05th November 2024

GBON National Contribution Plan of the Republic of the Marshall Islands

Systematic Observations Financing Facility

Weather and climate data for resilience

GBON National Contribution Plan

Republic of the Marshall Islands

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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	Reporting	Gap		To improve	New
			To improve	New		
	[# of stations]				[# of stations]	
Surface	9	0	9	0	9	0
Upper-air	3	1	1	1	1	1
Marine	*when applicable					

Figure 1 - Proposed GBON stations in blue showing 250km radius circles. Republic of Marshall Islands Exclusive Economic Zone (EEZ) area shown in yellow. Note: these are 9 of the 24 AWS stations to be installed under the CIS-Pac5 project – see Annex for details.

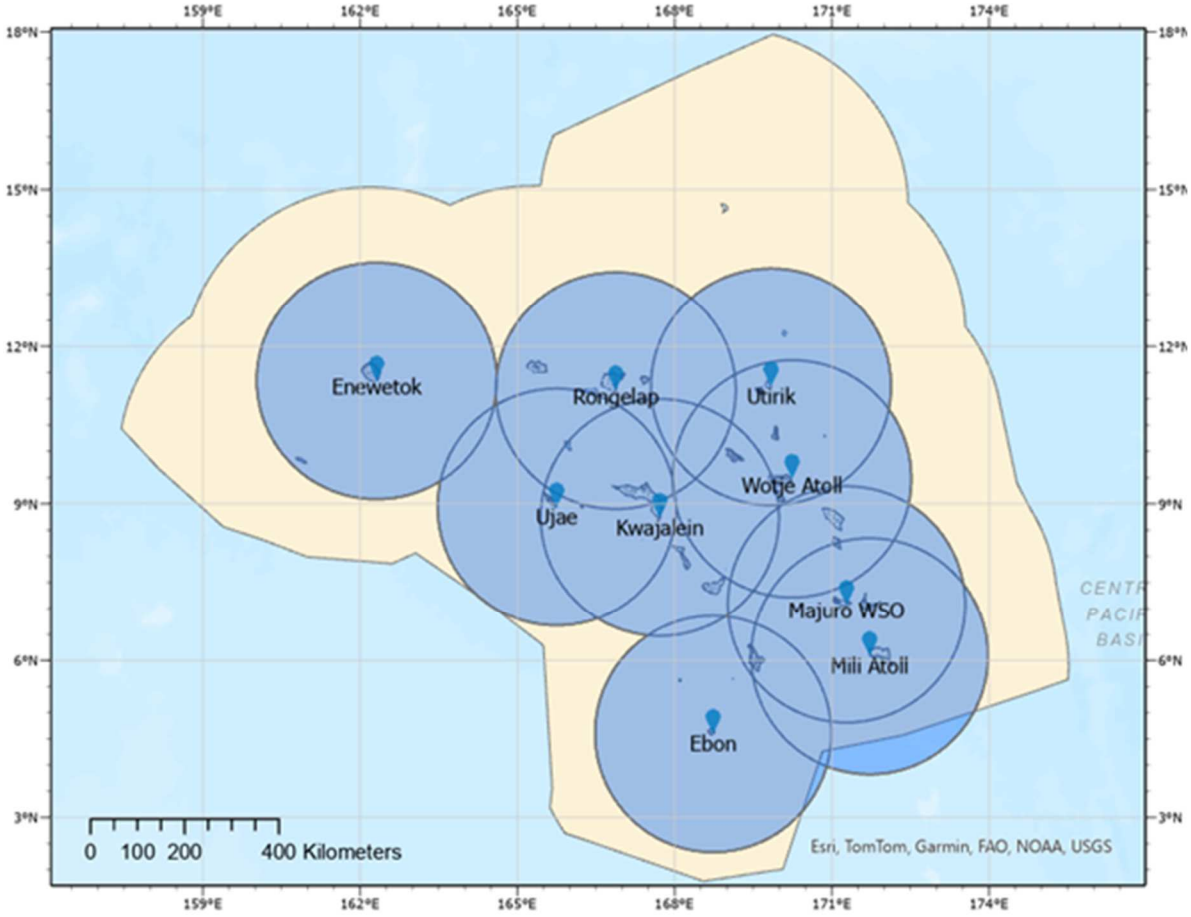
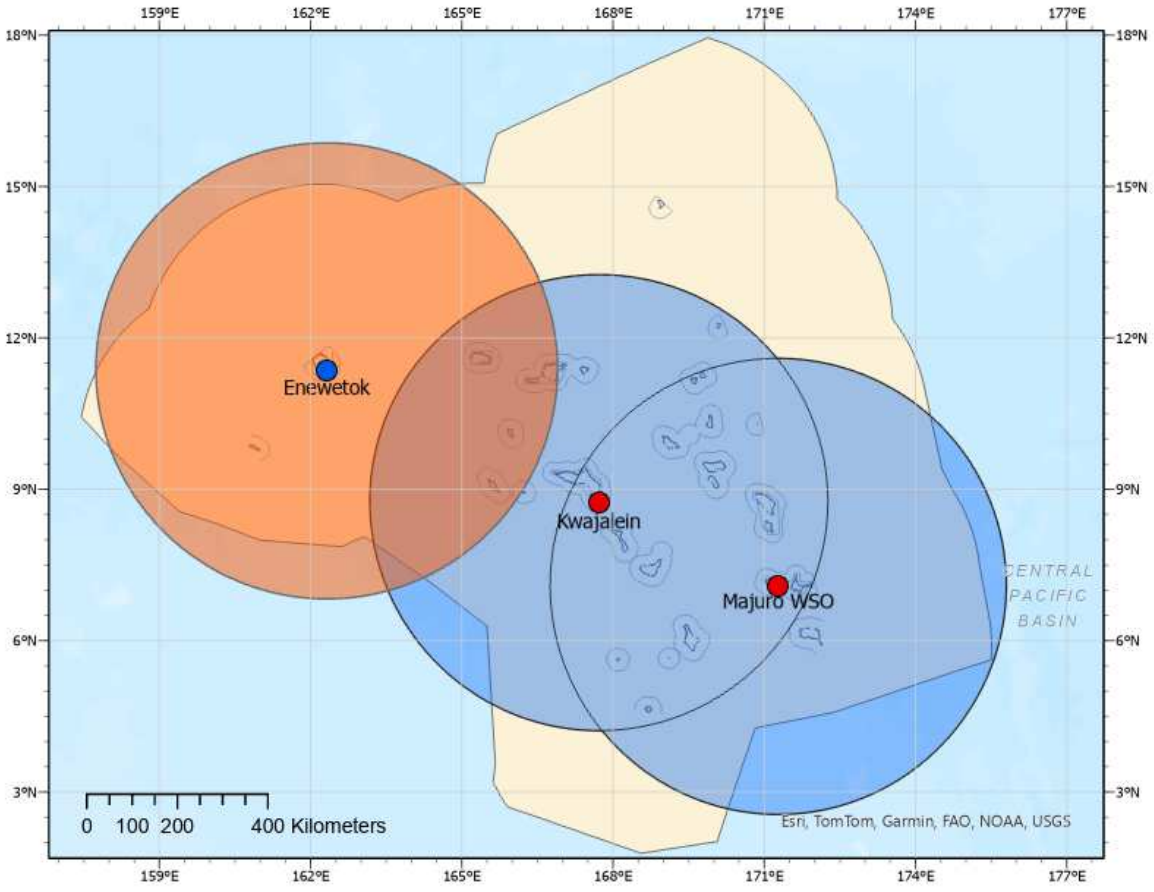


Figure 2 - Existing upper air stations in red dot showing 500km spacing. Proposed new upper air station with blue dot. Republic of Marshall Islands Exclusive Economic Zone (EEZ) area shown in yellow.



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

The Republic of the Marshall Islands (RMI) and the United States of America (USA) signed the Compact of Free Association (COFA) on June 25, 1983. This treaty requires the USA to provide three services for RMI, a postal service, an air traffic service and meteorological service. National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) deliver weather services and associated programs throughout the Republic in line with COFA's Article VII (Weather Services and Associated Programs). According to Sections 5 to 13 of Article VII of COFA, the United States NOAA NWS provides weather services through a Weather Service Office (WSO) created in Majuro, Republic of Marshall Islands, and currently known as WSO Majuro. Subsequently, at the operational level, the National Weather Service Pacific Region Headquarters (NWSPRH) based in Honolulu, Hawaii Islands provides administration, financial, operational, management, and oversight assistance to WSO Majuro via a contract between the NWS and the Government of the Republic of Marshall Islands.

WSO collaborate closely with NOAA and the NWS across all their operations and in particular with respect to observations. The existing upper air station on Majuro is funded through NWS including the costs associated with maintenance, spares and repairs. The NWS also provide technical and logistical support in relation to troubleshooting and securing supplies for the upper air network across RMI. Local technical staff in RMI are supported by NWS staff based in Guam and Hawaii.

Recommendation 2(1): We recommended that the relationship between WSO and NWS is strengthened further to incorporate close cooperation on the implementation and operation of the observation network.

The USA Federal Aviation Administration (FAA) provides the aviation service at Majuro airport, RMI. The WSO and NWS provide the meteorological observing equipment for the airport, and the FAA provide the observers. There is an opportunity to strengthen the relationship between the FAA and NWS in respect to services provided in RMI. WSO cooperates with the FAA regarding the operation of both observation stations and provision of weather services at several airports around the nation, including Majuro airport. These sites are favourable for selection as GBON stations where this is possible, as there is high security and good communication availability. Airport sites also tend to be well exposed.

Recommendation 2(2): We recommend the CIS-Pac5 installation for Majuro is deployed at the airport and this is designated as the GBON site for Majuro.

The upper air station in Kwajalein is located in close proximity to a US Department of Defense (DOD) property and the upper air site is funded and operated through the DOD. The operation of the site is contracted to RTS Weather who undertake radiosonde launches, perform routine maintenance and coordinate data storage and transmission for the site. At present the site undertakes two launches per week.

Recommendation 2(3): We recommend that Kwajalein is designated as one of the RMI upper air sites.

To achieve this, it will be necessary to undertake 2 launches per day and will require close cooperation and legal agreement between WSO / NWS and DOD.

The Australian Bureau of Meteorology (BOM) are operating as a partner in the GCF investment in RMI and operate infrastructure and software which forms a key part of the capability of RMI to store and transmit data internationally. The Climate Data for the Environment (CLIDE) database will be operated by BOM as well as communications systems and data processing. As part of the SOFF investment, provision for data sharing via WIS2.0 is recommended as this has not been implemented under the Green Climate Fund (GCF) program.

