19 June 2023

GBON National Gap Analysis of Timor-Leste

Systematic Observations Financing Facility

Weather and climate data for resilience

WEATHER CLIMATE WATER

Screening of the National Gap Analysis (NGA) of Timor Leste

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: 25th Sep 2023

Signature:

Albert Fischer

Director, WIGOS Branch, Infrastructure Department, WMO

Document review process notes:

- Version 21.12.2022 for SOFF peer advisors and Implementing Entities feedback by 10 January 2023
- This revised guidance note will be included into the SOFF Operational Guidance Handbook, which complements the SOFF Operational Manual

Table of Contents

Annex I. Template for GBON Gap Analysis Report by the Peer Advisor

GBON Gap Analysis Report
Timor-Leste

Beneficiary Country Focal Point	Mr Terencio Fernandes Moniz National Directorate of Meteorology and Geophysics, Ministry of Transports and Communications – Timor Leste (DNMG)
Peer Advisor Focal Point and Institute	Edith Rodriguez- Finnish Meteorological Institute (FMI) Nelly Florida - Indonesia Agency for Meteorology Climatology and Geophysics (BMKG)
WMO Technical Authority	

1. Country information from the GBON Global Gap Analysis

Timor-Leste is a country in Southeast Asia. It comprises the eastern half of the island of Timor, of which Indonesia administers the western half, the exclave of Oecusse on the island's north-western half, and the minor islands of Atauro and Jaco. Australia is the country's southern neighbour, separated by the Timor Sea. The country's size is 14874 square kilometres (5,743 sq mi). Dili is its capital and largest city.

Timor-Leste has registered two surface stations in WDQMS database. However, they do not provide data in the schedule compliant with GBON requirements (Figure. 1). Further information about the number and status of surface measurement stations is described in Annexes 1 and 2. No upper air observations are carried out in Timor-Leste (Figure. 2). Table 1 summarises the compliance relative to the WMO Global GBON requirements.

Figure 1. The status of surface weather stations in Timor-Leste and its neighbouring countries is based on WDQMS information.

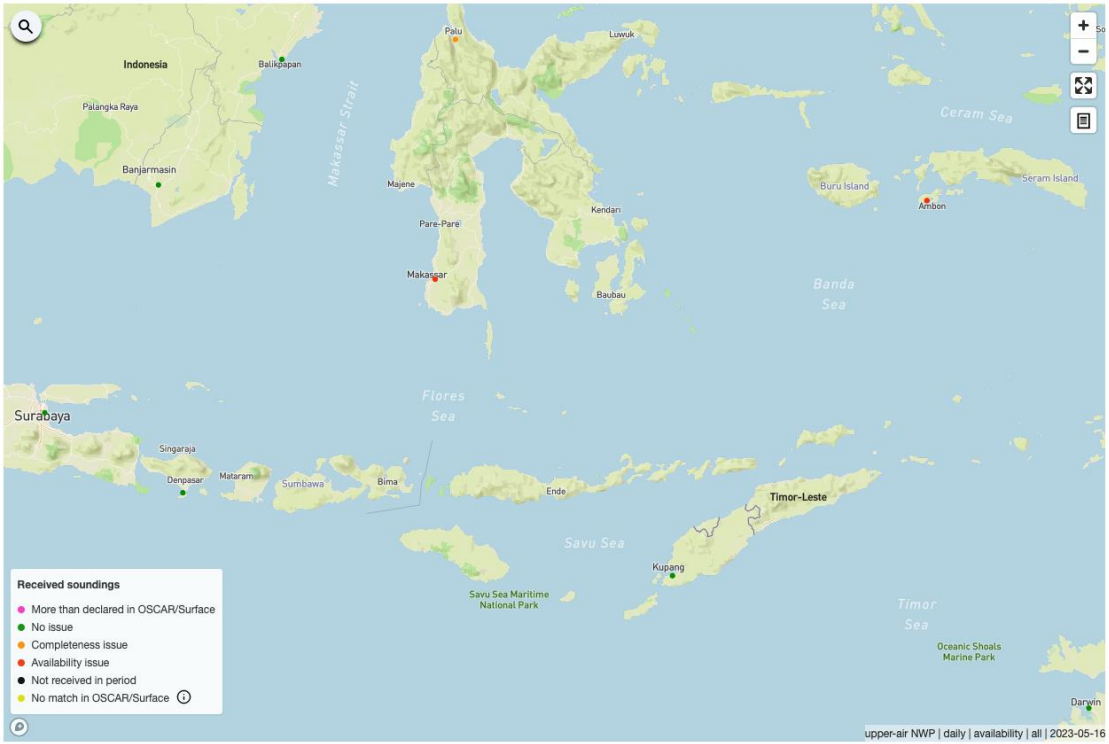


Figure 2. The status of upper air stations in Timor-Leste and its neighbouring countries is based on WDQMS information.

