA/M) |
|
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Further considerations for GBON implementation and operations**

With this analysis, there has not been investigated the reasons behind the gap. Based on the results from the GBON National Gap Analysis, the detailed GBON National Contribution Plan will be developed where to define the National GBON Target and address corresponding actions to fully comply with the GBON regulations.

Each Member must designate at a minimum the required number of surface, upper-air and marine stations as their contribution to GBON. Those stations which already comply with the GBON regulations should be considered as an initial subset of stations and designated to GBON network by registering the stations in OSCAR/Surface and addressing the metadata requirements.

If the national observing network does not meet a certain GBON requirement, and for some reason, actions to comply with the requirement are not going to be taken, the reason must be reported to the Secretary-General of WMO by seeking exception per Article 9 of WMO Convention (see section 3.3). As an example, a GBON requirement is not applicable in the territory of the Member because the requirement is not technologically possible or economically viable.

The GBON regulations is a comprehensive set of provisions which not only drive a certain density for observation network but also require a long-term commitment to GBON operations with expectations for high-quality and timeliness observational data available for all WMO Members. Therefore, operational observation network management practices should be reviewed, and capacity development activities considered as part of the National GBON Contribution Plan for guaranteeing the sustainable operations of GBON.

The Member can adjust and extend the templates provided in this guidance based on the national operational practices, as needed. The WMO Secretariat and the Infrastructure Commission (INFCOM) Task Team on GBON (TT-GBON) are available for responding to questions, providing support, and sharing best practices in every phase of GBON implementation.

**4.4 NATIONAL CONTRIBUTION PLAN (DELIVERABLE 1.4)**

The National GBON Contribution Plan (the Plan) constitutes the basis for NMHS plans and efforts to become GBON compliant. The National GBON Gap Analysis, completed prior to the development of this Plan, serves as an analytical basis to develop this Plan. Based on the results from the analysis, the NMHS sets a GBON target and the activities to achieve that target in the Plan.

The objective of the GBON National Contribution Plan is to identify the observing infrastructure, human and institutional capacity needed to achieve a progressive target towards GBON compliance, and sustainable level of operations and maintenance of the national observing network.

This section provides guidance on the activities and deliverables required to design and to develop a sustainable observing infrastructure. The defined deliverables guide the NMHS to assess and estimate the investments needed to achieve the GBON compliance. Thus, the guidance in this document provides the flexibility to prioritize and phase activities in line with NMHS’s resources and capabilities for successful implementation of new or upgraded observing system and operational practices.

The guidance is structured in five modules that constitute the building blocks of the Plan.

The five modules are undertaken in parallel so that the final plan is in consistent with each output of the modules.

**GBON National Contribution Plan**

This section guides the NMHS to develop the National GBON Contribution Plan.

For the consideration by the NMHS, the guidance is structured across five modules that cover different areas required for the implementation of GBON, providing, for each module, a list of activities and expected outputs which should be addressed in terms of the current facilities and capabilities in the national observing infrastructure.

The modules of the Plan are:

 **Module 1. National GBON Target:** National target towards GBON compliance that considers country’s circumstances.

 **Module 2. GBON institutional capacity development**: Institutional capabilities required to operate, maintain and manage the GBON observing network.

 **Module 3. GBON infrastructure development**: Observing network infrastructure required to achieve the national target and compliance with the GBON regulations.

 **Module 4. GBON human capacity development**: Human capacity needed to manage, operate, and maintain the GBON observing network.

 **Module 5. Risk Management:** Observing network operational risks and required mitigation measures.

Each module lists recommended activities and their expected deliverables. The key activities and best practices should be considered align with the national strategy for observing networks and as relevant for the NMHS. Operational systems, processes and practices already existing should be utilized where appropriate. The preliminary timeline and financial implications should be considered as a part of the Plan for each module.

The modules provide a standard approach which can be adjusted based on the national needs and expectations.

The activities are planned to meet the national target toward GBON compliance in each module. The Plan should be reviewed regularly with an aim to advance the activities defined for meeting the full GBON compliance in a sustainable manner.

