SOFF Investment Phase Funding Request

Madagascar

15th May 2024

Systematic Observations Financing Facility

Weather and climate data for resilience

SOFF Investment Phase Funding Request

The funding request should be prepared by the SOFF beneficiary country in collaboration with the SOFF implementing entity and supported by the SOFF peer advisor. The funding request reflects and is based on the National Contribution Plan. In case of questions on how to complete this template, please contact the SOFF Secretariat at: soffsecretariat@wmo.int.

The SOFF Investment Funding Request template includes the following sections:

1. **Basic Information**
2. **Programming Criteria**
3. **Readiness and Country Context**
4. **Investment Phase Outputs and Budget**
5. **Investment Phase Implementation Arrangements**
6. **Investment Phase Monitoring, Reporting, and Verification**
7. **Investment Phase Risk Management Framework**

The **GBON Gap Analysis**, the **GBON National Contribution Plan** and **Country Hydromet Diagnostic** are included in **Annex 1, 2, 3**.

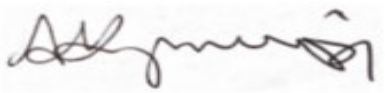
The **Terms of References** of the advisory services provided by the **SOFF peer advisor** are provided in **Annex 4.**

1. Basic Information

SOFF Beneficiary Country and Focal Point	**Dr. Nirivololona Raholijao**, Director General and WMO Permanent Representative; The National Meteorological and Hydrological Service of Madagascar (DGM)			
Country classification	☒ LDC	☐ SIDS	☐ FCS	☒ ODA-recipient
SOFF Implementing Entity and Focal Point	**Dr. James Kinyangi** and **Dr. Solomon Ngoze** The African Development Bank (AfDB)			
SOFF Peer Advisor and Focal Point	**Carolin Müller, Dr. Carmen Emmel**, and **Dr. Jan Lenkeit**, Deutscher Wetterdienst (DWD)			
Total Budget (USD)	Total Project costs inclusive of the Peer Advisor's fee: **4,404,671 USD** Project costs exclusive of the Peer Advisor's fee: **3,974,671USD**, which is divided into the following two tranches: First tranche: **2,583,536(65%) USD** Second tranche: **1,391,135(35%) USD**			
Delivery timeframe	**36 months** (3 years). The proposed period is **November 2024** to **November 2027**			
Date of Steering Committee Approval				

SOFF Steering Committee Co-Chairs Signature (signature confirms Steering Committee approval of the funding request)

Signatures



Dr. James Kinyangi, Coordinator, ClimDev Africa Special Fund, **The African Development Bank**

Dr. Nirivololona Raholijao, Director General and WMO Permanent Representative; **The National Meteorological and Hydrological Service of Madagascar (DGM)**

Deutscher Wetterdienst (DWD)

2. SOFF Programming Criteria (2 pages)

Alignment with the SOFF Programming Criteria

Close the most significant data gaps

Madagascar is a vast, diverse island and exposed to multiple climate hazards, including tropical cyclones, droughts, and floods. Because of its size and geographical location, Madagascar experiences different types of climate hazards and levels of exposures.

The country suffers from a limitation in observational network (based on the WMO Global GBON gap analysis conducted in June 2023). Strengthening of Madagascar's network will not only ensure availability of reliable data and improve the quality of numerical weather prediction products both at national level and contribute better to global model outputs but also, accelerate the sustained collection and international exchange of the most essential surface-based weather and climate observations in compliance with the internationally agreed Global Observing Basic Network (GBON). Madagascar has **24 synoptic surface observations stations**. The General Directorate of Meteorology Madagascar **(DGM) operates 20 synoptic surface observation stations**. The **Agency for Air Navigation Safety in Africa and Madagascar (ASCENA**) operates **4 synoptic surface observation stations and 2 upper air (UA**) stations. The ASCENA stations (**both synoptic surface observation and UA) are already GBON compliant and do not need any further support from SOFF.**

Table 1: GBON National Contribution Target

Type of station	Baseline (Results of the GBON Global Gap Analysis)				GBON National Contribution Target	
	Target (# of stations)[1]	GBON-compliant stations (#)	Gap		To improve	New
			New	To improve		
Surface	15	4	0	11	9	2
Upper-air	3	0	1	2	0	1

Madagascar requires **15 surface stations and 3 upper-air stations**[2] (UA) (see table 1) to close the most significant data gaps. The National GAP analysis conducted for Madagascar in June 2023, indicates that Madagascar needs to **upgrade 9 surface** stations and establish **2 new stations** to reach the target of **15 GBON-compliant stations**. In addition, **one more upper-air station** needs to be established (see 1). All these 9 surface stations and the 1 upper-air station need support from SOFF. The

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.

