September 2025

Systematic Observations Financing Facility

GBON National Contribution Plan of Tuvalu

Systematic Observations
Financing Facility

Weather and climate data for resilience

GBON National Contribution Plan

Tuvalu

SOFF beneficiary country focal point and institution	Mr Tauala Katea, Director, Tuvalu Meteorological Service
SOFF peer advisor focal point and institution	Ms Emma Coombe Senior Advisor - International Development Meteorological Service of New Zealand Ltd (MetService)

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List of acronyms

AWOS	Automated Weather Observing System (Aviation)
AWS	Automated Weather Station
BIP-M	Basic Instruction for Meteorologists
BIP-MT	Basic Instruction for Meteorological Technicians
Bureau	Bureau of Meteorology, Australia
CDMS	Climate Data Management System
CIEWS	Climate Information Early Warning System
CIS-Pac5	Enhancing Climate Information and Knowledge Services for resilience in the 5 island countries of the Pacific Ocean
CliDE	Climate Data for the Environment
CliDEsc	Climate Data for the Environment Services Client
CMSS	Central Messaging Switching Service
COSPPac	Climate and Oceans Support Programme in the Pacific
EEZ	Exclusive Economic Zone
FMS	Fiji Meteorological Service
GBON	Global Basic Observing Network
GCF	Green Climate Fund
GCOS	Global Climate Observing System
GSN	GCOS Surface Network
GTS	Global Telecommunications System
GUAN	GCOS Upper Air Network
ICT	Information and Communications Technology
LDC	Least Developed Country/ies
JICA	Japan International Cooperation Agency
MetService	Meteorological Service of New Zealand
METAR	Meteorological Aerodrome Report
NCP	National Contribution Plan
NFWCOS	National Framework for Weather, Climate and Ocean Services for Tuvalu 2023-2032
NMHS	National Meteorological and Hydrological Service
NIWA	National Institute of Water and Atmospheric Research (NZ)
PMC	Pacific Meteorological Council
RESPAC	UNDP Disaster Resilience for Pacific Small Island Developing States project
RIC	Regional Instrument Centre
RTC	Regional Training Centre
SIDS	Small Island Developing States
SPC	Secretariat for the Pacific Community
SOFF	Systematic Observations Financing Facility
SOP	Standard Operating Procedure
SPREP	Secretariat of the Pacific Regional Environment Programme
TMS	Tuvalu Meteorological Services
UKMO	United Kingdom Meteorological Office
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USP	University of the South Pacific
WIGOS	WMO Integrated Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
WRP	Weather Ready Pacific Decadal Programme

Module 1. National Target toward GBON Compliance

Table 1 - GBON National Contribution Target

Type of station	WMO GBON Global Gap Analysis, June 2023				GBON National Contribution Target	
	Target[1] (no. of stations)	GBON-compliant stations (no. of stations)	Gap		To improve	New
			To improve	New		
Surface	4	0	4	0	4	0
Upper-air	1	0	1	0	1	0

[1] 1 For SIDS, for the WMO GBON Global Gap Analysis in January 2022, 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.