**Module 1: Establishment of a national target toward GBON compliance**

Based on the results from the National GBON Gap Analysis, the NMHS sets a National GBON Target towards progressive GBON compliance. The target should be progressive so that the elements of the target are increased periodically for aiming the country to achieve full GBON compliance in a reasonable period of time. The target reflects the level of ambition of the NMHS, taking into account the gradual process, national circumstances and the feasibility of implementing the activities to achieve such a target.

**Table 1. Activities and outputs to be undertaken and delivered for Module 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Activity** | **Outputs** | **Relevant guidance material** |
| 1.1 | Conduct the National GBON Gap Analysis | Results of the gap analysis as the baseline | Guidance to National GBON Gap Analysis (section 4.3 of the GBON Guide) |
| 1.2 | Establishment of the national target towards GBON compliance | Based on the gap analysis, set a target in terms of number of new/improved stations and percentage of reports exchanged |  |

**Module 2: GBON institutional and financial capacity development**

In module 2, the NMHS institutional capabilities, including partnerships with other national governmental and private partners, sub- and regional GBON stakeholders, and financial capabilities, are assessed for strengthening the resources and activities to operate and maintain the observing network.

This module also includes assessing existing NMHS strategies for developing and improving observing networks and assessing the national legislation in terms of GBON regulations.

**Table 2. Activities and outputs to be undertaken and delivered for Module 2.**

| **Item** | **Activity** | **Outputs** | **Relevant guidance material** |
| --- | --- | --- | --- |
|
| 2.1 | Assessment of governmental partner organizations for supporting operations of GBON | Assessment of governmental partners and stakeholders and their potential contribution to GBON network operations  a) Existing partners and relationships;  b) Potential new partners and collaborators and their role |  |
| 2.2 | Assessment of private sector entities providing meteorological observations in the country and potential partnerships for supporting operations of GBON | 1. Private sector operators providing meteorological observations and data services in the country  2. Business model for public-private collaboration for the implementation of the Plan, including identified potential private sector operators for the collaboration | *[Guidelines for Public-Private Engagement](https://library.wmo.int/index.php?lvl=notice_display&id=21858)* (WMO‑No. 1258) |
| 2.3 | Assessment of potential subregional contributors for supporting operations of GBON | 1. Identified neighbouring countries and regional organizations of relevance for potential subregional collaboration  2. Plan for potential optimization of the observing network through subregional network design and other optimization arrangements for the implementation of the Plan |  |
| 2.4 | Assessment of the NMHS financial model | 1. Current funding sources, budget allocations and financial status related to operations of the national observing infrastructure  2. Develop a sustainable financial management plan to operate the GBON infrastructure in line with the proposed public-private business model in a form of:  a) Financial plan of operating the modernized infrastructure  b) Business plan over 5 to 10 years supporting an increase in financing for operations of GBON network |  |
| 2.5 | Assessment of existing national strategies and projects for developing and improving observing networks | 1. Review of the national strategies for developing and improving observing networks  2. Plan for harmonizing the activities defined in the general strategy of NMHS observation services along with this Plan  3. Review of existing or planned hydromet development projects related to GBON and consider action for avoiding duplications |  |
| 2.6 | Review of the national legislation in terms of GBON regulations | 1. Review of the legislation in terms of the national responsibility for measuring and providing weather observations related to GBON  2. Review of the legislation related to procurement, importation and customs processes to enable fluent implementation of the Plan  3. Recommendation on how to address any constraints imposed by the national legislation needed to implement GBON |  |

**Module 3: Infrastructure development**

In module 3, based on the gaps identified in the GBON National Gap Analysis, the NMHS develops a detailed plan for all components of the observing infrastructure and investments needed to meet the national target toward GBON compliance. The plan should follow the national strategy for the development and management of observing networks so that the components of the modernized infrastructure and operation practices are harmonized with the existing network.