2.2. Assessment of potential GBON sub-regional collaboration

NWS are a significant partner in the region and act as a coordinating entity between the WSOs RMI, FSM and Palau. There are regular Micronesia Managers Meetings chaired by NWS which provide coordination of activities and priorities in the region and represent strong ongoing collaboration between the WSOs.

NWS provide training opportunities in meteorology, forecasting and management through in person training courses run out of either Hawaii or Guam offices. The two primary training courses currently being run by NWS are the Pacific Leadership Academy, which provides leadership and management training to senior staff at the WSOs, and the Pacific International Training Desk in Honolulu and Guam which provide training courses focused on meteorology and forecasting.

The Secretariat of the Pacific Regional Environment Programme (SPREP) is the regional organisation established by the Governments and Administrations of the Pacific charged with protecting and managing the environment and natural resources of the Pacific. The Headquarters is based in Apia, Samoa with other SPREP offices in Fiji, the Republic of the Marshalls Islands and Vanuatu. SPREPs mandate is to promote cooperation in the Pacific region and provide assistance in order to protect and improve its environment and to ensure sustainable development for present and future generations. The Pacific Meteorological Council (PMC) is a specialised subsidiary body of SPREP, established in August 2011 to facilitate and coordinate the scientific and technical programme and activities of the regional meteorological services. The PMC provides policy relevant advice to the SPREP on the needs and priorities of its member countries and territories in relation to meteorology.

SPREP / PMC could serve as an important partner in the SOFF implementation phase, providing the opportunity to coordinate training programmes at a regional level, enabling efficiencies in the design and commissioning of the training programmes and enabling access to ongoing refresher training for SOFF countries in the region.

Recommendation 2(4): We recommend that training opportunities for the investment phase across the region are explored in consultation with SPREP / PMC, incorporating the findings and outputs from the SOFF Pacific Regional Event in April 2024.

The ongoing United Nations Environment Programme (UNEP) Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean (CIS-Pac5) project is under way in the Cook Islands, Niue, Palau, Tuvalu and Republic of Marshall Islands. The project includes the deployment of a network of surface observations across the region including 24 AWSs in RMI. The project has been developed with GBON compliance as a core part of the design of the instrumentation in partnership with the National Institute of Water and Atmospheric Research (NIWA). This program in RMI, along with the proposals for other neighbouring SOFF beneficiary

countries in the region (in particular the Federated States of Micronesia) has been considered as a principal part of the design of the GBON network in the region. This includes consideration for alignment of the network at national boundaries, alignment with respect to instrumentation and the full data process chain, and training opportunities. See annex 1 for further details.

There is scope for the establishment of a regional calibration and supply centre which could provide calibration services to all SOFF nations in the Pacific region. This would enable access to high quality calibration equipment and centralised expertise to all NMHSs in the region, where a distributed approach across the islands would be challenging to implement and sustain. This could be coordinated through regional organisations such as SPREP in recognition of the increasing need for calibration across the region.

2.3. Assessment of a business model to operate and maintain the network

The majority of the current operating budget of the WSO is provided through the Compact of Free Association. The funding is passed from NWS to the WSO via the RMI ministry of finance.

Recommendation 2(5): We recommend the 9 GBON surface stations in RMI are fully publicly owned by the RMI government, with SOFF support to fund the sustainability costs of these sites. Operation of the networks will remain the responsibility of WSO staff. An exception to this is the upper air station at Kwajalein, operated as a public-private partnership outlined below.

The UNEP led CIS-Pac5 programme includes the aim to strengthen the observation network of RMI and is installing 24 Automatic Weather Stations (AWS) across the islands this year. Of these, 9 will be designated as GBON stations and will be sustained through SOFF compliance funding. The remaining 15 sites will be owned by the RMI government and there is an expectation that the sustainability of these will also be provided by SOFF. See annex 1 for further details.

The upper air station at Kwajalein is operated by RTS Weather on behalf of the US DOD. At present the site undertakes around two launches per week, dependent on DOD operational requirements. An option for GBON compliance is to increase the launch frequency to 2 launches per day. This option will require a legal arrangement between RMI and RTS Weather to increase the staffing, infrastructure, and consumables at the site. Another option for upper air GBON compliance is to install an autosonde in the vicinity. This option is dependent on locating a suitable site and would require significant “up-front” investment.

Both options identified are complex.

Recommendation 2(6): We recommend the first option (to increase the launch frequency to 2 launches per day) and that negotiations between SOFF/UNEP and RTS Weather are conducted.

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

A strategic plan for WSO RMI was developed and drafted under the Climate Risk and Early Warning Systems (CREWS) project in 2022. The SOFF and GCF projects combined represents a significant change in the operational capabilities, responsibilities and the need for future planning at the WSO. These changes include the need to comply with GBON standards and report on this to SOFF through

the Investment and Compliance phases, activities not currently undertaken at the WSO. The WSO too have indicated that the strategic plan may not fully address the new requirements of the WSO.

Recommendation 2(7): We recommend a revision of the strategic plan and development of an operational plan to reflect the changing nature of the WSO operations.

The United Nations Environment Program (UNEP) and the Green Climate Fund (GCF) are implementing the Enhanced Climate Information and Knowledge Services programme in 5 countries in the pacific (Cook Islands, Niue, Palau, Tuvalu and Republic of Marshall Islands) known as CIS-Pac5. The purpose of the Programme is to support increased resilience to climate variability and change in the five targeted countries. It is consistent with national and regional policies, and with international agreements and frameworks to which the Programme countries are parties. It draws on extensive detailed research undertaken by United Nations (UN) agencies, the World Meteorological Organization (WMO), the Australian Bureau of Meteorology (BoM) and the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) into the current and projected future impacts of climate variability and change in the 14 independent Pacific Island countries, including the five Programme countries. As part of this programme, the installation of 24 AWS across the Marshall Islands is under implementation, with the majority of the stations to be installed in 2024/2025. The COFA funding is an essential agreement to the sustainability of the WSO in RMI. We recommend that the WSO and NWS ensure that the CIS-Pac5 observation network is considered in any future COFA review.

Pacific Meteorological Council (PMC) adopted the Pacific Island Meteorological Strategy (PIMS) 2017-2026, developed and published by SPREP, that sets out the strategic context and direction for strengthening the National Meteorological and Hydrological Services (NMHSs) in the region to be able to deliver effectively their basic and core functions on weather and climate, and to ensure that NMHSs have the capacity to fulfill their responsibilities over the next decade. The strategy identifies four priority areas for action: 1. Improved weather services, in particular aviation, marine and public weather services 2. Improved end-to-end Multi Hazard Early Warning Systems (MHEWS) 3. Enhanced infrastructure (data and information services) for weather, climate and water 4. Improved climate services.

2.5. Review of the national legislation of relevance for GBON

There is no national legislation related to the responsibility for measuring and providing weather observations or services in RMI. Draft legislation is under development as part of the GCF project, though the extent of the legislative mandate this will provide is currently unclear as it is under negotiation at present with RMI government.

Recommendation 2(8): We recommend that the WSO responsibility for the observations network is recognised in draft legislation.

The primary legislation relating to procurement is the RMI Government Procurement Act. The procurement process is undertaken through central government and requires approval via the finance ministry. Procurement for weather service operations, and government operations more broadly, is exempt from import tax requirements which would otherwise apply. The CIS-Pac5 project is actively procuring and installing the observations hardware and it is anticipated that the same processes and procedures will be used for the training and development activities.

Module 3. GBON Infrastructure Development

3.1. Design the surface and upper-air observing network and observational practices

Surface Observations

WSO RMI currently operate a network of 7 manual surface synoptic observation sites, which are comprised of manual observations located at or near airfields on 7 of the islands and atolls in RMI. The requirement for 9 GBON surface observations sites has been established through the GBON Global Gap Analysis. In 2024 the deployment of a network of 24 AWSs begun in RMI as part of the UNEP CIS-Pac5 project. This project has involved the procurement of AWS systems for 24 sites and the schedule for deployment includes 12 sites deployed during 2024 with a further 12 sites in 2025. Each of the existing 7 sites will have a CIS-Pac5 installation.

In order to ensure that WSO RMI can sustainably satisfy the GBON requirement for surface observations, it is recommended that RMI work towards establishing a core network of 9 surface observations. In consultation between WSO RMI and the peer advisor, 9 sites were identified representing locations with reliable access, power and communications and site security. See Annex 1 for the options for the sustainability for the 15 remaining stations.

A map of the existing observation sites is shown in

Figure 3Error! Reference source not found. and of the full 24 AWS sites is shown in **Figure 4**. A list of the sites is shown in Table 2.

Figure 3 - Map of existing (manual) observation sites in RMI. Republic of Marshall Islands Exclusive Economic Zone (EEZ) area shown in yellow.