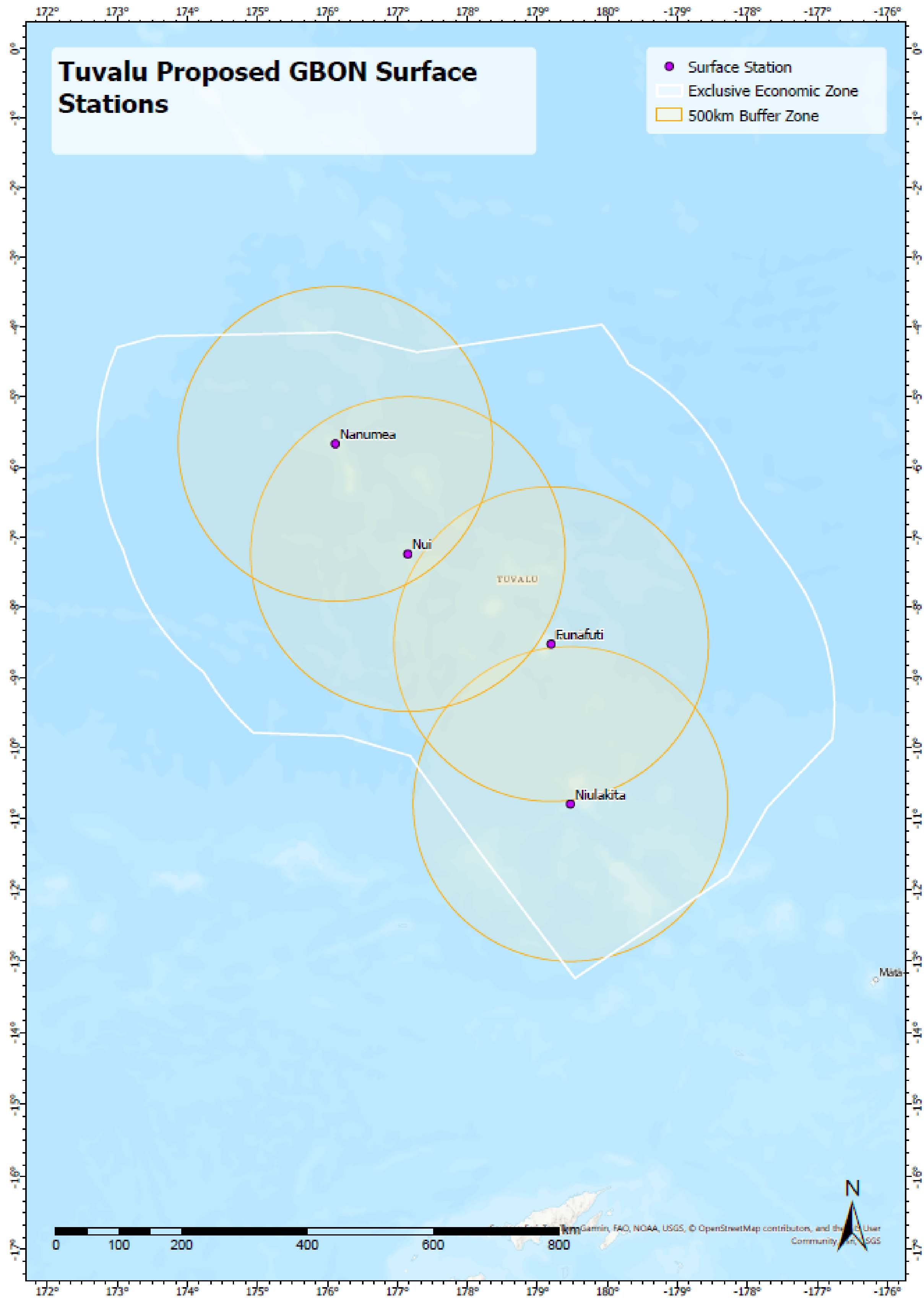

Figure 1 – Proposed GBON Surface stations showing 500 km circles

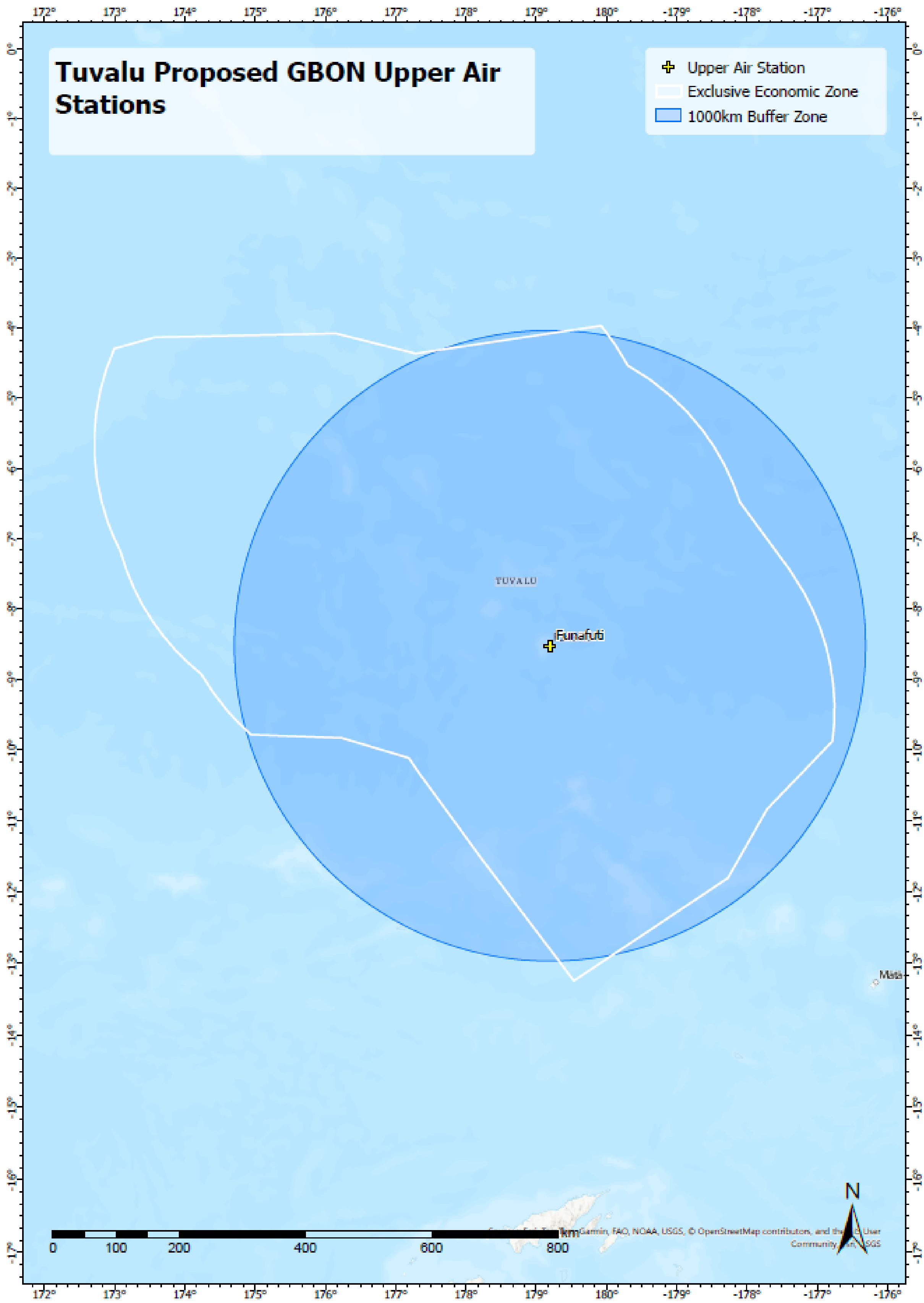

Figure 2 - proposed GBON upper air stations showing 1000 km circles

Module 2. GBON Business Model and Institutional Development

2.1. Assessment of national governmental and private organizations of relevance for the operation and maintenance of GBON

Climate and weather-related information and services in Tuvalu are provided by the Tuvalu Meteorological Service (TMS). The agency is mandated by the Government of Tuvalu, in the Meteorological Services Act (2020), as responsible for providing meteorological services for the country. The act also prohibits other entities from providing meteorological services. As such, TMS is the primary organization of relevance to the operation and maintenance of GBON observations in Tuvalu.

The Civil Aviation Authority has a recently refurbished Aviation Weather Observing System (AWOS) located within the Funafuti Meteorological Office compound. Historically this AWOS has not provided data to TMS and TMS also have no control over the operation and maintenance of the AWOS. It is anticipated that, with support from the Australian Government, the data will be made available to TMS and has the potential to contribute to GBON in the standard meteorological formats.

There are no other operators providing meteorological observations.

In terms of its ability to support GBON observations in the long term, TMS faces serious challenges. These include a lack of sufficiently skilled personnel, difficult and expensive logistics, sourcing and procurement of equipment and spares, and unreliable data communications. Together, these lead to reliability and data quality issues.

Financial planning for operations and maintenance over the lifetime of infrastructure is a critical component of modernizing observation systems. Such plans need to include freight and travel costs for proactive and reactive maintenance visits, communications costs (satellite), travel costs (air and boat), logistics costs and all other ongoing costs required to ensure GBON compliance.

To develop a strategy for addressing these challenges, during the Investment Phase, UNEP and TMS will engage with the Ministry of Finance and other potential partners such as SPREP and SPC, to develop a plan for ongoing procurement and funding of essential services to ensure the ongoing quality and reliability of the network **(Activity 2.1)**.

Another potentially significant cost for Pacific countries is Customs Duties for equipment and instrumentation that may be required to be sent offshore for calibration and/or maintenance. It is recommended that the potential for Custom Duties waivers be investigated by TMS and UNEP **(Activity 2.2).**

2.2. Assessment of potential GBON sub-regional collaboration

The Southwest Pacific region comprises many small countries and, through SPREP and SPC, there is a strong foundation for regional collaboration and numerous examples of this in practice.

The development of this plan has been undertaken in coordination with peer advisors for neighbouring countries. The proposed observations network for Tuvalu considers other national networks from Kiribati, Samoa, Fiji, Vanuatu, Solomon Islands and Nauru, which collectively contribute to a broader regional network across a critical, data-sparse region, with limited in situ observations available for global numerical weather prediction systems.

The NCP provides the flexibility to allow for future regional coordination initiatives such as regional calibration and maintenance services, training, and procurement of common equipment types. In this regard, the NCP is developed in the broader context of the decadal program of Weather Ready Pacific (WRP) which has the aim of improving and supporting capacity across the region.

To facilitate regional coordination, TMS will continue to be an active participant in relevant regional forums **(Activity 2.3)** including:

- Regional SOFF coordination workshops
- WMO RA-V committee
- Pacific Meteorological Council (PMC) and its sub-committees

TMS also has strong engagement with regional structures including:

- South Pacific Regional Environmental Programme (SPREP)
- Pacific Community (SPC)
- Weather Ready Pacific (WRP).

To support verification and calibration of instruments, the Regional Instrument Centre, being funded by JICA and constructed in Fiji, will be a key supporting capability for ensuring that GBON stations operated by TMS are producing quality, traceable observations. This development should be strongly supported by TMS (**Activity 2.4).**

During the Investment Phase, TMS and UNEP (as the Implementing Entity) will investigate further opportunities for regional synergies that can be implemented during the Compliance Phase. In particular, a regional approach could be beneficial beyond calibration and maintenance services, including training, procurement of common equipment types, and development of a common operations and maintenance plan.

The eight AWS funded under CIS-Pac5 (with three currently installed and additional installations planned) have been designed to be GBON compliant, so no upgrades are needed in this regard. Actioning Oscar Surface and WIS 2.0 is still required.

SOFF support will focus on maintenance for the four GBON stations, and Weather Ready Pacific should support the remaining stations, as outlined in the regional observation strategy that is currently under development. Due to Tuvalu's geographic isolation, opportunities to optimise maintenance travel are extremely limited, with travel dependent on a passenger ferry schedule or occasional charter of a fisheries

vessel, which is often unavailable due to mechanical issues.2.3. Assessment of a business model to operate and maintain the network

TMS's annual core budget has been relatively steady in recent years (around AUD $570,200 in 2022) and 57% of the budget goes towards staffing costs. The remaining funds are not sufficient for TMS to completely cover equipment and consumable purchases, provide staff training, or fund basic operations such as communications. For a significant portion of its operations, TMS is reliant on donor funding. To meet the requirements of the NCP and allow TMS to be GBON compliant, substantial additional and ongoing funding is required from both the government and donors.

Considering Tuvalu's legal framework, existing governmental processes, the skill levels within the NMHS, the legislated mandate of TMS, the remoteness of some sites and the lack of any private sector operators, the preferred model for operation of the observing network is the *Public model – Full state/NMHS owned and operated*. Within this model there remains a significant opportunity for the private sector to support the NMHS in areas such as training, calibration, procurement of equipment and spares, and ICT.

While options for Tuvalu are currently limited, ICT in the region as a whole, is something being looked at and developed by organisations such as the World Bank, the Weather Ready Pacific programme, and potentially the Pacific Islands Communications Infrastructure (PICI) panel.

