30th September 2024

GBON National Gap Analysis – Antigua and Barbuda

Systematic Observations Financing Facility

Weather and climate data for resilience

1WEATHER CLIMATE WATER

Screening of the National Gap Analysis (NGA) of Antigua and Barbuda

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: 12 December 2024

Signature:

Albert Fischer

Director, WIGOS Branch, Infrastructure Department, WMO

GBON National Gap Analysis Report
Antigua and Barbuda

Beneficiary Country Focal Point and Institute	Dale Destin, Antigua and Barbuda Meteorological Service (ABMS)
Peer Advisor Focal Point and Institute	Ali Price, UK Met Office

1. Country information from the GBON Global Gap Analysis

Please provide in this Table the country information as provided by the WMO Global GBON Gap Analysis.

Table I. WMO GBON Global Gap Analysis (June 2023). Illustration of the information that the WMO Secretariat provides to each country

A. GBON horizontal resolution requirements	B. Target	C. Reporting (GBON compliant)[1]	D. Gap to improve	E. Gap new	F. Gap total
	[# of stations]				
Surface stations Standard density[2] 200 km	1	0	1	0	1
Upper-air stations over land Standard density[2] 500km	1	0	0	1	1

[1] The rationale for classifying surface and upper-air stations as reporting is based on the WIGOS Data Quality Monitoring System (WDQMS) for the chosen time period (WMO GBON Global Gap analysis, June 2023). Stations with data availability more than 80% on at least 80% of days, are considered as reporting. Other listed stations are counted as having the possibility to be improved.

[2] For SIDS, for the WMO GBON Global Gap Analysis in June 2023, the EEZ area has been added to the total surface area which is the basis for the target number of stations. The standard density requirements for SIDS have been calculated with 500 km for surface stations and 1000 km for upper-air stations.

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

Please complete the two tables below and add remarks and Annexes with technical details as needed.

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

GBON Requirements	Existing observation stations (# of stations)			
	NMHS network		Third-party network	
	Reporting (GBON compliant) [3]	To improve	Reporting (GBON compliant) [3]	To improve
Surface land stations Standard density [4] 200km Variables: SLP, T, H, W, P, SD	0*	1	0	0
Upper-air stations operated from land Horizontal resolution[4]: 500km Vertical resolution: 100m, up to 30 hPa Variables: T, H, W	0	0	0	0
Surface marine stations in Exclusive Economic Zones:[7] 500 km Variables: SLP, SST	/	/	/	/
Upper-air stations operated in Exclusive Economic Zones:[5] 1000 km Vertical resolution: 100m, up to 30 hPa Variables: T, H, W	/	/	/	/

**Surface station not compliant June 2023 baseline; not compliant December 2024, occasionally compliant in between two dates but requiring improvement to improve sustainability of station*

[3] The rationale for classifying surface and upper-air stations as reporting is based on the WIGOS Data Quality Monitoring System (WDQMS) for the chosen time period during the development of National Gap Analysis Stations with data availability more than 80% on at least 80% of days, are considered as reporting. Other listed stations are counted as having the possibility to be improved.

[4] For SIDS, for the WMO GBON Global Gap Analysis in June 2023, the EEZ area has been added to the total surface area which is the basis for the target number of stations. The standard density requirements for SIDS have been calculated with 500 km for surface stations and 1000 km for upper-air stations.

[5]Although GBON marine stations and stations in EEZ are not part of initial SOFF scope, peer advisors are encouraged to analyze in this step when considered relevant e.g. SIDS, the status of current marine stations for future GBON marine observations investments.

Table III. Assessment of existing GBON stations per station characteristics. Station type: S: Surface, UA: Upper-Air; M: Marine; Owner of the station: NMHS or name of third-party; GBON variables: SLP: Atmospheric pressure; T: Temperature; H: Humidity; W: wind; P: Precipitation; SD: Snow depth; SST: Sea surface temperature; Reporting cycle: Number of observation reports exchanged internationally per day (0-24); GBON compliance: whether the station is GBON compliant or not (see GBON guide on compliance criteria).

Station name	Station type (S/UA/M[6])	Owner (NMHS /3rd party)	Funding source	GBON variable measured							Reporting cycle (obs/day)	GBON Compliant (Y/N)
				SLP	T	H	W	P	SD	SST		
V C Bird Intl Airport	S	ABMS	A & B Government & R Allen Stanford	x	x	x	x	x			24	N*

**Surface station not compliant June 2023 baseline; not compliant December 2024, occasionally compliant in between two dates but requiring improvement to improve sustainability of station*

[6] Please see guidance on marine stations in Section 2 on Scope.

