20 December, 2023

GBON National Gap Analysis

Cabo Verde

Systematic Observation Financing Facility

Weather and climate data for resilience

WEATHER CLIMATE WATER

Screening of the National Gap Analysis (NGA) of Cabo Verde

WMO Technical Authority screens the GBON National Gap Analysis to ensure consistency with the GBON regulations and provides feedback for revisions as needed. *The screening of the NGA is conducted according to the SOFF Operational Guidance Handbook, version: 04.07.2023 and the provisions in Decision 5.7 of the SOFF Steering Committee.*

Following iterations with the peer advisor and beneficiary country, WMO Technical Authority confirms that the National Gap Analysis is consistent with GBON regulations.

Date: 31st January 2024

Signature:

Albert Fischer

Director, WIGOS Branch, Infrastructure Department, WMO

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GBON National Gap Analysis

Cabo Verde

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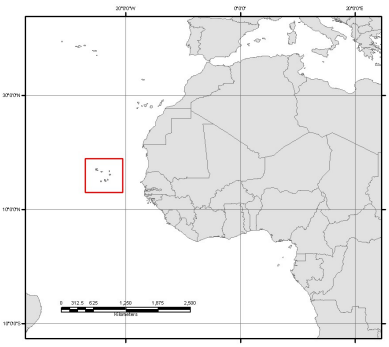
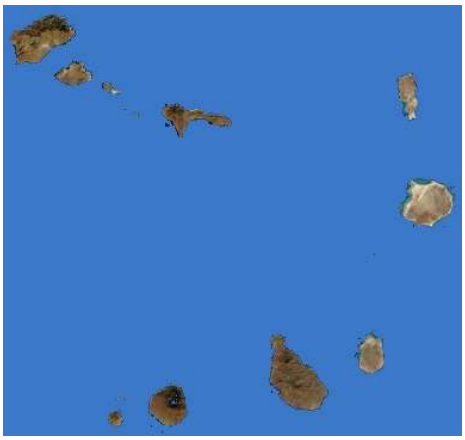
WMO Technical Authority	WMO

Country: short info



Location: Central East Atlantic; Lat 14.5-17.5 N - Long 22.5-26.5 W
Land area: Archipelago with 9 inhabited islands: 4,033. km^2
Land & Exclusive Economic Zone ocean area: 808,802. km^2
Geology/topo: volcanic, mountainous: Max.elev.: Fogo, 2,830.m.a.s.l.
Population #: ~598,683 (2023)[1].
Climate: semiarid. Köppen-Geiger Bwh classification.
Seasons: Dry: ~9-m (Nov - July); Wet: ~3-m (Aug – Oct)
Mean annual air temperatures[2] (Praia): avg 24.0C, min 20.5C, max 28.5C.
Mean annual rainfall: <200 mm/yr in coastal areas =>500 mm/yr at higher elevations.



As a Small Island Development State (SIDS), Cabo Verde faces particular challenges with respect to climate and management of natural resources[3] [4]. As most Western part of the Sahel region, Cabo Verde is particularly vulnerable to extreme weather and climate phenomena i.e., rainfall variations, presenting an enormous challenge for water & food security. Recurring droughts are an entire part of its climate and socio-economic history. During the Atlantic hurricane season (Aug-Oct) however, severe weather, next to supplying rainfall and replenishing water resources, creates high hazards to natural resources, infrastructure and populations.

Despite its insignificant contribution for global warming, Cabo Verde is suffering heavily from its consequences, and is paying an overly expensive bill for climate change. Cabo Verde therefore needs strong partnerships and sustainable interventions with clear impact on strengthening the country's institutional capacities. The hydrometeorological sector overseeing weather and climate observations and data plays a crucial role in service provision to the local society and the global community.

[1] Source: UN World Population Prospects https://population.un.org/wpp/
[2] CRU v4.06 global observed climate database from Climate Research Unit, Univ.of East Anglia, UK
[3] https://www.un.org/ohrlls/content/about-small-island-developing-states. UN Office of the High Representative for LDC and Small Island Development States - SIDS. (web portal visited June, 2023)
[4] [2] https://www.worldbank.org/en/country/caboverde. The World Bank in Cape Verde. (web portal visited June, 2023)

Preface

As of 1 January 2023, the extraordinary session of the World Meteorological Congress (Cg-Ext 2021) approved Resolution 2 Modifying the Technical Regulations relating to the establishment of the Global Basic Observing Network (GBON). The regulation puts an obligation on all Members to acquire and exchange the most essential surface observation data at a minimum level of spatial resolution and time interval internationally. Once implemented, GBON improves the availability of the most essential surface data, which has a direct positive impact on the quality of global and regional weather forecasts. To implement GBON at the national level, a country GBON National Gap Analysis was conducted to identify and understand existing gaps in the required observational network and create a national plan to close these gaps.