A possible way forward is to structure the procurement of observing equipment to include some level of vendor support over the lifetime of the equipment, including ICT capability(**Activity 2.5**). This could provide a capability complementary to the in-country technical staff.

While the Civil Aviation Authority may own the AWOS being installed under the Australia-Pacific Partnerships for Aviation Program, partnership would likely not extend beyond that.

2.4. Assessment of existing national strategies and projects related to observing networks

The National Framework for Weather, Climate and Ocean Services 2023-2032 (NFWCOS), developed through CIS-Pac5 Project, provides the strategic direction and appropriate actions for the Tuvalu Meteorological Services (TMS) and other key national stakeholders to improve weather, water, climate and ocean services in Tuvalu for the next 5 years.

The NFWCOS has three goals:

> **Goal 1**: Tuvalu Meteorological Service's partnership at national, regional, and international levels further strengthened and consolidated.
>
> **Goal 2**: Tuvalu Meteorological Service's has the ability to provide undisrupted national weather, water, climate and ocean services to meet national to community level user needs.

Goal 3: Tuvalu Meteorological Service's weather, hydrological, climate and ocean information are readily accessible, understood and utilized by the relevant government ministries, national stakeholders, Kaupules and villages/communities.

The achievement of each of these goals and related activities depends upon reliable and trustworthy observation networks.

Some existing and future Hydromet projects include:

- UNEP CIS-Pac5 programme. This programme has supplied four AWS for the outer islands/atolls with a further four to be shipped in early 2025. The programme also includes the supply of a weather radar. Three AWS have been installed with TMS technical staff working alongside technicians from New Zealand. TMS are to install the remaining five AWS with remote support provided from New Zealand. The programme provides ongoing operational support, funding for satellite communication, and further trainings in-country and in New Zealand until September 2026.
- Australian Government Pacific Aviation Initiative. The Australian government is assisting Tuvalu to upgrade aviation weather services. This includes, among other activities, restoration of the AWOS at Funafuti.
- Climate and Oceans Support Program in the Pacific (COSPPac). This Australian government programme is, among other activities, assisting Tuvalu to maintain its CliDE Climate Data Management System. Funded support for the web-based content management system and product generator Climate Data for the Environment Services Client (CliDEsc) is supplemented by support from the New Zealand government.
- Weather Ready Pacific. This is a broader regional multi-donor initiative to comprehensively strengthen the full hydro-meteorological system across the whole value chain in the Pacific region. Weather Ready Pacific can leverage the improved observations from SOFF investment as part of its broader focus on hydro-meteorological services. WRP is supported by the Australian and New Zealand Governments.

One recently completed initiative is the United Nations Development Programme (UNDP) Disaster Resilience for Pacific Small Island Development States (RESPAC) programme. This programme installed two AWS in the outer islands. The programme covered installation and commissioning, after which the stations were handed over the TMS for ongoing maintenance and operation. The stations are not currently telemetered and are visited periodically to collect the data via a SD card. These stations have not been considered further for GBON as they will be superseded by the CIS-Pac5 stations.

There are a number of development programmes in the region that are contributing to supporting capabilities, with opportunities for TMS to leverage these. These programmes, along with other regional activities, have been considered throughout this NCP.

Of particular note, a project is underway to establish a Regional Instrument Centre in Fiji, staffed by Fiji Meteorological Service (FMS), and supported by JICA. This will be a necessary and important component for maintaining GBON compliance, supporting the maintenance and calibration of national and regional standards, and the ability of TMS to verify its observation equipment.

Opportunities to leverage these activities have been considered in Module 3 below. CIS-Pac5 for example is very complementary to GBON with a requirement being that all of the AWS are to be GBON-compliant. To align with this NCP, it is proposed that three of the AWS are to be co-located with the staffed stations at each of the proposed GBON stations on the outer islands (see Activity 3.1).

It is recommended that, at the start of the implementation phase, UNEP and TMS monitor any projects and development activities relevant to GBON to identify other opportunities for leverage, and to ensure that all planned works are complementary, especially with CIS-Pac5 and Weather Ready Pacific. (**Activity 2.6**)

2.5. Review of the national legislation of relevance for GBON

The Meteorological Services Act 2020 was enacted to establish TMS as the sole national authority to provide official meteorological and ocean forecast, prediction, information, warnings and related services including dissemination of long-term and seasonal forecasts. This provides the mandate and outlines the functional responsibilities for TMS.

The legislation also places responsibility on TMS to ensure compliance with the conventions and any other relevant standards and recommended practices of WMO and ICAO, as appropriate. As such, the legislation is sufficient to permit the international exchange of observational data.

The Act does not apply to procurement, which is governed by separate legislation. Under the Tuvalu Public Procurement Regulations 2014, procurement thresholds are defined as follows: minor procurement refers to purchases not exceeding AUD 5,000, while major procurement covers any amount above AUD 5,000. Minor procurement items may be approved and signed by the TMS Director. For major procurement, the process must go through the Procurement Review Committee, whose composition is set by the Minister under the Regulations.

All equipment provided by donors or through projects is subject to customs duties being waived, subject to submission of a letter from the supplier or donor to the Government or TMS as proof.

Module 3. GBON Infrastructure Development

3.1. Surface and upper-air observing network and observational practices

Existing and planned stations in Tuvalu (Figure 3) include staffed weather stations, automated weather stations (AWS), automated weather observing stations (AWOS) at airports, an upper air station, and a sea level station.

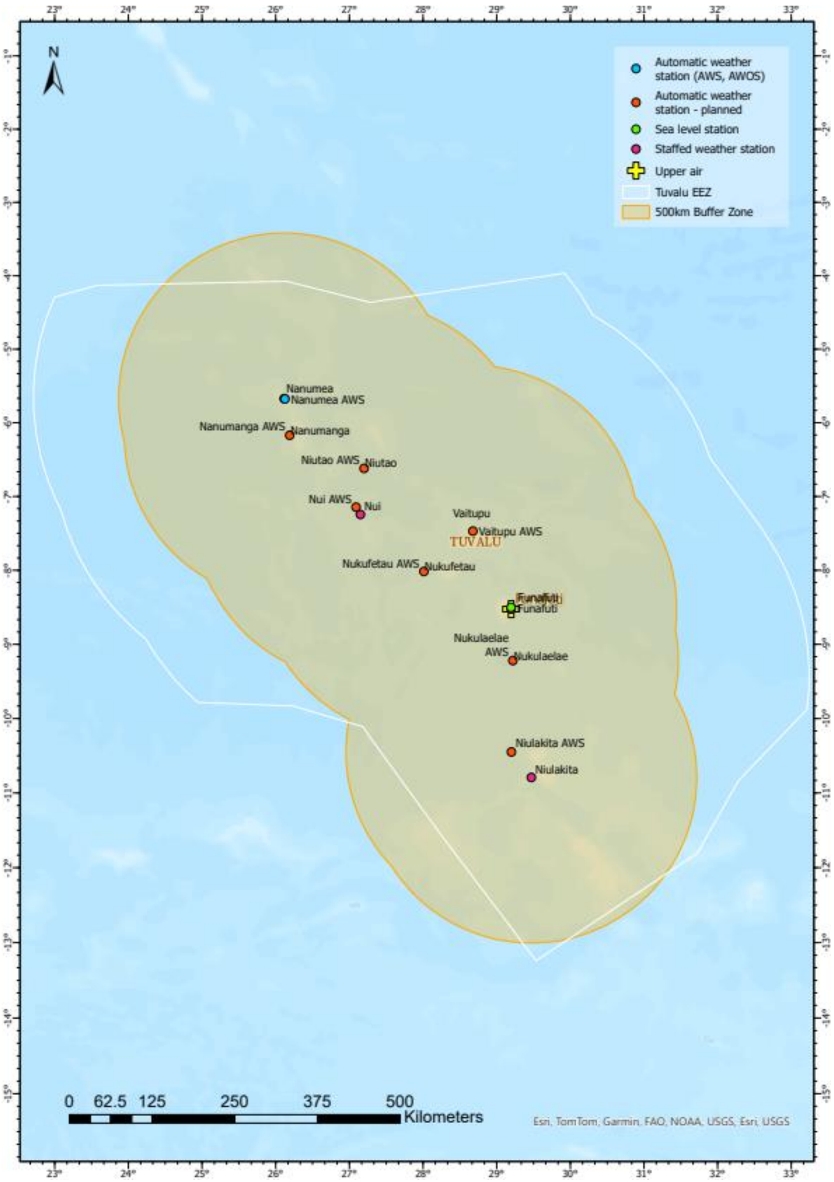

Figure 3 Map of existing and planned stations

The meteorological observation system operated by the Tuvalu Meteorological Service currently consists of:

- 4 staffed weather stations
- 6 automated weather stations (AWS/AWOS).
- 1 upper air station.

