The gaps in the Global Basic Observing Network (GBON)

SYSTEMATIC OBSERVATIONS FINANCING FACILITY

Weather and climate information for the global public good

SOFF
Systematic Observations Financing Facility

INFORMATION BRIEF

KEY TAKEAWAYS

1. In the context of increasing extreme weather events and a climate crisis, reliable, real-time access to observational data is critical for high quality weather forecasts and climate analyses.

2. GBON sets out an obligation and clear requirements for all WMO Members to acquire and internationally exchange the most essential surface-based observational data at a minimum level of spatial resolution and time interval. GBON is a landmark agreement and offers a new approach in which the basic surface-based observing network is designed, defined and monitored at the global level.

3. Whilst some regions provide a good and robust supply of surface-based observations, some areas of the world, notably Small Island Developing States (SIDS) and Least Developed Countries (LDCs) significantly lack the infrastructure and capacity to meet GBON requirements. This adversely impacts the accuracy of weather and climate products, both locally and in areas far from the missing data.

4. The GBON gap in SIDS and LDCs is substantial. In order to achieve the GBON target of about 2300 observation stations (surface and upper air stations) in these countries, about 2000 stations need to be rehabilitated or newly installed.

5. The GBON gap in some regions is becoming larger. The global GBON gap analysis was undertaken as of January 2020. It does not consider the potential additional deterioration due to the COVID-19 crisis.

6. Closing the GBON gap in SIDS and LDCs will result in more than a twelfth-fold increase in the number of surface-based observations generated and internationally exchanged.

7. Closing the GBON gap is highly economically efficient. According to the World Bank, for every dollar invested at least twenty-six dollars in socio-economic return could be realized.

8. Closing the gap requires a new way of financing. The Systematic Observations Financing Facility (SOFF) is being established to provide technical and financial assistance in new – more effective - ways. Based on the GBON gap analysis, the total estimated funding needed to support SIDS and LDCs in closing the GBON gap for the SOFF initial 5-year implementation period corresponds to USD 400 Million.

INTRODUCING THE SYSTEMATIC OBSERVATIONS FINANCING FACILITY

The Systematic Observations Financing Facility (SOFF) will support countries to generate and exchange basic observational data critical for improved weather forecasts and climate services. It will provide technical and financial assistance in new ways – applying internationally agreed metrics - the requirements of the Global Basic Observing Network (GBON) - to guide investments, using data exchange as a measure of success, and creating local benefits while delivering on a global public good. The SOFF will contribute to strengthen climate adaptation and resilience across the globe, benefitting in particular the most vulnerable.

The creation of the SOFF is spearheaded by the World Meteorological Organization in collaboration with a wide range of international organizations, including the members of the Alliance for Hydromet Development. The Alliance unites efforts of major development and climate finance partners to close the capacity gap on high-quality weather forecasts, early warning systems and climate information.

INTRODUCTION

Global Numerical Weather Prediction (NWP) and climate reanalysis play essential roles as they form the backbone for all weather and climate information products and services. These are essential in saving lives, protecting property, and fostering climate adaptation and resilience. This is only made possible by continued access to a wealth of real-time environmental observations from the entire globe.

Satellites provide global coverage and can measure parameters for both the atmosphere and the surface, making a substantial contribution to our ability to create forecasts. However, global NWP systems have a critical reliance on surface-based observations for certain key parameters that cannot yet be reliably measured from space. Surface-based observations are essential over land, over snow and ice surfaces, and they are critical to maximizing the benefits of increasingly available satellite data, including for validating global climate records from satellite observations.

Whilst some parts of the globe can provide a reliable feed of surface-based observational data, many areas have a limited availability of such data, and in several instances are worsening. For example, the situation in Africa shows a dramatic decrease of almost 50% from 2015 to 2020 in the number of radiosonde flights, the most important type of surface-based observations. Reporting now has poorer geographical coverage.

The inconsistency across the globe is striking, in both the network density and volume of observations that are exchanged internationally. Large data voids significantly limit the quality of weather and climate information. As these are used for informing decisions to address the impact of severe weather events and managing risks for effective climate adaptation and resilience, these decisions are impacted too.

What is Numerical Weather Prediction?