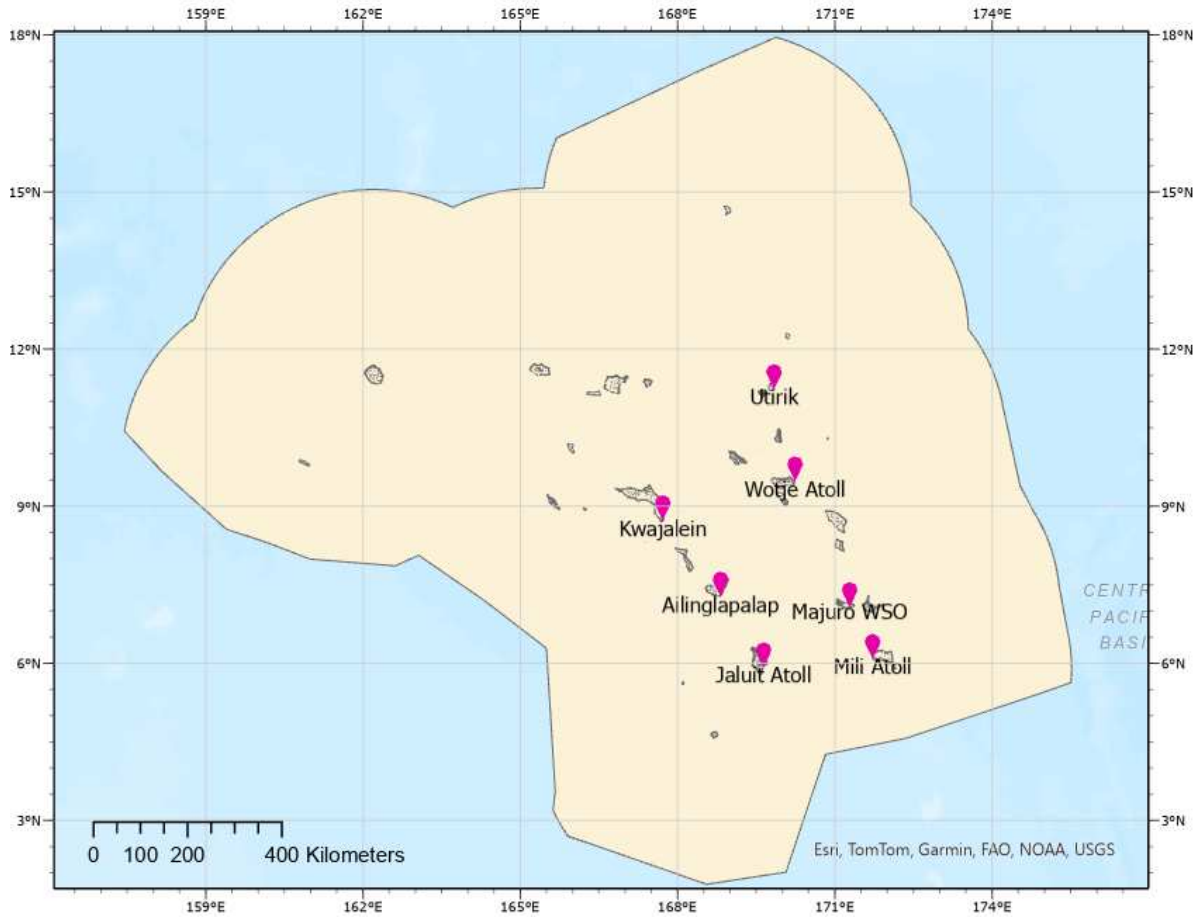


Figure 4 – Map of the 24 AWS sites to be installed under the UNEP CIS-Pac5 project. Republic of Marshall Islands Exclusive Economic Zone (EEZ) area shown in yellow.

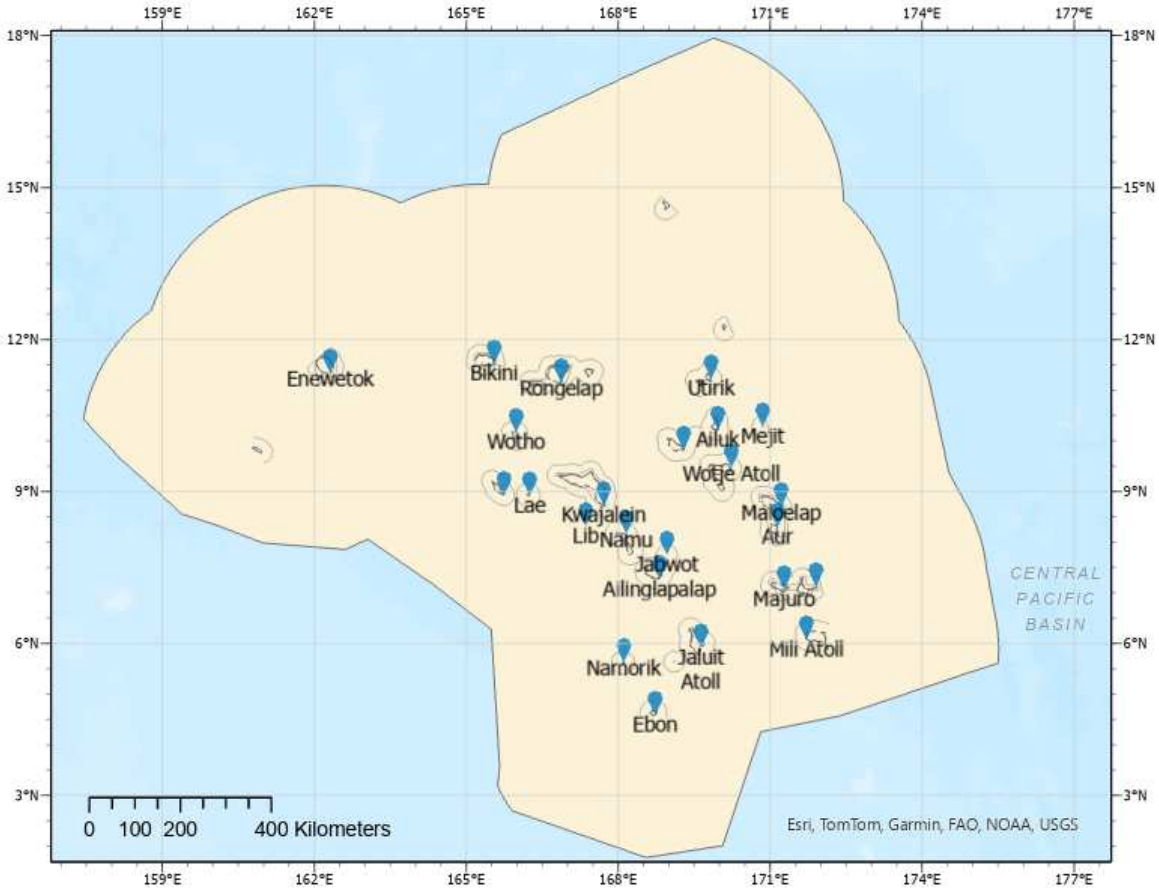


Figure 5 – Map of 9 proposed GBON surface stations in blue showing 250km radius circles. Republic of Marshall Islands EEZ area shown in yellow.

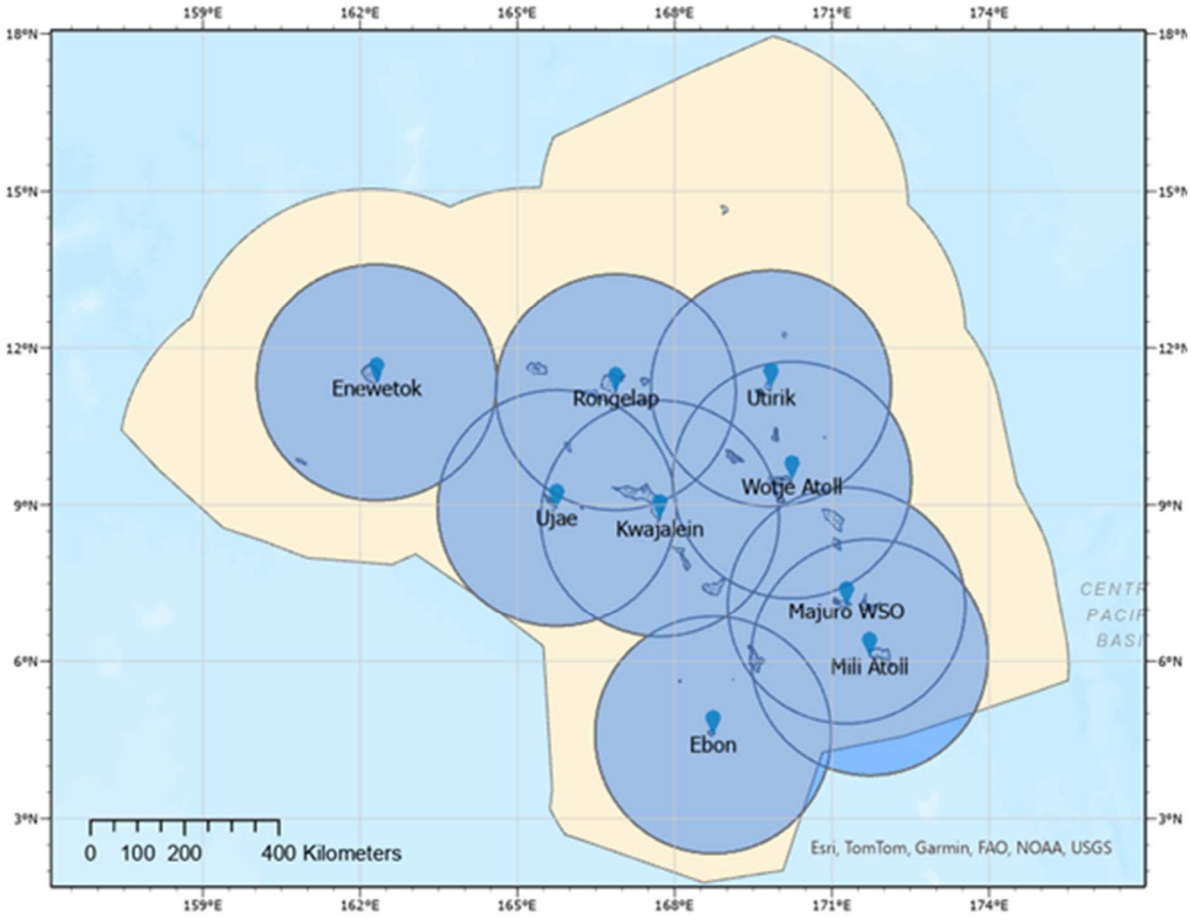


Table 2 - Details of GBON surface observation site locations

Station name	Station type (S/UA)	Owner (NMHS/third-party)	Funding source	GBON variable measured						Reporting cycle	GBON Compliance (Y/N)	Existing / New (CIS-Pac5) proposed location
				SLP	T	H	W	P	SD			
Majuro WSO	UA	NOAA NWS	COFA	x	x	x	x	x	NA	2	N	Existing
Kwajalein	UA	US Army Kwajalein Atoll (USAKA)	US Army Kwajalein Atoll (USAKA)	x	x	x	x	x	NA	<1	N	Existing
Majuro WSO	S	NOAA NWS	COFA	x	x	x	x	x	NA	24	N	Existing
Kwajalein	S	US Army Kwajalein Atoll (USAKA)	US Army Kwajalein Atoll (USAKA)	X	X	X	X	X	NA	24	N	Existing
Ailinglaplap	S	NOAA NWS	COFA	X	X	X	X	X	NA	24	N	Existing
Jaluit Atoll	S	NOAA NWS	COFA	X	X	X	X	X	NA	24	N	Existing
Utirik*	S	NOAA NWS	COFA	X	X	X	X	X	NA	24	N	Existing
Wotje Atoll	S	NOAA NWS	COFA	X	X	X	X	X	NA	24	N	Existing
Mili Atoll*	S	NOAA NWS	COFA	X	X	X	X	X	NA	24	N	Existing
Majuro Airport (PKMJ)	S	NMHS	CIS-Pac5	x	x	x	x	x	NA	24	Y	CIS-Pac5
Kwajalein	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Ailinglaplap	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Jaluit Atoll	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Utirik*	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Wotje Atoll	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Mili Atoll*	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Ebon	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Namorik	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Arno	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Jabwot	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Namu	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Lib	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Lae	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Ujae	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Wotho	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Likiep	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Ailuk	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Mejit	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Maloelap	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Aur	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Rongelap	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Bikini	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5
Enewetok	S	NMHS	CIS-Pac5	X	X	X	X	X	NA	24	Y	CIS-Pac5

* Mili Atoll and Utirik are currently not reporting as there are no observers available.