Summary of GBON regulations

The GBON regulations published in the WIGOS Manual (WMO-No. 1160), Annex VIII of the WMO Technical Regulations, 2019 edition, section 3.2.2, describes in clear terms the spatial and temporal resolution of surface weather stations. The inset below shows the spatial resolution requirement of surface and upper air stations in members' territories.

Summary of GBON requirements for surface and upper air stations

	HORIZONTAL RESOLUTION	VERTICAL RESOLUTION	OBSERVATIONS CYCLE	VARIABLES	EXCHANGE REQUIREMENT
SURFACE STATIONS	200 KM	-	1h	Atmospheric pressure, temperature, humidity, wind, precipitation, snow depth	Exchanged in real time through WIS2.0
UPPER AIR STATIONS OPERATED FROM LAND	500 KM	100-m up to 30 hpa	Twice a day	temperature, humidity and wind,	Exchanged in real time through WIS2.0

The SOFF and GBON process in Cabo Verde

The NMS of Cabo Verde (INMG)[5] experienced an important delay in 2022 in responding to WMO SOFF - GBON and CHD related matters. After a catch-up early 2023 with support of the peer-reviewer KNMI, INMG has been able to proceed fast the last months with the SOFF (Readiness phase) process, after signature of the Readiness phase documents begin 2023.

[5] INMG: Instituto Nacional de Meteorología e Geofysica (Cabo Verde)

1. Country information from the GBON Global Gap Analysis

Within the implementation of the new GBON or Global Basic Observation Network of WMO, the following information in Table 1 was provided by WMO to Cabo Verde (Aug, 2022)[6]. Using the new GBON target coverage and reporting requirements (e.g. 6-variables; hourly report cycle), a initial gap was identified based on the WGDQMS or WMO Global Data Quality Monitoring System screening of Cabo Verde. In view of the new WIGOS, GBON, e.g. WIS2 reporting system requirements, setup by WMO (end 2021), this information is considered realistic.

This GBON Gap Analysis Report suits the purpose to investigate the current reporting status and reply (as country) to this initial GBON country assessment. We use small explanatory footnotes to table references and in text comments below on the WMO Cabo Verde GBON status received.

A. GBON horizontal resolution requirements	B. Target	C. Reporting	D. Gap total	E. Gap improve	F. Gap new
Surface stations Horizontal resolution: 200km	4	0	4	4	0
Upper-air stations Horizontal resolution: 500km	1	0	1	1	0

Table 1. WMO GBON Global Gap Analysis (June, 2023)

1.1 Surface station horizontal resolution requirement

For evaluating the 200-km resolution requirement, we spatially plotted the Cabo Verde land area on a 200 km resolution grid (according GBON requirements) in Figure 1. Figure 1 confirms the 4 station GBON target, but also illustrates the large marine/ocean coverage compared to the land surface. We added the 3 current WMO_ID synoptic GBON registered stations. The EPSG:32672 Coordinate Reference System (CRS) and metric UTM (Universal Transverse Mercator) projection, using UTM Zone 27 North was used for analyzing the 200-km grid requirement.

[6] WMO document Ref. 18876/2022/I/WIGOS/ONM/GBON.