The [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160), the *Manual on Codes* (WMO-No. 306), Volumes [I.1](https://library.wmo.int/index.php?lvl=notice_display&id=13617), [I.2](https://library.wmo.int/index.php?lvl=notice_display&id=10684) and [I.3](https://library.wmo.int/index.php?lvl=notice_display&id=19508), the [Manual on the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=9254) (WMO‑No. 1060), and the [Manual on the Global Telecommunication System](https://library.wmo.int/index.php?lvl=notice_display&id=21811) (WMO‑No. 386) are the key WMO Technical Regulations to be followed for the establishment of a network, and for reporting and making observations and metadata internationally available through the WIS and WMO OSCAR/Surface metadata management system.

**Table 3. Activities and outputs to be undertaken and delivered for Module 3**

| **Item** | **Activity** | **Outputs** | **Relevant guidance material** |
| --- | --- | --- | --- |
|
| 3.1 | Design the surface, upper-air and marine observing networks and observational practices including networks ran by third parties | 1. Based on the GBON National Gap Analysis and the GBON national target, a harmonized observing network design completed including siting and instrumentation of new and improved stations, including:  a) A map of observing network design and a list of new/rehabilitated GBON stations;  b) A list of observation instruments and systems per site; and  c) Investments and activities needed for the installation of new station and the improvement of existing stations  2. Observational practices defined per network  3. Preliminary maintenance plan for existing and improved/new stations, including calibration practices  4. Technical specifications for new instruments and observing systems for the procurement process | [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160)  [Guide to Instruments and Methods of Observation](https://library.wmo.int/index.php?lvl=notice_display&id=12407) (WMO‑No. 8)  WMO IOM Report No. 136: [Generic Automatic Weather Station (AWS) Tender Specifications](https://library.wmo.int/index.php?lvl=notice_display&id=22031)  Guidance on the GBON Tender Specifications (see section x.x)  *(Comment: not decided yet)* |
| 3.2 | Design of the ICT infrastructure and services | a) ICT infrastructure and services design for solutions on data transmission from an observing station to the national real-time data management system and to GTS and WIS 2.0 including  b) Detailed description of the ICT infrastructure and services design  c) Technical specifications for the data collection system from observing station to collection point  d) Technical specifications of the data services (compatible with the requirements of WIS 2.0)  e) Detailed description of the measures to ensure resilience and continuity of the full data processing chain | *Manual on Codes* (WMO-No. 306), Volumes [I.1](https://library.wmo.int/index.php?lvl=notice_display&id=13617), [I.2](https://library.wmo.int/index.php?lvl=notice_display&id=10684) and [I.3](https://library.wmo.int/index.php?lvl=notice_display&id=19508)  [Manual on the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=9254) (WMO‑No. 1060),  [Manual on the Global Telecommunication System](https://library.wmo.int/index.php?lvl=notice_display&id=21811) (WMO‑No. 386)  WIS 2.0 requirements http://docs.wis2box.wis.wmo.int |
| 3.3 | Design the data management system | 1. Requirements for a data management system aimed to provide access to data used by operational applications on a real-time basis as well as the capability to deliver data to a Climate Data Management System (CDMS) for long-term archiving purposes. The system should provide  a) Short term data storage and access through the services and protocols required by applications for national and international operational activities  b) Acquisition of data to and from WIS/GTS, WIS 2.0 and other national or international sources required for operational activities  c) Data delivery to the national CDMS  d) Discovery and descriptive metadata management  e) Monitoring of data, processing and services | [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160)  *Manual on Codes* (WMO‑No. 306), Volumes [I.1](https://library.wmo.int/index.php?lvl=notice_display&id=13617), [I.2](https://library.wmo.int/index.php?lvl=notice_display&id=10684) and [I.3](https://library.wmo.int/index.php?lvl=notice_display&id=19508)  [Manual on the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=9254) (WMO‑No. 1060),  [Manual on the Global Telecommunication System](https://library.wmo.int/index.php?lvl=notice_display&id=21811) (WMO‑No. 386)  *[Climate Data Management System Specifications](https://library.wmo.int/index.php?lvl=notice_display&id=16300)* (WMO-No. 1131) |

**Module 4: Human capacity development**

Human capacity development is the backbone of GBON implementation and critical to ensure the sustainability of the observing network. Modernized observation infrastructure requires increased knowledge and skills of the staff to overcome future challenges in the operations of the network.