All 7 existing sites are manual synoptic sites except for Majuro and Kwajalein and will be enhanced with an AWS under the CIS-Pac5 project. The AWS network to be installed under CIS-Pac5 has been developed in partnership with NIWA to contribute to improving the national and regional understanding of weather and climate and enable integration of station data within WMO's GBON network.

Table 3 Recommended existing surface stations to be designated to GBON.

Station name	Station type (S/UA/M[16])
Majuro airport (PKMJ)	S
Kwajalein	S
Enewetok	S
Rongelap	S
Utirik	S
Wotje	S
Ujae	S
Ebon	S
Mili	S

Recommendation 3(1): We recommend that 9 of the 24 new CIS-Pac5 AWSs are designated as Surface GBON sites for RMI.

Each AWS measures all required parameters for GBON and provides data in near-real time including:

- Wind speed and direction measurements at 10 meters minimum.
- Air temperature and relative humidity measurements.
- Solar radiation.
- Rainfall intensity.
- Barometric pressure.
- *(*Grass and ground temperatures (10,20,50,100).)*
- *(*Soil Moisture.) Not GBON requirement.*

**Note: not GBON requirement*

The sensors selected to deliver these requirements are listed in **Error! Reference source not found.** It is expected that SOFF will only support ongoing maintenance for the GBON elements for the supported stations. A summary of the general characteristics and requirements for each AWS and the associated monitoring system includes;

- Data should be logged locally at 10-minute intervals and available at least hourly.
- The telemetry should include communications diversity and where possible include satellite and cellular options. If one path isn't available, the data stream should automatically default to the other.
- All stations should be self-contained, suitably exposed and include sufficient infrastructure, security and solar power supply.
- For some locations the measured data should be available for local real-time visualization and review.
- The telemetered data should be integrated with their National Weather Service Office CliDE database management system.

Table 4 Automatic Weather Station Sensors – Expected CIS-PAC5 AWS system specifications with capacity for inclusion of other sensors as required.

Parameter	Manufacturer	Model	Range	Accuracy
Core GBON parameters supported by SOFF.				
Wind speed	Vaisala	WMT703	0 to 75m/s	0 … 75 m/s (168 mph): ±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater
Wind direction	Vaisala	WMT703	0 to 360^0	Accuracy ±2°
Relative humidity	Vaisala	HMP155A	0 to 100%	Accuracy (including non-linearity, hysteresis, and repeatability) At +15 … +25 °C (+59 … +77 °F) ±1 %RH (0 … 90 %RH) ±1.7 %RH (90 … 100 %RH) At −20 … +40 °C (−4 … +104 °F) ±(1.0 + 0.008 × reading) %RH At −40 … −20 °C (−40 … −4 °F) ±(1.2 + 0.012 × reading) %RH At +40 … +60 °C (+104 … +140 °F) ±(1.2 + 0.012 × reading) %RH At −60 … −40 °C (−76 … −40 °F) ±(1.4 + 0.032 × reading) %RH
Air temperature	Intech	PT100	-30 to +180 ^{0}C	**Class AA** ± (0,1+0,0017 * t), ±0,1 °C (0 °C), ±0,27 °C (100 °C), defined on range -50…+250 °C (wire wound resistor), 0…+150 °C (thin film resistor)
Barometric pressure	Vaisala	PTB330	500 to 1100 hPa	Accuracy at +20 °C (+68 °F) *** ±0.10 hPa Class A
Rainfall	Hydrological Services	TB3	0.5mm / tip	0-250 mm per hour: +/-2 % 250-500 mm per hour: +/-3 %
Additional parameters being delivered under CIS-Pac5, not supported by SOFF.				
Solar radiation	LiCor	LI200R	0-3000 W/m^{-2}	± 3% typical; ± 5% maximum.
Grass and earth temperature	Unidata	LM34	-30° to +100°C	Temperature Accuracy: ±0.2°C (Calibrated)
Soil moisture	Acclima	SM	0 to100%	Absolute VWC Accuracy: ±2% typical

These sensors and stations have been designed and selected to meet the technical specifications set out in TT-GBON approved technical specifications (TT-GBON approved material | World Meteorological Organization (wmo.int)) 6.1 – GBON Tender Specifications for AWS and 6.2 – Requirement document to be used as input to tender specifications for radiosonde-related procurements. As the CIS-Pac5 AWS deployment has been designed around GBON compliance, the procurement and installation of instruments will fully satisfy the GBON requirements for RMI. There

is no additional activity required for the installation of AWS instruments (some further action is required to implement reporting to WIS2.0, see section 3.2).

Recommendation 3(2): We recommend a full review of the ongoing deployment of stations is undertaken in the investment phase to assess sustainability of the solution in order to ensure that any technical difficulties or challenges related to logistics and maintenance can be overcome as early as possible and to ensure that the rollout of the project continues to align with the GBON network.

Outline maintenance plan for GBON surface stations

In line with international best practice, a four stage maintenance process is proposed for the GBON surface stations:

1. Remote monitoring

Remote monitoring will be conducted by the RMI WSO technical team in Majuro. They will check the availability of data on the WIS2.0 box as well as on their central database via NEON or CLIDE. They will also regularly check data from neighbouring sites to spot anomalous data in real-time. Monthly statistical analysis will identify trends in the data over time that could indicate calibration drift, or complete sensor failure.

The Electronics and Facilities team will maintain a backlog of potential faults which will be communicated to regional maintenance staff. This will be updated once potential faults have been investigated and resolved. In this way any systematic faults across the network can be identified and addressed.

2. Routine site inspection & Maintenance

WSO RMI technical team will be responsible for conducting routine inspection & maintenance, as well as fault resolution site visits – depending on the scale of SOFF support across either the 9 GBON nominated sites or the wider set of 24 stations, this will be a significant logistical challenge across the large national maritime expanse of the Marshall Islands. It is expected that each site will be visited at least once every 6-months. During these visits, routine tasks such as grass cutting will be undertaken. The team will also conduct calibration checks during each visit and carry spares so that sensors and other hardware (e.g. solar panels, batteries and loggers) can be exchanged if they are found to be out of tolerance. Sensors will also be rotated during these visits so that they can be sent back to the regional calibration centre for more thorough calibration testing against known standards. A central maintenance log will be updated and any changes to meta-data recorded as part of each visit. However, for outstanding maintenance and repair faults that will not be resolved by the regional maintenance teams will be resolved by the central technical team.

3. Fault resolution

If a potential fault at a station has been identified, the technical team will direct regional maintenance staff to undertake a fault resolution visit. These visits will take priority over routine maintenance visits in order to maintain GBON compliance on data availability. It is expected that most faults will be resolved by the team swapping out a component at a site with a spare. It is expected that during a fault resolution visit, the regional team will also conduct routine site inspection and maintenance of the site (in line with point 2. above).

4. Calibration & supplier support

Faulty sensors, or sensors that require calibration, will be rotated out of sites and back to WSO Majuro or the regional (western Pacific and to be agreed) calibration centre for calibration. It is expected that some instruments will need to be either directly replaced or calibrated through an ongoing relationship with the AWS supplier (NIWA). An ongoing service agreement would enable this process. It would also provide 3rd line support to WSO RMI staff in maintaining the network and in dealing with more complex issues. It would also be expected that this agreement would provide training throughout the SOFF investment and compliance phases, so that WSO RMI staff continually increase their capacity and skill.

Upper air observations

The existing manual upper air observation at Majuro is supported by the USNWS and currently undertakes 2 radiosonde launches per day to GBON standard. This site does not require further intervention beyond integration into the data management process outlined in Section 3.2 to process store and transmit data internationally. It also needs to be actively managed in the future – see section 4.3

Recommendation 3(3): We recommend WSO Majuro is nominated as a GBON upper air site for RMI.

In addition, a manual upper air station is operated on Kwajalein atoll on behalf of USDOD. This site currently launches fewer than 2 radiosondes per day and the provision of data from the site is dependent upon USDOD operational requirements from their Kwajalein site. Initial engagement with USDOD has indicated that the frequency of launches could be increased to 2 per day and data shared to WIS2.0 and with WSO RMI. This would require additional funding to cover the cost of additional staff time and consumables. This additional support could be provided through SOFF support and an agreement needs to be reached on how to fund the increased frequency of radiosonde launches from the site. **It is recommended that Kwajalein is nominated as a GBON upper air site for RMI, see recommendation 2(3).**

Practical implementation of an additional upper air station would be challenging in RMI at present, owing to the remoteness of potential sites required to satisfy the spatial threshold of the GBON upper air network, the lack of available staff at these locations and the logistical difficulties for maintenance.

Recommendation 3(4): We recommend the addition of a third upper air station in the northwest of RMI (Enewetok) is considered at a later stage, when the operation of the currently proposed GBON network has been established and achieved sustainability. This recommendation has been discussed and agreed between the beneficiary country and peer advisor.

Figure 6 - Existing upper air stations in red dot showing 500km spacing. Proposed new upper air station with blue dot. Republic of Marshall Islands Exclusive Economic Zone (EEZ) area shown in yellow.

