20.10.2023

GBON National Contribution Plan Of The Maldives

Systematic Observations Financing Facility

Weather and climate data for resilience

GBON National Contribution Plan
The Maldives

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Module 1. National Target toward GBON compliance

Table1. GBON National Contribution Target

Type of station	Baseline (Results of the GBON National Gap Analysis)				GBON National Contribution Target	
	Target (# of stations)[1]	GBON-compliant stations (#)	Gap		To improve	New
			New	To improve		
Surface	5	0	1	4	4	1
Upper-air	1	0	0	1	1	0
Marine	***when applicable**					

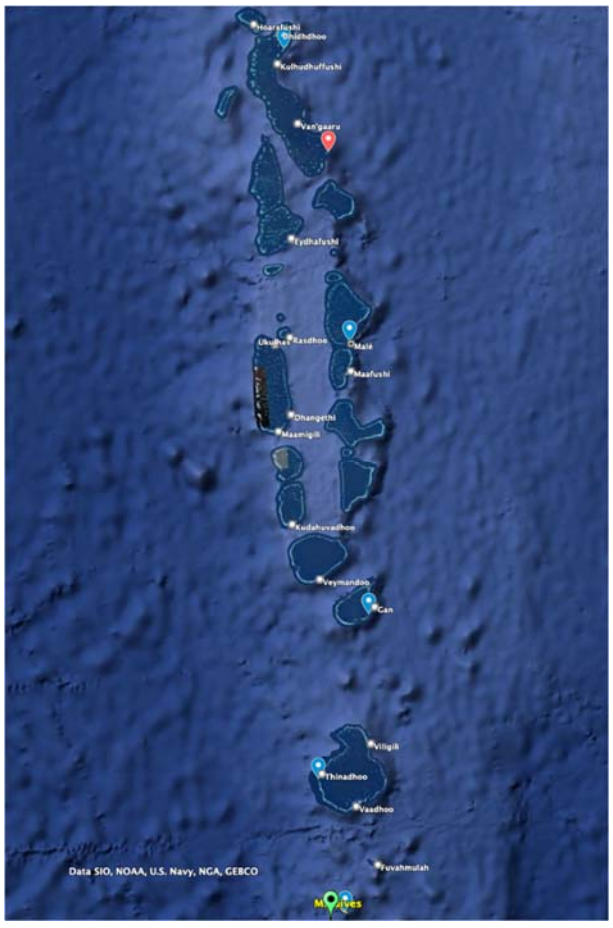


Figure 1 Map of existing and proposed surface and upper-air stations. Existing surface stations in Blue, proposed new surface station in red and sounding station in green.

[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.

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 in the Maldives are provided by the Maldives Meteorological Services (MMS). It is the main government agency mandated by the President Office, responsible for providing meteorological services in the country. Currently the MMS remains as semi-autonomous body under Ministry of Environment, Climate Change and Technology (MoECCT). There are no private sector operators providing meteorological observations or data services in the Maldives.

Stakeholder Analysis

The main governmental stakeholder for the MMS is the National Disaster Management Authority (NDMA), which at the national level is the main coordinating body for disaster management activities. It is responsible for mainstreaming disaster risk reduction at the national level and supporting the strengthening of emergency communication and early warning systems in the country. In addition to the NDMA, other key governmental stakeholders for the MMS includes the Marine Police, Maldives National Defence Force (MNDF), and Ministry of Environment, Climate Change and Technology (MoECCT). MMS regularly exchanges information with these stakeholders.

The following private sector actors have been mapped as relevant stakeholders to the MMS: tourism, industry, aviation, cargo boat operators, passenger & tour operation, ferries, fisheries and farmers[2]. The nature of collaboration with private sector operators is currently mostly an end-user relationship, where some users highly depend on the services provided by the MMS and some only to some extent. Most stakeholders highlighted the need for more tailored weather services and end products to better fit their growing needs. Discussions with the MMS revealed that there could also be potential opportunities to work more closely and partner with the agriculture and health authorities.

In terms of research activities, the MMS currently undertakes limited research endeavors, often reliant on budget funding. Currently there are no active national or international research projects within the purview of the MMS. Research priorities are primarily established by the MoECCT, which occasionally submits research requests to guide the MMS's focus. However, these findings do not preclude future opportunities for research expansion and collaboration on both national and international fronts. The MMS could develop tailored information in climate-related topics, share data and participate in joint research, to increase collaboration with research institutes.

[2] USAID, July 2023, Potential for Impact Based Forecasting in the Maldives to mitigate climate risks

Overall, in the realm of private sector participation, the MMS currently operates without specific legislative provisions governing private sector involvement in the delivery of information. This absence of a legal framework leaves room for potential future developments in this regard.

While the private sector does not currently provide services within the area of meteorology, the MMS should remain open for potential future developments in this area as the landscape evolves. Collaborating with private sector is important to the future effectiveness of the MMS and it is recommended that these **partnerships continue to be strengthened and further developed where possible and useful.** Recommendations for continuing to collaborate with relevant stakeholders based on discussions with the MMS and stakeholders include:

- Collaboration with Civil Aviation Authority (CAA) in providing Aeronautical Meteorological Services
- Collaboration with National Disaster Management Authority (NDMA) in providing early warning information and development of IBF
- Collaboration with Velana International Airport in providing weather and climate information and warning to support airport operation
- Collaboration with island council in disseminating information to the community
- Collaboration with water management authority in providing weather prediction related to the harvesting rain water

Stakeholder Consultations

To determine how MMS's key stakeholders could further contribute to the implementation of the NCP, a stakeholder consultation meeting was held. Participants included representatives from MMS, FMI, BMKG, MoECCT, Maldives Airports Company Limited (MACL), WATSAN, Ministry of Fisheries, Marine Resources and Agriculture (MoFMRA), Health Protection Agency (HPA), and Maldives Red Crescent (MRC). The MRC was selected to represent the civil society, as they have been one of the most important local NGO partner for the MMS. Aviation representatives were present as they regularly use the MMS information for their airport and flight operations.

Some key outcomes from the meeting were:

- The stakeholders agreed that there are enough well-functioning and effective coordination meetings with the MMS. It was recommended to use already existing coordination platforms when necessary, instead of inventing new ones to avoid duplication.
- Although stakeholders expressed appreciation for the MMS services, some mentioned that they were looking for improved services and accuracy in terms of alert and warning information based on sectoral activity (sector-based and impact-based forecasting).
- User needs oriented information needs to be provided by the MMS for specific users (e.g. agricultural sector). This can be covered by IBF information.

A separate meeting was also held with the NDMA, who have a close working relationship and strong collaboration with the MMS. The frequent information sharing and coordination between the agencies is recommended to continue at the current level, to maximise resources

produced for communities and to avoid and reduce duplication of tasks and information. It was also discussed how to work together with the civil society to reach the most vulnerable people and more rural communities, to better support them in interpreting forecasts and early warning alerts. Despite of appreciating the MMS services, the NDMA also indicated their inquiry of better services and accuracy in term of alert and warning information based on the sectoral activity (sectoral-based and impact-based forecasting). Additionally, the NDMA stated that although the Maldives is a country with a low impact but high frequency of disasters, the effects of climate change are beginning to be observed in the form of an upward trend in the frequency of localized disaster events. Accordingly, it is suggested that alert and warning information from the MMS be improved in order to be even faster, more accurate, and easier to comprehend. It should also be contextualized locally.