2 When the term upper-air station is used, we only refer to radiosonde observations.

	already GBON compliant 4 surface stations and 2 upper air stations belonging to ASECNA will not require any SOFF support. Figure 1 shows the proposed observation network for Madagascar, presenting suggested sites for new stations as well already existing stations. The figure presents the existing and proposed surface and upper air station sites, and five regional maintenance centres (RMC). The project proposes to replace **Six (6)** out of **nine (9) surface stations** that need to be upgraded with new Automatic Weather Stations (AWS): only some of the existing infrastructure can still be used, as repairing them would no longer be economical. The project proposes to install **two (2) new stations:** one close to the capital region at **Arivonimamo** and one at **Ambatondrazaka airport**. While there may exist additional stations that could benefit from improvement, the construction of these 2 new stations (one close to the capital region at Arivonimamo and one at Ambatondrazaka airport with a high population density and relatively good infrastructure) is considered more sustainable and appropriate due to accessibility and infrastructure. The new stations in this area improve maintenance possibilities and early warning for a large proportion of the population, which is mainly concentrated around the capital and along the east coast. Three (3) surface stations are already AWS but need minor repairs, replacements and civil work (one solar panel replacement, two wind towers, two foundations, three LPS, two fences). The proposed site for the **third upper-air station (one new upper air station)** is **Antsiranana (Diego Suarez)**. This is a former site of an upper-air station and it will also ensure coverage of the north in addition to a station in the south and centre. The DGM will operate the third upper air station, while ASECNA will operate the other two upper air stations.Ensuring the required maintenance for durability and functionality is one of the most significant challenges. The DGM lacks fuel for supervision and maintenance of equipment, the government which is responsible for the recruitment and deployment of staff within the DGM is unable to employ additional personnel since 1990. A lack of personnel with the appropriate profile is also preventing the NMHS from obtaining ISO certification. The DGM requires an additional 200 employees to fulfil its official mandate including 16 staff to maintain the GBON Network as well as four additional Regional Maintenance Centres.

Figure 1: Map of current and planned observation network for Madagascar (Source: Madagascar NCP)

Target easy fixes	The target quick wins are to ensure sustained operation of the already existing infrastructure that builds maximum capacity for the country. This entails: • upgrading existing 9 surface stations (AWS) and installing 2 new AWS and one new upper air station. **Six (6)** out of **nine (9) surface stations** to be upgraded, need replacement with new Automatic Weather Stations (AWS): only some of the existing infrastructure can still be used, as repairing them would no longer be economical. • To guarantee sustainability of the network and individual stations, upgrade of existing infrastructure and the deployment of new stations factor in all expenses linked to procurement, operations, encompassing data transfer, communication, maintenance, calibration, field checks and replacement costs. This includes indirect expenditures associated with its operations, such as vehicles, transportation for maintenance, ICT, licensing, spare parts, equipment, training, as well as the managerial and administrative workload. • Optimize resource utilization through geographical proximity and local expertise, the project proposes to establish **four (4) Regional Maintenance Centers (RMC)** to be based in the following areas: Toliara, Farafangana, Mahajanga and Antalaha. While three out of four RMC need to be refurbished, the RMC in Farafangana will need to be newly built. However, all four need to be newly equipped with spare parts, calibration equipment and tools. This is in addition to the headquarters Antananarivo serving as the central RMC. Each RMC, serving as maintenance hub for its region and allow for faster responsiveness and better accessibility of the stations distributed over the whole island. It will also hold a calibration laboratory, including field check equipment and all essential spare parts for the AWS installed in its administration area, allowing for more maintenance and repeatedly calibration activities, covering temperature, humidity and pressure. The RMC will be equipped with a 4-wheel drive vehicle, a waterproof laptop, air condition to ensure safe working environment and equipment, and necessary office equipment. The staff requirement for each RMC is as follows: one Regional Manager with an engineering degree and **3 to 4 technical experts**, holding a degree in electronics. These RMCs are important for long-term GBON compliance due to the size, the topography and the infrastructure of the country. Calibration of instrumentation at all stations would barely be possible at the required intervals and many more replacement sensors would be needed as travel time from the headquarter is immense and accessibility from the capital, where the headquarter is located, can be limited substantially, especially during rainy and tropical cyclone season, when good measurements are especially crucial. Having RMCs located in the planned towns would substantially improve the possibility to react to outages and fulfil maintenance and calibration schedules as required for GBON. Without the RMCs, long-term operations of especially very remote stations could be in jeopardy. The