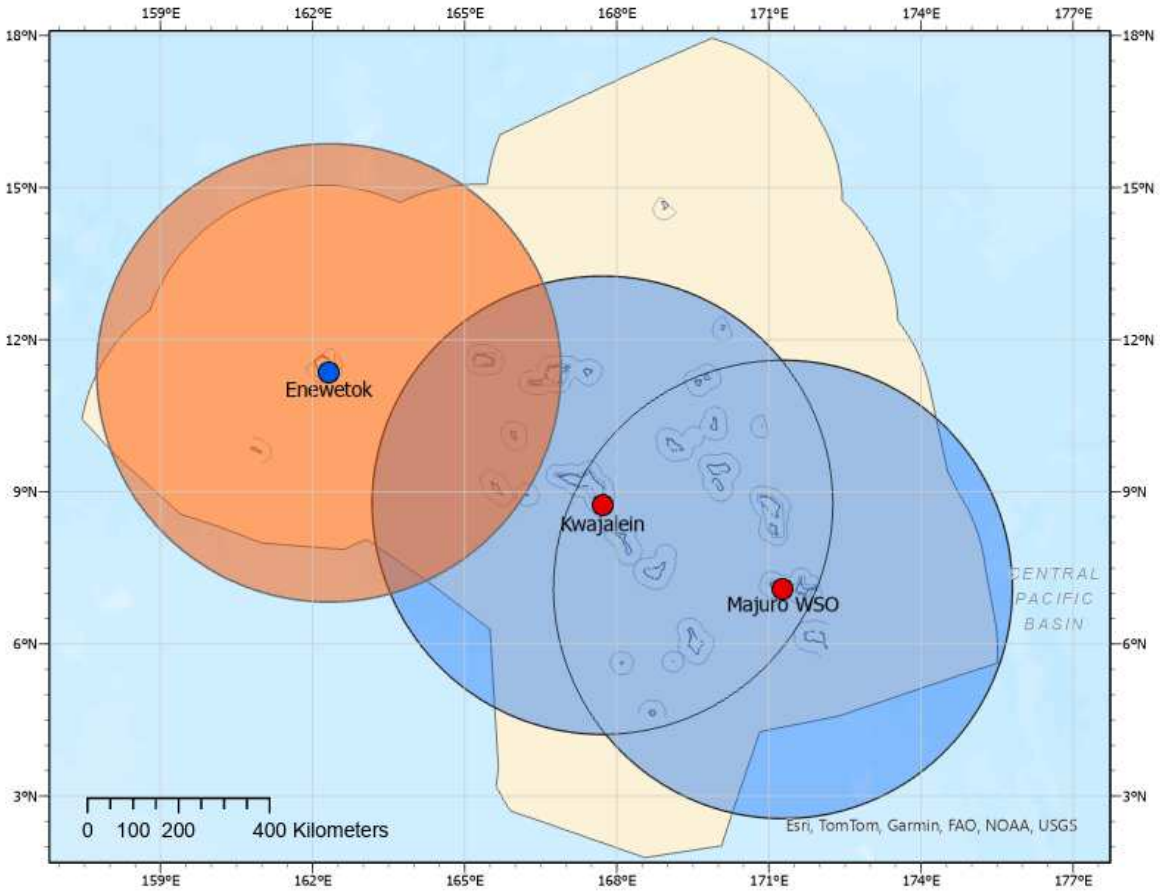


Table 5 - Details of GBON upper air observation location

Station name	Station type (S/UA)
Majuro WSO	UA
Kwajalein	UA
Enewetok	UA

Technical specifications for new instruments and observing systems

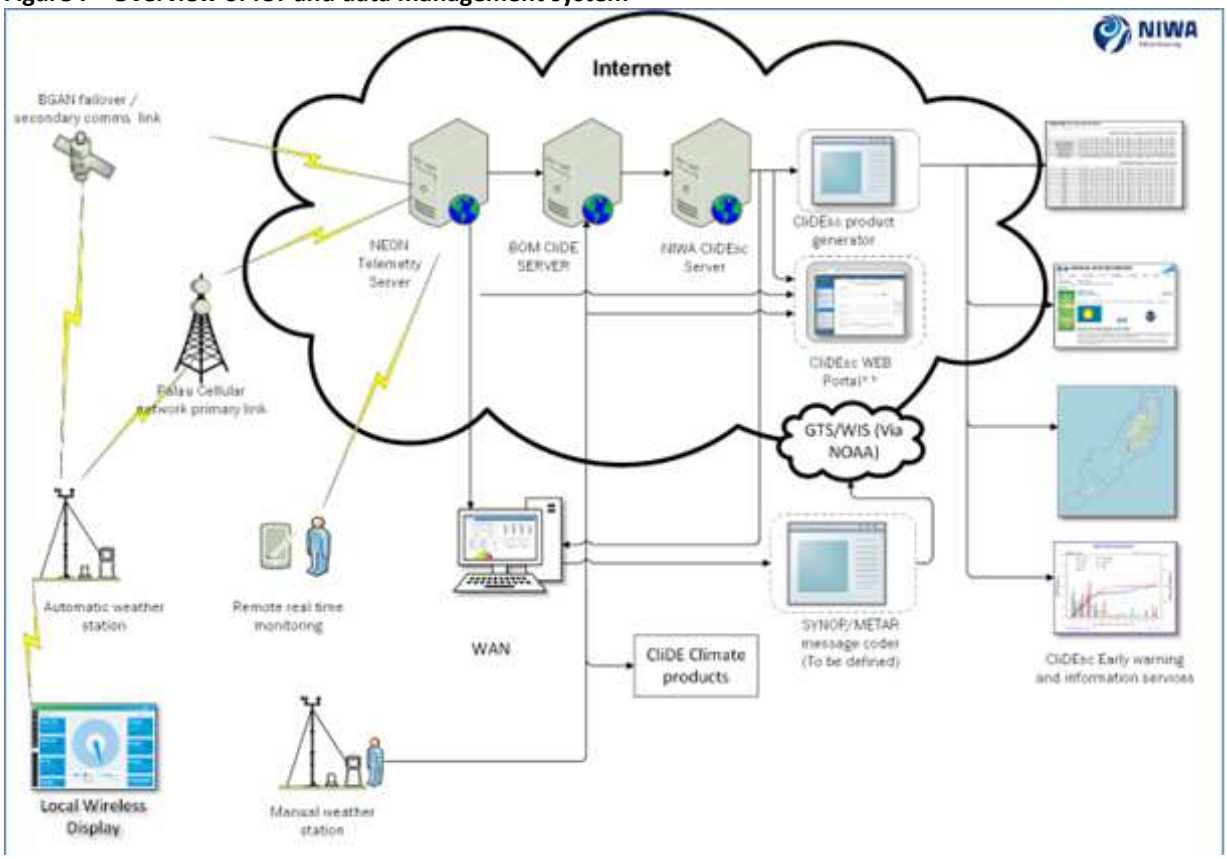
The specifications for instruments at the GBON surface observations sites are designed to align with TT-GBON approved material | World Meteorological Organization (wmo.int) for each observation instrument and observing system. The recommended instruments listed in Table 4**Error! Reference source not found.** meet or exceed these specifications in all cases and should alternative instruments or systems be identified as part of the procurement process, these must meet the specifications referred to above.

3.2. Design of the ICT infrastructure and services / 3.3. Design the data management system

The design of the ICT infrastructure and data management system has been incorporated into the CIS-Pac5 project deployment and has been designed for GBON compliance. Some further action is required to implement WIS2.0 interoperability and it is recommended that this requirement is addressed and implemented as part of the CLIDE data management system currently employed.

An overview of the proposed solution is shown in **Figure 7** and a detailed description of the ICT infrastructure, services and data management system follows.

Figure 7 - Overview of ICT and data management system



Data from each station are being telemetered via dual communications. Where available IP (Internet Protocol) cellular modems (TCC) provide the primary mode of IP telemetry, with IP BGAN satellite serving as the failover back-up in the event of disruption to the primary telemetry mode.

Near-real time telemetered data, for use in operational monitoring and forecasting, can be accessed and viewed via the web-based NEON user interface. This interface is developed and maintained by NIWA and allows the regular (10 minute) observations made on the IP based NRT data logger to be reviewed at various user defined intervals using a web-based system.

All data are stored in the NEON web server and the data are accessible using any web browser that has authorised access credentials and the NEON web interface/dashboard. Data in NEON are fully managed including full IT backup processes.

NEON will be deployed as a hosted system in which data is collected using NIWA central telemetry servers and a WEB hosted NEON system. Our recommendation is that WSO operate a NIWA-hosted network as it overcomes the difficulties of managing local IT systems.

NEON has a user security model that allows creation of user profiles, each with varying abilities to access data.

Profiles can be from simple "view only" access to station data through to full data management access. The system allows the appointment of a local NEON node manager, who will have the capability to enable users, and to create views of data for client organisations that are accessible by only those clients.

As well as data capture from remote stations, NEON provides basic data review and includes alarm handling and automated data reporting capabilities.

The NEON interface provides record of the most recently received data and a gateway to data to be display, or if the profile allows, to download data directly from the WEB interface. Data can be shown as a combination of sites and as an individual site.

The real-time data transmitted from each station are able to be viewed and monitored for TMS operations in the NEON web-based telemetry system, and have been automatically ingested into CliDE (Climate Database for the Environment) for archival and generation of data summaries.

WSO RMI uses the CliDE database management system developed by the Australian Bureau of Meteorology as its primary climate data archive.

All station metadata such as commissioning reports, and site and instrument details and photographs, have been developed electronically for archiving in the CliDE database file system. This serves as a permanent record for the installations and is a base reference for subsequent maintenance management and recording of subsequent site visits for instrument inspections, and calibration, and general maintenance. WSO RMI staff are encouraged to build on these records to track and record all maintenance activities that support climate network operations.

To provide a local access to the near real-time on-site data, the NEON system has an optional Real-time MODBUS Display Module (RTMDM) that reports the logger scan rate (typ. 3 second) data for all (or some) sensors to a local display module.

The display option can include a local wireless link that can operate over several kilometers of a line-of-sight path. The remote display unit can be solar or mains powered.

If the station has nearby wide area network (WAN) or local area network (LAN) the display data can also be made available on any terminal on those networks (Intranet only).

The local display stores and allows display of up to 1 week of data and can also automatically derive METAR/SYNOP reports based upon the automatically retrieved AWS data.

3.4. Environmental and sustainability considerations

Recommendation: 3(5): We recommend the following considerations are incorporated into installation and operational plans. Environmental and sustainability considerations should be incorporated into the procurement process as part of the specifications including the use of reusable instruments where possible and sustainable methods of observation. Surface instruments should be reusable where appropriate and consideration of the environmental and sustainability impacts of maintenance (including associated travel) should be made as part of the SOP for maintenance and calibration. Similarly, consideration of the use of biodegradable materials for upper air observations should be made where possible as well as the environmental impact of shipping methods and materials.