In module 4, the NMHS assesses human capacity development needs and activities to close that gap are defined. The capacity development activities should target technical staff to maintain the modernized observation infrastructure and senior management to manage long‑term strategic implementation of the Plan.

The type of human expertise and training depends on the infrastructure design chosen and the NMHS’s human capacity gaps. Emphasis ensures that the country maintains essential capacity related to the generation and exchange of observations. In the case of opting for private sector partners, it is important to ensure that the country has the expertise and capacity to engage in, monitor, and manage the contractual relationships and control the services purchased.

**Table 4. Activities and outputs to be undertaken and delivered for Module 4**

| **Item** | **Activity** | **Outputs** | **Relevant guidance material** |
| --- | --- | --- | --- |
|
| 4.1 | Assessment of human capacity gaps | 1. Staff skills, education levels and capacity gaps for technicians; experts; and management | *[Guide to Competency](https://library.wmo.int/index.php?lvl=notice_display&id=20181)* (WMO‑No. 1205)  *[Guidelines for Trainers in Meteorological, Hydrological and Climate Services](https://library.wmo.int/index.php?lvl=notice_display&id=15292)* (WMO‑ No. 1114) |
| 4.2 | Design capacity development activities for technical staff | 1. Training activities and recruitments needed for technical staff in  a) Instrument and station maintenance at site;  b) Calibration and maintenance at the workshop;  c) Network monitoring; and  d) ICT system operations | *[Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology](https://library.wmo.int/index.php?lvl=notice_display&id=10770)* (WMO–No. 1083) |
| 4.3 | Design capacity development activities for senior management | 1. Training activities and recruitments needed for management in:  a) Strategic and financial planning; and  b) Project management | *[Guidelines for Applying for a WMO Fellowship](https://library.wmo.int/index.php?lvl=notice_display&id=15227)* (WMO‑No. 1104)  *[A Compendium of Topics to Support Management Development in National Meteorological and Hydrological Services](https://library.wmo.int/index.php?lvl=notice_display&id=20744)* (ETR‑No. 24) |

**Module 5. Risk Management**

Proactive risk management activity consists of trying to anticipate deviations from the Plan and implementing mitigation actions so that the objectives are reached despite the risks. Risks materialized may prevent the infrastructure from satisfying the specified requirements, the successful implementation and the sustainability of operations of the modernized observation infrastructure.

The NMHS should assess the most relevant and expected operational risks for the implementation of the Plan and define mitigation measures. For this, the risk and control matrix should include the following:

 Identified risks and their effects

 Risk category

 Likelihood and impact scoring with total impact

 Mitigation action

 Responsibility

**Table 5. Activities and outputs to be undertaken and delivered for Module 5**

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity item** | **Activity** | **Outputs** | **Relevant guidance material** |
|
| 5.1 | Assess the operational risks for the implementation of the Plan and define mitigation measures | 1. Identify risks and control matrix to manage risks and proposed mitigation activities, including  a) Identification of operational risks  b) Analysis of risks  c) Actions for mitigating the risks  d) d. Monitor and evaluate risks following implementation of mitigation actions | *[Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers](https://library.wmo.int/index.php?lvl=notice_display&id=15574)* (WMO-No. 1100) |

**4.5 GBON HIGH DENSITY NETWORK REQUIREMENTS**

GBON high density requirements are defined where Members operate networks of surface land observing networks/platforms at horizontal resolutions of 100 km or higher, and networks of upper-air stations/platforms providing horizontal resolutions of 200 km or higher. According to GBON provisions 3.2.2.8 and 3.2.2.13 Members should operate their networks at such density. At the same time, provisions 3.2.2.9 and 3.2.2.16 respectively, state that they shall make such data available internationally through WIS all GBON observations in real time or near‑real time according to the overall WMO data policy.

Accordingly, for surface land observing networks, GBON compliance monitoring will be performed against both 200 km standard density and 100 km high density requirement, providing two distinct targets regardless of if Members are operating their networks in the standard or high density configuration.