	objective is to reach sustainable operationalization of all GBON stations under SOFF. The project will promote the importance of RMC's as maintenance as well as training centres to other NMHSs within the Southern African Development Community (SADC). Since Madagascar is a member of SADC, which comprises 16 member states in the Southern region of Africa and working together on climate information services aspects through the SADC Climate Services Centre (SADC CSC)[3]- Which the AfDB helped to establish and equip through the Satellite and Weather Information for Disaster Resilience (SAWIDRA) Program, the project will promote these RMCs as training facilities and maintenance of equipment and effective observational network coverage. • To ensure **security and safety of stations**, theft proof equipment will be installed (for example, climbing defence system on wind towers), as solar panels and other valuable equipment often gets stolen, if they are not securely mounted. In addition, all AWS will be equipped with a Lightening Protection System (LPS). Surge protection for all electrical equipment in the AWS will also be part of the overall lightning protection concept. • To support the DGM to carry out quality assurance through **maintenance and calibration of existing and new equipment** , including conducting field checks of atmospheric pressure, humidity and temperature, to guarantee continuous data collection and transmission, the project proposes to train the DGM staff in maintenance and calibration to make use of the calibration equipment procured through the project "*Project to improve the adaptation and resilience capacities of rural communities in the face of climate change*" (PACARC)[4] initiative. The equipment has not been used yet due to a lack of knowledge on how to use these instruments. All RMCs will be equipped with their own set of calibration equipment in order to allow for regional calibration activities. The PACARC project is funded by GEF and implemented by UNDP. The project is multi-sectorial, working mainly with Ministry of Agriculture. The DGM was funded under the component 1 of the project: "Use of agroclimatological information for the adaptation of agriculture sector" The project procured one four-wheel vehicle (Toyota) for maintenance and 2 AWS, 5 agroclimatological stations, 4 hydrological stations to be installed. • DGM is currently collaborating with TAHMO to enhance the internal data flow of DGM, improve their technical capabilities to manage the transmission, storage, and backup of their meteorological data more effectively, and integrate AWS to the system. The process of digitization of the data has started and is currently in progress with the integration of the data into Climsoft by the Hydrometeorological Database and Archives Department SBDAH, a unit under the DGM (Service de la Base des Données et des Archives

[3] SADC CSC provides operational, regional services for monitoring and predicting extremes in climate condition.it also provides training in climate prediction for personnel in the National Meteorological/Hydrological Services (NMHSs), also, covering the end users in all aspects of climate

[4] Projet d'Amélioration des Capacités d'Adaptation et de Résilience des Communes Rurales face aux Changements Climatiques

	Hydrométéorologiques). However, there is not yet an adequate backup process in place. To date, only manual backups are performed on a second computer at a different physical location. The project proposes to support the installation of an automatic back-up system between two servers allowing for frequent mirroring of the data as well as geo redundant storage, requiring: Extra server (rack/tower); UPS; 5 hard drives (5 TB each, for RAID systems on both servers) and a medium sized generator to overcome longer power outages at the computing center, which cannot be buffered by the UPS alone. All hardware will be suitable for 24/7 operations, possibly at high ambient temperatures (in case of AC failure) and frequent read/write access. Country regulations do not allow for cloud-based solutions, as there is no service provider available in Madagascar and data are not allowed to be stored outside of the country borders.
Create leverage	DGM works closely with the government departments and non-government institutions within Madagascar. It provides service products to sectors such as agriculture health energy, water and many other private sectors where weather forecasting and climate projections are critically vital for decision-making support across the energy, biodiversity, and water sectors. It provides meteorological, climatological, hydrological, and environmental services to the Malagasy society and is represented in each of the 23[5] regions of Madagascar by a Regional Meteorological Service supervised by the Regional Directorate of Transport and Meteorology. This SOFF investment will forge close working relationships with the respective ministries or Bureaus (e.g. Bureau National de Coordination des Changement Climatiques, du Carbone et de la Réduction des Emissions dues à la Déforestation et Dégradation des Forêts ou BNCCREDD+ belonging to the Ministry of Environment and Sustainable Development and the Ministry of Agriculture, Livestock and Fisheries) that could be beneficial to create synergies and build the capacity needed to implement GBON. DGM uses observational data and forecast profiles, numerical weather prediction (NWP) models and satellite imagery, from several meteorological centers for its forecasting activities, The most important sources are the Global Forecast System (GFS), the Hurricane Weather Research and Forecast (HWRF) and the WAVEWATCH III (WW3) of the National Oceanic and Atmospheric Administration of the USA (NOAA), the Integrated Forecast System (IFS) and the Wave Model (WAM) from the European Centre for Medium-Range Weather Forecasts (ECMWF), the Global Deterministic and Met Office Global and Regional Ensemble Prediction System (MOGREPS) from the United Kingdom Met Office (UKMO), LAM AROME-IO[6] from the Tropical Cyclone Centre of La Réunion (RSMC-TC La Réunion) and the Unified Model UM4 from the Regional Specialised Meteorological Centre of South Africa (RSMC Pretoria-SAWS), which are