Module 4. GBON Human Capacity Development Module

4.1. Assessment of human capacity gaps

The RMI Weather Service Office maintained the following staffing levels:

- One Meteorologist-In-Charge (MIC)
- One Staff Meteorologist (vacant) ¬
- One Supervisory Weather Service Specialist (SWSS)
- Five Weather Service Specialist (WSS)
- One Supervisory Electronic Program Specialist (EPS)
- One Facilities Technician (vacant)
- One Tradesman (vacant)
- Technical consultant for O&M (funded by CIS-Pac5)
- Ocean expert, (funded by CIS-Pac5)
- Climate expert, (funded by CIS-Pac5)
- Data expert (funded by CIS-Pac5)

As a prerequisite to taking on the role, Weather Service Specialist staff have completed the selected online training on meteorology and hydrology through the University Corporation for Atmospheric Research (UCAR) Comet Met Ed program. WSO RMI staff have undertaken a range of training courses through the Pacific International Training Desk covering: Tropical Meteorology topics, including: Thermodynamics; Satellite Interpretation; Surface and Upper-Air Analysis; General Circulation; Local Circulations; Tropical Weather Features; Numerical Weather Prediction; Forecast Philosophy; Forecast Verification; Marine Forecasts; Tsunamis; Severe Weather and Tropical Cyclones; Tropical Climate Variability; and Messaging and Weather Communications.

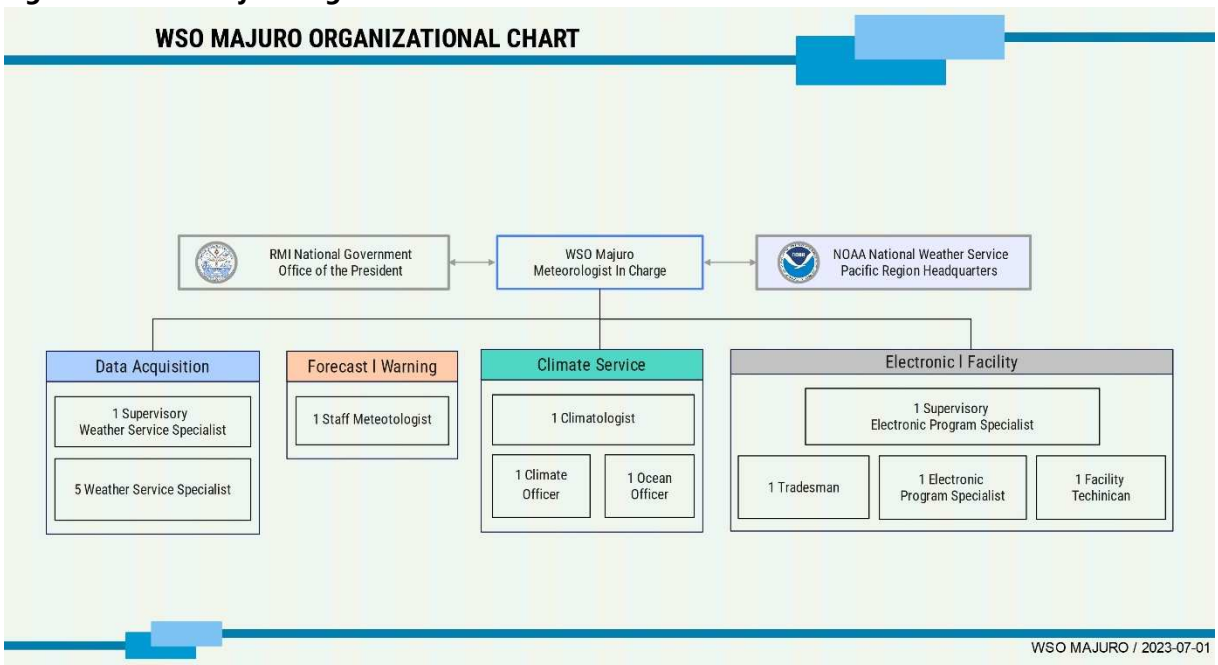
Two members of the WSS staff completed the USP/Pacific TAFE Certificate IV in Project Management Practice in sponsored by USAID Climate Ready. Completed in November 2017. Later completing the USP/Pacific TAFE Certificate IV in Climate Change Resilience in April 2022.

A summary of staffing, education levels and gender balance are set out in Table 6

Table 6 - Summary of staff skills, education and gender balance at WSO Majuro

Staff	Qualification	Division/Section	No. Professional Staff		Total
Staff Name	(Description the qualification under each division) Example; WMO Class 1-4 or other qualification or professional training, education and research)	Responsibility of Staff (Forecast, Climate, Observation, Administration, etc)	Male	Female	Total Number of Staff
Reginald White	WMO Class 1 Forecaster, BSc in Meteorology	Forecast, Climate, Ocean, Severe Weather warning, National Technical Advisor, member of the RMI National Disaster Committee and Administration.	1	0	1
Lee Jacklick	WMO Class 2 Forecaster Senior-level Meteorological Technician Data acquisition Manager	Forecast, Climate, Ocean, Severe Weather warning, Observation, technical advisor to the NEOC and WASH Cluster, and Administration.	1	0	1
Simon Kattil	WMO Class 2 Forecaster Senior-level Meteorological Technician Surface observation program focal point	Forecast Climate, Ocean, Severe Weather warning, and Observation.	1	0	1
Samson Kaneko	WMO Class 2 Forecaster Mid-level Meteorological Technician Ocean and Tides program focal point	Forecast, Climate, Ocean, Severe Weather warning, and Observation.	1	0	1
Nover Juria	WMO Class 2 Forecaster Mid-level Meteorological Technician Climate Service focal point	Forecast, Climate, Ocean, Severe Weather warning, and Observation.	1	0	1
Dindin Jitkelong	WMO Class 4 Forecaster Mid-level Meteorological Technician Upper Air Observation focal point	Climate, Ocean, Severe Weather warning, and Observation.	1	0	1
Julius Edward	Meteorological Technician trainee	Observation, Administrative assistance duties.	1	0	1
Winson Bosin	Supervisory Electronic Program Specialist	Instrument maintenance and calibration and supervisory	1	0	1
Johnny Milne	Electronic Program Specialist Safety Officer	Instrument maintenance and calibration	1	0	1

Figure 8 - WSO Majuro organisational chart.



The WSO RMI has currently got good skills capacity, currently with some staff vacancies.

The installation of 24 AWSs in the CIS-Pac5 project and the necessity to assign GBON compliant surface and upper air observations will introduce significant changes and new responsibilities for the WSO management and staff. These additional responsibilities, which extend beyond the scope of COFA, need to be carefully managed in the SOFF investment phase. This can be achieved by updating the strategic plan and implemented through an operational plan – see recommendation 2(8) and 4.3.

To achieve GBON compliance and sustainability, there needs to be a review of the current job roles at the WSO. GBON compliance in RMI requires a member of staff to be dedicated to take full responsibility for the establishment and sustainability of the observations network, fully documented in a Quality Management System (QMS). This role doesn't currently exist at the WSO in RMI.

Recommendation 4(1) We recommend the establishment of a new Observations Network Manager role at the WSO RMI, with appropriate resource allocation.

There is also an urgent need to promote gender balance at the WSO – see section 4.4.

4.2. Design capacity development activities for technical staff

To ensure that the maintenance and operations of observing and network equipment is high quality and consistent **Recommendation 4(2): We recommend an ongoing programme of formal and informal training is undertaken across the technical staff at WSO RMI.** In addition, as the department grows and changes in line with the updated strategic plan it is essential that all new staff are similarly trained.

Recommendation 4(3): We recommend the initial procurement and deployment of observations equipment is supported by the supplier and partner as set out in the project plans for the UNEP CIS-Pac5 programme.

Recommendation 4(4): We recommend the new role of Observations Network Manager (ONM) takes responsibility for this (Recommendation 4(3)) activity. As the WSO develops, any new staff will be trained and be able to assume responsibility for the GBON stations, as required.

Technical staff across the organisation require formal training in the operation and maintenance of the instruments which could be sourced from the manufacturer or supplier of the instruments. This requirement will be consistent with other SOFF nations in the region and can be coordinated through SPREP and NIWA. Specific training on the maintenance and observation practices associated with the surface observations should be provisioned for existing technical staff and extended to new staff as necessary. The need for BIP-MT training has been identified and any training programmes related to the operations of the surface network should align with existing WMO guidance – see WMO 49.

Recommendation 4(5): We recommend a repository of reusable training materials be developed, managed by the ONM and made available to ensure consistent training can be efficiently provided in the case of staff turnover. Similarly, training on the calibration of instruments should be provisioned for the technical staff and updated in the event of staff turnover.

Recommendation 4(6): We recommend this is coordinated as a regional training workshop activity including other SOFF beneficiary countries in the region who have deployed the same instrumentation.

Training on the operation, maintenance and calibration of instruments, as well as the use of the proposed ICT and data management infrastructure has been provided by NIWA through the CIS-Pac5 project. An outline of the training programme is shown in **Table** 7. It is recommended that this training should be continued and refreshed as necessary for staff at WSO RMI, and the process managed by the ONM.

Table 7 - Outline of technical training provided by NIWA through CIS-Pac5 project

Topics	Expectations/Outcomes
Travel	
1. **Programme Overview:** **a) Christchurch site induction, staff introductions, orientation, health & safety** **b) Programme overview/logistics, workbook, WMO Competency framework and course expectations**	Familiarization with site and programme logistics.
2. **Technical workshop exercise – baseline knowledge assessment (with focus on RMI context):** **a) Weather/climate/hydrology services in RMI** **b) Instruments and measurements** **c) Data transfer, telemetry, and integration** **d) Data storage and quality management** **e) Products and client services** **f) Sector/user engagement, decision support and risk management** **g) Challenges, opportunities, potential pathways.**	Knowledge sharing on the state of services in RMI.
3. Development of activity for review at completion of Technical Training in conjunction with trainees – e.g. Planning and drafting a routine inspection and maintenance plan including quality assurance - Participant to work independently under supervision.	Demonstration of knowledge transferred via the development of a draft routine inspections and maintenance plan, which can be refined/incorporated into annual workplans upon return to RMI.
4. **Workshop / calibration lab** **a) Troubleshooting** **b) Fault repair** **Validation/Verification/Calibration (Use equipment supplied RMI)**	Basic and advanced learning of monitoring systems/network operations, maintenance, troubleshooting.
5. **Re-cap and refresh on Telemetry systems currently in use** **a) Modem configuration and testing**	Refurbishment (servicing, repair, calibration) of currently non-operational instruments.
6. **Re-cap and refresh on existing instruments used by RMI, and new instruments.**	Basic and advanced learning of monitoring systems/network operations, maintenance, troubleshooting.