Similarly, for upper-air networks, the GBON compliance monitoring will be performed against both 500km standard density and 200km high density requirement.

Members will decide on the selection of GBON stations according to their national plans and aspirations (SOFF will initially focus on bringing a broad group of beneficiary countries up to standard density compliance, before moving to high horizontal density where applicable).

GBON compliance reports will then show which countries are operating their surface land and upper-air networks at high density and which country are operating them at standard density configuration.

**4.6 NATIONAL IMPLEMENTATION (DELIVERABLE 7.1)**

Guidance material is provided in the *[Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026)* (WMO‑No. 1165), Chapter 6.

**4.7 NATIONAL DATA PARTNERSHIP (DELIVERABLE 7.1)**

Guidance material is provided in the *[Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026)* (WMO‑No. 1165), Chapter 7.

#### Annex 1: Template for GBON National Gap Analysis Report

**GBON Gap Analysis Report**

**[Country Name]**

**1. GBON horizontal resolution requirements**

Please analyse the GBON horizontal resolution requirements based on the Global Gap Analysis results performed by the WMO Secretariat and adjust these default numbers as per the country-specific geographical characteristics, as necessary. The gap improve, new and total can be taken as default and confirmed in step 3.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GBON HORIZONTAL RESOLUTION REQUIREMENTS | GBON TARGET | REPORTING | GAP IMPROVE | GAP NEW | GAP TOTAL |
| SURFACE STATIONS   STANDARD DENSITY, 200km |  |  |  |  |  |
| SURFACE STATIONS   HIGH DENSITY, 100km |  |  |  |  |  |
| UPPER-AIR STATIONS   OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |  |
| MARINE STATIONS   500km |  |  |  |  |  |

**2. Analysis of existing GBON stations and their status against GBON requirements**

Please fill in the number of existing stations according to the elements described in the guidance and present a map of existing stations with colour coding according to the station type and ownership.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GBON  REQUIREMENTS | Existing observation stations (# of stations) | | | |
| NMHS network | | third party network | |
| Reporting | Improve | Reporting | Improve |
| SURFACE STATIONS   STANDARD DENSITY, 200km |  |  |  |  |
| SURFACE STATIONS   HIGH DENSITY, 100km |  |  |  |  |
| UPPER-AIR STATIONS   OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |
| MARINE STATIONS   500km |  |  |  |  |

*\*\*\* Placeholder for maps of existing surface and upper-air networks \*\*\**

Please fill in the station information of operational stations: name, its type, ownership, variables measured, and the number of observations reported per day. Please add rows as needed.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| STATION NAME | STATION TYPE (S/UA/M) | OWNER (NMHS/ 3RD PARTY) | GBON VARIABLE MEASURED | | | | | | REPORTING CYCLE | GBON COMPLIANT (Y/N) |
| AP | T | H | W | P | SD |
|  |  |  |  |  |  |  |  |  |  |  |
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**3. Results of the GBON Gap Analysis**

Please fill in the results from steps 1 and 2 and the outcome of stations needed to install or rehabilitate and provide a map of existing stations with the location of gaps indicated in circles of 200km (surface) and 500km (upper-air) radius.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GBON REQUIREMENTS | GBON TARGET | COMPLIANT STATIONS WITH GBON | STATIONS NEEDED AGAINST GBON REQUIREMENT | |
| NEW | IMPROVED |
| SURFACE STATIONS  STANDARD DENSITY, 200km |  |  |  |  |
| SURFACE STATIONS  HIGH DENSITY, 100km |  |  |  |  |
| UPPER-AIR STATIONS  OVER LAND 500km, OVER MARINE 1000km |  |  |  |  |
| MARINE STATIONS  500km |  |  |  |  |

*\*\*\* Placeholder for maps of existing surface and upper-air networks and gaps \*\*\**

Please list surface, upper-air and marine stations which are compliant with the GBON regulations and recommended to designate to GBON.

|  |  |
| --- | --- |
| STATION NAME | STATION TYPE (S/UA/M) |
|
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

#### Annex 2: Template for the GBON National Contribution Plan Report

**GBON National Contribution Plan**

**[Country Name]**

Please summarize the outputs of the Plan by each module and provide technical details for each activity in the form of annexes.