[5] According to DGM, the number of regions will increase to 26 in the coming years.

[6] limited-area coupled model called **AROME**-Indian Ocean (**AROME-IO**)

	part of the WMO Severe Weather Forecasting Programme (SWFP). The DGM uses a combination of regional and global NWP models, such as the NWP from the WMO Regional and Global Centres For short range forecasts, DGM is using the Ensemble Prediction System (EPS) of the ECMWF, the Global Ensemble Forecast System (GEFS) as well as UK's MOGREPS. Satellite imagery is received directly from EUMETCast[7] and accessed through the EUMETView Web portal. The DGM does not currently operate a weather radar station in Madagascar, but is in dialogue with the African Development Bank (AfDB), the World Bank and the Hydromet IOC project to assess future options in this regard. This SOFF investment will also leverage and complement other initiatives undertaken by other bodies under the supervision of the Ministry of Transport and Meteorology, such as ASECNA and the *National School of Aeronautics and Meteorology* "Ecole Nationale d'Enseignement de l'Aéronautique et de la Météorologie" (ENEAM[8]), with which the DGM already has a close partnership. ASECNA - Agency for the Safety of Air Navigation in Africa and Madagascar – is an international public body governed by the Dakar Convention revised in 2010, with legal status and financial autonomy. In Madagascar, ASECNA operates four surface stations and two UA stations. All of them are already GBON compliant. ASECNA is currently responsible for the transmission of weather data (their own and data from DGM) to the Global Telecommunication System (GTS). The number of stations operated by ASECNA are included in the national GBON target, which makes ASECNA a crucial partner in the establishment of GBON. Those stations are operated and maintained by ASECNA on their own funds and do not require any SOFF support. DGM will forge and work closely with ongoing initiatives that are of great importance to GBON including the **Trans-African Hydro Meteorological Observatory (TAHMO) and the *Deutsche Gesellschaft für Internationale Zusammenarbeit*[9] - GIZ Madagascar**. **TAHMO** is working towards the goal to establish a 30 km dens network of hydro-meteorological monitoring stations in sub-Sahara-Africa, using an integrated and sustainable approach. TAHMO collaborates with the **GIZ program PrAda (Project for enhancing adaptation and resilience capacities of rural communities facing climate change)** to create a broader agro-climatological station observation network. This will provide stakeholders in agricultural value chains with a dependable database for informed decision-making. Although these stations do not conform to GBON standards, they will still contribute to the establishment of an observation network that

[7] EUMETCast is a method of disseminating various (mainly satellite based) meteorological data operated by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)

[8] Accredited by the WMO, the meteorology courses of ENEAM and École Supérieure Polytechnique d'Antananarivo (ESPA) are further part of the WMO Regional Training Centres (RTCs) based in Madagascar