In terms of stakeholder coordination efforts, the MMS is currently coordinating and sharing information between different stakeholders by facilitating multi-sector dialogue and cooperative engagement, the Monsoon Forum, on an annual basis. This forum brings together a diverse array of participants, including representatives from nine non-governmental organizations (NGOs) spanning sectors such as fisheries, agriculture, gender, and more. Additionally, it engages 10 Island Councils from the islands of Laamu Atoll and approximately 13 government officials, with the exact number varying depending on the specific area under discussion. The active participation of these sectors underscores the commitment to fostering multi-sector collaboration in addressing meteorological and hydrometeorological challenges. The MMS serves as the main organizer of this multi-sector dialogue, positioning itself as a central hub for cooperative discussions and information exchange among various stakeholders. However, as mentioned previously, there is untapped potential to work closer with individual stakeholders and potential new ones, particularly with the private sector. It is therefore recommended for the MMS to **establish a stakeholder engagement plan** to ensure that future stakeholder engagement is more strategic and systematic. The plan should be **managed and monitored regularly by a designated person, such as a specific partnerships or new business development focal point.**

2.2. Assessment of potential GBON sub-regional collaboration

MMS is a member of several regional organizations co-operating in the field of hydrometeorology, most importantly the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES). Its main regional information exchange is related to tsunami warnings, provided through regional centers such as RTSPs (Australia, India & Indonesia). Cross-border exchanges of warnings with neighboring countries are effectively realized through bilateral and multilateral agreements. National warnings are shared in CAP format at the WMO Alert Hub, and within the IOC UNESCO framework, regional warnings on tsunamis are coordinated through the Regional Specialized Meteorological Centre (RSMC) in Delhi for tropical cyclones. The MMS receives regional warning information from the mentioned sources. **It is recommended for MMS to engage with Rimes more regularly, to share more data and regional alerts to strengthen its regional position, and to attend regional trainings provided by Rimes. Reinforcing regional collaboration should be included in the next strategy of the MMS. It is also recommended to explore capacity**

development on stations metadata and data quality performance provided by Regional WIGOS Centre RA II.

Strengthening collaboration and communication with potential donors and training centers in the region is a strategic approach for the MMS to acquire additional resources for capacity development. It is suggested that the **MMS further establishes direct and ongoing communication channels with donor organizations such as the World Bank, ADB, USAID, and JICA to stay updated on their funding opportunities, priorities, and application procedures.** Close collaboration and partnership with the established training centers of WMO in the region, which are hosted by the India Meteorological Department (IMD), China Meteorological Administration (CMA), and Korea Meteorological Administration (KMA), as well as the Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia, is also important to explore more opportunities for training programs, knowledge exchange, and technical assistance. By proactively pursuing these strategies and maintaining open lines of communication, MMS can enhance its capacity development efforts and secure additional resources to bolster its hydro-meteorological services for the community's safety and welfare.

As the Maldives is uniquely isolated in its location, optimizing of the observing network through sub-regional network design is not plausible and therefore not applicable. However, **possible co-operation with nearby countries with similar equipment should be evaluated, to find out if maintenance could also be done more regionally**. Currently, maintenance of some systems, such as calibration, is done by sending the system to be fixed abroad, at the firm location that makes the product for repair. There is a need to explore **more collaboration with neighboring countries or institutions related to training on maintenance and calibration of instruments.**

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

The financial status of the MMS consists of governmental budget funding and funding through international development collaboration projects. The total annual budget for the MMS in the year 2023 amounts to USD 2,350,000. In the allocation of the budget, it is noted that staff costs account for 70%, operational costs make up 27%, and investments represent 3% of the total budget. Over the past 3-5 years, there has been an increasing trend in the government component of the budget, apart from 2021, when the budget was cut mostly due to Covid-19. Since then, the budget has increased again, particularly in terms of capital expenses, but continues to be lower than the ambition level of the MMS.

Table 2. MMS Budget Trend for the Past 5 years

	2018	2019	2020	2021	2022
Increasing	3.24%	12.34%	11.73%	-	7.54%
Decreasing	-	-	-	24.73%	-
Steady	-	-	-	-	-

The budget breakdown of the annual budget gives a better indication of the MMS activities. Some specific budget lines, such as maintenance and replacement of equipment, have increased annually, however the MMS is struggling to spend these funds due to the lack of technicians available.

Table 3. MMS 2022 Annual Budget Breakdown

Type of Activity (2022)	2022 Annual Budget in Maldivian Rufiyaa (MVR) / USD
Staff salary	27,681,439.00 MVR / 1,797,530.94 USD
Operational activities	3,219,343.00 MVR / 209,052.31 USD
Maintenance and replacement of equipment	2,111,948.00 MVR / 137,142.14 USD
Maintenance of the premises	749,870.00 MVR / 48,693.80 USD
Investment in new technology and research	0.00 MVR / 0.00 USD
Training	0.00 MVR / 0.00 USD

Based on discussions, it became clear that there is no real possibility to outsource a technical (preventive and/or malfunction) maintenance of AWS nor upper air sounding station to private sector in the Maldives. **It is therefore recommended that five new technicians will be hired to the MMS.** Currently the repair & maintenance costs budget line does not include staff costs, which is a significant gap. With no adequate staff and budget for maintenance, there is a risk of not maintaining GBON compliance in the future. Additional travel costs also need to be included in the master budget.

To avoid gaps between the development project funding cycles, **the MMS should ensure that there is appropriate maintenance budget available, after the development project cycles end**, covered either by the main government budget or in the future from cost recovery or commercial activities. To systematically justify budget and project funding allocation for maintenance, replacing sensors at stations, the MMS **needs to develop lifecycle plan for AWS and ITC infrastructure**. Lifecycle plan will support sufficient financing for timely maintenance.

In the area of public-private sector collaboration within the MMS, the current landscape presents a mix of elements. While formal agreements for service delivery with the private sector are not currently in place, the MMS has established crucial public sector agreements, particularly in the field of civil aviation. However, formal arrangements regarding the operation and maintenance of networks, as well as the sharing of observation data with the private sector, are yet to be realized.

SOFF Operational Manual defines 4 possible basic business models.

1. **Fully public:** Fully State/NMHS owned and operated GBON infrastructure
2. **Public-Private:** State/NMHS owned and Private Partner operated
3. **Public-Private:** State/NMHS and Private Partner owned
4. **Fully Private:** Owned and operated by a private partner contracted by the State/NMHS

As there are no feasible private partners operating in meteorological field in the Maldives, the current business model of the MMS is **fully public** and it is recommended that **it continues with this model.** However, it is also important to remain flexible to any changes occurring in the next programme period. The development of a legal framework for public-private sector collaboration could also be explored as a part of the new strategy.

Currently the MMS does not have cost recovery mechanism in place for any services, including aviation services. Additionally, there are no commercial activities contributing to the master budget. The new Meteorological Act, under preparation, would enable cost recovered activities. This is strongly encouraged to ensure financial flexibility to independently support and sustain operations, including meteorological observations. The flexibility brought by the cost recovered income would also support the planned investments to remain GBON compliant. It is recommended that **the cost recovery mechanism would be included in the next strategy of the MMS.** However, this is beyond the scope of GBON and this project**.**

Once the cost recovery mechanism is approved, it is encouraged for the MSS to **draft, review and update their cost recovery recommendations regularly, to include targeting other sectors if new opportunities arise.** There is strong potential to engage more with existing partners and end-users, as well as to explore new partnerships opportunities already identified in section 2.1. Implementing a data sharing policy with established data pricing procedure could also generate income when cost recovered. Here, the MMS could explore collaboration with the two insurance companies operating in the Maldives, as the MMS is currently receiving frequent requests for data from them.