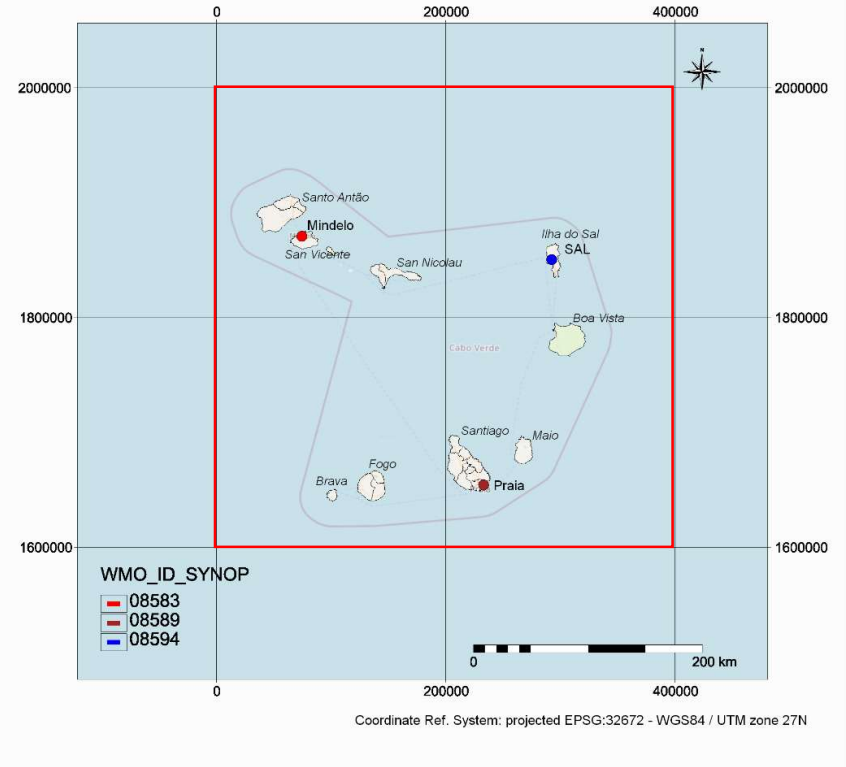


Figure 1: Cabo Verde in a 200-km UTM projected grid resolution (with 3 WMO_ID Synoptic aeronautical stations, registered in WMO-OSCAR).

1.2 The Cabo Verde Exclusive Economic Zone (EEZ)

The WMO also indicated and used the Exclusive Economic Zone (200 nautical miles of coastline) for SIDS (see WMO document Ref. 18876). We therefore also delignated and quick plotted the EEZ of Cabo Verde. We added WMO_ID and ICAO (airport) stations extracted from the GSOD[7] global database. Cabo Verde attains a 808,802. km^2 EEZ, compared to a 4,033. km^2 land area.

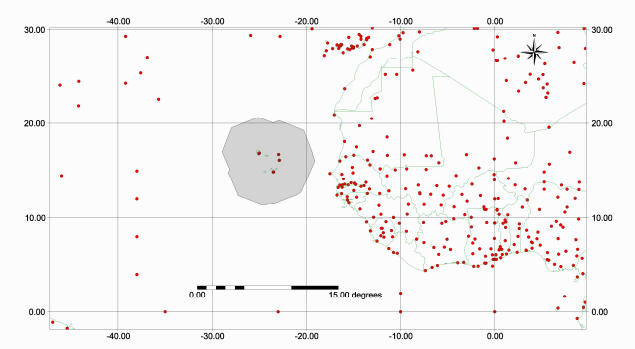


Figure 2: Illustration of the Marine Exclusive Economic Zone of Cabo Verde (ps. 200-miles zone not adjusted to African neighboring EEZ countries: Senegal, Mauritania)

[7] Data retrieved from GSOD - Global Summary of Day database https://www.ncei.noaa.gov/ (ref. WMO Res.41)

1.3 WMO Country Information available on WIGOS: OSCAR, WGDQMS and GBON

Before initiating the Gap analysis, we reviewed (June, 2023) the information available about Cabo Verde in the WMO – WIGOS i.e., OSCAR, WGDQMS and GBON global database systems.

Cabo Verde stations in WMO-OSCAR

Cabo Verde has five (5) stations registered and declared partly operational in the WMO-OSCAR https://oscar.wmo.int/surface/ global observation inventory database. The assessed reporting status is currently for all: "partly operational" based on WMO – OSCAR status check by WMO dated: 2023-06-10. Site accessed: June, 10 2023. Reporting stations (partly according WMO – OSCAR and WDQMS evaluations) are: SAL (Ilha do Sal); HQs NMS service; MINDELO (São Vicente); PRAIA (Santiago). There exists a fourth (METAR/TAF messaging station) i.e. BOA VISTA (Int'l airport) but this is currently not reporting to WMO i.e. listed as non reporting station (ref. WMO – OSCAR and WDQMS). INMG is currently updating it's OSCAR station registrations and metadata, but manpower (focal point) is limited for the purpose, so the process is underway. A third-party station i.e., the GAW-CVAO or Cape Verde Atmospheric Observatory is also listed in OSCAR as fifth item (see separate Annex 1 for more info on CVAO).

Cabo Verde stations in WMO-WGDQMS

In the WMO-WDQMS or Data Quality Monitoring System, on https://wdqms.wmo.int the % available data reports for three (3) SYNOP stations are variable, pending weather variable data (SLP,TMP,RH, W, PCP, etc.) checked. In general an orange score[8] is seen for CV.

Cabo Verde stations in the WMO-GBON Visualization Tool

In May 2023, there was still no Cabo Verde (as country) and GBON stations in the WMO GBON visualization Tool on https://community.wmo.int/en/global-basic-observing-network-gbon-station-visualisation-web-tool . When we compare the GBON stations (from Table 1 WMO inventory Aug, 2022) with the WMO GBON Visualization Tool, checked on 03-Jul-2023, we find 3 synoptic GBON Cabo Verde stations visible. The current reporting status for e.g. the main INMG centre and Sal airport station is orange = >7 reports and < 19 per day. In fact 8 or 4 synoptic observations per day (3-hourly and 6-hourly) are currently communicated to WMO by the three WMO_GBON listed stations for Cabo Verde (see also later).