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

GBON horizontal resolution requirements	GBON target	Reporting	Gap improve	Gap new	Gap total
Surface stations Horizontal resolution: 500km	1	0	1	0	1
Upper-air stations Horizontal resolution: 1000km	1	0	0	1	1

A. GBON Target:

Based on the SOFF secretariat proposal, the location selected for the surface station to be updated is Baucau, located in the eastern part of the country, where the risk of hydrometeorological hazards is persistent, including floods and landslides during the rainy season and forest fires during the dry season. Furthermore, the station will support the aviation forecast, especially for foggy conditions at Baucau International Airport. Baucau is the second largest city of Timor Leste and one business region in the country, which involves the largest cargo airport in the country and one of the most touristic areas. The city location covers the 500 km radius requested by GBON for surface observations. The current conditions of the stations do not have an easy way to be fixed, considering that none of the sensors has been calibrated since 2013 and all the sensors have malfunctionings (see pictures below), so a major renovation is recommend for the station including a new access for the observers responsible of the stations. A detail description of the full modification will be included in the NCP.

UNEP GCF early warning project- FP171 will purchase and install 11 new stations 9 AWS, 2 AWOS and 1 manual station (annexe 1). Currently, Timor Leste has 15 surface observation stations. The station in Dili is an existing observation point and has a WIGOS ID. However, the station is not fully operational; the sensor requires routine maintenance and calibration. The replacement of this station is included in the UNEP GCF early warning.



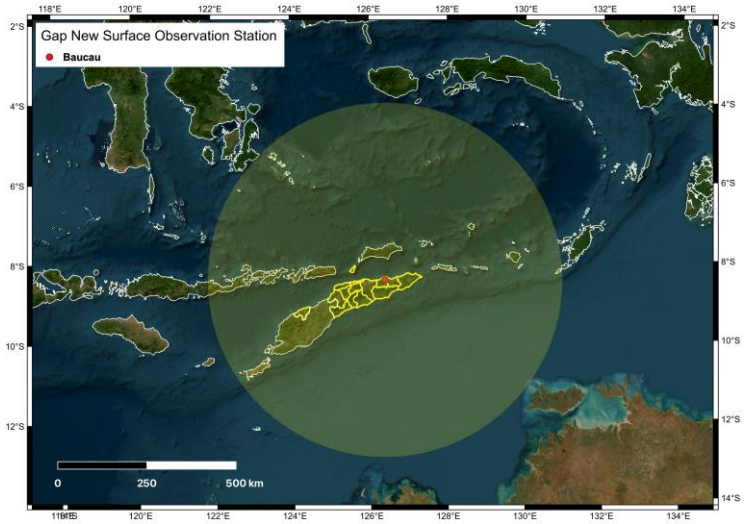


Figure 3. Number of surface observation stations required as per the standard GBON horizontal resolution and its coverage.

Timor Leste does not have any upper-air station. To fulfil the GBON requirements for Upper-air stations horizontal resolution, there is a need for upper-air observations in Dili (Figure 4). The station will be important because Timor Leste plans to build an international airport is located in Dili.

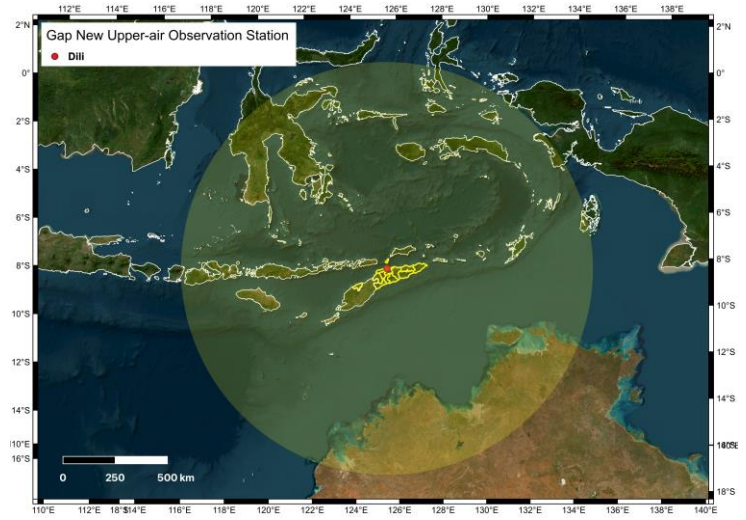


Figure 4. New upper-air station needs to be installed (Dili) to cover the GBON requirements.