[9] German Development Cooperation

	will eventually go beyond the GBON criteria and provide useful additional information. Options for training workshops working on capacity building in quality management, particularly on aspects of station maintenance including field checks for sensor testing facilitated through GIZ and TAHMO should be explored. Furthermore, TAHMO can provide support for DGM in setting up a connection to the Global Telecommunication System (GTS), which will be replaced by the WMO World Information System (WIS) 2.0. A non-cloud-based approach is envisaged. This is a vital aspect in the accomplishment of the GBON requirements, and is therefore of major importance to the SOFF project. Further collaboration holds crucial importance. This SOFF investment will also pursue and work closely with other international organizations or programs involved in related fields, such as climate change and disaster risk, within the country or region is recommended. PACARC[10] (GEF/PNUD), CREWS (WB/GFDRR/WMO/UNDRR), PRRC (WB) and SADC SAWIDRA/SARCIS-DR (EU/AfDB) are potential programs of particular interest. For future collaboration programs, The project will also work with other financing mechanisms such as the GFCS (WMO) or the Green Climate Fund. For example, the CREWS project through the HYROMET IOC, to Support institutional reform for DGM (A transition from public institution to an Agency) and QMS for climate services. The following activities essential for this project (output 1.1 and 1.2) will be covered under the project "Project Building Regional Resilience through Strengthened Meteorological, Hydrological and Climate Services in the Indian Ocean Commission Member Countries" (IOC Hydromet Project): • Stakeholder engagement workshops with inclusion of CSO (topic on information dissemination last mile, acceptance of observation network, RMC as potential information hub for regions) • Feedback workshops on product and service quality (user feedback) Workshop on Gender mainstreaming in the provision of climate service • Capacity building for NMHS management and staff in strategic planning, project development and management, leadership and team management, gender sensitivity • Generation of Standard Operating Procedure (SOP) and quality assurance/quality control for the station operations • Establishing a cost recovery mechanism for NMHS (legal authority for DGM to be paid for services/data etc.) Madagascar is also part of the Early Warning for All (EW4All) initiative, where SOFF is seen as a foundational element and delivery vehicle for the second pillar of the initiative: "Hazard detection, observation, monitoring, analysis and forecasting". The

[10] PACARC: Projet d'amélioration des capacités d'adaptation et de résilience des communautaés rurales face au changement climatique

	convergence of the two programs aims to achieve the defined outcomes of EW4All by SOFF supporting the improvement of national monitoring systems not only to close the GBON gap in Africa, but also to strengthen national capacities for effective disaster preparedness and early warning systems. An international exchange of GBON data is a key objective.
Maximize delivery capacity	DGM is represented in each of the 23 regions of Madagascar by a Regional Meteorological Service supervised by the Regional Directorate of Transport and Meteorology. Established in 1962 then as the National Meteorological Service of Madagascar, DGM has a longstanding experience in data collection, management of weather stations and meteorological network operation across Madagascar. The AfDB has a country office in Madagascar, supported by the AfDB's South Africa Regional Headquarters based in Pretoria South Africa, with excellent contacts with the Government and other organizations relevant to facilitating interactions for SOFF work and missions during the implementation stage. The AfDB is a member of the Alliance for Hydromet Development and SOFF implementing entity for an investment project in South Sudan. The South Sudan SOFF project was approved last year (2023). Over the last 4 years it has implemented hydromet and climate risks interventions worth over US$ 100 million (including the Cyclone Idai Emergency Recovery and Resilience Project (IERRP). The AfDB has a long-standing and experienced working relationship with the Madagascar Government through various projects implemented in the country. The projects include agriculture, energy, climate change, etc.- for example, the AfDB implemented the Satellite and Weather Information for Disaster Resilience in Africa (SAWIDRA) project in the SADC region, including Madagascar between 2016 to 2021. The project provided the National Meteorological and Hydrological Services (NHMS) with relevant data and Numerical Weather Predication (NWP) capability to facilitate provision of severe weather early warning to meet the needs of Disaster Risk Management. The project operationalized four (4) automatic weather stations and deployed 1 HPC in Madagascar. This project was in line with *The Sendai Framework for Disaster Risk Reduction 2015-2030* (SFDRR) which recognizes the need to strengthen Multi-Hazard Early Warning Systems (MHEWS), especially by enhancing the hydrometeorological warning services combined with improving the emergency preparedness and response plans and operations to better prepare for climate-related hazards. The programme contributed to achieving operationalization of a Regional Advanced Retransmission Service (RARS) for the SADC region, Madagascar included in this program- there are other three RARs stations across Africa to complete full coverage from meteorological satellites. From last year, 2023, the AfDB, with funding from the African Development Fund's Project Preparation Facility is helping Madagascar Government to tackle the socio-economic and environmental impact of climate change on communities and ecosystems.in the regions of Amoron'i Mania, Vakinankaratra, Analamanga (Centre), Haute Matsiatra, Ihorombe (South-east) and Androy (South).