[8] WMO WDQMS Orange score -> <30% availability..

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

Following the WMO GBON gap analysis inventory requirements, we made an assessment of the GBON existing stations (inventory date: July, 2023) in Tables 2 and 3. We refer to the footnotes and textual comments for explanation on the numbers in Table 2.

GBON Requirements	Existing observation stations (# of stations)			
	NMHS network		Third-party network	
	Reporting	Improve	Reporting	Improve
Surface stations Horizontal resolution: 200km Variables: SLP, T, H, W, P, SD	3	3	0	1
Upper-air stations Horizontal resolution: 500km Vertical resolution: 100m, up to 30 hPa - Variables: T, H, W	0	1	0	0

Table 2. Assessment of existent stations according operational status and network ownership

The INMG's weather observation network is made up of several sub-networks, serving different monitoring purposes i.e., aviation, maritime, agrometeorology, climate and seismic hazard. Figure 3 and Annex (as separate document) gives an inventory of the weather, atmosphere and climate related observation infrastructure in Cabo Verde. Hereunder, we give a succinct description of the main weather observation infrastructure related to the GBON gap analysis.

2.1 Succint overview of Cabo Verde's weather and climate observation infrastructure

Synoptic stations

Currently, three aviation weather observation systems (AWOS) with WMO-IDs (name): 08594 (Sal), 08583 (Mindelo), 08589 (Praia) are classified as Synoptic Aeronautical AWS. They are owned by ASA and operated by INMG. These manned stations operate on a continuous 24/7 basis, with observations made on a hourly basis, serving aeronautical purposes. METAR/TAF hourly messages can be easily traced on aviation weather data gateways and int'l data servers. SYNOP messages are written and transmitted every 3-hour for Sal and every 6-hour for Mindelo and Praia. The AFTN or Automated Fixed Telecommunication Network (ICAO) is used to transmit the messages for aviation - aeronautical purposes and to the WMO GTS system.

Aeronautical stations

There are in total seven (7) AWS, classified as aeronautical stations in Cabo Verde, and operated by INMG. They serve aviation weather purposes for the 4 int'l airports (Amilcar Cabral on Sal Island, São Pedro on San Vicente, Boa Vista (on BV) and Nelson Mandela int'l airport (Praia) on Santiago

Island and three (3) domestic airports on San Nicolau, Maio and Fogo Islands. See Figure 3. They all are ICAO coded. Boa Vista int'l airport station is also WMO coded (WMO_ID: 08593).

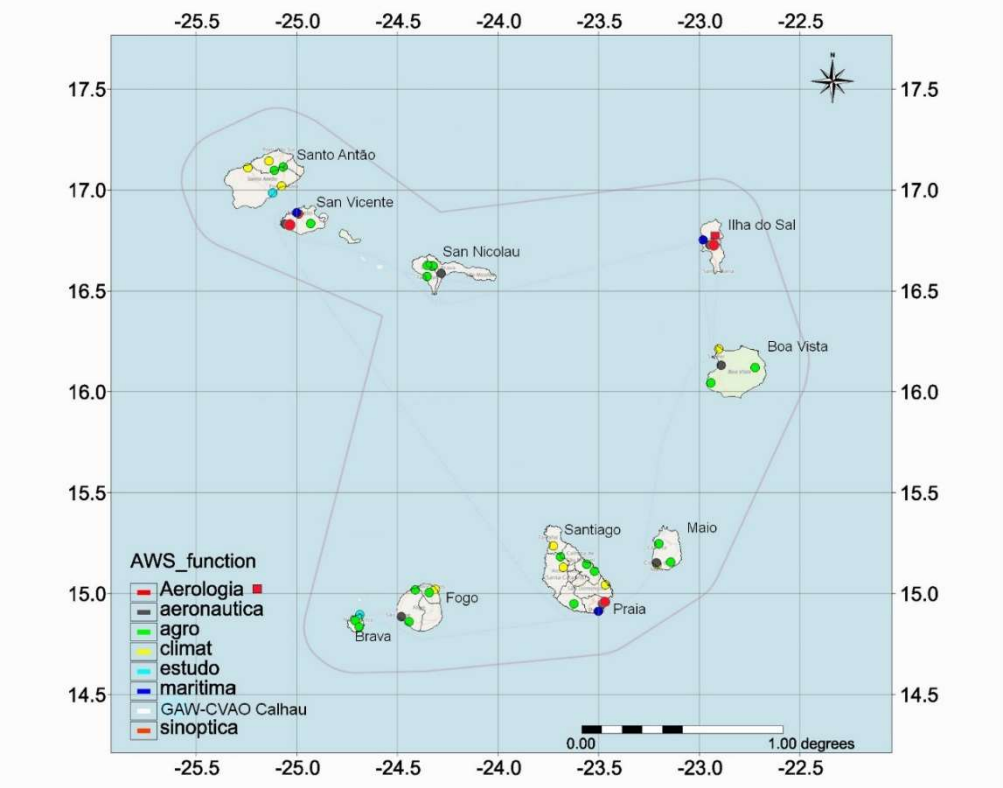


Figure 3: Automatic weather station (AWS) network of Cabo Verde and station functions