Tuvalu currently does not have direct access to a GTS/WIS node. Surface and upper air messages are emailed to the New Zealand MetService and the Australian Bureau of Meteorology for international exchange.

OSCAR/Surface also requires updating for the Tuvalu stations, including registration of the AWS to be shared internationally.

Nanumea and Funafuti are also designated as GCOS Surface Network (GSN) stations with Funafuti also designated as a GCOS Upper Air Network (GUAN) station.

At present, there is no active engagement with Regional WIGOS Centres (RWCs). Fiji Met Service hosts the RWC with responsibility for the Southwest Pacific, but its capacity to deliver all RWC functions for the region is currently constrained, as the RWC itself has not yet fully implemented the necessary systems and processes to support comprehensive metadata management and data quality monitoring across the region.

In future, there will be engagement with the RWC to advance WIGOS implementation, including support for metadata management, integration of station information into OSCAR/Surface, and the development of regional mechanisms for monitoring data quality and system performance.

The current implementation schedule for the AWS installations in Tuvalu, under the CIP-Pac5 programme, is as follows:

- 23 February – 6 March: Two technicians will travel to New Zealand to undertake AWS technical training.
- 24 March – 7 April: Installation of the Niulakita AWS will be carried out, alongside support for establishing the national instrument workshop.
- May (tentative): Two additional AWS installations, Nanumanga and Niutao, are proposed for May, but not yet confirmed.

Siting considerations for the proposed AWS on Nui remain under review and require resolution before installation can proceed. All AWS equipment procured under CIP-Pac5 has been delivered and is currently held in secure storage on Funafuti pending deployment.

3.1.1 Staffed Surface Stations

TMS maintains four staffed weather stations: Nanumea, Nui, Funafuti and Niulakita.

The staffed office at Funafuti provides observations every three hours (eight times per day). The three staffed offices in the outer islands provide synoptic observations four times per day. Whilst these observations are shared internationally, the stations do not meet the GBON requirements in terms of temporal resolution. Hourly METAR/SPECI observation are also made at Funafuti. In some cases, due to staffing, equipment or communication issues, observation frequency is less than targeted.

Observations at the staffed stations are taken manually. The instruments include wet and dry bulb thermometers housed in a Stevenson screen (mix of liquid-in-glass or digital depending on location), a digital barometer and a raingauge. Funafuti has an anemometer with a digital display for wind speed and direction. Wind speed and direction are estimated in the outer stations.

General instrument and equipment maintenance at the stations is limited. Due to a lack of functioning sensors at some stations, measurements are estimated or not available.

Figure 4 Funafuti meteorological enclosure. Recently built office is visible to the right of the image.

3.1.2 Automated Weather Stations

There currently five AWS and one AWOS systems installed in Tuvalu.

The AWOS at Funafuti was recently restored with support from the Australian government, after having been inoperable for many years. It is expected that the data will in future be available on international networks, but this is still to be activated.

There are two AWS from an earlier RESPAC project, but these are not telemetered. Data are collected periodically via SD cards whenever the island/atolls are visited. These stations have not been considered further for GBON as they will be superseded by the CIS-Pac5 stations.

Tuvalu is part of the Pacific Sea Level and Geodetic Monitoring Project, a component of COSPPac. Under this project there is an AWS associated with the sea level station in Funafuti. Given its proximity to other surface stations on Funafuti, however, it has not been considered further for GBON.

The eight AWS (four currently installed) funded by CIS-Pac5 (one for each island) are all capable of being GBON compliant with 10 m wind speed and direction, air temperature and relative humidity, pressure and precipitation all being measured. Additionally, solar radiation, soil moisture, and soil temperature (10 cm, 20 cm, and 30 cm depths) are also made by these AWS. 1-minute, and 10-minute data are being recorded and transmitted.

These AWS are solar powered with sufficient battery capacity to enable hourly communications via satellite and more than two weeks operation without charge.

The AWS installed under CIS-Pac5 report on an hourly basis with data available to TMS staff, the observations are currently not shared internationally. These AWS are not yet registered in OSCAR/Surface.

Due to the very small land area in Tuvalu, siting of observation stations is a challenge with some compromises in exposure evident. For example, the atoll of Nanumea has a total land area of 3.9 km^2 (Figure 5).

As an example, the newly installed AWS at Nanumea is located alongside the runway which is being re-developed. While there are many coconut palm trees surrounding the runway influencing the observations (Figure 6), the station is located to best measure the prevailing conditions.

Figure 5 Nanumea Atoll showing location of met office (and proposed new office) and the AWS

Figure 6 Newly installed Nanumea AWS alongside redeveloped runway (September 2023)

3.1.3 Upper Air Station

There is one existing upper air station in Tuvalu at the TMS compound in Funafuti. The station and its consumables are funded by the United Kingdom MetOffice (UKMO) and implemented by SPREP. Maintenance is undertaken by TMS technical staff with the support of the NZ MetService on behalf of SPREP.

Figure 7 Funafuti compound (AWOS front, enclosure to left, (old) main office with carport centre, and balloon shed to right).

There is currently one balloon launch per day at Funafuti. SOFF support will be required to increase this to two flights per day for GBON compliance.

3.1.4 Maintenance

General security and maintenance of the weather stations and surrounds, including cutting of vegetation, is undertaken by the observing staff on site.

TMS technical staff attempt to visit the outer island offices quarterly; however, with inter-island travel currently only undertaken via sea, this can be a lengthy, unreliable, and expensive process, often falling outside the nominal TMS operational budget. Additionally, due to the shipping schedules, time on island may be limited to only a few hours, or conversely, more than two weeks, if it is necessary to wait for the next ship.

Sourcing of instruments, parts and materials is a major challenge. With no local supplier, all parts and components must be procured from overseas, with at times lengthy delivery times and costly freight. Some tools and spares for the AWS have been supplied with the CIS-Pac5 programme, however these are limited.

The CIS-Pac5 programme has provided TMS with verification standards (air and soil temperature, relative humidity, pressure, rainfall and solar radiation) to enable station inspections and verifications.

There are no calibration facilities in Tuvalu and the workshop and laboratory facilities are inadequate and not suitable for the maintenance and testing of AWS components and systems. As a result, the verification standards are unable to be calibrated in Tuvalu.

TMS have been encouraged to make use of neighbouring existing Regional Instrument Centres (RIC) in Australia and Philippines, or to send to New Zealand or Fiji for calibration services of their instruments and travelling standards.

The balloon shed and associated infrastructure for the upper air programme at Funafuti is generally well maintained and in good condition with recent painting evident inside and outside of the building. Electrical and hydrogen generation and storage are in good condition (Figure 8 and Figure 9).

Figure 8 Hydrogen generation

Figure 9 Hydrogen storage

3.2 Target state and recommended activities

3.2.1 Surface stations

Considering the difficulties in accessing the remote locations, and drawing on similar experiences elsewhere, the suggested approach for the GBON surface stations is for AWS to be co-located with staffed weather stations (**Activity 3.1**).

This approach is recommended for the following reasons:

- Co-locating the AWS with the remote staffed stations will enable stations to provide 24 hours/day observations without increasing staff numbers.
- Having trained staff on site is a cost-effective way of providing front line maintenance and ensuring sufficient up-time to meet GBON requirements.
- Having both manual and automated observations provides a degree of redundancy in the case of equipment failure. In times of AWS downtime, the frequency of manual observations could temporarily be increased as needed.
- The presence of trained staff on site will provide quality control and allow for quick fault identification and restoration of equipment.
- Staff on site will be able to provide security and grounds maintenance to ensure the station continues to comply with WMO siting requirements.