	Early this year, 2024, the DGM applied to the AfDB Climate Action Window for a project on closing the observation gap with weather radars to improve their capacity for monitoring cyclone activity and strengthen their early warning system. The AfDB will make decision on funding by the end of May 2024. If approved, the project will procure and install weather radar, and lightning-detection networks techniques for short-term prediction of thunderstorm movement. It Is envisaged that the AfDB supported project will also have capacity building aspects that are relevant to early warnings and development of protocols and shared resources in maintaining observation networks. Both basic observation networks and radar networks will help to build your early warning system of Madagascar. In addition, the close cooperation with SADC's Climate Services Center, facilitates any action towards improving delivery capacity for GBON compliance. SADC CSC provides operational, regional services for monitoring and predicting extremes in climate condition. it also provides training in climate prediction for personnel in the National Meteorological/Hydrological Services (NMHSs), also, covering the end users in all aspects of climate. The SADC CSC will be instrumental in providing training and capacity building to maintain robust data exchange within the region and across the globe. Google one hour Thanks to its decades of experience and expertise, the German Weather Service (DWD) can offer technical and planning support. In addition, there has been very good cooperation between the DWD and the DGM for many years, which can be built upon here.
Sub-regional gains	Madagascar is a member of various regional alliances such as the Indian Ocean Commission (IOC), the Southern Africa Development Committee (SADC), the Tropical Cyclone Committee (RA I TCC), the Severe Weather Forecasting Programme South Africa (SWFP SA). Specific projects that have emerged from these regional collaborations and are of interest to GBON are outlined below: "*Building Regional Resilience through Strengthened Meteorological, Hydrological and Climate Services in the Indian Ocean Commission Member Countries*" ***(IOC Hydromet Project)***, will improve the National Meteorological and Hydrological Services (NMHSs) in Madagascar, Seychelles, Mauritius and the Comoros through a regional approach, by creating a Regional Climate Centre Network (RCC-Network). the project further will develop an optimized surface observation network and associated Information and Communication Technology (ICT) systems for the South West Indian Ocean Region, aligning with the GBON concept. The SOFF project will initiate dialog to leverage synergies regarding information sharing, resource mobilization and project implementation is crucial. The implementation of a Regional Maintenance Center approach could serve as a platform for the DGM to promote the exchange of

	knowledge and experiences among NHMS facing similar issues. This presents a valuable opportunity to apply capacity-building programs and explore the beneficial utilization of shared resources. The CREWS South West Indian Ocean project project aims to strengthen the interface between DGM and Bureau National de Gestion de Risques et des Catastrophes (BNGRC) for disaster risk management and CPGU with respect to early warning systems.[11] Additionally, Madagascar is a beneficiary country of the World Bank Regional Resilience Project for Eastern and Southern Africa. Through this project DGM is expecting 6 new AWS, 6 new automatic Hydrology stations and 1 weather radar. However, the project is still under planning and there is no clear installation plan or time schedule yet. In case the project will be implemented as initially planned, the 6 AWS would serve as an extension of the GBON Network to increase the coverage and encourage Madagascar's effort to aim for GBON high density. In order to make use of possible synergies and to avoid overlapping project targets, constant exchange of the projects is envisaged. SOFF activities further complement the IOC Hydromet Projects activities within Madagascar, which also allow for sub-regional leverages between the Indian Ocean Commission countries. The IOC Hydromet project intends to develop an optimized surface observation network and associated Information and Communication Technology (ICT) systems for the South West Indian Ocean Region, aligning with the GBON concept. To avoid duplication of effort, early and ongoing communication between the two projects was established. Madagascar is currently covered by the regional WIGOS Center (RWC) southern Africa countries. DGM will benefit from the maintenance of the observation observational metadata and data performance. Madagascar is currently a member state of the Southern African Development Community (SADC) and SADC's Climate Services Centre (SADC CSC) based in Botswana. The linkage between the project and SADC CSC will benefit Madagascar in observational data access and management. The SADC CSC currently hosts one of four AfDB funded Regional Advanced Retransmission Service (RARS) in South Africa, installed in Africa and Numeric weather prediction infrastructure (high performances computers with modelling capabilities) linked to all SADC regional members. The RARs will enhance access to satellite data from low polar orbiting meteorological satellites

[11] South-West_Indian_Ocean_-_CREWS_Proposal_3-final.pdf (South-West_Indian_Ocean_-_CREWS_Proposal_3-final.pdf (ane4bf-datap1.s3-eu-west-1.amazonaws.com)

3. Readiness and Country context (1 page)

SOFF Beneficiary Country Capacity Assessment

This section should summarize existing Beneficiary Country capacity to execute the GBON National Contribution Plan.