Maritime AWS stations network

INMG operates three MARINEMET stations (AWS) operating in the 3 main int'l harbors (Palmeira/Sal, Mindelo/San Vicente and Praia/Santiago). These weather stations (type SUTRON/ Ott Hydrometry / Hach Inc.) are also equipped with a tidal and wave height gauging system MIROS SM-140. NRT data transmission is via GPRS to Sal INMG Headquarters data server.

Agrohydrometeorological stations

INMG operates 18 AWS, dedicated to support weather and climate monitoring for the agricultural, (re)forestation sector of the Ministry of Agriculture & Environment and rural communities. The newer stations (14 AWS of the Reflor project; funding/EU, IE/PNUD,FAO, 2020; Manuf.: Campbell Stokes Inc.) record all six weather variables (incl. direct/diffuse radiation) at 10-min intervals, and include soil temperature and moisture sensors at 3 soil depths. Data are transferred via GPRS to INMG HQs and also managed/accessible via a web-based AmbiDS Data System by INMG.

Climatic AWS stations

INMG operates twelve (12) older (>10-15 years operation) medium-term observation stations across the islands. These stations monitor a variable number of weather parameters (Temperature, Humidity, Precipitation, Wind). Not all stations are equipped with solar Radiation and atmospheric Pressure sensors. We note that a number of the older stations, especially in remote locations are not fully operational anymore a/o defunct, and require servicing or taking out of operation.

Precipitation Gauge Network

Next to it's AWS network, INMG also oversees a large number (~250) of manually-operated raingauges, in order to capture the extremely high local variability in rainfall during the monsoon season (~ 15-July to 15-October). Due to the mountainous nature of several islands, a strong orographic effect of precipitation is noted during precipitation events. Rainfall information is typically used by the agricultural sector and also by the civil protection services (in case of extreme precipitation alerts). These manual raingauges operate usually only in the rainfall season (July-October), except on North Westerly San Antao island, where at higher elevations (> 1,000 m.a.s.l.), low precipitations (Jan-Mar) may be measured related to North Central Atlantic atmospheric weather phenomena. Observers receive a small gratification for their monitoring task from INMG. Data collection, transmission and quality control however remain issues for maintaining this extended local manual raingauge network.

Aerology – Upper Air Station (UAS)

The INMG Head Office at Ilha do Sal (Sal) and close to the airport, has an Upper-Air Sounding facility, in operation since the 1960's, and which was functional until recently (2018). It is currently out of operation, due to equipment age issues e.g. Hydrogen (H_2) production electrolyzer and financial funding of the atmospheric sounding observations. In the past, the Agency for Airports Security and Air Traffic Control (ASA) co-funded the troposphere soundings.

Third-party weather & atmospheric observations

INMG also oversees and co-manages meteo data collection with int'l cooperation partners, and several other observations related to global earth and atmospheric sciences.

Cape Verde Atmospheric Observatory (GAW-CVAO)

A WMO - Global Atmospheric Watch (GAW) Observation facility is operating in Cabo Verde since 2007 on a continuous basis at Calhau, on San Vicente island. This station is the result of a joint int'l cooperation of INMG and international researchers and institutions, Max-Planck-Institute for Biogeochemistry, Jena (MPI-BGC), Leibniz Institute for Tropospheric Research, Leipzig (TROPOS), both from Germany, and the University of York (UoY), acting on behalf of and under contract from the UK National Centre for Atmospheric Science (NCAS). This global environmental air monitoring tower station (GHG, Ozone, dust, aerosols, long range atmospheric contaminant transports (Hg), etc.) is listed in the WMO OSCAR database Cabo Verde. The facility is fully operational (visit 02-July 2023), and serves the int'l global climate change research community.

2.2 Status summary of the existing reporting weather stations

Among the surface weather stations, currently only three (3) operate on a 24/7 manned basis and also issue SYNOP reports. SYNOP data are transmitted via AFTN to the WMO GTS via the Sal airport ASA - INMG operated AFTN Centre. The reporting cycle is a 3-hourly basis for WMO-ID 08594 Sal and a standard SYNOP 6-hourly basis for Mindelo and Praia stations, WMO_IDs: 08583 and 08589. We note that hourly METAR/TAF aviation weather messages are issued from all 3 synoptic stations mentioned.