3. Results of the GBON National Gap Analysis

Please complete the two tables below and add remarks and technical details in Annexes as needed.

Table IV. Results of the GBON national gap analysis. SLP: Atmospheric pressure; T: Temperature; H: Humidity; W: wind; P: Precipitation; SD: Snow depth; SST: Sea surface temperature**.**

GBON requirements	Global GBON target	Approved national target	Reporting	Gap	
				To improve	New
	[# of stations]				
Surface land stations	1	1	0*	1	0
Upper-air stations operated from land	1	1**	0	0	1**
Surface marine stations in Exclusive Economic Zones:[7] Density 500 km Variables: SLP, SST Observing cycle: 1h	/	/	/	/	/
Upper-air stations operated in Exclusive Economic Zones:[8] Density 1000 km Vertical resolution: 100 m, up to 30 hPa Variables: T, H, W Observing cycle: twice a day	/	/	/	/	/

**Surface station not compliant June 2023 baseline; not compliant December 2024, occasionally compliant in between two dates but requiring improvement to improve sustainability of station*

***Note: Subject to further regional evaluation of GBON Global Gap Analysis with Small Island Developing State (SIDS) criteria*

[7] Although GBON marine stations are not part of initial SOFF scope, peer advisors are encouraged to analyze in this step when considered relevant e.g. SIDS, the need for future GBON marine observations investments according to the GBON requirements.
[8] Although GBON marine stations are not part of initial SOFF scope, peer advisors are encouraged to analyze in this step when considered relevant e.g. SIDS, the need for future GBON marine observations investments according to the GBON requirements.

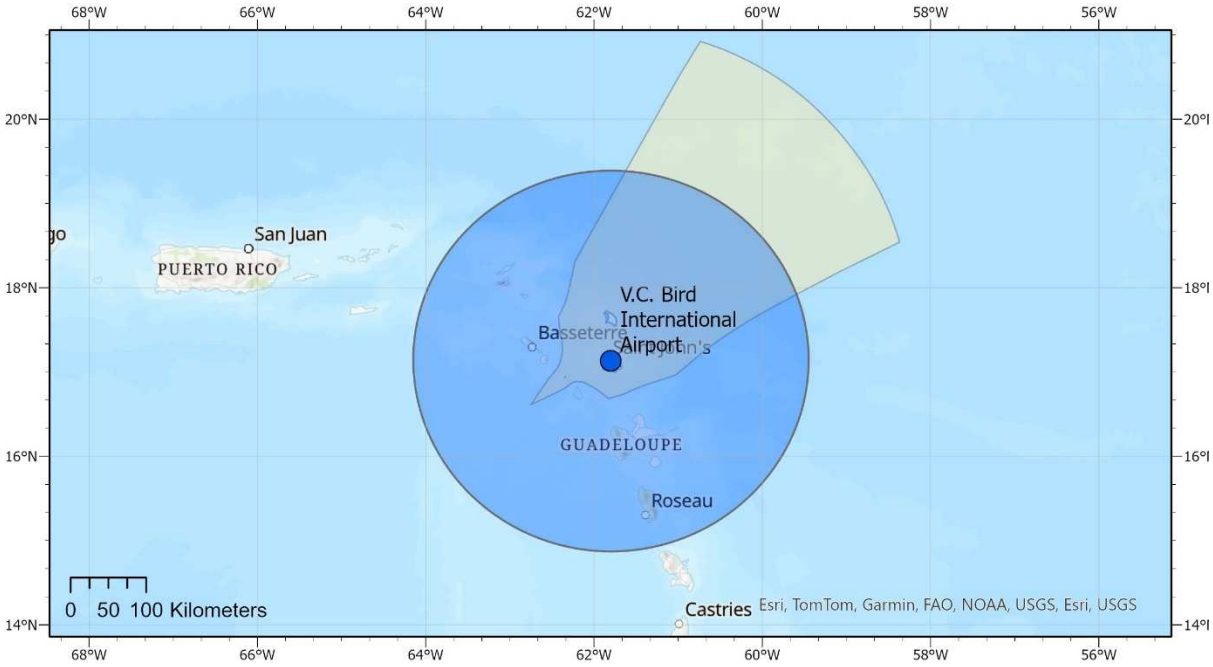
3.1 Recommended existing surface, upper-air and marine[9] stations to be designated to GBON