The DGM (National Meteorological and Hydrological Service of Madagascar) Was established on February 28th 1962 by a decree No 62- 099 bis and is under the Ministry of Transport and Meteorology of the government of Madagascar. It consists of two main departments namely: the Directorate of Meteorological Operations[12] (DEM) and the Directorate of Hydrometeorological Research and Development[13] (DRDH).

DGM is mandated to protect life and property against natural disasters of meteorological and climatic origin. It is responsible for the development and sustainable maintenance of a national hydro-meteorological network, weather analysis and forecasting, and climate services that serves the public interest.

Other Institutions under the supervision of the Ministry of Transport and Meteorology And working in collaboration with DGM include, ASECNA and the *National School of Aeronautics and Meteorology* "Ecole Nationale d'Enseignement de l'Aéronautique et de la Météorologie" (ENEAM[14]). ASECNA - Agency for the Safety of Air Navigation in Africa and Madagascar operates four surface stations and two UA stations. All of them are already GBON compliant. ASECNA is currently responsible for the transmission of weather data (their own and data from DGM) to the Global Telecommunication System (GTS). The number of stations operated by ASECNA are included in the national GBON target, making ASECNA a strong partner in the establishment of GBON. In the future it is foreseen that all GBON stations (including the ASECNA stations) will be integrated into WIS 2.0. The future responsibility for data exchange to WIS 2.0 is currently being discussed between DGM and ASECNA.

DGM works closely with the BNGRC on disaster risk management and early warning systems. The DGM is officially recognized as the National Warning Authority for Hydrometeorological Hazards in Madagascar, but the Integrated Multi-Hazard Early Warning System (MHEWS) is operated by the BNGRC and the Centre for Studies, Reflection, Monitoring and Guidance[15] (CERVO), its focal point for all warnings and disaster information.

DGM works closely other government ministries or Bureaus that could support or benefit from G GBON activities (e.g. Bureau National de Coordination des Changement Climatiques, du Carbone et de la Réduction des Emissions dues à la Déforestation et Dégradation des Forêts ou BNCCREDD+ belonging to the Ministry of Environment and Sustainable Development and the Ministry of

[12] Direction des Exploitations Météorologiques

[13] Direction des Recherches et Développements Hydrométéorologiques

[14] Accredited by the WMO, the meteorology courses of ENEAM and École Supérieure Polytechnique d'Antananarivo (ESPA) are further part of the WMO Regional Training Centres (RTCs) based in Madagascar

[15] Centre d'Etudes, de Réflexion, de Veille et de l'Orientation

Agriculture, Livestock and Fisheries). These officers and ministries could be beneficial to create synergies and build the capacity needed to implement GBON.

The Madagascar observation network needs expansion and to be fully operational. DGM provides climate and weather services to Madagascar and is represented in each of the 23.[16] regions in the country by a Regional Meteorological Service supervised by the Regional Directorate of Transport and Meteorology. Data are derived from the national observation network comprising 24 synoptic surface observation stations (54% (partly) operational), 36 agro-climatological stations (47% operational) and 2 upper-air stations (100% operational).

The current business model for the DGM is public. The project recommends a fully public business model. Although the public business model carries some risks, strengthening the public sector is the most sustainable model at this point in time. The DGM has a solid organizational structure supporting the chosen business model. There is currently no private service provider that could take over. In addition, most of the actors in the country are from the public sector, with whom close cooperation is explicitly desired (e.g. GIZ, UN, etc.).

In order to become more financially independent of the funds provided by the Ministry, the possibility of a cost recovery mechanism is currently being examined (NCP). The RMCs provide further potential in this regard, as calibration services for neighbouring countries and island states can be integrated.

The assessment of the capacity of the DGM to deliver on the GBON National contribution plan recommends, support and strengthening of DGM's climate and information systems including, Data gathering, storage, processing and sharing as described in the NCP.

To maintain a GBON-compliant network, there is need to sustained national budget allocations to strengthen DGM capacity. While the SOFF investment will cover the initial investment for operations and deployment, as well as long-term results-based funding triggered by verified data exchange results monitored globally in real time by the World Meteorological Organisation, it is advisable to develop a national financing plan in parallel, which can guarantee and ensure the sustainable continuation of the observation network to be implemented, even with limited external financial support. Capacity building of staff is emphasized, The NCP highlights the involvement of stakeholders and end users cater to their needs more effectively.