7. **CliDE** **CliDEsc server** **Extremes dashboard**	Basic and advanced knowledge on CliDE and CliDEsc operations. CliDE training in Metadata Management. Station numbers (WIGOS identifiers)
8. **Field visit**	Siting and measurement considerations (WMO Siting classification) Key AWS maintenance tasks.
9. **Familiarisation with new equipment** **a) Station wiring** **b) Sensor testing and verification.** **c) Modem configuration and testing** **d) Fault diagnosis and resolution** 10. **Station hardware** **a) Mast configuration** **b) Boxing and concrete quantity calculation** **c) Re-termination of parafil guys** 11. **Metadata updating** **a) NEON** **b) CliDE**	Basic and advanced learning of monitoring systems/network operations, maintenance, troubleshooting.
12. **Course completion:** **a) Activity assessment, feedback, and reflection** **b) Course feedback and reflection of outcomes/achievements relative to expectations** **c) Certification.**	Assessment of skills learned course relevance/applicability, challenges, and opportunities.

Training on the operation and maintenance of the upper air observations must also be provisioned including routine operations of the radiosonde sites and the hydrogen generation equipment.

Recommendation 4(7): We recommend this training is provisioned for all staff with responsibility for upper air observations including those on site at the upper air station and a selection of technical staff from WSO HQ to ensure resilience and sustainability.

Recommendation 4(8): We recommend technical staff utilise existing online resources including WMO training materials in the WMO Education and Training Programme, in particular courses under the Instruments and Methods of Observation section and the available training and workshops on the implementation of WIS2.0.

Recommendation 4(9): We recommend recruitment of additional staff for the sustainable operation and maintenance of the surface and upper air network in RMI. Recruitment into the 2 currently vacant technician roles is required along with the associated training in operation and maintenance of the surface network. The scope of these roles also needs to be amended to incorporate additional responsibilities to satisfy GBON compliance.

4.3. Design capacity development activities for senior management

WSO RMI have a broad and diverse range of responsibilities, and as awareness of the climate crisis increases, demand for more services from the NMS is also increasing. This situation puts an increasing burden on WSO RMI, especially the Director and the leadership team, and puts their ability to sustain the GBON at risk. To manage this situation requires a range of interventions that will rapidly satisfy the needs in an effective and sustainable manner.

Recommendation 2(8) identifies the need to refresh the Strategic and Operational plans and will clearly highlight priority needs and provide relevant evidence to government and investors. Thereafter, it is recommended to provide development in two forms.

Recommendation 4(10): Firstly, we recommend off-the-shelf training packages, such as Management and Leadership training, Managing Successful Projects training, Financial Management, Gender, Equality and Social Inclusion (GESI) training and Human Resource Management training.

Recommendation 4(11): Secondly, through practical implementation of the NMS Strategy and Operational plans with a peer to deliver GBON compliance. This will include the development of standard operating procedures for quality assurance, maintenance, and sustainability, and their adoption into a Quality Management System (QMS).

In recognition of the existing significant workload of the NMS, it is recommended that a project officer/unit is established and recruited. This post(s) would be responsible for the effective introduction of all SOFF funded outputs to the NMS. As the project approaches it end, this post could evolve to have more stakeholder engagement responsibilities and ensure sustainability of the GBON is maintained. The existing role which has been created to support the UNEP CIS-Pac5 programme should be continued throughout the life of the SOFF investment.

4.4. Gender and CSOs considerations

WSO RMI recognises the importance of Gender, Equality and Social Inclusion (GESI) and the crucial role of WSO RMI to address the issues of GESI and support people and communities disproportionately impacted by extreme weather, seasonal events and climate change. Proactive support for women, girls and marginalised people who are more likely to be negatively affected by the impacts of a climate and weather-related extreme event is essential.

Recommendation 4(12): We recommend WSO RMI undertake Gender, Equality and Social Inclusion (GESI) training as part of a broader activity to ensure GESI is mainstreamed in WSO RMI working practices.

In addition, the following guidelines (from the WISER GESI Minimum Standards) should be followed and adhered to on all SOFF activities:

1. Is there a GESI context analysis to inform programming which identifies:
   i. Barriers and enablers to people of different gender, ages and ability, social economic constraints, or marginalised groups accessing project services.
   ii. The risks of project activities which might negatively impact GESI and how to mitigate such risks?
2. Can people of different gender, ages and ability, social economic constraints, or marginalised groups with differing abilities meaningfully participate in the design, implementation and Monitoring, Evaluation and cross-Learning (MEL) of the project, so they can build individual agency, change gender and group relations, transform systems and structures

3. How does the project contribute to gender equity, protection, and longer term empowerment of different genders, ages and ability, social economic constraints, or marginalised people?
4. Is there a plan for building the capacity of local partners on GESI using these Minimum Standards and GESI upskilling?
5. Does the MEL system enable analysis of GESI issues and does the project Logframe or results framework integrate qualitative and quantitative:
    i. Gender and social inclusion targets, that capture evidence of leadership, empowerment and meaningful participation in decision-making?
    ii. Sex, age, and differing ability disaggregated data and account for intracommunity diversity and complexity?

There was no formal gender assessment undertaken during the readiness phase, so it is recommended that a gender assessment of the institution is undertaken in the investment phase and include insights to their modernisation plans. During the Investment Phase, and any further modernisation, recruitment and training should follow these guidelines:

- Women should represent at least 50 % of all participants in SOFF-related and supported training
- Women should represent at least 50 % of all participants in SOFF consultations, planning workshops, etc.
- Women should represent at least 50 % of staff for operating and maintaining GBON stations
- Women should represent at least 50 % of decision-making and project management positions where applicable

It is also recognized that engagement with civil society is an important factor, to raise awareness of WSO RMI and the observation sites and how they play an important role in the value-chain that provides high-impact weather information, especially to women and girls. The proposed investment in GBON sites across RMI will require cooperation with CSOs in that area and a series of engagement events will be held to engage with this sector to mitigate against the risk of theft and vandalism and ensure that the value of the project is communicated.

Recommendation 4(13): We recommend a consultation event be held with CSOs, including those focused on women's empowerment.

Module 5. Risk Management Framework

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

The primary risks to the observation network are set out in the risk register below. **Recommendation 5(1): We recommend this risk register is owned and maintained by the Meteorologist-In-Charge (MIC) and updated on a quarterly basis.**

Operational risks to the observations network						
Risk description	**Impact description**	**Impact level**	**Probability level**	**Priority level**	**Mitigation**	**Owner**
Maritime sea salt and humidity degradation of equipment.	Loss of equipment due to sea salt degradation	moderate	Very likely		Use marine grade stainless steel where possible. Frequent maintenance routines.	
Degradation of service and loss of data.	Lack of routine maintenance routine being conducted.	moderate	likely		Recruit/promote observations network manager, responsible for observation delivery. Recruit technicians for maintenance. Ensure adequate training	
Tropical cyclone / severe weather event	Damage to building and ingress of water to damage electrical Equipment. Sudden downbursts.	extreme	unlikely		Siting, lightning grounding rod, Specs of equipment resilient to outlier events	
Storm surge	Damage to building and ingress of water to damage electrical equipment.	extreme	possible		Store of spare equipment at safe location, elevate equipment above ground level, consideration for siting, SOP for redeployment	
Sea level rise	Damage to building and ingress of water to damage electrical equipment.	major	rare		Store of spare equipment at safe location	
Security	Damage or theft	moderate	rare		Government locations,	

					permanent staff on site, Work with local authority close to district office, local security , Fences, NDMO staff, community outreach and engagement	
Staff leave after training – staff retention	Staff numbers and skills	moderate	rare		Staff engagement. Fair pay. At least 2 people with each skill set	
Remoteness / unavailability of flights / boats	Loss of data and potential calibration issues	major	possible		Ensure suitable transport is available. Engage with civil society organisations. Co-locate with manual obs sites. Network management in place	
Recruitment	Lack of available skills	major	likely		Outreach program with schools and colleges.	
Communications	Lost data for duration of communication outage				Temporary storage in datalogger. Support contract with comms provider.	
Communications	Loss of HF radio connections				Communication redundancy and routine maintenance.	
Surrounding land use change	Development of land surrounding observation sites		rare		Site selection	
Political	Change of gov. In outer islands. Personnel changes in outer islands as a result	minor	possible		Work with local governments / communities	
Radiation	Inability to travel easily to radiation affected islands / atolls	moderate	possible		Limit exposure, consult with DoE contractors	

Module 6. Transition to SOFF investment phase

Recommendation 6(1): We recommend that, on approval of the Investment Phase Funding Request, a workshop including the WSO RMI, UNEP, NWS and Met Office is arranged to review the outputs of the readiness phase and discuss the transition to the investment phase.

Recommendation 6 (2): We recommend routine project board meetings undertaken in the readiness phase should continue under the coordination of UNEP and should include the peer advisor and other relevant partners as necessary.