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

The strategic planning timeline for the MMS is aligned with the governmental SAP until the end of 2023. However, to strengthen its operational abilities, it is recommended that **the MMS should have its own organizational strategy.** The strategy could match the 5-year presidential term, as there are currently on-going Presidential elections in the Maldives (September 2023). This way it would be best in line with its operating environment and the strategy of the Ministry. The strategy would cover in detail the vision, strategic objectives, conditions for success and values of the MMS.

The MMS has on-going international development projects with various donors, however, these projects are complementary in supporting other elements of the value chain and do not have a specific focus on the infrastructure for basic observation/GBON.

The projects include:

- USAID, Climate Change Adaptation Project

- UNEP, Preparation of Technology Needs Assessment (TNA) under UNFCCC for the Republic of Maldives
- Government of Italy, Bilateral Cooperation Project
- JICA/GCF Project, Building Climate Resilient Safer Islands in the Maldives
- UNDP, UNESCAP / Joint SDG Fund, Strengthening National and Subnational Capacity for Sustainable Disaster Risk Reduction, Climate Change Adaptation and Mitigation in Maldives
- World Bank, South Asia Hydrometeorological Forum Training

In terms of capacity building, each project has a training component related to that project's activities. For example, the USAID project includes training on NWP modeling and Impact Based Forecasting, and within the JICA/GCF project an onsite hands-on training for operating and data visualization of marine instruments is to be installed. No upper-air station purchases or replacement of spare parts are planned under any project. It is recommended to continue **strong coordination between different projects to avoid overlapping and ensuring that pipeline projects can cover any gaps in the existing projects.** This is currently being actioned by the MMS to some extent, as pipeline projects are being modified at the same time as active projects are being reviewed during their operational stage.

2.5. Review of the national legislation of relevance for GBON

Maldives Meteorological Service (initially named as Department of Meteorology) was formed by presidential decree as per Act No.3/68 (11 Nov 1968). Accordingly, the MMS is mandated by the Government to carry out following activities related to Meteorology, Tsunami and Earthquake in the Maldives. MM's official mandate is stated as the following (un-official translation, as only available in Dhivehi, Annex 1):

- Plan, administer and develop activities related to meteorology in the Maldives
- Maintaining the data on climate, earthquake and tsunami, required for economically and socially sustainable development. Develop and maintain such a knowledgebase, and facilitate access to these information to those who require it.
- Conduct research activities on meteorology and seismology in the Maldives.
- Provide aeronautical meteorological services to international and domestic aviation requirements as per the required standards of International Civil Aviation Organization and World Meteorological Organization.
- Monitor weather, earthquake and tsunami over the region. Issue impact based forecast and early warning alerts to concerned authorities and general public.

Under the Government of Maldives Strategic Action Plan (SAP) 2019-2023, MMS's responsibilities are stated as the following:

- Strengthening aeronautical meteorology and multi-hazard early warning capacity
- Maritime Safety Information (including navigational and meteorological warnings, forecasts, alerts of missing vessels, and other urgent messages pertaining to the safety of vessels and crews, in line with IMO obligations)
- Strengthening national institutional framework on DRR and climate resilience

- Establishing and strengthening national-level early warning mechanisms to efficiently disseminate early warning information to the public.

The MMS is officially recognized as the national alerting authority for hydrometeorological hazards in the country or territory. As a result, the government empowers the MMS with the mandate to produce services for the Maldives Meteorological and Hydrological Early Warning System (EWS). Additionally, the Disaster Management Act grants authority to the MMS to monitor EWS in the Maldives.

The Maldives has taken significant steps in addressing climate change by drafting the Maldives's Nationally Determined Contribution (NDC) Implementation Plan in 2018. This plan reflects the country's commitment to mitigating the impacts of climate change and outlines specific strategies and actions to achieve its climate goals. These efforts are closely tied to the work of the MMS, particularly in the realm of climate services. By aligning with the NDC, MMS can contribute significantly to the national climate action agenda. It can provide essential climate information, data, and forecasts that enable informed decision-making and help implement the strategies outlined in the NDC. Furthermore, MMS's role in monitoring and reporting on climate-related indicators is crucial for tracking progress toward NDC goals. In essence, the NDC serves as a guiding framework that reinforces the importance and relevance of climate services provided by the MMS. It underscores the interconnectedness of climate action and meteorological services, highlighting how the MMS contributes to the broader national effort to address climate change and safeguard the Maldives' vulnerable environment and communities.

The legislation related to procurement, importation and customs processes are detailed in the Ministry of Finance's Procurement Plan 2023. "Procurement Plan provides information on the Good, Works, Consultancy Services and Non-Consultancy Services which a government procuring entity is planning to procure throughout the year. The plan comprises of procuring entity and description of procurement along with the planned dates to carry-out the procurement" (Procurement Plan 2023). Within the plan, for the MMS, the legislation processes for procurement are stated under the guidance for Ministry of Environment, Climate Change and Technology. There is also a separate MMS Procurement process document from 14 June 2023 outlining the process. **It is recommended that MMS continues to include taxes and custom costs in their master budget and future project proposals, to avoid any issues related to procurement.**

Overall there are no legal constrains for implementation of GBON activities in the Maldives, and as mentioned earlier, the MMS is currently working on passing the Meteorology Act to strengthen their legislative capacity. The Implementing Entity for this SOFF project, UNEP, will ensure that the Grant Proceeds are utilized in accordance with the terms of the current Funding Request and that procurement is carried out according to relevant UN principles: .a. Best Value for Money; b. Fairness, integrity, and transparency; c. Effective international competition; d. The interest of the UN.

Module 3. GBON Infrastructure Development

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

The aim of SOFF investment phase project is to maximize the impact of observations on global numeral weather prediction (NWP) skill through:

- Installing or rehabilitating upper-air sounding stations.
- Installing surface weather stations in significantly under-observed regions (far from currently reporting stations).
- A sub-regional optimization of the network design.

Four improved surface-based station and one new observation station (Table 1): As indicated in the Gap Analysis for Maldives, the existing civil infrastructure (wind mast, electricity etc.) for the existing GBON weather stations are in good condition and in addition the observation stations already serve the aviation weather observation purposes. However, none of the stations are compliant with GBON due to a capacity gap in automatic data delivery. The required hardware investment within SOFF programme will include new observation sensors (related to GBON variables) and data logger which will replace the manual ones.

Table 4. GBON observation stations in Maldives to be improved

Name	Lat	Lon	Variables	Reporting cycle
Hanimaadhoo	6°44'53.7"N	73°10'10.3"	SLP,T,H,P,W	8
Hulhule (Male)	4°11'34.0"N	73°31'39.4"	SLP,T,H,P,W	8
Kadhdhoo	1° 51' 36.3"N	73° 31' 12.8"	SLP,T,H,P,W	8
Gan	0°41'24.4"S	73°08'59.3"	SLP,T,H,P,W	8

Moreover, there will be an additional new station to be installed to fill the geographical gap between the Hanimaadhoo (43533) and Male (43555) stations in Maafaru. Technical specifications provided by GBON task team[3] will be utilized when supporting IE in preparing tender documents during investment phase.