**Module 1. National Target toward GBON compliance**

|  |  |  |
| --- | --- | --- |
| **Requirements** | **National target toward GBON compliance and timeline** | **Long-term target toward full GBON compliance and timeline** |
| **Horizontal resolution** |  |  |
| Surface-based | # of stations by XX | # of stations by XX |
| Upper-air | # of stations by XX | # of stations by XX |
| Marine | # of stations by XX | # of stations by XX |
| **Reporting cycle** |  |  |
| Surface-based | % of monthly reports exchanged | % of monthly reports exchanged by XX |
| Upper-air | % of monthly reports exchanged | % of monthly reports exchanged h by XX |
| Marine | % of monthly reports exchanged | % of monthly reports exchanged by XX |

**Modules 2–5 Outputs**

|  |  |
| --- | --- |
| **Activities per Output** | **Technical Details** |
| **Module 2. Institutional capacity development** | Annex xx |
|  | Annex xx |
|  | Annex xx |
|  | … |
|  |  |
|  |  |
| **Module 3. Infrastructure development** |  |
|  |  |
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| **Module 4. Human capacity development** |  |
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|  |  |
| **Module 5. Operational risks management** |  |
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5. REGULATIONS FOR REPORTING GBON PARAMETERS

5.1 REPORTING OF HOURLY OBSERVATIONS (DELIVERABLE 8.1)

In accordance with the [Manual on the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=19223) (WMO‑No. 1160), section 3.2.2, a GBON-Surface-Land observing station and upper-air stations shall observe a minimum number of required variables. Reporting practices for these GBON required variables are specified in the Manual on Codes (WMO‑No. 306), Volume [I.2](https://library.wmo.int/index.php?lvl=notice_display&id=10684), Part D Regulations for reporting GBON parameters *(new one)*.

5.2 ADDITIONAL WIS GUIDANCE

In accordance with Resolution ##/1 (EC-76) - WIS 2.0 Implementation Plan, Members are requested to exchange GBON observations through GTS and WIS until WIS 2.0 becomes operational in 2024. Parallel dissemination of data through GTS and WIS 2.0 is recommended from the start of the pilot phase in 2023.

Members are requested to exchange GBON observations through GTS and WIS in accordance with the [Manual on the Global Telecommunication System](https://library.wmo.int/index.php?lvl=notice_display&id=21811) (WMO-No. 386), the *[Manual on the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=9254)* (WMO-No. 1060), Volume I.

Further details are provided in the *[Guide to the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=6856)* (WMO-No. 1061).

Exchange of GBON observations through WIS 2.0 will be regulated by the *[Manual on the WMO Information System](https://library.wmo.int/index.php?lvl=notice_display&id=9254)* (WMO-No. 1060), Volume II.

6. RECORDING OF WIGOS METADATA IN OSCAR/SURFACE IMPLEMENTATION

6.1 OSCAR GUIDANCE FOR GBON (DELIVERABLE 4.2)

*Editorial note: To be submitted to TT-GBON-8 in November 2022.*

6.2 PROCEDURE FOR IDENTIFYING A GIVEN STATION AS A GBON CONTRIBUTOR AND LINKING TO WDQMS FOR ACCURATE MONITORING AND REPORTING (DELIVERABLE 4.1)

GBON stations will be identified in [OSCAR/Surface](https://oscar.wmo.int/surface/) by linking a station with the GBON programme/network affiliation. GBON stations will be displayed in [OSCAR/Surface](https://oscar.wmo.int/surface/) once saved in the system, but their status will be displayed as “pending approval” in the station details until endorsement of the station by the GBON governance.

[WDQMS](https://wdqms.wmo.int/) will identify the list of GBON stations by using the [OSCAR/Surface](https://oscar.wmo.int/surface/) REST API".