As this activity is already being planned under the CIS-Pac5 project, the installation of AWS at Nui and Niulakita should be prioritized (**Activity 3.2**).

In addition to the plans to establish AWS to the four staffed stations, through CIS-Pac5 there are plans to establish AWS and staffed offices at the remaining islands. Whilst these will not be needed to meet Tuvalu's GBON requirements, these locations will provide critical information to underpin local service delivery and can be integrated into the WMO Regional Basic Observing Network (RBON). International exchange of these observations is encouraged to enhance the accuracy of NWP output over Tuvalu. The stations may also provide an additional level of redundancy in the event of outage of a GBON station.

The Funafuti office is currently staffed 24/7. While SYNOPs are produced every 3-hours, METAR/SPECIs for aviation are produced every hour. As a first step, it should be straightforward for SYNOPs be generated and sent hourly to meet GBON requirements for Funafuti (**Activity 3.3**).

To ensure that the station at Funafuti attains and continues to meet GBON surface and upper-air requirements, additional staffing may need to be funded through SOFF (**Activity 3.4**).

Once AWS and AWOS works are completed at Funafuti, transition to fully automated operations with on-site support from observing staff (**Activity 3.5**).

Mobile internet and cellular services are limited in their coverage and reliability across the country. AWS data transmission is via satellite, with HF radio backup used for reporting of manual observations. The AWS data is transmitted using the Inmarsat BGAN satellite service, the costs of which are covered by the CIS-Pac5 project. This funding extends to the end of September 2026. These monthly costs will need to be covered when the CIS-Pac5 project ends (**Activity 3.6**). There may be a possibility to centrally manage satellite communications through SPREP or WRP as these systems are used widely throughout the region.

The surface stations to be upgraded as per this plan are listed in Table 2.

Table 2. **Planned GBON surface stations.**

Station name	Existing station status	Planned GBON configuration
Nanumea	Existing staffed station	AWS with on-site staff support (limited hours)
Nui	Existing staffed station	AWS with on-site staff support (limited hours)
Funafuti	Existing staffed station	AWS with on-site staff support (24 hours)
Niulakita	Existing staffed station	AWS with on-site staff support (limited hours)

The proposed minimum set of instrumentation and systems for these stations are summarized in Table 3. Selection and installation of instruments will be compliant (as far as possible noting comment above re-siting) with WMO-No. 8 Guide to Instruments and Methods of Observation and the GBON Tender Specification for AWS. Wind observations are currently estimated at the outer stations. The provision of wind monitoring instruments is necessary at these locations to meet GBON requirements.

There are limited spares (instruments, components, consumables) for both manual and AWS surface stations. A complete set of spares should be procured to ensure manual observations are able to continue in the event of breakages of failures (**Activity 3.7**).

Table 3. Instruments and observing systems for GBON surface stations.

Manual synoptic sites	**Automated synoptic sites**
Instruments*	Instruments*
• Electronic temperature and humidity sensors with digital readout. (Capable of displaying maximum and minimum air temperature.) Sensors at 1.25m above ground level. • Barometer with digital readout. • 5" (127mm) manual raingauge • Wind vane (for estimated wind speed and direction), or wind sensors (measured wind speed and direction) at 10 m with a digital display.	• Air temperature (Platinum resistance (PT100) at 1.25 m above ground level. • Relative humidity (Capacitance sensor) at 1.25 m above ground level. • Barometer (Class A) • Raingauge (≥ 200 mm diameter, tipping bucket • Wind speed and direction (10 m) • AWS processor to collate and transmit data. (Minimum buffer storage to be 30 days.)
Structures	Structures
• Stevenson screen, double louvered (may be same screen as used for AWS if co-located in same enclosure) • 10 m tilting mast if sensors installed (may be co-located with AWS)	• Stevenson screen, double louvered (may be same screen as used for manual station if co-located in same enclosure) • 10 m tilting mast (may be co-located with manual station)
Facilities	Facilities
• Suitable sized enclosure to meet exposure requirements as specified by WMO**. • Ability to house and store observing consumables, cleaning materials, station records and stationery, and preferably, a workstation (with PC and monitor/s) for the manual observer. • A local display for any electronic data (T/RH/WS/WD/PP) recorded on site. • A power supply for the operation of any digital instruments and displays. • A power supply to enable communication of coded messages. • An uninterruptable power supply to ensure message transmission. • Supply of clean water for cleaning and wet bulb readings.	• Suitable sized enclosure to meet exposure requirements as specified by WMO**. • Mains and/or solar power supply to AWS including batteries to support solar, and/or to act as UPS for message transmission. •
Communications	Communications
• Cellular, e-mail or HF radio backup.	• Satellite communications to ensure regular, timely message transmission.

* Other instruments may be required, such as evaporation, solar radiation, soil temperatures but these are currently outside the scope of SOFF/GBON.

** Land availability is limited and there are many palm trees which will cause various compromises to recommended siting requirements.

*** All stations installed under CISPAC-5 are equipped with these instruments, and all future planned stations will include the same. To note, Funafuti is the only station with an anemometer

3.2.2 Upper air stations

The upper air station at Funafuti is functioning well and provides reliable and regular soundings once per day.

Table 4. Planned GBON upper air stations

Station name	Existing station status	Planned GBON configuration
Funafuti	Existing staffed station. One flight per day.	Increase flights to two per day.

To improve this upper-air station to meet GBON requirements, the following activities should be undertaken:

- **Activity 3.8:** Secure funding for provision of consumables, and extra staffing if required, to enable two flights per day (see also Activities 3.4 and 4.8).

Selection and installation of instruments will be compliant with WMO-No. 8 Guide to Instruments and Methods of Observation and the GBON Tender Specification for Upper air stations. Instruments and observing systems required for upper air observations are listed in Table 5.

Table 5. Instruments and observing systems for planned GBON upper air stations

Manual balloon release system
Instruments and consumables
• Radiosondes • Balloons • Personal Protective Equipment (PPE) suitable for dealing with explosive environments
Structures
• Balloon shed where manually constructed balloon trains can be safely inflated and released. • Separate (or partitioned) Hydrogen generation shed and storage tanks • Fencing, adequate for the required security of the site. • Exclusion zones (painted lines), beacons/lighting and paths within the site
Facilities
• An area sufficient to ensure exclusion of the public and obstacles that may impact or be impacted by balloon releases. • Ability to store upper air consumables, cleaning materials, various computer and communications systems supporting the upper air observations, and a work area for the manual observer to assemble balloon trains as appropriate. • A local display for the radiosonde profile and access to sensors for ground check data (T/RH/WS/WD/press). • A hydrogen generation system and storage facility to ensure adequate supply for the anticipated upper air program. • Power supply to enable hydrogen generation and monitoring, constant communication with the radiosonde and the transmission of coded messages. • An uninterruptable power supply to ensure the above. • Supply of clean water for hydrogen generation
Communications
• Communications systems integral to the upper air program (to receive sonde data, normally supplied with the Upper Air system). • Robust communications to ensure regular, timely message transmission.

3.2.3 Maintenance

Maintenance is one of the most significant challenges for TMS in terms of meeting its GBON requirements. Maintenance (see also **Module 4**) is therefore a critical focus of the contribution plan.

Maintenance is crucial to maintaining routine operations, addressing faults as they arise and ensuring the safety of staff. Examples of maintenance tasks are shown in Table 6.

Table 6. Example maintenance tasks for GBON stations

Level	Description	Surface tasks	Upper air tasks
1	• Basic tasks requiring few consumables or parts carried out by local personnel, local staff or contractors. • Moderately complex tasks carried out by staff following standard operating procedures (SOPs). • Tools, parts and consumables will be required.	• Clean Stevenson screen. • Change wet-bulb wick. • Cut grass/ vegetation.	• Attach sondes and launch balloons. • Change over hydrogen cylinders. • Cleaning of balloon shed and equipment
2	• Technical tasks carried out by staff following SOPs. • Tools, parts and consumables will be required.	• Collect station metadata. • First line maintenance e.g., unblocking and checking raingauge. • Under guidance of remote technicians, replace and verify performance of sensors.	• Check operation of HoGen • Check gas lines for leaks • Check operation of water spray
3	• Specialised maintenance actions carried out by trained staff. • Procedures are complex and fault-finding is a required skill.	• Replace infrastructure. • Set up and configure new equipment and sensors. • Advanced fault finding. • Verification and/or calibration of sensor/instruments. • Install data communications system.	• Annual maintenance of UA system. • Advanced fault-finding. • Set up and configure new equipment and sensors. • Install data communications system.
4	• Specialised repair or replacement by manufacturer or agent	• Return to agent/ manufacturer of component	• Return to agent/manufacturer of component.