One improved upper-air station:

Table 5. GBON sounding stations in Maldives to be improved

Name	Lat		Lon
Gan	0°41'24.4"S		73°08'59.3"

[3] GBON Tender Specifications for AWS and radiosounding

The information of the atmospheric state (temperature, humidity, pressure, and horizontal wind) in the vertical profile is critically important when initializing weather forecast models and for air navigation. Upper-air radio sounding has proven to produce observations in good quality. A requirement of spatial resolution for upper-air sounding is 1000 km (in marine areas, applied for SIDS) or better with sufficient temporal resolution for observation per location being 1-4 sounding in 24 h.

The basic principle of measurement includes releasing measurement device (sonde) for temperature, humidity and pressure with a balloon filled with gas lighter than air (hydrogen or helium). This sonde-balloon package will be carried by air motion while lifted upwards. Typically balloon bursts somewhere at 24-30 km altitudes. The observations from descending path are also collected. Based on the drifting of sounding system, wind speed and direction can be calculated.

Two types of upper-air radio sounding systems are available: semi-automatic with manual launching and fully automatic. Both types of systems use the same sonde models (manufacturer specific), and thus, produce equally accurate observations. Daily operation with manual launching is laborious, and thus, salary costs are a burden with semi-automatic sounding system. The fully automatic system does not require daily attention from technical staff, but it requires annual preventive maintenance which, due to need for advanced level capacity, is recommended to be made by manufacturer (operational cost implication). Corrective maintenance may also require remote and/or on-site support from the technical team of manufacturer. When the system ages care must be taken to avoid long data gaps.

Before entering the SOFF investment phase, the project execute team evaluated carefully budget schemes for investment and operation. The following were included:

- The cost of initial investment (semi vs. fully automatic station)
- The cost of establishing sounding station (needed civil infrastructure work)
- The cost of consumables (sounder, balloon, rope, and winder)
- The cost of operating the sounding system (daily human work, maintenance, and relevant spare parts)

Based on the financial analysis an investment cost of fully automatic sounding system is typically higher compared to semi-automatic system. However, the difference in investment costs are later compensated for the automated station in operational costs (i.e., salary costs). This compensation is considered to be comparatively small in Maldives as the observation station in Gan is already staffed. **After careful considerations, the best operational model and way to ensure fulfilling GBON requirements in short-, medium- and long-terms is to operate manual upper-air sounding system.**

Technical specifications provided by GBON task team will be utilized when supporting IE in preparing tender documents during investment phase; Deliverable 6.1 and Deliverable 6.2 ,(Annex 1, 2). In addition to system technical specifications, tender process must include construction renovation work needed for gas storage, and the radiosounding ground system.

Budgeting guidance for the investment of manual upper-air station from SOFF secretariat is acknowledged.Based on the Gap Analysis, the SOFF project executive team of Maldives is recommending the following initial investments for MMS to produce GBON compliant observations:

- **Renew four surface stations to AWSs with**
    - Temperature sensor
    - Humidity sensor
    - Atmospheric pressure sensor
    - Precipitation sensor
    - Wind sensor
    - Data logger including solar panel.
    - One spare sensor for temperature, humidity, atmospheric pressure, and wind delivered one year after the initial delivery of AWS for making periodical maintenance.
- **One new surface AWSs with**
    - Temperature sensor
    - Humidity sensor
    - Atmospheric pressure sensor
    - Precipitation sensor
    - Wind sensor
    - Mast for instruments (especially wind)
    - Data logger including solar panel.
    - One spare sensor for temperature, humidity, atmospheric pressure, and wind delivered one year after the initial delivery of AWS for making periodical maintenance.
    - Required civil works for the station
- **One manual upper-air radiosounding station including**
    - Hydrogen generator and required shelter (ATEX requirements apply)
    - Consumable parts (balloons, sondes etc.) for the first year of operation
    - Required maintenance/renovation to infrastructure
    - Include annual maintenance during warranty period
- **IT hardware for data collection, database and data transfer for WIS2.0 together with required software. At the moment it seems that the Corobor data management system under modernization in MMS, shall be capable of covering this feature and service.**

The IE will be supported to carry out tender process by following WMO guidance (WMO no. 8[4], Report no. 136[5]) and GBON instructions for tendering AWS and upper-air radiosounding station.

The operation of AWS and radiosounding station require a robust process including preventive and corrective maintenance together with Standard Operation Procedures (SOP).

[4] WMO no. 8
[5] Report no. 136

The beneficiary has already a long history for making measurements with weather stations, and subsequently, process for operation and maintenance including SOPs. Also the radiosounding station has been earlier operated by the MMS. The peer adviser will support in updating and developing operation procedures for the observation systems during the implementation phase.

Operating an upper-air radiosounding station during the investment phase requires annual investments on consumable parts and budget for annual maintenance, and thus, investment phase funding request must consider that.

The AWS -network maintenance program will be designed together with the MMS and equipment manufacturer based also on the conditions and recommendations set by the manufacturer. However, initially the maintenance plan includes annual maintenance visits to the station and annual calibration of at least temperature, humidity, pressure and precipitation sensors. A suitable country and NHMS for conducting the calibration will be sought during the investment phase (MMS doesn't have own calibration laboratory), Initial discussions with the BMKG Indonesia have already taken place.

The proposed locations of the SOFF target stations are in the following maps.

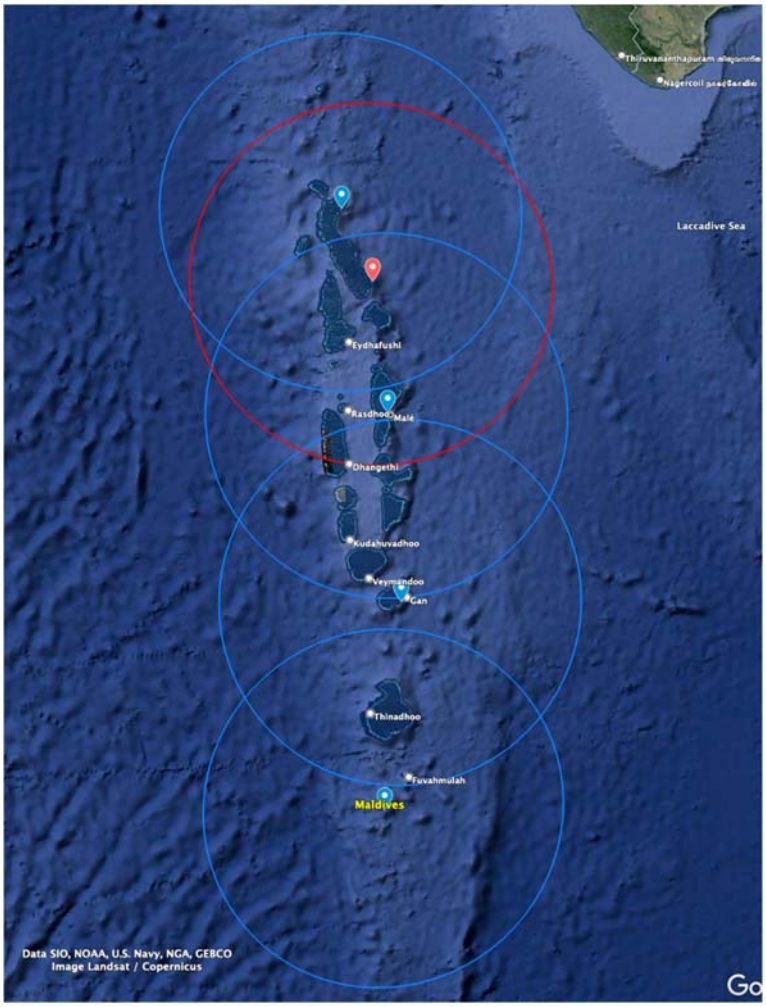


Figure 2 Geographical visualization of the distribution of proposed GBON surface stations to be supported by SOFF. Existing stations in blue markers and proposed new station (tentatively in Maafaru) in red, all with diameter of 500 km.