All other AWS recorded observation data of Cabo Verde are transmitted to the INMG main data server (on Sal Island) using GPRS / GSM transmission protocols. The GAW-CVO in Calhau also directly reports to its int'l research partners.

2.3 Reporting frequency of meteorological variables

In Table 3, the status of the existing stations is analysed in terms of the GBON variables and int'l reporting cycle requirements. The reporting cycle is assessed per station according to the reporting frequency of once per hour for surface and marine stations and twice per day for upper-air stations.

Station name	Station type (S/UA)	Owner NMS/third-party)	Funding source	GBON variable measured ****						Report cycle (hr)	GBON Compliance (Y/N)
				SLP	T	H	W	P	SD		
SAL	surface	ASA*	ASA[9]	x	x	x	x	x	x[10]	3-hr [11]	N
MINDELO	surface	ASA	ASA	x	x	x	x	x	x	6-hr	N
PRAIA	surface	ASA	ASA	x	x	x	x	x	x	6-hr	N
SAL	UpperAir	INMG	INMG	-	x	x	x	-	-	(-)	N

Table 3. Assessment of current GBON stations per station characteristics.

3. Results of the GBON National Gap Analysis

[9] ASA: Agency for Air Traffic Control and Security; "Empresa Nacional de Segurança Aérea" ; the AWOS or aviation weather observation systems are operated and managed by INMG under contract with owner ASA.

[10] Snow Depths (SD) probabilities assessed as near zero (P=99.99%) at near coastal station elevations (~50 m m.a.s.l.) and tropical latitudes 15-17N – longitudes 23-26W of current Cabo Verde GBON stations

[11] Current reporting cycle for SYNOP aeronautical station data (6-hourly and 3-hourly UTC intermediates) -> 8 per 24-hour for Sal WMO_ID 08584 ; 4 per 24-hour for Praia WMO_ID 08589 and Mindelo WMO_ID 08583

The results of the Gap Analysys steps 1 and 2 are summarized in Table 4. From Table 4, we observe that currently no station fully complies with the GBON requirements. We give remarks and considerations on the reported gap analysis results of Table 4 and GBON compliance below. The GBON National Contribution Plan will outline more details on the next steps.

GBON requirements	Target (# of stations)	GBON Compliant stations (#)	Stations gap	
			New	Improved
Surface stations • **Horizontal resolution**: 200km • **Variables**: SLP, T, H, W, SD • Observation cycle: 1h	4	0	1	3
Upper-air stations • **Horizontal resolution**: 500km • **Vertical** resolution: 100m, up to 30 hpa **Variables**: T, H, W • **Reporting cycle**: twice a day	1	0	0	1

Table 4. Results of the GBON National Gap Analysis

SLP: Sea-level pressure; T: Temperature; H: Humidity; W: wind; P: Precipitation; SD: Snow depth

3.1 Reporting frequency and cycle

Cabo Verde currently relies entirely on aeronautical synoptic stations for real time weather data communication, in first place to the aviation sector. 3-hourly SYNOP data from Sal int'l airport station and AFTN Centre, and 6-hourly SYNOP messages from the two other synoptic stations are continuously 24/7 reported , manually by national INMG weather observer and forecaster staff. These int'l (airport) stations are manned 24/7. The Automated Fixed Telecommunication Network or AFTN - ICAO protocols do not permit " hourly SYNOP"[12] to be communicated in the network (internal comm.: according INMG) [13].

[12] An issue raised by Cabo Verde aviation meteorologists, was the definition of SYNOP? Do hourly SYNOP data exist, according WMO definitions? (ref. WMO-306 a/o other publications).

[13] The NMS Cabo Verde remarks that – in their opinion – SYNOP data are defined as weather data with a 6-hourly and with intermediates 3-hourly report cycle (see footnote). The SYNOP data definition (according WMO #306) is a 6-hour (00:00, 06:00, 12:00, 18:00 UTC) + intermediates (00:30, 09:00,15:00, 21:00 UTC) or a 3-hourly reporting of weather parameters (maximum reporting cycle is 3-hours or 8 per day or 4 as standard Synop).[13]

Since June 2023, data from the 3 aeronautical synoptic airport stations are also forwarded to the DGM Maroc/Casablanca using a WIS2.0-DGM manual communication web interface. INMG notes that only the three int'l airport stations are currently manned with continuous 24-hr/7-day observer or meteorologist staff, transferring the data manually via the WIS2.0-DGM web application. INMG noted that the GBON requirement of hourly data transmission to the WMO - WIS2.0 system requires "de facto" automated methods for data transmission.