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

The country has 15 stations installed, but none of them are fully operational or have the conditions to be improved. There are 82 Automatic rain stations allocated in the country by third parties. Tables 2 and 3 and Figure 5 show the current situation of the Timor Leste network.

DNMG is under the Ministry of Transport and Communications (described in Decree No. 01/2014 on the Establishment of the National Institute of Meteorology and Geophysics); In terms of data management, DNMG has a written agreement with the Ministry of Agriculture for data exchange policy. One of the gap is the lack of a proper telecommunication system to submit the report through WIS or GTS.

Table 2. 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 Horizontal resolution: 500km Variables: SLP, T, H, W, P, SD	**0**	**0**	**0**	**0**
Upper-air stations Horizontal resolution: 1000km Vertical resolution: 100m, up to 30 hPa Variables: T, H, W	**0**	**0**	**0**	**0**

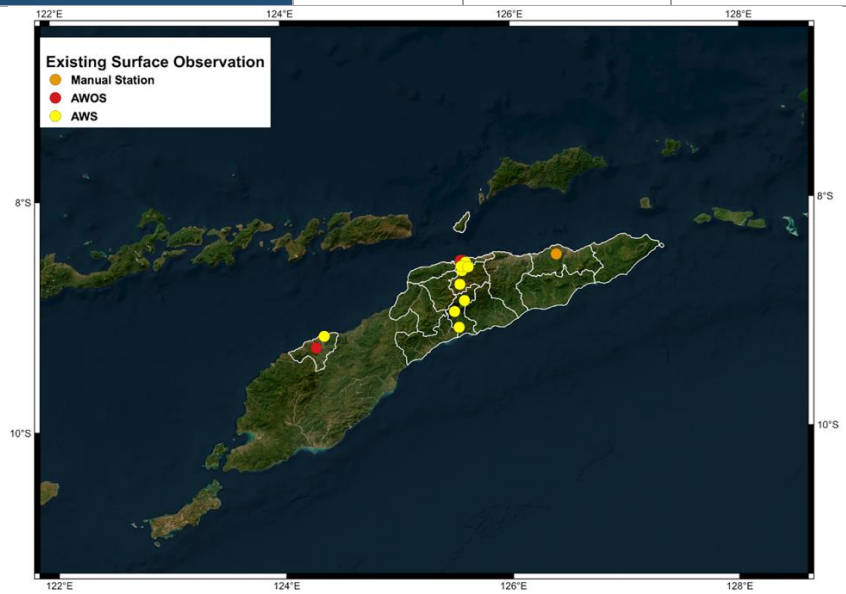


Figure 5. Existing surface observation networks and their type.

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

Station Name	Station Type S/UA	Owner	Funding Source	SLP	T	H	W	P	SD	Reporting Cycle	GBON Compliant
Dili (Airport)	S	DNMG		N	N	N	N	N	N	N	N
Dili- Comoro	S	DNMG		Y	Y	Y	Y	Y	N	N	N
Baucau	S	DNMG		Y	Y	Y	N	N	N	N	N

Oecusse (AWS)	S	DNMG		Y	Y	Y	Y	Y	N	N	N
Oecusse (AWOS)	S	Airport Administration		N	N	N	N	N	N	N	N
Dare	S	DNMG		N	N	N	N	N	N	N	N
Madabeno	S	DNMG		N	N	N	N	N	N	N	N
Aituto	S	DNMG		N	N	N	N	N	N	N	N
Vila	S	DNMG		N	N	N	N	N	N	N	N
Cassa	S	DNMG		N	N	N	N	N	N	N	N
Liurai	S	DNMG		N	N	N	N	N	N	N	N
EPF Laulara (Municipality Aileu)	S	DNMG		N	N	N	N	N	N	N	N
STM Becora (Dili)	S	DNMG		Y	Y	Y	Y	Y	N	N	N
Dare Comando (Dili)	S	DNMG		Y	Y	Y	Y	Y	N	N	N
EPF Darlau(Aileu)	S	DNMG		Y	Y	Y	Y	Y	N	N	N

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

3. Results of the GBON National Gap Analysis

3.1 GBON surface stations

Up to now, there has been no international reporting of surface data based on WDQMS information. To be able to provide data to the GBON, DNMG needs to establish a calibration and maintenance division. Currently, DNMG does not have technical personnel to take care of the stations. Although some staff training is included in the UNEP GCF early warning project, there is a need to contract new personnel with a technical degree to take care of these tasks.