7. WDQMS PERFORMANCE MONITORING

7.1 ROLES AND RESPONSIBILITIES OF MEMBERS WITH REGARD TO WIGOS/OSCAR/WDQMS NFPS, RWCS ETC.

*Details are provided in section 4.1 ROLES AND RESPONSIBILITIES*

7.2 CONTRIBUTION OF NWP CENTRES (DELIVERABLE 5.1)

Guidance material is provided in the *[Guide to the WMO Integrated Global Observing System](https://library.wmo.int/index.php?lvl=notice_display&id=20026)* (WMO‑No. 1165), Chapter 9.

7.3 WDQMS USERS GUIDE FOR GBON (DELIVERABLE 5.2)

The GBON module of WDQMS provides Members timely feedback about the station level performance in relation to the GBON provisions. The system is based on the GBON compliance criteria adopted by TT-GBON. The GBON module of WDQMS also provides the quantitative data which contributes to the Member level GBON compliance monitoring.

More information about the GBON module of WDQMS can be found in the [WDQMS Online user guide](https://confluence.ecmwf.int/display/WIGOSWT" \t "_blank).

7.4 UPDATE TO EXISTING TECHNICAL GUIDANCE FOR RWCS (QUALITY MONITORING, EVALUATION AND INCIDENT MANAGEMENT) (DELIVERABLE 5.5)

8. *RESERVED*

*To be used if needed* *…*

1. To predict the weather, modern meteorology depends upon the near-instantaneous exchange of weather information across the entire globe. Established in 1963, the World Weather Watch – the core of the WMO Programmes – combines observing systems, telecommunications facilities, and data-processing and forecasting centres operated by Members to make available the meteorological and related environmental information needed to provide efficient services in all countries. [↑](#footnote-ref-1)
2. High density requirement is mandatory for data exchange where capability exists [↑](#footnote-ref-2)
3. Requirement is mandatory for data exchange where capability exists [↑](#footnote-ref-3)
4. Monthly aggregation of observed variables from SYNOP reports from WDQMS [↑](#footnote-ref-4)
5. Monthly aggregation of reports that missed time cut-off from NWP centres/WIS [↑](#footnote-ref-5)
6. Monthly aggregation of rejected reports from NWP centres, could also be gross errors or outside of OB-FG threshold [↑](#footnote-ref-6)
7. WDQMS monitoring of Precipitation and Snow Depth is not currently available. If there is no precipitation or snow measured over the time period this should still be reported as zero. [↑](#footnote-ref-7)
8. Monthly aggregation of observed variables from reports from WDQMS or OCEANOPS? [↑](#footnote-ref-8)
9. Monthly aggregation of reports that missed time cut-off from NWP centres/WIS or OCEANOPS? [↑](#footnote-ref-9)
10. Monthly aggregation of rejected reports from NWP centres/OCEANOPS, could also be gross errors or outside of OB-FG threshold [↑](#footnote-ref-10)
11. Monthly aggregation of observed variables from reports from WDQMS [↑](#footnote-ref-11)
12. High Resolution data (BUFR) being received confirmed by NWP centre [↑](#footnote-ref-12)
13. Monthly aggregation of reports that missed time cut-off from NWP centres/WIS [↑](#footnote-ref-13)
14. Monthly aggregation of rejected reports from NWP centres, could also be gross errors or outside of OB-FG threshold [↑](#footnote-ref-14)
15. Monthly aggregation of observed variables from SYNOP reports from WDQMS, received by at least two of the NWP centres monitored by WDQMS [↑](#footnote-ref-15)
16. If a station is manually operated but is not operational 24 hours, this number can be reduced to the operational hours (hourly reporting i.e. 0800 – 1700 = 10 reports) as recorded in OSCAR/Surface. This needs to be registered as an exception to GBON regulations [↑](#footnote-ref-16)
17. Monthly aggregation of observed variables from TEMP reports from WDQMS, received by at least two of the NWP centres monitored by WDQMS [↑](#footnote-ref-17)
18. If a radiosonde station is only able to undertake one sounding per day, this number can be reduced to the scheduled as recorded in OSCAR/Surface. This needs to be registered as an exception to GBON regulations [↑](#footnote-ref-18)