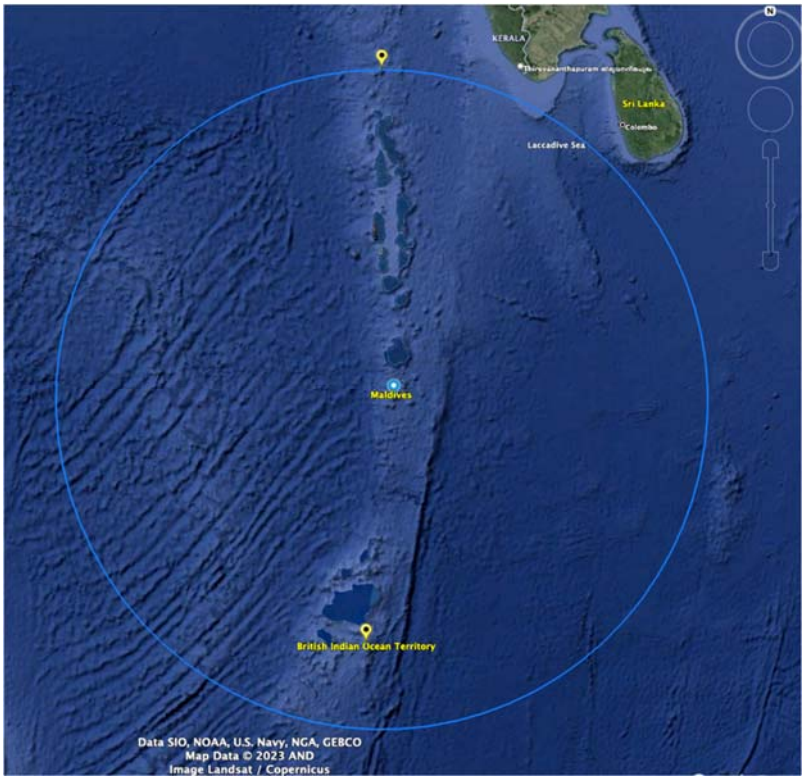


Figure 3 Gan sounding station location in blue dot and circle of 1000 km radius. (Neighboring counties' sounding stations in yellow markers).

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

A development of ICT infrastructure for a value chain of automatic observation network is recommended to begin with building required human capacity and resources. Enough staff to ensure resilience should be tasked and trained in skills and knowledge relevant to IT in meteorological observation. The organization is recommended to gain knowledge and skills in meteorological data, data processing principles and tools, data formats (e.g., NetCDFv4 and BUFR), system architecting, software developing, database, API, network management, as well as web developing.

The ICT infrastructure should be able to support a principle of automatic data collection from station and data delivery to international and stakeholder distribution as well as to operational forecasters through a database including an automatic Quality Control (QC) of observation. In the following considerations for the specific technical ICT development needs in Maldives Meteorological Service are considered.

Technical specifications for database: In addition to automatic and/or manual meteorological observations on site and transfer, a modern, functional Data Management

System (DMS) is a key element in the value chain of observation from measurement station to end user interface. The following specifies general key elements to consider in technical and budgetary perspectives.

Data management system is recommended to use open-source technologies and open protocols (e.g., Open CDMS[6]) to ensure sustainable and redundant operation, maintenance, and development throughout their lifecycles and beyond. DMS can be built cloud-based or on premises-based depending on national legislation and regulation, staff capacity as well as a decision of the organization. DMS must meet the following criteria/specifications:

- Ability to ingest and store multiple different types of weather observation data formats. Including, but not limited to, the following:
    - Surface weather observations
    - Upper-air radiosounding observations
    - Aviation weather observations
    - Lightning observations

Weather radar data have such a big volume and requires much more from storage capacity than a single point/profile data and is thus beyond the considerations of this document. Data ingestion to the data warehouse (database) should be made with a modular approach so that new data feeds may be added with minimal effort and modification to the already existing components and database structures.

For smooth data acquisition, database system must provide relevant APIs for data ingestion. Supported protocols for data transfer must include at least MSQT and SFTP, as defined in GBON specifications. An ability to receive and decode messages from 3rd party data collection systems must be provided. Additionally, a www-based tool for manual observation entry from stations must be provided.

A data quality control (QC) module should be an independent and/or modular part of the system. The QC module must be made so that it is capable of producing quality control regardless of the underlying database system. Additionally, the quality control module must be able to perform real-time quality control and should enable non-real-time manual quality control.

The database system should support queries of timeseries with adequate performance. System must be able to serve as real-time and long-term (climatological) data storage. Modules to calculate added value parameters and use of data from the archive should be made possible. These may include aggregate parameters like daily means, minimums, and maximums.

The data management system must be made capable of offering data to a standard API for a retrieval of the database contents. The API could include the following but not limited to

- WFS
- EDR
- WMS

[6] OpenCDMS

- Export to SYNOP & BUFR message format and delivery to GTS-network
- WIS 2.0[7] (GBON compliance)

System must be able to store relevant metadata regarding stations, station networks and observations. Automatic updates to the WMO/OSCAR -system are preferred.

The delivery of GBON hourly observations should be reported by following WMO guidance (no. 306[8]) and GBON practices[9].

Budget considerations: Budget must consider the infrastructure needed to run a DMS and store the data. Also, a solution for a backup of essential data needs to be accounted for. A valid support contract with a hardware vendor is advisable during the lifetime of the hardware. The lifespan of such hardware may be estimated to be between 5-8 years before the need of renewal of the systems. Currently the MMS in modernizing the Corobor system for data management. It should be capable of fulfill the database requirements and data transmission to WIS2.0. However, a separate data collection module for collecting the AWS data is most likely needed from the AWS manufacturer, that shall be integrated to the overall Corobor data management system. The Corobor data management system shall cover the needed systems and services for Short-term data storage and access, Acquisition of data to and from WIS/GTS, WIS 2.0, Data delivery to the national CDMS, Discovery and descriptive metadata management and Monitoring of data, processing and services. To ensure full compliance with WIS 2.0, a provision has been included in this SOFF project.

3.4. Environmental and sustainability considerations

The key suggest factor for sustainable investment, and day-to-day operation of GBON stations relay on highly competent and motivated management and staff in the organization. Further system specific considerations include at least:

Upper-air sounding station: The GBON compliant sounding system is recommended to be located at a site where permanent staff works daily. This will decrease unnecessary travelling and burdening financial implications when the sounding station requires an attention of staff. Such regular attention will include e.g., filling the system with sondes. The tender process should emphasize quality criteria related to composability in material selection where applicable.

The investment in sounding system is made for 20-30 years, and thus, care must be taken to ensure that annual maintenance is ensured throughout its lifecycle. This has high financial cost implication for the operation, especially in the case of fully automatic sounding systems.

Generation of hydrogen, needed by balloon, locally at the station will make the operation more environmentally sustainable and independent from importing gas by the 3rd party.