Numerical weather prediction (NWP) refers to the practice of predicting the future state of the atmosphere from the present state, using computer-encoded versions of the predictive equations of atmospheric behavior. The present state is calculated from a comprehensive set of observational data from the entire global domain. The word "weather" refers to the origin of NWP as a tool for medium range prediction. The technique has since been universally adopted also for monitoring and understanding how climate has changed in the past, and how it may be evolving in the future.

WHAT IS GBON?

In 2019, the World Meteorological Congress and its 193 member countries and territories agreed to establish the Global Basic Observing Network (GBON). GBON sets out an obligation and clear requirements for all WMO Members to acquire and internationally exchange the most essential surface-based observational data at a minimum resolution and timeframe level. GBON is a landmark agreement and offers a new approach in which the basic surface-based observing network is designed, defined and monitored at the global level. Reliable, real-time access to observational data is critical to the quality of weather forecasts and climate analysis. Global numerical weather prediction (NWP) is the basis on which all weather and climate services are built, and it requires a constant supply of observations from around the world.

Achieving sustained compliance with the GBON requirements needs substantial investments and strengthened capacity in many countries. The Systematic Observations Financing Facility (SOFF) is being established to provide technical and financial assistance in new – more effective - ways.

Closing the GBON gap is highly economically efficient. According to the World Bank, for every dollar invested, at least twenty-six dollars in socio-economic return could be realized (see 'The value of Surface-Based Meteorological Observation Data: Costs and benefits for the Global Basic Observing Network' information brief for more detail).

The detailed GBON technical requirements will be submitted to the World Meteorological Congress for its approval in 2021.

What is WDQMS?

WDQMS - WMO Integrated Global Observing System Data Quality Monitoring System

The WDQMS webtool is a resource developed by WMO, and hosted by ECMWF, to monitor the actual routine delivery of data into WMO's international data exchange system. The current operational version of the webtool monitors the availability and quality of observational data based on near-real-time monitoring information from the four participating global Numerical Weather Prediction (NWP) centres: the German Weather Service (DWD), the European Centre for Medium range Weather Forecasts (ECMWF), the Japan Meteorological Agency (JMA) and the United States National Centers for Environmental Prediction (NCEP).

This system was used to calculate the GBON gap. Due to the recent decline in the amount of observational data caused by the COVID-19, the average availability of data over the month of January 2020 was used as a measure of whether a given station was reporting data internationally.

The WDQMS will be the monitoring system used by WMO as the SOFF technical authority to monitor GBON compliance for the results-based finance support provided to beneficiary countries.

Access the tool here: https://wdqms.wmo.int/nwp/synop/six_hour/availability/pressure/all/2020-08-19/18

 Surface land-based observations	For surface-based land observations, weather stations are used. These are typically Automated Weather Stations that measure basic surface variables such as atmospheric pressure, temperature and humidity, and where applicable snow cover.	Members must operate surface land observing stations measuring atmospheric pressure, air temperature, humidity, horizontal wind, precipitation and snow depth, at a horizontal resolution of 200km or better, and data must be reported hourly. Members with networks operating at higher horizontal resolution must report their observations either at the full resolution of the network or at a minimum resolution of 100km, whichever is larger.
 Upper-air land-based observations	For upper-air land-based observations, weather balloons are used. These are typically, but not exclusively, radiosonde stations that provide profiles of atmospheric temperature and humidity along with wind speed and direction, ranging from the surface up to an altitude of about 30 km, at a required minimum resolution and time-frame.	Members must operate a set of upper-air stations over land that observe temperature, humidity and horizontal wind profiles, with a vertical resolution of 100m or higher, twice a day or better, up to a level of 30hPa or higher, with a horizontal resolution of 500km or better.

Figure 1 GBON draft tecnical requirements* and types of observations

*to be submitted to the World Meteorological Congress in 2021 for its approval.

MEASURING THE GBON GLOBAL GAP

In 2020, WMO undertook a GBON gap analysis for each of its 193 Members, based on draft GBON provisions. This gap analysis provides a quantitative estimate of the number of surface-based observing stations of the two main types (surface and upper air stations) that will need to be installed, rehabilitated or upgraded, and exchange data in order to meet the GBON requirements.