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

Station name	Station type (S/UA/M[10])
V C Bird International Airport	S
V C Bird International Airport	UA*

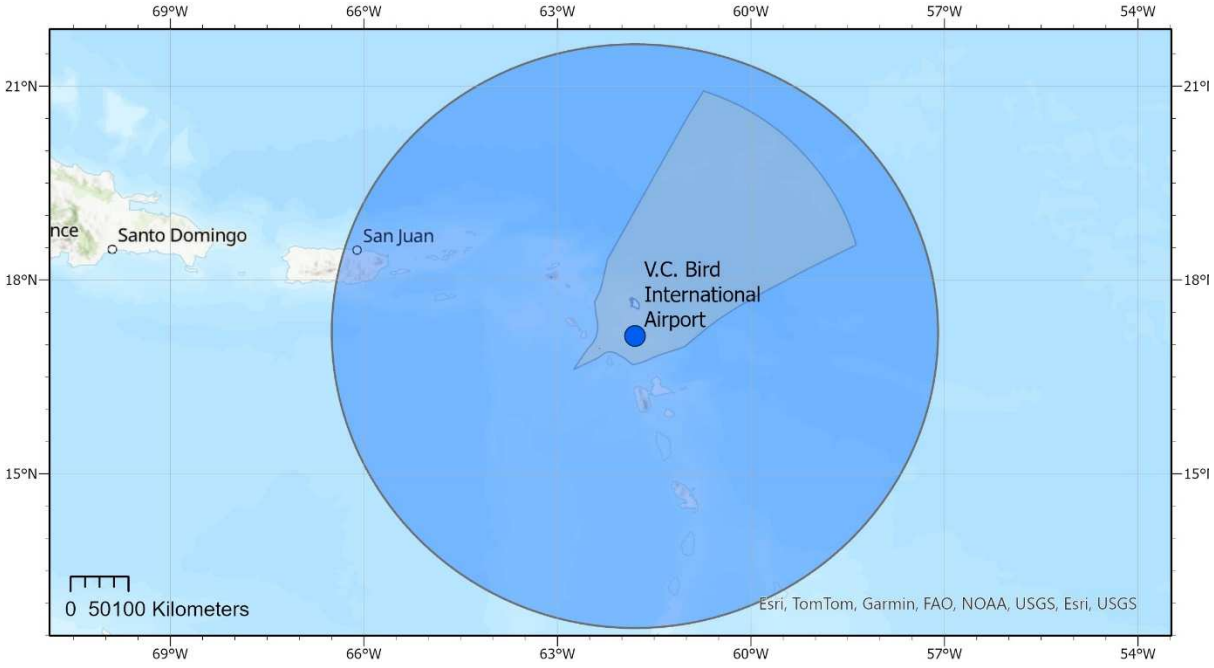
**Note: Subject to further regional evaluation of GBON Global Gap Analysis with Small Island Developing State (SIDS) criteria*

Figure 1 Map of (i) existing surface station with 500 km diameter SIDS circle and (ii) proposed upper-air station with 1000 km diameter SIDS circle (in BLUE) to indicate station coverage (note A&B EEZ underlaid in YELLOW)



[9] Although GBON marine stations are not part of initial SOFF scope, peer advisors are encouraged to analyze in this step when considered relevant e.g., SIDS, the need for future GBON marine observations investments according to the GBON requirements.

[10] Please see guidance on marine stations in Section 2 on Scope.