3.2 Number of target stations and areal coverage

The number of GBON required Target stations by WMO is four (4). As described and commented in Tables 2 and 3, three airport stations are currently (July 2023) partly compliant with the GBON reporting requirements. One long-standing (non operating) Upper-Air facility is present on Sal Island. INMG is keen to re-equip and re-activate the UAS soundings. The facility requires to be improved with up-to-date instruments which can be considered a significant investment (ref. the GBON National Contributing Plan).

INMG proposes to improve 3 AWS and INMG-owned stations at Sal NMS Head Office near Sal int'l airport and the Mindelo and Praia regional INMG offices and AWS, to GBON compliance. INMG will install one (1) new AWS in the South West sector on Brava island. The extra station, South west on Brava Island, would meet the GBON 4-surface stations resolution requirement for Cabo Verde.

The western island regions show important weather information. The South Western islands of Fogo and Brava (~15N - 24.5W) are more prone to the monsoonal depressions and Atlantic hurricane passages.

We added the all stations on the GBON AWS en UAS station map in Figure 4a and 4b. We refer further to the GBON National Contribution Plan report for more information.

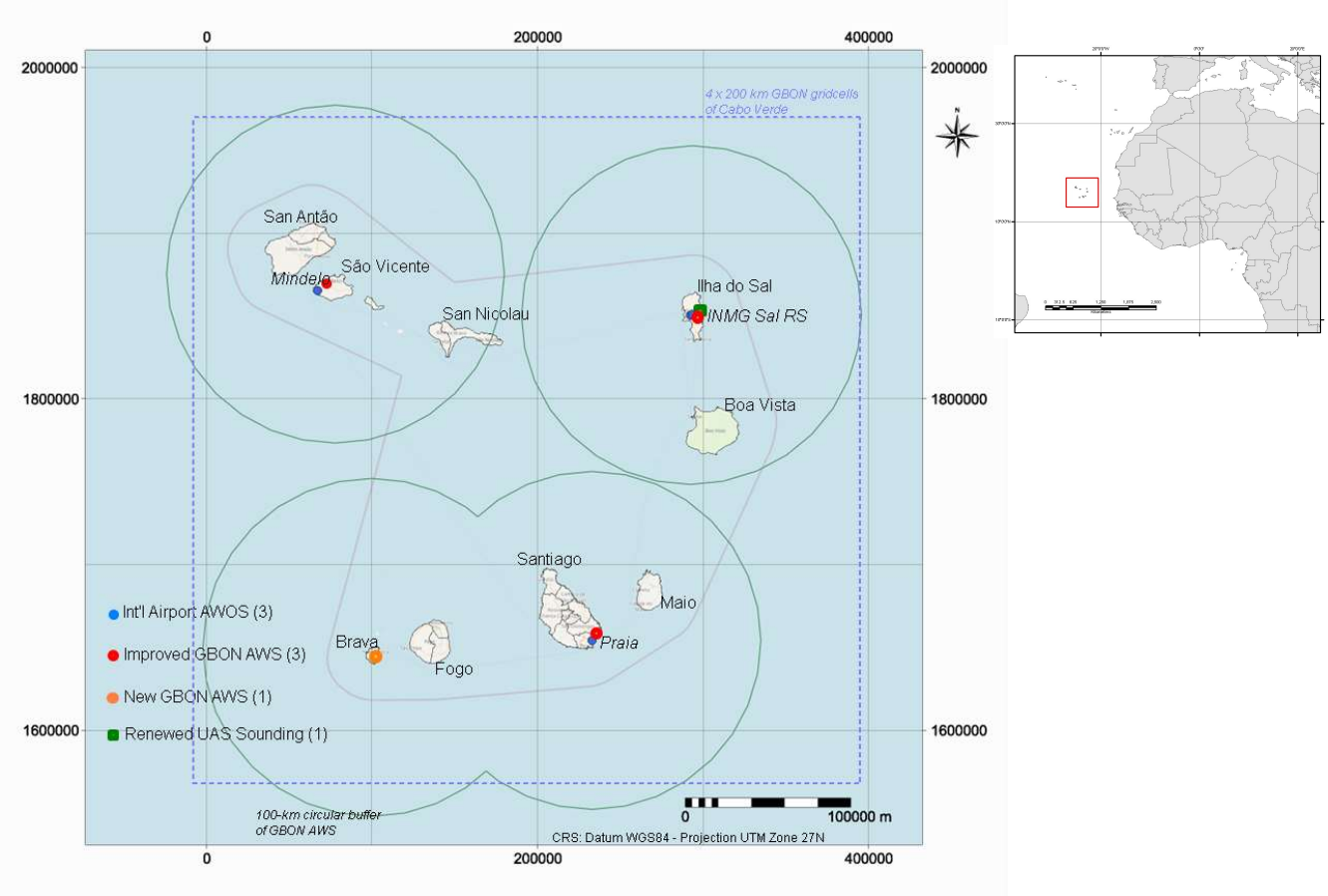


Figure 4a: Locations of the GBON "to be improved and new" Surface and UA target stations for meeting the GBON compliance requirements.