The GBON gap is defined based on the calculation of three variables:

- First, required number of stations (surface and upper air stations) in order to meet GBON requirements – "GBON national contribution";[1]
- Second, number of stations that are currently operating and reporting data internationally according to GBON expected requirements (See box on WDQMS);
- Third, based on the numbers above, how many stations of each type (surface and upper air stations) need to be rehabilitated or newly installed in order to meet the "GBON national contribution".

Who are the members of the Alliance for Hydromet Development?

The members of the Alliance for Hydromet Development include 12 founding partners: Adaptation Fund, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Global Environment Facility, Green Climate Fund, Islamic Development Bank, United Nations Development Programme, United Nations Environment Programme, World Bank, World Food Programme, World Meteorological Organization. The Climate Investment Funds joined the Alliance in October 2020.
See here more information.

THE GLOBAL GBON GAP

Figures 2 and 3 below show the percentage of GBON compliance for all areas of the globe. Blue shades indicate areas that meet or exceed GBON requirements. Red shades indicate GBON gaps, areas that do not meet the GBON requirements.

The figures show that in particular Small Island Development States (SIDS) and Least Developed Countries (LDCs) are currently far from meeting the GBON requirements. This is largely due to a lack of infrastructure and capacity.

Surface Reporting Horizontal Resolution by Country

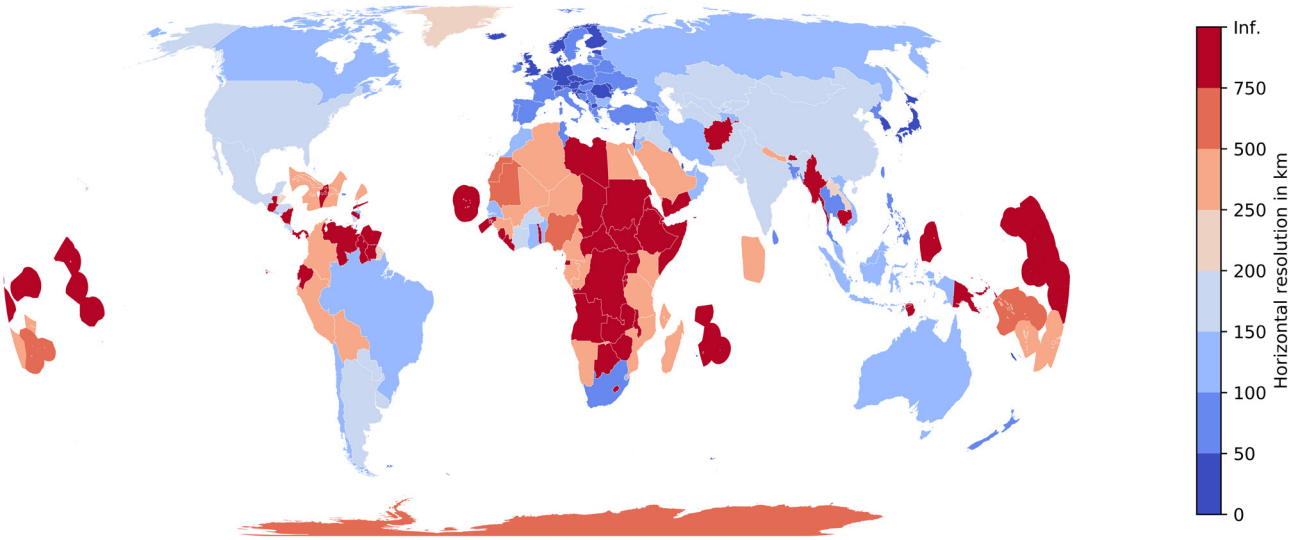

Figure 2 This map shows the horizontal resolution of surface observations in different countries based on stations actively reporting in January 2020. *Source: WMO Secretariat.*