Freight costs within Tuvalu and the region are very high, especially relative to operational budgets (See also Module 2 and related activities). There are also freight logistics and handling to deal with, adding to the challenges and exacerbating the budget constraints faced by TMS.

Therefore, it is important that a detailed Operations and Maintenance plan be developed for the GBON observation network and systems (**Activity 3.9**). This will include regular instrument and sensor maintenance and calibration, with instrument calibration being carried out in Fiji, New Zealand or Australia. The plan must be fully costed (see Activity 2.1), including both preventive and reactive maintenance, and needs to result in supporting budget decisions.

A portable communications system (Starlink Mini) has been purchased through CIS-Pac5 to enable reliable remote communications for TMS technical staff to use when visiting remote stations and when additional technical support is required. Communications are also important for health and safety considerations. The data plans on these systems are flexible and it is recommended that an appropriate plan be supported via SOFF after the conclusion of CIS-Pac5 (**Activity 3.10**).

Funding for ongoing essential services such as logistics, travel and communications, during both the Investment and Compliance phases will be key to ensuring ongoing GBON compliance. As outlined in Module 2, UNEP and TMS will develop a plan for ongoing procurement of essential services to support TMS to operate and maintain the stations to a GBON standard through both Investment and Compliance phases.

As most Pacific Island NMHS have a small staff, an effective and sustainable approach would be to establish a regional maintenance capability that can support multiple Pacific Island Countries. Therefore, it is proposed that a Pacific regional solution also be identified for maintenance and repair (see Table 6), instrument calibration and train-the-trainer services (see also Module 4, Section 4.2).

3.3 Design of the ICT infrastructure and services

3.3.1 Data collection and transmission

Internet connectivity in Tuvalu is via geostationary satellite and bandwidth is very limited. Communications are subject to significant attenuation during heavy precipitation events. This is even more of an issue in the outer islands and atolls.

TMS do not have direct access to the GTS and do not have access to a WIS 2.0 node. Observations from the existing staffed stations are recorded by the observers in logbooks and transcribed into coded messages. These messages are then relayed to the Funafuti office. The Funafuti observers then forward the coded messages to MetService and the Bureau of Meteorology via e-mail. The Bureau converts the messages to BUFR format and submits them to the WMO's Global Telecommunications System (GTS). This process is labour intensive and has the possibility to introduce errors at multiple points in the process.

Problems with the reliability of cellular-based internet services can also lead to significant delays in e-mail transmission. Radio and Chatty Beetle (Figure 10) are used as backup means of transmission from the remote stations to Funafuti.

Figure 10 Radio (left) and Chatty Beetle (right) at Funafuti office

3.3.2 AWS reporting

The AWS installed under CIS-Pac5 use Inmarsat's BGAN service to transmit data on an hourly basis to a NEON web-based system hosted by Earth Science New Zealand (formerly NIWA). Data are automatically ingested into CliDE from NEON.

It is a requirement of the CIS-Pac5 project for the AWS observations to be exchanged internationally via the GTS/WIS; however, this is not currently the case. Despite the system architecture being "end to end" (Figure 11) and climate services products being produced and disseminated, observations are not currently being transmitted to the GTS/WIS.

To enable this is technically relatively straightforward. However, it is still to be determined if the WIS 2.0 node is implemented in-country or hosted elsewhere, such as Fiji or New Zealand.

For a WIS2.0 node to be installed at TMS headquarters, there would need to be a robust communications mechanism to the remote stations. The current BGAN solution does not address this issue, as data is routed to Wellington. One possible solution could be commercial internet via Starlink or another provider. A number of Starlink terminals have been procured under the CIS-Pac5 project and these could provide a viable alternative to BGAN and provide a mechanism to bring data back to TMS Headquarters.

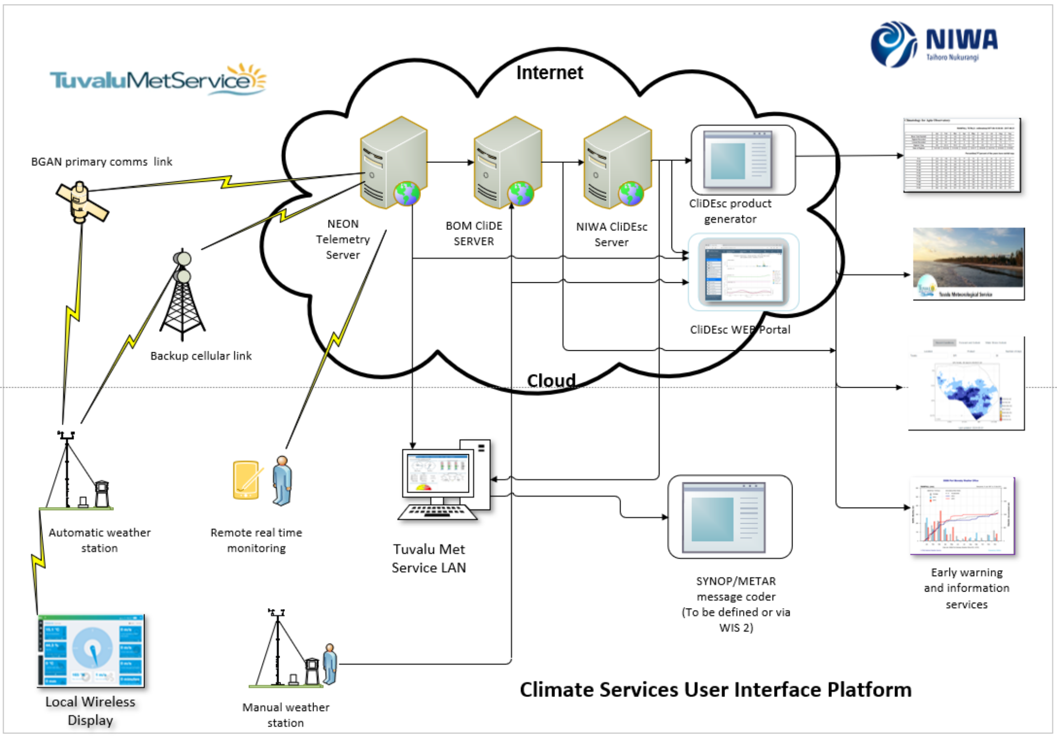

Figure 11 Tuvalu CIS-Pac5 system schematic

For WIS 2.0 to be implemented, OSCAR/Surface also requires updating and stations to be registered. This is currently not possible as the sole registered, and trained, Focal Point is on training leave for three years. Limited internet access and available time in-country meant alternative OSCAR access was not possible to arrange during the country visit.

The AWS installed under RESPAC are not telemetered. Data collection is periodic with SD cards. Data are ingested into CliDE but are not available in real time.

Specific actions required to enable data to be transmitted via WIS 2.0 include:

- **Activity 3.11:** Investigate and invest in robust data communications between the remote stations and TMS headquarters
- **Activity 3.12**: Updating, and registration of, stations in OSCAR/Surface.
- **Activity 3.13**: WIS 2.0 node implementation to support data integration into GBON.

3.4 Design the data management system

The Climate Data for the Environment (CliDE) database is a well-established Climate Data Management System (CDMS) used in 14 Pacific Island Countries. Each country maintains a local version of CliDE database along with a product generator, CliDEsc. It is desirable for data from observation systems in the region to be made available to CliDE.

CliDE provides data entry, storage, basic visualization and extraction tools for weather and climate data, comprehensive metadata, instrument/equipment tracking and reporting. Manual observations are currently entered by hand into CliDE by climate staff, introducing the possibility for errors at multiple points in the process. Data from the CIS-Pac5 AWS are ingested automatically into the TMS CliDE database.

Data from the GBON stations, in addition to being made available for international exchange via WIS2.0, should be automatically ingested into the CliDE database (**Activity 3.14**).