4. Report completion signatures

Peer Advisor signature

Helen Bye - Head of International Engagement
Met Office 30/09/2024

Beneficiary Country signature

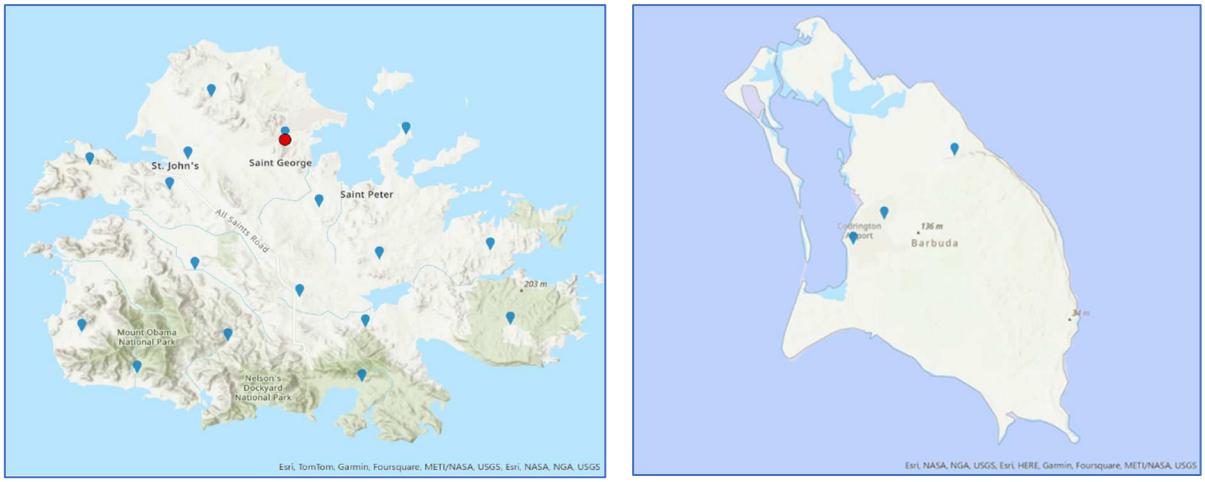
Dale Destin - Director ABMS
Antigua & Barbuda Meteorological Services
V. C. Bird International Airport Antigua

WMO Technical Authority screening signature

Appendix 1: Assessment of GBON SOFF support requirements

1) VC Bird Surface GBON Station: Antigua and Barbuda Meteorological Service currently operate a network consisting of 23 Surface Automatic Weather Stations (see Figure 2 below). Currently, only one of these stations, located at V C Bird International Airport (VCBIA), is transmitting data globally. Data from this station are aimed to be shared hourly in compliance with GBON requirements for standard temporal resolution. In terms of both data and spatial resolution, *the GBON Global Gap Analysis based on the June 2023 baseline assessment indicates that Antigua & Barbuda was non-compliant with the GBON national contribution requirement for surface weather stations on WDQMS.* The station is not compliant as of December 2024 – it has been occasionally compliant in between June 2023 and December 2023 but compliance is inconsistent. This has resulted from periodic outages of given parameters due to inability to maintain support and led to the Global Gap Analysis recommendation to improve the station at VCBIA.

Figure 2 Existing Antigua (left) & Barbuda (right) Surface stations incl V C Bird International Airport GBON station (in RED)



There is a requirement to ensure the future sustainability of the VCBIA observing station - the AWS at this site, which is used for SYNOP and METAR observations, is over 20 years old and has ongoing structural and operational issues. The wind sensor has been replaced multiple times in this period but remains unreliable and the remainder of the sensors have never been calibrated. Data are currently shared internationally through WIS and GTS via two methods – EDIS, the US NWS Email Data Input System and COROBOR (now Campbell Scientific France) Forecast Workstation. The COROBOR system is the country's only source of official data from WIS. This system is over 20 years old, frequently experiences connection issues and requires replacement. Lack of finance has obstructed the urgent need for replacement of the AWS at this site.

According to WDQMS, data from several stations in neighbouring countries, eg Montserrat, St Kitts & Nevis, can also often be non-compliant with Surface GBON requirements (availability and quality). Additionally, there are no GBON stations out to the North and East over the Atlantic Ocean and Antigua's Exclusive Economic Zone (EEZ – see Figure 1). This is also the direction of the prevailing North-Easterly Trade Winds and first landfall for tropical storms moving westwards across the Leeward Islands, making the V C Bird surface station important to maintain.

2) V C Bird Upper Air GBON station: There are currently no Upper Air observations in Antigua and Barbuda, though noting that the US Navy have previously operated a radiosonde station in the vicinity of V C Bird International Airport. The *GBON Global Gap Assessment indicates a requirement to implement a new UA station in the country* and there is some support for this in an assessment of regional provision in the Leeward Islands using standard GBON 500km station spacing resolution. Noting that the Eastern Caribbean is an entry point for hurricanes to the region, this would be consistent with the approach taken to neighbouring larger islands further west that may not, technically, be considered as Small Island Developing States (SIDS) with accompanying 1000k resolution – see Figure 4 below.