Upper Air Reporting Horizontal Resolution by Country

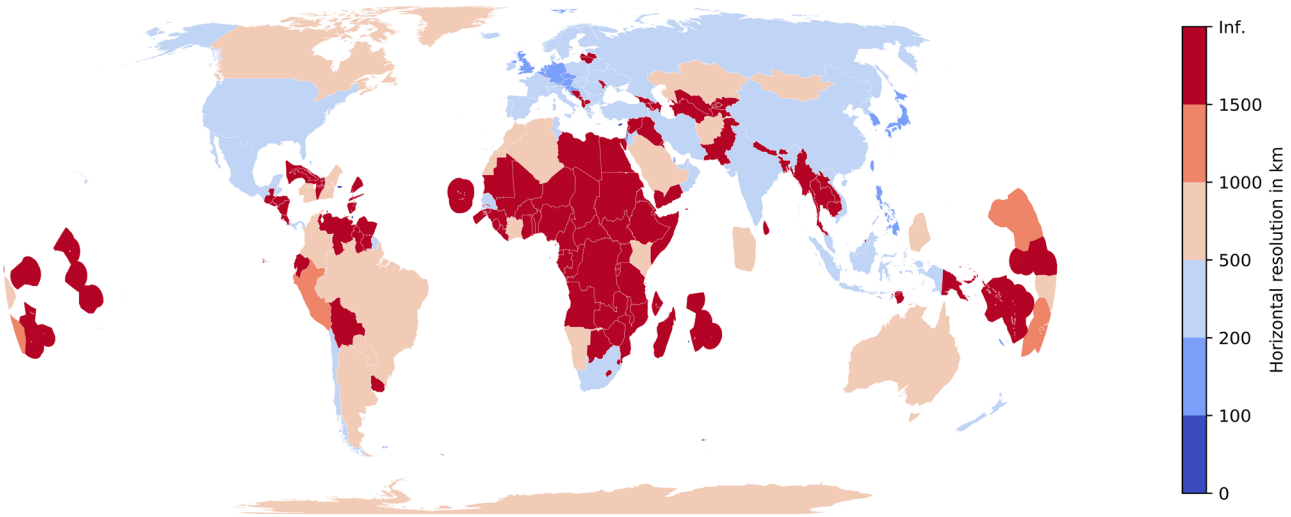

Figure 3 This map shows the horizontal resolution of upper air observations in different countries based on stations actively reporting in January 2020. *Source: WMO Secretariat.*

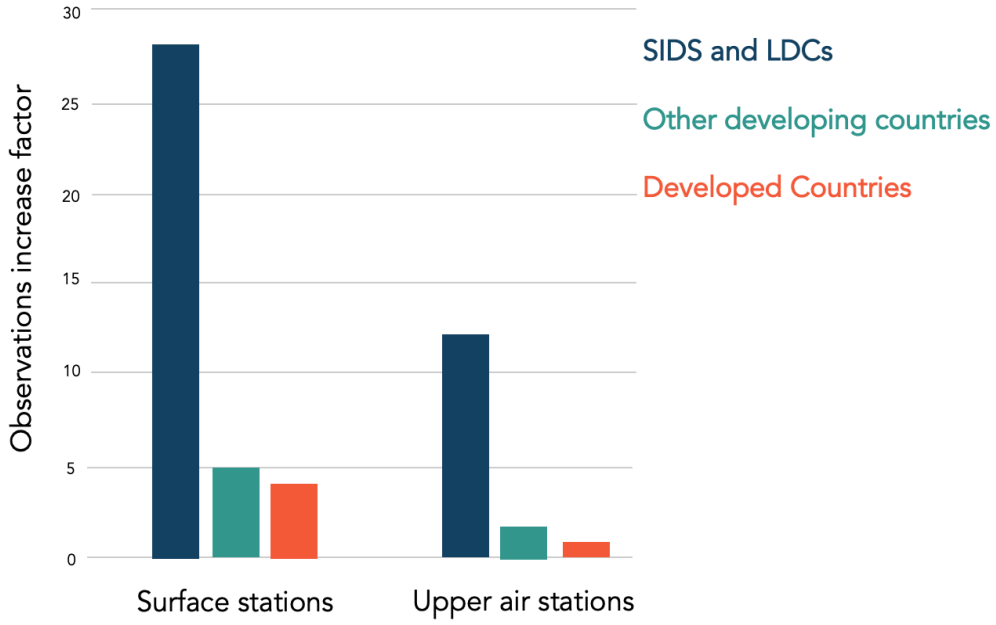

Figure 4 A graph showing the expected relative increase in observations (surface and upper air). SIDS and LDCs require by far the largest increase in shared observation to achieve the GBON target.

GBON GAP IN SIDS AND LDCS

In order to close the GBON gap and meet the GBON requirements in SIDS and LDCs, about 2000 new and/or rehabilitated stations (surface and upper air stations) need to become operational and exchange data. This will allow SIDS and LDCs to achieve the full GBON target of about 2300 stations exchanging observations.