3.4. Environmental and sustainability considerations

Environment and sustainability are very important for Tuvalu, where the available land resource is extremely limited.

Some national documents relevant to TMS include:

- Te Keke: National Strategy for Sustainable Development 2021 – 2030
- Tuvalu National Environment Management Strategy 2022 - 2026

Education and repeated and progressive training are key to improving the maintenance, repair and reuse of equipment, where practicable, and therefore reducing levels of waste. This can start with relatively simple tasks such as keeping equipment clean to extend its useful life. This can be particularly applicable to masts and housings.

Shipment of items in wooden, cardboard or paper packaging rather than plastics is simple to specify and comply with. These materials can be repurposed or recycled.

The CIS-Pac5 AWS are all solar-powered but battery use is still a concern. It is also important to note that due to environmental, cultural and sustainability reasons, some compromises in exposure are required. Hence valuable palm trees and other food sources are not completely removed.

Mercury instruments are virtually non-existent except for a single mercury thermometer at Funafuti. Digital systems are used for air temperature (including maximum and minimum) and pressure at the staffed offices.

The thermometer screens in use are now the longer-life plastic screens except for Funafuti. These are longer lasting, very easy to clean/wipe down, do not need the frequent repainting or replacing necessary with wooden screens. Funafuti still uses a wooden screen which is in a state of disrepair, but this is planned to be replaced with a plastic screen when the enclosure is moved to accommodate the new office.

Improving coordination between various projects and programmes is crucial. A particular challenge is the proliferation of different systems that are currently being installed. It is important that ongoing operational support (maintenance, fault resolution, data access) are built into any activities. Having multiple types of equipment, such as AWS, increases significantly the training required, the complexity of work and the need to hold multiple types of spare parts.

Module 4. GBON Human Capacity Development Module

4.1. Assessment of human capacity gaps

TMS has 25 full time staff including the director. There are 18 Male and 7 Female staff (Table 7).

Table 7 - TMS Staffing by category

Classification	**Division**	Number
Director	Administration	1
Clerical Officer	Administration	1
Forecaster/Meteorologist	Forecast Section	5
Observer/Meteorological Technician	Forecast Section	10
Climate Services	Climate Section	4
Technician/Other	Technical Section	4

The technical staff consist of a Principal Technical Officer (PTO), an IT Officer, a Senior Technician and Handyman. There are a further seven staff attached to TMS through the CIS-Pac5 project and Climate Information Early Warning System (CIEWS). These are all fixed term for the duration of project. Most of these additional staff are female with only 2 male staffs.

All observers receive forecasting training and other regional training such as that conducted by JICA, the Regional Training Centre in Fiji, and Pacific Desk in Hawaii.

Four staff have undertaken short-term training at the Pacific Desk. A further two staff are overseas on long-term (multi-year tertiary) training at University of South Pacific.

The key gaps, or vulnerabilities, in human capacity necessary for continued GBON compliance are:

- Limited technical qualifications among the technical and observing personnel.
- Observation staff have no training in basic (first line) maintenance of AWS.
- Technical staff have limited training in "end to end" AWS maintenance and operation.
- Technical staff have limited training in satellite communications and the various tools to support these systems.
- Additional observing staff may be required to support the increased observation programme – specifically two upper air soundings per day.
- TMS are extremely vulnerable in their ICT capacity. Further ICT expertise will be required with the implementation of WIS 2.0.

It is also worth noting that Tuvalu typically has high staff turnover as individuals and their families migrate to other countries. TMS is also affected by this and any training in operational systems and services needs to be regular and repeated. The problems of staff turnover may be exacerbated by the announcement of a climate visa program with Australia.

A common request from the region is for accredited training. Outside of tertiary qualifications, this can be difficult to source. The BIP-MT as conducted by the Regional Training Centre in Fiji (RTC Fiji) has Diploma status and may be suitable for observers, but there is no equivalent qualification for field technicians.

4.2. Design capacity development activities for technical staff

Staff recruitment and training will be critical to ensure that TMS has sufficient capacity to sustain GBON compliance in the medium to long term.

Technical training, especially on AWS maintenance, needs to be ongoing, regular and progressive. The UNEP CIS-Pac5 project is a good example where the project includes two-weeks of training on AWS maintenance hosted in New Zealand in years 1, 3, and 5 as well as on the ground training during the installation phase.

AWS training is complex, especially when factoring in the onsite maintenance, calibration, network management and ICT. A multi-level approach is recommended to get the best outcomes.

A Pacific Regional approach to training and development will be most effective and sustainable. It is recommended that the Pacific Island Education, Training and Research (PIETR) panel be supported by SOFF to prepare advice and recommendations to develop a detailed training plan for the PMC and its members (**Activity 4.1**).

It is recommended to centralize calibration activities, in particular the calibration of the travelling references used by technical staff. This may need to be undertaken at multiple facilities, as the effort to calibrate instruments across the region to meet GBON requirements alone will be significant (**Activity 4.2**).

To address some of the vulnerabilities and gaps identified, the following additional capacity development activities are recommended:

- **Activity 4.3:** Conduct training in basic automated and manual weather station maintenance and field checks for observation staff.
- **Activity 4.4:** Conduct advanced training in automated and manual weather station maintenance and field checks for field technicians.
- **Activity 4.5:** Conduct training across observers and field technicians on compilation and maintenance of discovery and descriptive metadata and use of CliDE for maintaining metadata.
- **Activity 4.6:** Conduct training in radiosonde preparation and launch, as well as hydrogen safety, for observing staff involved in the upper air program.
- **Activity 4.7:** Conduct training in WMO WIGOS tools OSCAR/Surface and WDQMS and CliDE/CliDEsc to selected members of the Observations, Climate, and Technical teams for system monitoring and maintenance.
- **Activity 4.8:** Recruit and fund any additional staff required at Funafuti to expand the upper air program to two flights per day (See also Activities 3.4 and 3.8)
- **Activity 4.9:** Recruit and fund at least one new ICT technician with appropriate technical skills and qualifications in networks, communications and database technologies critical to support operations.

4.3. Design capacity development activities for senior management

There are nine staff attached to TMS through CIS-Pac5 and CIEWS. The provision of project management activities is supported through these programs. However, CIS-Pac5 is due to end in September 2026. It is therefore recommended that SOFF consider continuing with a SOFF-funded programme/project manager to oversee network and programme management during the Implementation phase (**Activity 4.10**).

4.4. Gender and CSOs considerations

With the inclusion of the CIS-Pac5 and CIEWS staff, TMS currently has 21 male staff and 11 female staff.

There are no existing gender action plans or gender assessments being carried out with TMS through other projects or donors.

The SOFF Gender Action Plan includes a target for 50% of the people participating in SOFF-funded capacity development activities to be female.

Recommendations to further address this imbalance:

- **Activity 4.9:** Engagement with civil society organisations (CSO). This could include working with other programmes and/NGOs, community and school group presentations.

- **Activity 4.10:** Active inclusion of gender considerations in SOFF-related recruitment activities with the target of 50% of people participating to be women.

- **Activity 4.11:** Develop a Gender Action Plan during the Investment Phase to guide the mainstreaming of gender and social inclusion initiatives into SOFF investments.

The Gender Action plan could include targets for female participation with SOFF Investment and Compliance phases in Tuvalu (staff recruitment) and the development of ongoing campaign in schools and communities to promote female participation in roles linked to TMS. It should include metrics and KPIs to be measured over time.

Module 5. Risk Management Framework

5.1 Assess the risks of the observing network and propose mitigation measures

A high-level risk assessment has been undertaken focusing on risks that were identified during the readiness phase, with planned mitigation measures. The mitigation measures will be implemented during the investment phase (**Activity 5.1**).

A key benefit of SOFF is the recognition and mitigation of some overarching issues common to many historical projects in the region and elsewhere. Mitigation of these issues is key to the successful implementation of SOFF. Common issues include:

- No operational and maintenance funding for project-funded AWS.
- AWS not integrated into existing systems, limiting their usefulness and creating additional overheads.
- Disparate networks with different equipment, funded by separate projects.
- "Automation" is often misunderstood and taken to mean "not requiring staff"
    - Generates push-back from staff.
    - Jeopardizes essential functions such and maintenance, repair and calibration.
- Successful implementation requires training in installation, maintenance, repair, calibration and utilization of data.