Figure 4 GBON 500km Standard Upper Air circles applied to stations across the Caribbean on WDQMS (as opposed to larger 1000km circles for the Eastern Caribbean states if considered under SIDS criteria)

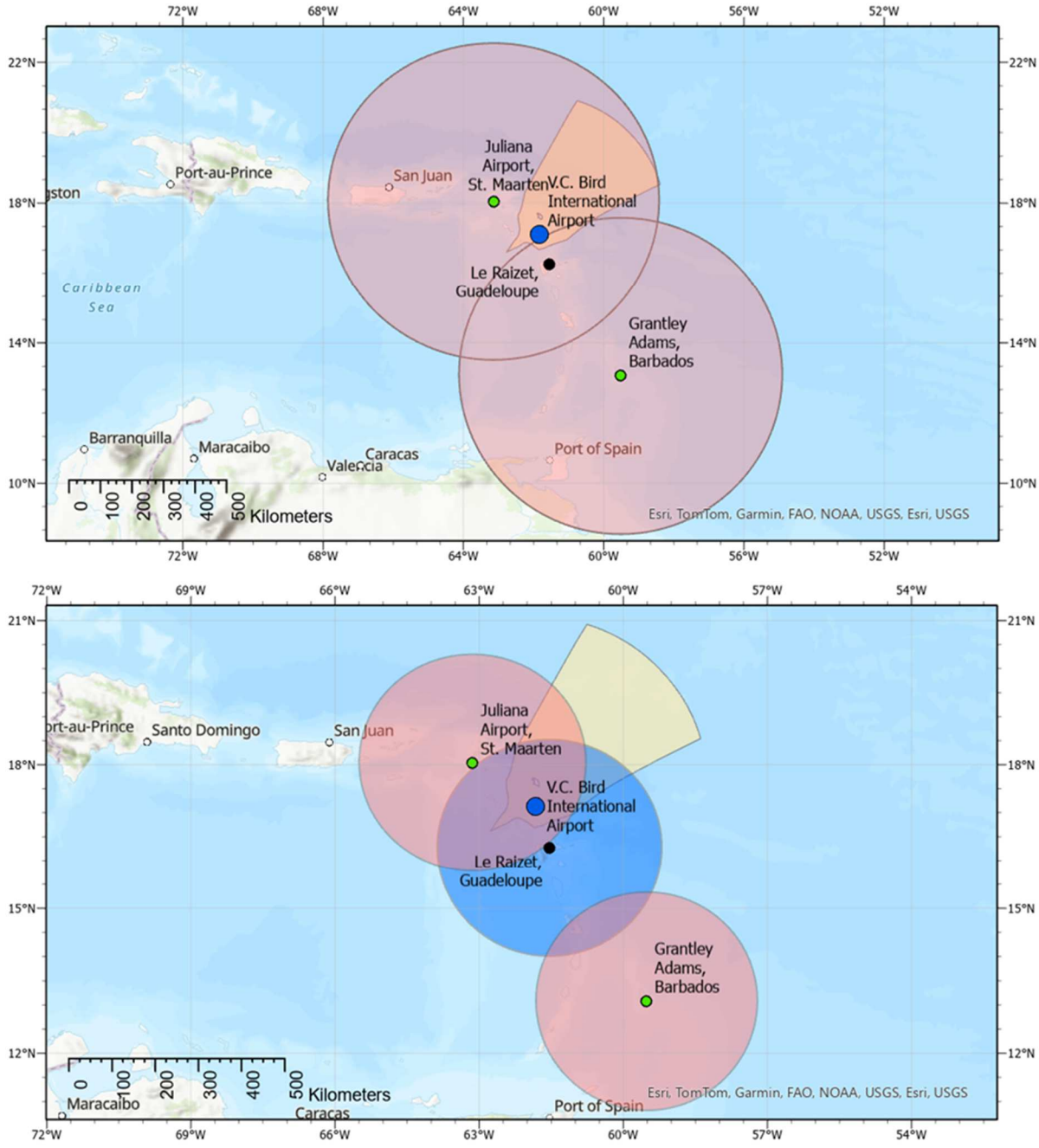
The Lesser Antilles in the Eastern Caribbean have a string of routinely-operated UA stations running along the archipelago from Juliana Airport in Sint Maarten (c.170 km NW of V C Bird; operated by the Meteorological Department Sint Maarten) through Le Raizet station in Guadeloupe (c.100 km South of V C Bird; operated by Meteo France) to Grantley Adams station in Barbados (c.500km SE from VC Bird; operated by the Barbados Met Service). The next nearest stations after that to the South in a data-sparse region subject to developing hurricanes developing hurricanes to the Caribbean are then to be found in Trinidad & Tobago and on the South American coast. In the immediate vicinity of Antigua & Barbuda, the St Maarten UA station lies downwind in the easterly Trade winds, but while Guadeloupe offers a nearby representative radiosonde ascent in an optimal location for the region, it does not consistently meet GBON data availability requirements throughout the year. Guadeloupe produces two or more ascents a day in the hurricane season but this falls to only one ascent in the dry season - Meteo France have an agreed GBON compliance exemption for Guadeloupe to cover this mode of operation. This also presents a regional compliance gap (in the dry season) where the Barbados station is c.670 km from St Maarten, exceeding the 500 km Standard GBON station density requirement. As a result, unless Guadeloupe can increase output for year-round compliance, then it *may* be desirable to operate UA capability in Antigua, with 500km station separation from Barbados, if standard criteria is applied.