Closing the GBON gap in SIDS and LDCs will lead to a more than 20 fold increase of exchanged observations from surface stations and more than a 10 fold increase of exchanged observations from upper air stations.

CLOSING THE GBON GAP = THE NEED FOR SOFF

The Systematic Observations Financing Facility (SOFF) will support beneficiary countries to acquire and exchange basic observational data critical for improved weather forecasts and climate services. It will provide technical and financial assistance in new ways – applying internationally agreed metrics to guide investments - GBON, using data exchange as a measure of success, and creating local benefits while delivering on a global public good (see 'A new way of financing basic observations: How will SOFF work' information brief for more detail). SOFF will contribute to strengthen climate adaptation and resilience across the globe, benefitting the most vulnerable in paticular.

Based on the GBON gap analysis, the total estimated funding needed to support SIDS and LDCs for the initial SOFF 5-year implementation period corresponds to USD 400 Million. This is less than what is currently invested in observations by the members of the Alliance for Hydromet Development, yet it would support at least a 10-fold increase of observations from SIDS and LDCs – see figure 4 above.

The creation of the SOFF is spearheaded by the World Meteorological Organization in collaboration with a wide range of international organizations, including the members of the Alliance for Hydromet Development. The Alliance members are committed to seeking innovative ways to finance developing country surface-based observations, aimed at the creation of the Systematic Observations Financing Facility.

Endnotes

1 GBON requirements used for the calculation of the GBON gap were based on draft GBON provisions per 22 September 2020.

SPECIAL THANKS TO:

This information brief has been produced by the **World Meteorological Organization** in collaboration with Acclimatise. It is based on the work of the SOFF Working Groups established in February 2020 with members from: **Adaptation Fund, African Development Bank, African Risk Capacity, Asian Development Bank, Austrian Central Agency for Meteorology and Geodynamics, Climate Investment Funds, Climate Policy Initiative, Climate Risk and Early Warning Systems Initiative, Coalition for Climate Resilient Investment, Deutsche Gesellschaft für Internationale Zusammenarbeit, Deutscher Wetterdienst, Direction de la Météorologie Nationale de la SODEXAM Côte d'Ivoire, European Bank for Reconstruction and Development, European Centre for Medium-Range Weather Forecasts, Global Environment Facility, Green Climate Fund, Inter-American Development Bank, Insurance Development Forum, InsuResilience Investment Fund, Islamic Development Bank, Lloyds of London, Munich Climate Insurance Initiative, Oasis Loss Modelling Framework, Switzerland Federal Office for the Environment, UK Met Office, United Nations Development Programme, United Nations Environment Programme, Willis Towers Watson, World Bank, World Food Programme** and **World Meteorological Organization**.

FURTHER RESOURCES:

SOFF
Follow link here.

Alliance for Hydromet Development
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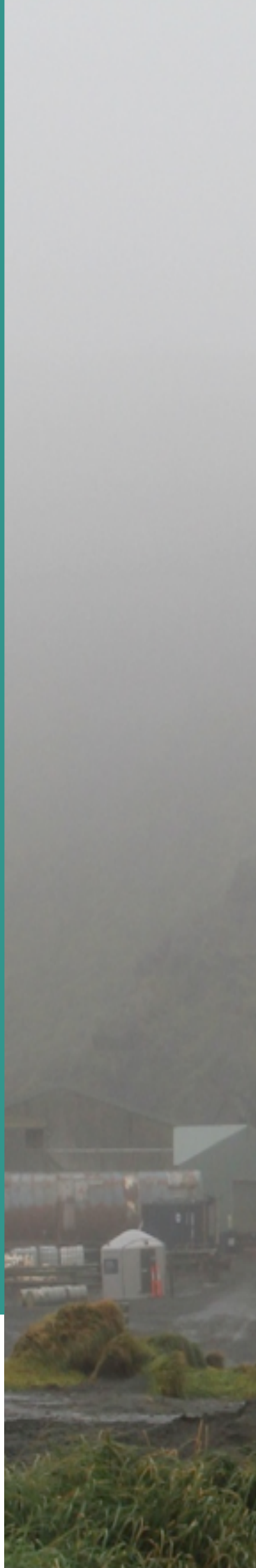

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