These and other risks along with mitigating measures are included in Table 8.

Table 8. Risk analysis

Identified Risk	Mitigation Measures	Responsibility	Monitoring and Evaluation
Failure to meet GBON targets due to inadequate equipment maintenance or delays in return to service **Risk level is high.**	• Create a costed operations and maintenance plan. • Limit the number of different technologies and systems used. Use common technology and instruments and therefore reduce costs, and risks, of the overhead of operating multiple systems. • Establish funding mechanism for annual procurement of spares and spare parts. • Establish protocol for the routine procurement of spares and spare parts. • Ensure adequate spares are held at all remote stations. • Co-location of automated weather stations with manual stations. • Train manual observers to provide basic maintenance and redundancy.	TMS/UNEP	• Regular (annual) review of O&M and budgets. • Monthly reporting on logistics needs and activities. • Monthly review of GBON compliance via WDQMS • Annual review of staff training records
Failure to meet GBON targets through loss of data due to long lead-times for repairs due to travel distance and complicated logistics. **Risk is medium.**	• Co-locate automated weather stations with manual weather stations. • Ensure adequate spares are held at all remote stations. • Train manual observers to provide basic maintenance and redundancy	TMS and UNEP	• Regular (annual) review of O&M • Monthly review of CliDE, WDQMS and GBON compliance. • Annual review of staff training records.
Poor data quality or lack of data from unattended AWS due to degradation of site (environmental) conditions, vandalism or theft. **Risk is high.**	• Proactive maintenance by TMS staff funded through establishment of 'logistics fund' • Community engagement of importance of reliable data. • Fencing protection from wandering animals (dogs, pigs) • Review of data that fails automated quality checks	TMS and UNEP	• Monthly review of CliDE, WDQMS and GBON compliance. • Weekly review of quality flagged data.
Poor data quality due to inadequate workspace and tools for servicing, repair and calibration of	• Provision of appropriate facilities and tools at Funafuti for repair and maintenance of equipment and instruments.	TMS and UNEP	• Annual quality audit by TMS quality manager

equipment and sensors. **Risk is high.**	• Make use of regional neighbours and partners for calibration. • Establish a funding mechanism for transport of instruments for calibration.		
High turnover of new and developing technologies. **Risk is high.**	• Use of established vendors with track record. • Undertake targeted training and capacity building activities for the entire value chain.	TMS and UNEP	• Monthly review of CliDE, WDQMS and GBON compliance. • Annual review of staff training records.
Poor internet connections or unreliable power leading to communication outages and data transmission delays. **Risk is high.**	• Equip all stations with alternative communication methods e.g., Chatty Bettle, HF Radio. • Equip all stations with battery backups.	TMS and UNEP	• Monthly review of CliDE, WDQMS and GBON compliance.
Inadequate and/or fragmented storage or workspaces for equipment leading to degradation of equipment. **Risk is high.**	• Provision of appropriate facilities (Funafuti and remote stations) for storage of equipment to protect from environment and fauna.	TMS and UNEP	• Annual quality audit by TMS quality manager
Insufficient human resources or technical skills to install or maintain stations, equipment and ICT system **Risk is medium.**	• Develop training and capacity building plan for technical staff. • Regular, and repeated, training of technical and observing staff during Investment and Compliance phase. • Recruitment of additional skilled staff during both Investment and Compliance Phase as outlined in Module 4. • Workforce planning to address attrition. • Use of common technology and instruments to limit the number of different technologies and systems used.	TMS and UNEP	• Annual human resources audit by TMS • Including review of staff training records.

Module 6. Transition to SOFF investment phase

The activities outlined in this National Contribution Plan will provide the basis for developing the Investment Proposal for the Tuvalu National GBON Network. The Investment Proposal will be developed by UNEP and TMS, with input from New Zealand (MetService and Earth Science New Zealand) **(Activity 6.1).**

Summary of GBON National Contribution Plan

Components	Recommended activities
Module 2. GBON business model and institutional development	1. Engage with the Ministry of Finance, and other potential partners, to develop a robust plan for ongoing funding and procurement of essential services such as travel, communication, and consumables. (see also 2.2 and 3.9)
	2. Engage with the Ministry of Finance and other regional partners, to investigate potential for waiver of customs duties for meteorological equipment for maintenance and calibration.
	3. Engage in regional forums to pursue opportunities for regional coordination in Investment Phase and Compliance Phase elements such as maintenance, calibration, training, common equipment types.
	4. Actively support the development and utilization of the Regional Instrument Centre within Regional forums and in the context of Weather Ready Pacific
	5. Develop procurement plan that allows for the procurement of equipment to include private sector ongoing support (e.g. maintenance, training, advice, spare parts, etc.) for the life of the equipment.
	6. Undertake a comprehensive scan at start of Investment Phase of planned development activities related to GBON to identify opportunities for leverage and to ensure activities are complementary.
Module 3. GBON infrastructure development	1. Co-locate AWS with staffed stations. This will provide 24/7 coverage, some redundancy of observations, and maintenance of equipment.
	2. As this activity is already being planned for under the CIS-Pac5 project, the Nui and Niulakita installations should be prioritized.
	3. Observing staff to produce manual hourly SYNOPs at Funafuti (they already produce METAR/SPECIs 24/7).
	4. An increase in staffing levels may be required to ensure 24/7 operations at Funafuti for provision of hourly SYNOPs and a second Upper-air sounding.
	5. Once AWS and AWOS works are completed at Funafuti, transition to fully automated operations with on-site support from observing staff.
	6. Inmarsat BGAN service charges will need to be funded following the end of CIS-Pac5 funding.
	7. Procure observing equipment as required for staffed offices, including spares and consumables

	8. Provision of consumables, and extra staff if required, to enable two radiosonde flights per day at Funafuti.
	9. Develop an Operations and Maintenance plan for the TMS observation networks. This will include calibration plans, periodic (annual) and incremental investment for spares and components.
	10. Additional budget for monthly Starlink Mini data plans to for remote technical support.
	11. Investigate and invest in robust data communications between the remote stations and TMS headquarters
	12. Updating, and registration of, stations in OSCAR/Surface.
	13. WIS 2.0 node implemented to support data integration into GBON.
	14. Data from the GBON stations, in addition to being made available for international exchange via WIS2.0, should be automatically ingested into the CliDE database
Module 4. GBON human capacity development	1. Support the PIETR Panel in preparing advice and recommendations to take to PMC for developing a detailed Pacific region training plan covering all aspects of the data chain.
	2. Support the development of a detailed Pacific region calibration plan, including facilities required.
	3. Conduct training in basic automated and manual weather station maintenance and field checks for observation staff.
	4. Conduct advanced training in automated and manual weather station maintenance and field checks for field technicians.
	5. Conduct training across observers and field technicians on compilation and maintenance of discovery and descriptive metadata and use of CliDE for maintaining metadata.
	6. Conduct raining in radiosonde preparation and launch, as well as hydrogen safety, for observing staff involved in the upper air program.
	7. Conduct training in WMO WIGOS tools OSCAR/Surface and WDQMS and CliDE/CliDEsc to selected members of the Observations, Climate, and Technical teams for system monitoring and maintenance.
	8. Recruit and fund any additional staff required at Funafuti to expand the upper air program to two flights per day.
	9. Recruit and fund at least one new ICT technician with appropriate technical skills and qualifications in networks, communications and database technologies critical to support operations.

	10. Recruit a programme/project manager to oversee network and programme management during the Implementation phase.
	11. Engagement with civil society organisations (CSO). This could include working with other programmes and/NGOs, community and school group presentations.
	12. Develop a Gender Action Plan during the Investment Phase to guide the mainstreaming of gender and social inclusion initiatives into SOFF investments.
Module 5. Risk Management	1. Implement mitigation measures as outlined in the risk management framework.
Module 6. Transition to SOFF investment phase	1. Develop the investment proposal, incorporating activities from this GBON national contribution plan.

Annexes (if any)

Report completion signatures

Peer Advisor signature
Beneficiary Country signature
WMO Technical Authority signature