If SIDS criteria is applied, then St Maarten and Barbados would be within 1000km of each other (see Figure 5 below) and thus there would in principle be less dependence on Guadeloupe to operate year-round. *A new UA station in Antigua & Barbuda would not be required*, however representativity of these ascents for Antigua & Barbuda at this range may be questionable. Indeed, St Maarten's

500km radius SIDS circle (diameter/station spacing = 1000km) would cover the entirety of the Antigua & Barbuda EEZ, though, as above, it should be noted that a radiosonde would in fact likely head west on release into the easterly Trades, thus diminishing any notional benefit here.

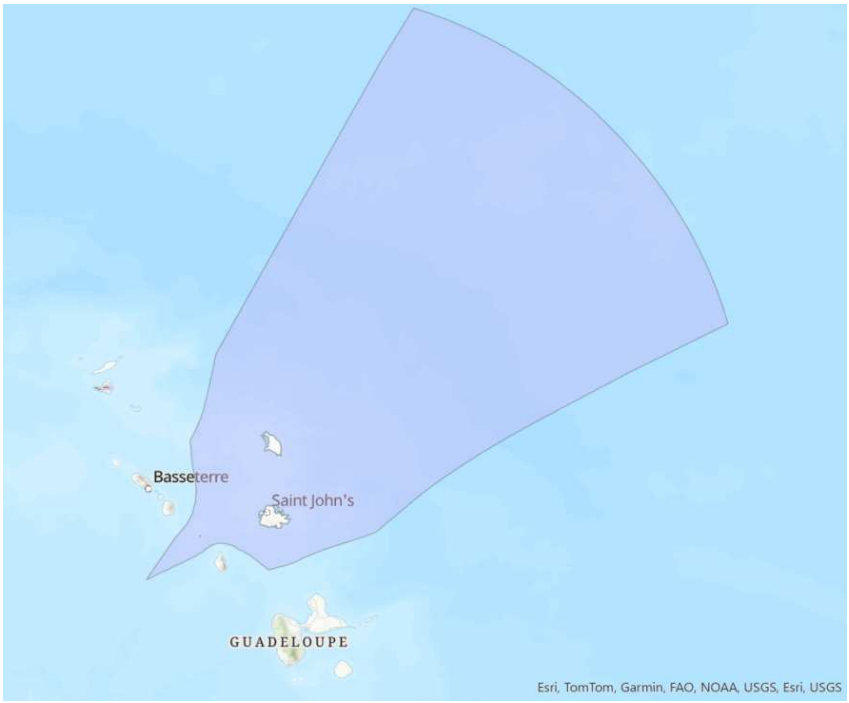
In summary, it may be advantageous, in line with the Global GBON analysis, to establish an upper air station in Antigua & Barbuda, depending on the outcome of discussion on the Caribbean regional design required, including whether standard or SIDS criteria is applied. A new V C Bird station may provide some valuable infill and redundancy, especially in this hurricane-prone area in the northern Leeward Islands, but further coordination with other Caribbean assessments, targeting an overarching design should be undertaken to validate the overall requirement.

Figure 5 Existing GBON Upper Air stations in A&B vicinity with (i) 1000km SIDS and (ii) 500km Standard station spacing distance (RED circles); including St Maarten and Barbados (currently compliant) and Guadeloupe (seasonally compliant



3) A&B EEZ Marine GBON capability: *There are currently no marine observations in Antigua and Barbuda*, which has an Exclusive Economic Zone of 111,568km^2 in an extremely data sparse region.

Figure 6 A&B Marine EEZ



SOFF Guidance states that: "Marine meteorological stations may be considered by SOFF at a later stage, including potentially through sub-regional/regional cooperation modalities. Therefore, SOFF peer advisors are encouraged to include in their GBON National Gap Analysis the assessment of country marine stations and related GBON requirements when considered relevant". This is an area subject to tropical storm passage and it is recommended that future consideration be given to implementation of ship, buoy or drifting buoy coverage at a later stage if considered sustainable.