The implementation of the maintenance division must include spare parts for the maintenance and operation of the surface station. The DNMG also needs a new vehicle to go to the Baucau station because the headquarters of DNMG is located in Dili.

To calibrate the station sensors, it is recommended subcontract BMKG; due to the vicinity of the country and the expertise and the already existing facilities, calibrations of the different sensors can be performed every one or two years, depending on the needs. Enough budget must be allocated for maintenance and calibration.

DNMG needs a better data management system, including an integrated database and data quality control of the data. Currently, the data transfer and data processes are handled mostly manually. Even though the UNEP GCF project is currently developing a climate data management and governance, it is still unclear to which extent it will fulfil the requirements of WMO (e.g. it does not cover WIS 2.0.); therefore, there are still gaps remaining which should be covered by SOFF, taking into account the work on the data management system developed under the GCF project.

For the data transfer, there is a lack of network connectivity for the data exchange.

New staff that specialise in data quality control and assurance are needed/ HR training is needed to control and guarantee data quality. BMKG is delivering training for DNMG staff on QMS from years 1-5 in the UNEP GCF project, but there is only one IT expert at the institute; therefore more experts are needed. The DNMG's current staff is included in Annexe 2.

The network must also be supported by a system for exchanging data and sending data to WIGOS.

In addition to the number of GBON compliant observation stations, the discussions of Gap Analysis included a short review of the Quality Management System (QMS) for the observation process, the status and capacity gaps in data transfer, database, sensor maintenance and calibration, metadata, and quality control is given in annexe 3.

Even though DNMG has staff with academic degrees (annexe 2), there is still a need to support technical staff education. The DNMG will benefit if higher education support is included in the project provision.

The above mention gaps are expected to be covered under the SOFF to ensure the data flow and the sustainability of the data.

3.2 GBON upper-air station

Timor Leste does not operate any upper-air soundings. Another station on Timor Island is part of the Indonesian network and is located in Kupang, 350 km from Baucau. The new sounding station is proposed to be installed in Timor Leste under SOFF. DNMG will need support to increase the technical staff to keep the stations running and the needed supplies to operate the station.

Needs for data storage and data management also applied for the upper-air station, so the capacity of the new database needs to include the needs for the new upper-air station operation.

The results of the national gap analysis for both surface and upper-air stations are presented in table 4.

Table 4. Results of the GBON national gap analysis

GBON requirements	Target (# of stations)	GBON Compliant stations (#)	Stations gap	
			New	Improved
Surface stations • **Horizontal resolution**: 500km • **Variables**: SLP, T, H, W, SD • Observation cycle: 1h	1	0		1
Upper-air stations • **Horizontal resolution**: 1000km • **Vertical** resolution: 100m, up to 30 hpa **Variables**: T, H, W • **Reporting cycle**: twice a day	1	0	1	0

3.3 Recommended existing surface, upper-air and marine[2] 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[3])
	None exisiting stations are recommened to be desigated to GBON.

[1] Although GBON marine stations are not part of initial SOFF scope, peer advisors are encouraged to analyse in this step when considered relevant e.g., SIDS, the need for future GBON marine observations investments according to the GBON requirements.
[2] Although GBON marine stations are not part of initial SOFF scope, peer advisors are encouraged to analyse in this step when considered relevant e.g., SIDS, the need for future GBON marine observations investments according to the GBON requirements.
[3] Please see guidance on marine stations in Section 2 on Scope.

4. Report completion signatures

Peer Advisor signature 
WMO Technical Authority screening remarks and signature 
Beneficiary Country remarks and signature 

Annexes

Annexe 1: Information on proposed AWS Sites under UNEP GCF Project FP171: Enhancing Early Warning Systems in Timor-Leste