Summary of GBON National Contribution Plan

Components	Recommended activities	Related outputs and technical details
Module 2. GBON business model and institutional development	**2(1):** the relationship between WSO and NWS is strengthened further to incorporate close cooperation on the implementation and operation of the observation network.	2.1
	2(2): the CIS-Pac5 installation for Majuro is deployed at the airport and this is designated as the GBON site for Majuro.	2.1
	2(3): Kwajalein is designated as one of the RMI upper air sites**.**	2.1
	2(4): training opportunities for the investment phase across the region are explored in consultation with SPREP / PMC, incorporating the findings and outputs from the SOFF Pacific Regional Event in April 2024.	2.2
	2(5): the 9 GBON surface stations in RMI are fully publicly owned by the RMI government, with SOFF support to fund the sustainability costs of these sites.	2.3
	2(6): that negotiations between SOFF/UNEP and RTS Weather are conducted to agree a GBON compliant launch schedule at Kwajalein.	2.3
	2(7): a revision of the strategic plan and development of an operational plan.	2.4
	2(8): the WSO responsibility for the observations network is recognised in draft legislation.	2.5
Module 3. GBON infrastructure development	**3(1):** 9 of the new CIS-Pac5 AWSs are designated as GBON sites for RMI.	3.1
	3(2): a full review of the ongoing deployment of stations is	3.1

	undertaken in the investment phase.	
	3(3): WSO Majuro is nominated as a GBON upper air site for RMI.	3.1
	3(4): the addition of a third upper air station in the northwest of RMI (Enewetok) is considered at a later stage, when the operation of the currently proposed GBON network has been established and achieved sustainability.	3.1
	3(5): environmental and sustainability considerations are incorporated into procurement, installation, and operational plans.	3.4
Module 4. GBON human capacity development	**4(1)** the establishment of a new Observations Network Manager role at the WSO RMI, with appropriate resource allocation.	4.1
	4(2): an ongoing programme of formal and informal training is undertaken across the technical staff at WSO RMI.	4.2
	4(3): the initial procurement and deployment of observations equipment is supported by the supplier and partner as set out in the project plans for the UNEP CIS-Pac5 programme.	4.2
	4(4): the new role of Observations Network Manager (ONM) takes responsibility for this (Recommendation 4(3)) activity.	4.2
	4(5): a repository of reusable training materials be developed, managed by the ONM and made available to ensure consistent training can be efficiently provided in the case of staff turnover.	4.2
	4(6): a regional training workshop on the calibration of instruments, including other SOFF beneficiary countries in the region who have deployed the same instrumentation.	4.2
	4(7): upper air training is provisioned for all staff with responsibility for upper air observations including those on site	4.2

	at the upper air station and a selection of technical staff from WSO HQ to ensure resilience and sustainability.	
	4(8): technical staff utilise existing online resources including WMO training materials in the WMO Education and Training Programme, in particular courses under the Instruments and Methods of Observation section and the available training and workshops on the implementation of WIS2.0.	4.2
	4(9): recruitment of additional staff for the sustainable operation and maintenance of the surface and upper air network in RMI. Recruitment into the 2 currently vacant technician roles is required along with the associated training in operation and maintenance of the surface network. The scope of these roles also needs to be amended to incorporate additional responsibilities to satisfy GBON compliance.	4.2
	4(10): off-the-shelf training packages, such as Management and Leadership training, Managing Successful Projects training, Financial Management, Gender, Equality and Social Inclusion (GESI) training and Human Resource Management training.	4.3
	4(11): practical implementation of the NMS Strategy and Operational plans with a peer to deliver GBON compliance.	4.3
	4(12): WSO RMI undertake Gender, Equality and Social Inclusion (GESI) training as part of a broader activity to ensure GESI is mainstreamed in WSO RMI working practices.	4.4
	4(13): a consultation event be held with CSOs, including those focused on women's empowerment.	4.4
Module 5. Risk Management	**5(1**): the risk register is owned and maintained by the Meteorologist-In-Charge (MIC) and updated on a quarterly basis**.**	5.1

Module 6. Transition to SOFF investment phase	**6(1):** on approval of the Investment Phase Funding Request, a workshop including the WSO RMI, UNEP, NWS and Met Office is arranged to review the outputs of the readiness phase and discuss the transition to the investment phase.	6
	6 (2): routine project board meetings undertaken in the readiness phase should continue under the coordination of UNEP and should include the peer advisor and other relevant partners as necessary.	6

Annex 1: Easy fix options:

As part of the SOFF readiness phase in RMI, it became apparent there was significant overlap and mutual dependencies between the CIS-Pac5 and SOFF initiatives. The CIS-Pac5 project includes the installation of 24 AWSs in RMI. The national gap analysis identified the need for 9 surface stations and consideration is required for the remaining 15 stations. Through discussions with all the relevant stakeholders, the SOFF Secretariat advised us to set out the easy fix options separately to the main national contribution plan. This annex sets out the options for consideration by the SOFF Secretariat/SOFF Steering Committee for the sustainability of the remaining 15 stations.

Background:
The ongoing United Nations Environment Programme (UNEP) Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean (CIS-Pac5) project is under way in the Cook Islands, Niue, Palau, Tuvalu and Republic of Marshall Islands. The project includes the deployment of a network of surface observations across the region including 24 AWSs in RMI. The project has been developed with GBON compliance as a core part of the design of the instrumentation in partnership with the National Institute of Water and Atmospheric Research (NIWA). This program in RMI, along with the proposals for other neighbouring SOFF beneficiary countries in the region (in particular the Federated States of Micronesia) has been considered as a principal part of the design of the GBON network in the region. This includes consideration for alignment of the network at national boundaries, alignment with respect to instrumentation and the full data process chain, and training opportunities.

The UNEP led CIS-Pac5 programme includes the aim to strengthen the observation network of RMI and is installing 24 Automatic Weather Stations (AWS) across the islands this year. Of these, 9 will be designated as GBON stations and will be sustained through SOFF compliance funding. The remaining 15 sites will be owned by the RMI government and there is an expectation that the sustainability of these will also be provided by SOFF.

A sustainability strategy for the CIS-Pac5 programme was developed as a part of the CIS-Pac5 funding request jointly with WMO and mentioned SOFF as one of its key components. At the time the CIS-Pac5 funding request was being drafted, 2021, there was consideration by WMO that GBON would require observations with 100km spacing – see Figure 9 below. In addition, the installation of these sites by CIS-Pac5 presents an opportunity to have a high-density, GBON compliant surface network, with all the benefits that provides, with only investment required for operations and maintenance. If funding for the operations and maintenance of the 15 additional stations is not secured, there is a high likelihood that WSO RMI will be unable to sustain them beyond the CIS-Pac5 project.

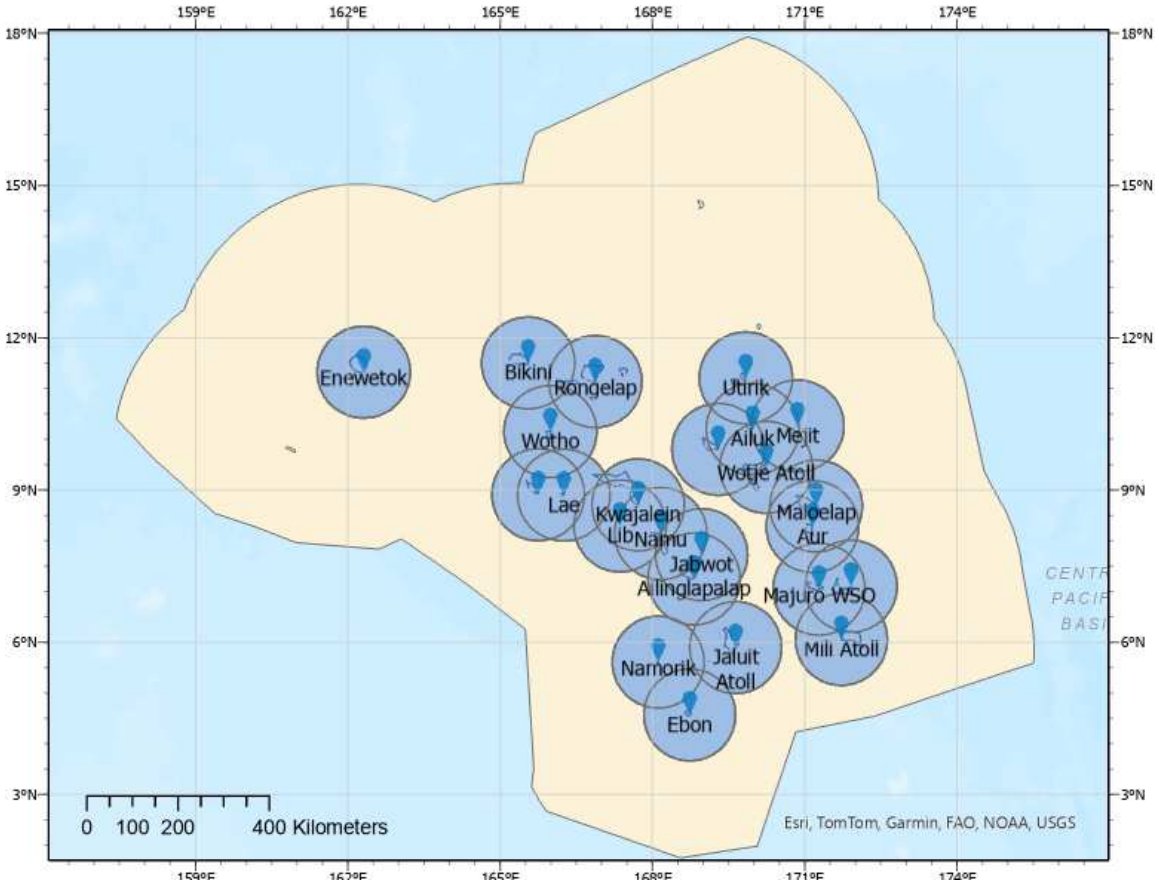


Figure 9 - Map showing the 24 AWS to be installed under CIS-Pac5 with 100km radius

Easy fix options:

Option 1:

SOFF provides funding for the operations and maintenance of the additional 15 sites beyond the end of the CIS-Pac5 project.

This option provides an opportunity for SOFF investment to fully leverage the benefits of ongoing projects in RMI and in accordance with the principles set out in the SOFF framework. This option will deliver sustained operation of a high resolution, homogeneous network of GBON compliant observations in a data sparse region. This option will increase the level of investment required by SOFF. The expanded observation network represents a greater obligation on the WSO RMI operations to maintain 24 sites to GBON standards and will require close management.

Option 2:

UNEP/WSO RMI identifies an alternative entity to provide sustainability funding for the additional 15 stations.

This option will require another entity to fund the ongoing operations and maintenance of the 15 additional observation sites. This option will deliver operation of a high resolution, homogeneous network for the duration of the available funding. In the event the funding is limited, the quality of the observation could potentially degrade over time, resulting in a non-homogeneous (non GBON compliant) network.

Option 3:

Funding for operations and maintenance of the 15 stations beyond the CIS-Pac5 project is not available.

This option represents a circumstance in which the 15 additional stations will not be maintained and become non-operational. This option limits the scope of the observation network, making it easier for WSO RMI to maintain the 9 stations to GBON standards. This option will deny CIS-Pac5 full benefit realization of a component of the project. This option would deny SOFF the full benefit of delivering an “easy fix.”

Report completion signatures

Peer Advisor signature 
Beneficiary Country signature 
WMO Technical Authority signature