[7] WIS2box
[8] WMO no 306
[9] GBON link

AWS: The GBON weather stations are recommended to upgraded to AWSs with civil infrastructure (e.g., electricity, wind mast etc.) that is reusable. With scheduled preventive maintenance and calibration, the lifecycle of sensors will be lengthened as long as appropriate. Moreover, this project recommends replacing of obsolete and environmentally unfriendly technology of mercury thermometers into more environmentally friendly instruments.

Scheduled preventive maintenance and calibration routines require, as a rule of thumb, about 1.3 times more sensors than there are stations. As an example, for 100 stations with temperature sensor, the organization is recommended to own 130 temperature sensors, when 30 of them are in storage or under calibration procedure. In the case of GBON compliance in Maldives, only one surface weather station will be invested in, and thus, each sensor must accompany a spare sensor in initial investment to ensure a sustainable operation of station. Frequency for preventive maintenance may be rarefied based on the scientific experience and statistics gained through calibration.

Use of solar panels support environmental sustainability through an availability of renewable energy.

Module 4. GBON Human Capacity Development

4.1. Assessment of human capacity gaps

The gaps in human capacity of the MMS have been analysed previously by UNEP in 2018[10], by the Indian Meteorological Department, through Country Hydromet Diagnostics (CHD) Report on Maldives in 2021[11] and most recently by USAID in July 2023[12]. All reports found gaps in human resources and technical skills at the MMS, mostly due to lack of funding and adequate training.

Currently the MMS employs 107 individuals, comprising of 77 males and 30 females. The MMS conducts regular assessments for staff competency frameworks. Specifically, assessments are carried out every two years for forecasters and observers, ensuring that these key personnel maintain and enhance their competencies in line with the evolving requirements of meteorological services. The government has established a comprehensive training policy for civil servants, which encompasses the MMS as well. This policy sets the framework for ongoing training and development activities within the organization.

The staff members relevant to operate and maintain observation networks at the MMS, taking care of data transfer and archiving include the following:

- **Observers** at the manual stations: educational background varies from university diploma to university degree on meteorology. They receive a basic

[10] UNEP, February 2018, Toward Risk-Aware and Climate-resilient communities (TRACT) - Strengthening climate services and impact-based multi-hazard early warning in Maldives

[11] India Meteorological Department, 2021. Country Hydromet Diagnostics Report on Maldives

[12] USAID, July 2023, Potential for Impact Based Forecasting in the Maldives to mitigate climate risks

instruction package for which is conducted in regional training centres. Some of these costs are covered by the MMS, such as travel and accommodation costs. There are also online trainings available, which are mandatory for all observers. However, more training is necessary, despite funding being very limited.

- **Technical staff members:** Most technicians do not receive any specific training for their job and mostly 'learn by doing'. Technicians are also trained to do calibration work. Usually, these persons require to have some form of previous knowledge on calibration and then receive more training at the job.
- **IT experts:** Have background in IT, but similarly to technical staff members, they do not receive any additional training but are mostly learning by doing at the job.

All staff members have sufficient background education. The gap in capacity is in specific job/task related areas: the installation, maintenance, and calibration of observation networks. In a similar way, capacity gaps exist in data transfer, handling, and quality control. Hence, a continuous internal capacity and training is needed to adequately fill the gaps. The MMS is planning to have a dedicated person who has a basic observation instructor certificate from the WMO, who can then train others (recommendation to have a certificate on ToT BIP-MT and BIP-M). The MMS has also taken steps to improve their internal qualification system by trying to register its standard meteorological training under the Ministry of Higher Education.

The MMS actively participates in capacity-building initiatives through collaborations with both national and regional institutions. This engagement extends to training programs conducted by the World Meteorological Organization (WMO) and regional centres, which collectively contribute to the enhancement of the MMS's capabilities and expertise in the field of meteorology. However, any additional training budget that the MMS previously had was cut during Covid-19. There is some budget for the staff to attend international trainings, including regional seminars and workshops, but this budget is small and enough for max 1-2 such trips annually.

The gender balance at MMS is 29% female and 71% male. There is no specific Gender Policy, but the MMS has committed to the Ministry of Gender, Family and Social Services Republic of Maldives National Gender Equality Action Plan 2022- 2026. The Action Plan includes 5 policy goals, from which especially Policy Goal 2: Economic Empowerment and Policy Goal 3: Institutional Gender Mainstreaming are relevant to all state institutions, including the MMS. Currently the MMS is aware of the Action Plan, but not applying it in practice, which is why it is recommended that the **MMS will have its own Gender Policy, that is based on the Maldives National Gender Equality Action Plan and WMO's Gender Action Plan 2020-2023.**

MMS has established a Gender Committee, which deals with gender bias issues and monitors any cases of harassment or complaints reported to it. It is recommended that **the Committee's purpose and goal is stated in the new Gender Policy, and that the complaint mechanisms within MMS are made anonymous and easily available to all staff.** In addition, it is recommended that the **MMS considers the implementation of at least 1-2 gender workshops during the next programme period**. These workshops will serve **as a platform**

for staff members to voice their perspectives and aspirations concerning gender-related issues within the MMS. This initiative aligns with the MMS's commitment to promoting gender equality and ensuring that the voices of all staff members are heard and valued.

4.2. Design capacity development activities for technical staff

Recommendations on training activities within SOFF framework to support work towards gaining minimum competence relative to WMO guiding no. 1083[13]. The training needs identified are:

- **Quality management system (QMS):**
  Effective and continuously developing QMS is a basis for the systematic operation and maintenance of observation network(s). The organization has strong understanding and knowledge about QMS, but currently it only has ISO 9001 certification for aviation services. Looking ahead, the MMS plans to implement QMS for the entirety of its forecast services. The timeline for this implementation will depend on annual budget allocations, indicating the MMS's commitment to continuously improving and standardizing its services to meet international quality standards and the needs of its users and stakeholders. An effective development of observation process including lifecycle planning also requires support through benchmarking mature sub-processes for upper air sounding and surface weather stations in other organizations. It is recommended to include extensive training of staff for internal auditing.
- **Data transfer:** Programmers need training on the automatization of data transfer from stations to data base, and subsequently, to WMO WIS2.0 interface, which will replace GTS system. Complementary training to manage and update information in OSCAR surface service is also needed.
- **Data quality control and assurance:** Training on understanding of weather parameters and each others relations, as well as meteorological phenomena. Relevant IT knowledge to implement checks and algorithms data management systems.
- **Instrument and station maintenance at site:** As timely repair and existing equipment in synoptic stations as well as the AWS across the country is crucial, at least five new technicians is required to be hired to MMS in network monitoring, one for each station modernised and one for the new station. The technical staff would also benefit from good quality SOPs and competence requirement criteria. Both the SOPs and owning required competence support self-confidence at any work. Training on upper-air system operation and lifecycle maintenance could also be beneficial. Moreover, it was identified in the National Gap Analysis of the SOFF in Maldives that 4 new technical staff members should be hired to conduct instrument maintenance procedures.
- **ICT system operations:** Operation, maintenance and development of data management system is required. This will include specific training on data management. At least 2 ICT expert and/or masters level engineers should be recruited. Additional training of IT experts on system testing, deployment, operationalization and maintenance is also required. Moreover, it is recommended

[13] WMO guide no. 1083

that the additional ICT staff member pool have skills in running high performance computing (HPC).

- **Calibration and maintenance:** The MMS staff is responsible for calibrating meteorological observation sensors in the Maldives**.** They have received little technical training how to use calibration and testing equipment in laboratory/field. It is recommended that the technical staff receives training in calibration, as well as possibly capacity building in scientific understanding and handling calibration results. MMS technicians require capacity building on understanding a concept of quality through calibration and how calibration information must be inserted in the value chain of observation. It is critically important that scientists are capable of analysing calibration results to support lifecycle and maintenance planning. Here benchmarking sister organizations would support in developing this area in the beneficiary organization.