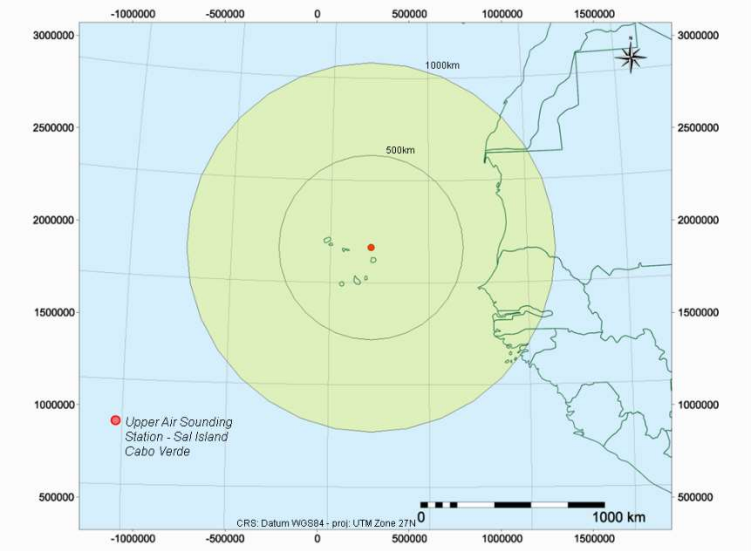


Figure 4b: Mapview of horizontal resolutions of the UAS on Sal Island - Cabo verde

3.3 Identified rapid actions to meet GBON requirements (anticipating the GBON National Contribution Plan)

One of the objectives of GBON, i.e. increasing the station data reporting frequency as well as global spatial coverage and resolution is judged important by the Cabo Verde NMS. Current global weather forecast model resolutions (NOAA GFS, ECMWF, etc.) do not always permit to detect meso- and microscale weather phenomena in the Cabo Verde ROI (region of interest). These phenomena however highly impact human and economic activities on islands (and SIDS in general) and the maritime sector (e.g. fisheries, tourism, transport, environment). The importance to include more sea (incl. small island-based observations, SIDS) a/o marine ocean observations in GBON is therefore judged important by Cabo Verde.

WIS2 Network Communication (incl. staff capacity development)

Hourly data communication in the new (2021) WMO WIS2.0 Network, requires automated data transmission protocols, to be implemented by INMG Cabo Verde. An important issue here is WIS2-in-box staff capacity building. The staff of INMG is not yet accustomed with the WIS2.0 data protocols, new software tools and coding language (i.e., Python 3). An urgent need for capacity development by preference in a bilingual format (English/Portuguese) is therefore present. Learning of these new Free and Open Source (FOSS) computing and data communication environments (i.e. use of Python) will require a capacity development traject (e.g. continuing support by peer-advisor a/o other edu-partners).

GBON Target # stations

Cabo Verde can meet the GBON resolution requirement by improving three AWS and adding 1 (fourth) station in the South western part of the archipelago. The installation of a new GBON station will require careful examination of the local situation, as e.g. Brava Island is a rather remote island (estimated population ~<6,000 inhabitants), only accessible by sea using small vessels from e.g. Fogo or Praia/Santiago Island. We refer further to the GBON National Contribution Plan for more study and details.

INMG is also keen to install a fifth (5) GBON compliant station in the North West island of Santo Antão in the future. This AWS will contribute to observing central Atlantic weather phenomena, in the context of global and North and Central Atlantic weather prediction modelling.

Upper Air Sounding Facility

Renewing (e.g. new Hydrogen gas equipments and other instrumentation) the existing UAS facility on Sal Island is a condition for meeting the GBON requirements. Next to new equipment, also training and capacity development of staff will be needed for INMG staff to carry out the sounding operations. INMG Sal had a long-standing status of UAS observations.

4. Report completion signatures

Peer Advisor signature

Dr. Gé Verver
Royal Netherlands Meteorological Institute (KNMI)

WMO Technical Authority screening remarks and signature

Beneficiary Country remarks and signature

Ester Araújo de Brito
Executive Administrator of the Cabo Verde Institute National of Meteorology and Geofisycs, and SOFF Focal Point