No.	Location	Latitude	Longitude	Type	Type of Government Owned-Land *(public school? Government facility? Health center? Community center? etc.)*	What is the land size of the site?	Is there a power supply source? *(yes/no)*	What kind of telecommu-nications connection is there? *(LAN, wireless)* And what is the upload/download speed?	Is the site easily accessible? *(yes/no)*	Is the ground level? (no steep slope) *(yes/no)*	Is the site well away from trees, buildings, walls, overhead lines, radio transmitters, etc.? *(yes/no)*	Who will regularly maintain the equipment?
1	Liquica	-8.58997	125.347	New AWS	Government Facility	125 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
2	Ermera	-8.74995	125.3998	New AWS	Government Facility	125 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
3	Manatuto	-8.51337	126.0283	New AWS	Government Facility	125 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
4	Same	-9.009	125.6481	New AWS	Regional Airport	136 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
5	Viqueque	-8.88262	126.372	New AWS	Regional Airport	136 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
6	Lospalos	-8.44539	126.9886	New AWS	Regional Airport	136 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
7	Atauro	-8.24421	125.6062	New AWS	Regional Airport	136 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
8	Baucau	-8.47934	126.3972	New AWS	Cargo Airport	2400 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
9	Maliana	-8.9696	125.2102	New AWS	Regional Airport	136 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BMKG
10	Dili	-8.5496	125.5249	New AWOS (upgra	International Airport	3600 m^2	yes	LAN, wireless, modem	yes	yes	yes	DNMG/BoM

				ded from AWS)	Dili Airport AWS will be upgraded to AWOS							
11	Suai	-9.3007	125.2854	New AWOS	International Airport	2400 m^2	yes	LAN, wireless, modem	yes	no	yes	DNMG/BoM
12	Suai	-9.299	125.283	New Manual Station	International Airport	2400 m^2	yes	LAN, wireless, modem	yes	no	yes	DNMG/BMKG

Annexe 2. DNMG staff

- 7 Meteorologists:
  1 person with MSc Atmospheric Science
  6 person with a degree in meteorology
- 1 Physics Science Degree
- 4 climate staff: Telecommunications and Information degrees;
- 3 in IT Section with a degree in Information Technology;
- 8 meteorological observers; and
- The remaining staff are in administration and finance.

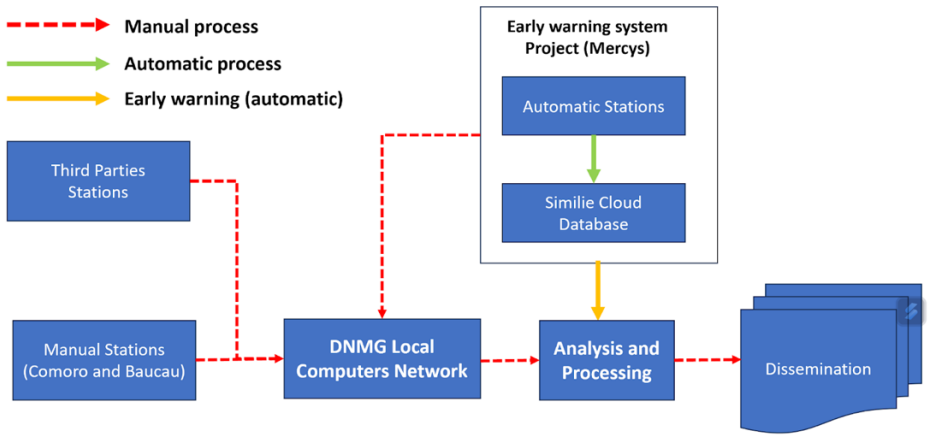
Annexe 3. Overview of the DNMG Quality Management System (QMS)

QMS

The QMS process needs to be improved. The NMHS need to develop SOPs for the observation process, data processing, to product dissemination.

Central database

The database needs to be integrated. There are various systems for sending and collecting data from different projects.
Each observation result from a different project has its database system and is processed manually on a local computer. Within the scope of the UNEP GCF project a Climate data informatics system (CDIS) will be established by RIMES.



Existing Database Scheme

Data transfer

- There is no standard system in the process of sending and exchanging data.
- Data from third parties is obtained manually by downloading on the direct site.

Metadata:

- There is an inventory of observation networks with their coordinates.
- The data archive of each observation is still limited.
- There are records regarding metadata, but they are not systematically documented.

Data quality control and assurance:

- There is no SOP regarding data quality control and assurance;
- There is no staff specifically dealing with data quality control and assurance.

Annexe 4. Gap analyse team

The Gap analysis was carried out through Zoom meetings and exchanging emails as well as the BMKG experts visit. The working group included the following members:

Terencio Fernandes Moniz – DNMG
Sebastião da Silva - DNMG
Simão Teles Fernandez - DNMG
Flaviana Pinto Fernandes - DNMG
João Bosco Gonçalves Soares - DNMG
Nelly Florida – BMKG
Noer Nurhayati – BMKG
Rr. Yuliana Purwanti – BMKG
Wandayantolis – BMKG
Imma Redha Nugraheni – BMKG
Edith Rodriguez – FMI