As there are several extensive needs for capacity development activities for technical staff, it is recommended that a **detailed capacity building plan is developed.** This plan is crucial for the monitoring and evaluation of the trainings, as well as ensuring the plan is adequate funded and to ensure that the plans are sustainable. It is also recommended to partner when possible with other sister institutions, preferably from the same region, that already have some training programs available that match the training needs by MMS. This international collaboration would further grant the MMS access to expertise and resources to strengthen its technical capacity.

4.3. Design capacity development activities for senior management

Some key trainings for senior management level that were identified in discussions include:

- **Finance:** MMS indicated a need for more training for Support and Senior Finance staff. This training will equip the MMS staff with the latest financial best practices, regulatory compliance knowledge, and advanced financial management techniques. It is essential for ensuring the most effective allocation and utilization of resources, ultimately supporting the success of the MMS mission.
- **Media/Communications:** MMS is regularly having to answer a variety of media inquiries and has identified the need for more communication and media training for the staff. This training will equip the MMS team, particularly the senior management team, with the skills and strategies required to engage with the media, convey information accurately, and maintain transparent and effective communication with the public and stakeholders.
- **Project Management Training:** MMS indicated a need for project management and new business development training. These essential skills will enable MMS to efficiently plan, execute, and oversee projects, ensuring their successful completion. Moreover, proficiency in new business development will empower MMS to explore innovative opportunities, foster partnerships, and secure resources vital to MMS mission. It is also recommended to add positions to manage this SOFF project.

4.4. Gender and CSOs considerations

Climate change and extreme weather events are not gender neutral, but they affect women, girls, men, and boys differently[14]. This is due to socioeconomic circumstances, cultural beliefs or traditions that can all contribute to inequality, resulting in women being put in situations of disadvantage when disasters strike. Therefore, it is important that in the pre-disaster context, those who likely will be the most affected by crisis, are also included in the preparedness process[15]. This includes having equal access on political, social, and economic levels as well as being able to participate in decision making. Not only is it fair, that population is equally engaged in climate change adaptation and resilience building, but there is also substantial evidence that shows that women are often the most resilient members of society and the powerful agents of change in the event of a disaster. They also have historic coping mechanisms that can be of use when designing and tailoring local grass-root level early warning systems or other climate change adaptation services and activities. To include women in designing hydrometeorological and climate services directly leads to saving lives and livelihoods, as the needs of different groups have been better identified.

The rational for organisations to pursue gender equality in governance, strategy, programmes, and decision making, is highlighted in WMO's recently updated Gender Action Plan[16]. It emphasizes that organizations that respect and value gender equality and diversity attract and retain talented staff and improve overall organizational performance, have more satisfied employees, are more innovative and have better governance. Teams that have gender diversity have better decision-making processes and attract more external partnerships, as well as have better access to local communities. Encouraging women to take up leadership positions has also shown to lead to important achievements in the field of climate change adaptation and disaster preparedness.

In the Maldives, the government encourages the institutions to have a gender balance, and significant policy papers to combat gender inequality have been introduced recently, such as the Ministry of Gender, Family and Social Services Republic of Maldives National Gender Equality Action Plan 2022- 2026. Despite Maldivian women being "among the most emancipated in South Asia"[17], there is still a big gap in the number of women participating in the labour force.

In the MMS the balance between female and male is around 30/70. The MMS does not have gender policy nor measures for gender discrimination. According to discussions with the MMS, new staff members are hired based on their competence, not based on gender. In the Maldives, as in many countries, it is men who tend to study topics like IT, engineering, electronics, physics, and meteorology more often compared to female. This can cause natural gender unbalance in different tasks within the MMS.

Recommendations:

In addition to the previously recommended Gender Policy, **a gender assessment should be conducted as part of the human capacity assessment.** This could be included as part of a

[14] UNDP, 2017, Gender adaptation and disaster risk reduction

[15] Disaster Recovery Guidance Series, 2018, Gender Equality and Women's Empowerment in Disaster Recovery

[16] WMO Gender Action Plan

[17] Asian Development Bank, Sept 2007, Maldives: Gender and Development Assessment

Gender Workshop. It is also recommended that the following gender quota as recommended by WMO is implemented at MMS:

- Women should represent at least 50 % of all participants in SOFF-related and supported trainings
- 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

The following actions from the WMO Gender Action Plan[17], have been selected as recommendations to include in the Gender Policy and to be discussed during the gender workshops:

- Increase the participation of women by: (i) identifying and nominating female experts from NMHSs or other national institutions to participate in the work of WMO governance bodies and their working structures and (ii) seeking equality in the composition of delegations to sessions (1.1.1(c) in WMO Gender Action Plan).
- Strive for gender balance, including in management and working structures (1.1.2(c) in WMO Gender Action Plan).
- Encourage and support female networks of experts (1.1.3(c) in WMO Gender Action Plan).
- Designate NMHS gender equality focal points (1.3.4(c) in WMO Gender Action Plan).
- Develop monitoring mechanisms at the national level by (i) adapting the WMO gender monitoring indicators or (ii) using an existing national framework (2.4.1 in WMO Gender Action Plan).
- Include gender equality (including the WMO Policy, GAP, link to online trainings and gender webpage, information on key activities) in the induction of new PRs and NMHS staff (3.1.4(c) in WMO Gender Action Plan)
- Develop the capacity of NMHS staff on unconscious bias, inclusive leadership, gender mainstreaming, and gender responsive service delivery through trainings and workshops (3.1.5(c) in WMO Gender Action Plan)
- Offer internships to young professionals, especially female, and secondments of staff from meteorological services on a rotational basis. (3.4.2(c) in WMO Gender Action Plan)
- Engage with international organizations field offices, such as UN Women, UNDP, etc. (5.1.4 (c) in WMO Gender Action Plan)
- Conduct research and provide the Secretariat with case studies, stories and examples of gender mainstreaming, including in service provision, for the development of a compendium of good practices (5.3.3(c) in WMO Gender Action Plan).
- Develop and disseminate communication materials (i) highlighting the role of women in meteorology, hydrology and climatology, (ii) promoting female role models, and (iii) advocating for gender responsive weather, hydrological and climate services (5.1.3(c) in WMO Gender Action Plan).

- (i) Customize weather and climate services to the particular needs and roles of women and men and (ii) Provide education and training to target female users in accessing and using weather and climate information and products (7.3.1(c) in WMO Gender Action Plan).

CSO Participation

To include CSO engagement during and after the SOFF implementation phase will bring mutual benefit and grounds for sustainable operation. The following actions are recommended to ensure that CSO's are regularly consulted during the entire length of the programme cycle:

- Conduct stakeholder engagement workshops on the implementation of the SOFF project deliverables (observational data exchange to support weather/climate and water services and products), bringing together key stakeholders and CSOs, to involve and collaborate with the MMS and the SOFF project team from the early onset, as well as ensure the stakeholders are consulted on operations and maintenance.
- Organise awareness-raising activities for the community by engaging the Red Crescent, i.a. to prevent vandalism.
- Organise high level dialogues on benefits, co-production, and ownership of the new national GBON infrastructure.
- Organize stakeholder engagement workshops/consultations including, where possible, local civil society organizations (CSOs) focused on women's empowerment
- Ensure that 50% of the MMS staff and stakeholders participating in consultations with civil society organizations are women.

Module 5. Risk Management Framework

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

As stated in the SOFF Operations Manual[18] the risk mitigation procedures of the IE will be relied upon for SOFF implementation during the Investment phase. The Operational phase is supported by the risk mitigation procedures of beneficiary. The following summarises overarching key risks for investment and operation phase to be carefully considered and handled by IE, beneficiary, and peer adviser. The SOFF Risk Management Framework should be monitored and updated regularly to ensure that it is up to date, and any new risks and mitigation measures should be added to the matrix as soon as they surface.

Potential key risks for investment and operation during SOFF implementation	Mitigation measures and responsibilities	Monitoring and evaluation

[18] SOFF Operations Manual

Slow implementation and delays in procurement, installation and capacity building activities	Seamless collaboration between the Implementing Entity, peer advisor, beneficiary country and technical partners will help to ensure that the project activities are executed without any delays.	Implementing Entity, peer advisor, beneficiary country and technical partners jointly monitoring regularly as the project progresses
After the conclusion of the Investment phase, GBON data are not collected or shared or are shared of insufficient quality	The Investment Phase will include budget operations and maintenance of the equipment to ensure that GBON Infrastructure has been installed and internationally exchanges data. This will also help in smooth transition to the compliance phase. After this the country will receive SOFF support in the compliance phase which will help to ensure that all the equipment is properly functioning and sharing data. In addition, trainings held during the Investment Phase trainings will help to ensure that the beneficiary country has the capacity to manage quality of the data.	The management of beneficiary country is responsible for reviewing and monitoring that work has been conducted as intended
Decrease in funding support for operations	Sufficient lifecycle planning, and subsequent, annual budget planning combining different funding source (SOFF, budget, UNEP support, cost-recovery)	IE and the management of MMS are responsible for monitoring and taking required corrective actions.
Insufficient staff competence	internal capacity building plan is developed including the criteria of competence requirements for technical staff. A duplication of skilled staff members for critical tasks.	The management of beneficiary organization is responsible for monitoring and evaluation.
NMHS staff depart after being trained	To mitigate the risk of the staff departing, the Investment Phase will work on providing additional incentives for the staff including regular opportunities for regional trainings and workshops. It is recommended that the	The management of beneficiary organization is responsible for monitoring and evaluation.

	Compliance phase includes budget to cover salaries for the new staff, as well as to cover participation in some of the trainings and workshops which would contribute to the staff wellbeing.	

Module 6. Transition to SOFF investment phase

This module involves supporting the beneficiary country and the IE in preparing the Investment phase funding request based on the recommendations provided in the Plan.

Please provide any additional recommendation relevant for the translation of the National Contribution Plan into an Investment Phase Funding Request.

Summary of GBON National Contribution Plan

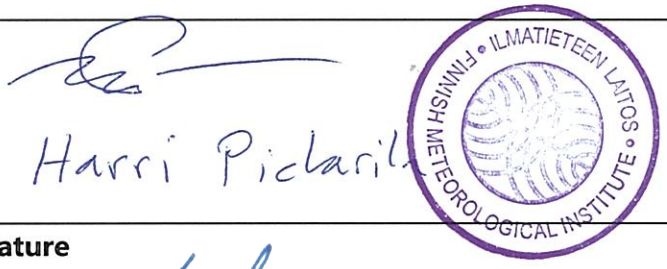
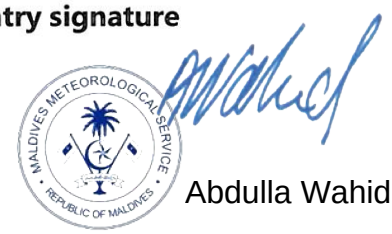
Components	Recommended activities
Module 2. GBON business model and institutional development	Collaborate with existing governmental and private stakeholders to increase the effectiveness of the MMS. To support this, draft a concrete stakeholder engagement plan.
	Engage more actively and regularly in regional fora, such as Rimes. Share more data, information and regional alerts to strengthen regional position. Explore capacity development on stations metadata and data quality performance provided by Regional WIGOS Centre RA II.
	Further establish direct and ongoing communication channels with international donors to stay updated on their funding opportunities, priorities, and application procedures.
	Evaluate possible co-operation opportunities with nearby countries with similar equipment to find out if some maintenance could be done more regionally (e.g doing calibrations at BMKG).
	Draft an institutional strategy, that will clearly outline the action plan for how the MMS will achieve its short and long-term goals and become GBON compliant.
	Continue with the business model Fully public: Fully State/NMHS owned and operated GBON infrastructure. The development of a legal framework for public-private sector collaboration could also be explored in the new programme period.
	Develop lifecycle plans for AWS and ITC infrastructure.
	Ensure strong coordination between different projects to avoid overlapping and ensure sufficient budget for maintenance costs even after the project life cycle ends
	Continue to include taxes and custom costs in the organizational master budget and future project proposals, to avoid any issues related to procurement.
Module 3. GBON infrastructure development	Renew the Gan sounding station.
	Renew the thermometers and wind sensors in all GBON stations, including automating the stations in terms of GBON variables.
	Install a new surface observation station (in Maafaru).
	Start one-hour observation/data sharing cycle in all GBON stations.
	Implement WIS2.0 compliant data sharing including implementation of data management system.
	Establish a spare part stock, design calibration procedures and training of the staff.
Module 4. GBON human capacity development	Increase training activities on impact-based forecasting, NWP, calibration, aviation, radar and satellite operation. Map opportunities to collaborate with neighboring countries or institutions related to training on maintenance and calibration of instruments.
	Include training on data transfer and data quality control and assurance, ICT system operations and data management.
	Recruit five additional technical staff and three ICT staff

	Increase capacity building and allocate budget for media and communications training, to better be able to answer the growing needs and requests from the media and other news outlets.
	Conduct QMS training to ensure QMS is fully implemented in the MMS (currently only in the aviation services)
	Add training on project and partnership management. Recruit 1-2 personnel to support in the management of the SOFF project. Add additional financial training for the finance staff
	Ensure that CSO's are regularly consulted during the entire length of the programme cycle (specific recommendations included in the report)
	Conduct a gender analysis and draft a new organizational Gender Policy, with specific actions that are measurable and regularly monitored, that are based on the WMO Gender Action Plan. Work closely with local CSOs to implement the new Gender Policy and action plan. Clarify the responsibilities of the MMS' existing Gender Committee and designate an active Gender Equality Focal Point
	Ensure a quota is enforced of 50% of women participating in the capacity building activities and 50% of women participating in consultations with civil society organizations
Module 5. Risk Management	The SOFF Risk Management Framework should be monitored and updated regularly to ensure that it is up to date, and any new risks and mitigation measures should be added to the matrix as soon as they surface.
Module 6. Transition to SOFF investment phase	The transition to SOFF investment phase is recommended to carry out by following the Gap Analysis (submitted to SOFF secretariat) and National Contribution plan (this document). The Funding Request has been filled out together by UNEP, FMI and MMS for the SOFF Investment phase.

Annexes (if any)

Annex 1. Maldives Meteorological Service Mandate (un-official translation)
Annex 2. Deliverable 6.1 – GBON Tender Specifications for AWSs
Annex 3. Deliverable 6.2 – Requirement document to be used as input to tender specifications for radiosonde-related procurements

Report completion signatures

Peer Advisor signature  Harri Pichari
Beneficiary Country signature  Abdulla Wahid
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