Appropriate mitigation measures have been identified (and are summarized in the Risk Management section in this proposal). It is envisaged that in the course of implementing this project, the DGM will build its capacity and better equipped to implement similar programs and projects in the future. The capacity building program proposed in this proposal will greatly build the capacity of DGM during the course of this project.

Investment Phase Alignment with the GBON National Contribution Plan

[16] According to DGM, the number of regions will increase to 26 in the coming years.

Please attach the National GBON Gap Analysis and GBON National Contribution Plan as Annex 1.
The National GBON Gap Analysis and GBON National Contribution Plan - Annex 1.

4. Investment Phase Outputs and Budget

The GBON National Contribution Plan provides detailed information on the Investment Phase Outputs (please see Annex 1).

Output 1. GBON institutional and human capacity developed	Main activities	Budget (USD)
1.1 **National consultations** including with CSOs, and other relevant stakeholders conducted	• Activities under this output will be funded by the IOC Hydromet Project	**nil**
1.2 **NMHS institutional capacity** required to operate the GBON network developed	• Set up four (4) Regional Maintenance Centres (RMC) in addition to the Headquarters, staffed with 1 head of service (engineer) and 3-4 technicians per RMC • Procure Wifi RMC sim cards • Procure and install wifi boxes for Internet • Procure and install a standby generator	**909,316**
1.3 **NMHS human capacity** required to operate the GBON network developed	• Capacity building for NMHS staff covering the following main topics (Table 10 in NCP): Weather monitoring and Forecasting, Weather forecasting enabler, ICT and IT, Management of Observation Network AWS, Management of Observation Network UA, Database and Data Management, Network Management. For all trainings a gender sensitive approach must be followed. Where possible online courses as well as WMO trainings offered in the region as well as certifications and qualifications will be considered. • Staff availability for installation and maintenance of the improved observation network, including cleaning activities, and transportation).	**560,714**
Output 2. GBON infrastructure in place	**Main activities**	**Budget (USD)**
2.1 **New land-based** stations and related equipment, ICT systems, data management systems and standard operating practices in place	• Procurement and installation of two (2) new land-based stations (AWS) (solar powered) • Construction of 2 fences, 2 foundations, 2 wind towers 2 Lightning Protection Systems,	**357,814**

	• Procurement and installation of red obstruction lights for stations close to an airport • Assessment of further requirements concerning frangibility of towers/fences • Theft-protection at all stations • Installation costs. • Storage costs for equipment. • Continued collaboration with TAHMO in Data management and Data Transfer measures (GTS/WIS2.0 linkage, back-up system). WIS 2.0 deployment and operation funded by SOFF for existing and new surface and UA stations.	
2.2 **Improved land-based** stations and related equipment, ICT systems, data management systems and standard operating practices in place	• Replace 6 stations with new AWS • Replace 1 solar panel at already in place AWS • Deconstruction of 6 old wind masts • Construction of 8 fences, 8 foundations, 8 wind towers, 9 Lighting Protection Systems, • Theft-protection at 9 stations Follow implementation route (NCP) ICT and IT • Procurement of a backup Server /rack/tower) including 5 hard drives and UPS, AC • Availability of required software and capacity building	**380,607**
2.3 **New upper-air** stations and related equipment, ICT systems, data management systems and standard operating practices in place	• Construction of ATEX compliant buildings for upper air station (hydrogen generator, gas storage tank cabins, filling room, compartment for electrical installations) • Procurement and installation of one new upper air station (including spare parts, annual maintenance contract, factory training, ICT systems and software, uninterrupted power supply, consumables)	**393,714**
2.4 **Improved upper-air** stations, related equipment, ICT systems, data management systems and standard operating practices in place		

Outcome: Sustained compliance with GBON	Main activities	Budget (USD)
3.1 **GBON land-based stations' commissioning period completed**, country-specific standard cost for operations and maintenance established, and data sharing verified by WMO Technical Authority	Maintenance, calibration, and operationalization of surface observation stations conducted. Five Regional Maintenance Centers (Headquarters included) equip with spare parts, servicing and calibration equipment.	**752,714**
3.2 **GBON upper air stations' commissioning period completed**, country-specific standard cost for operations and maintenance established, and data sharing verified by WMO Technical Authority	Maintenance, calibration, and operationalization of upper air observation stations conducted (including procurement of balloons and radio sondes) **2 sondes and 2 balloons per day + spare in case of failure**	**359,767**
Total for all Outputs		**3,714,646**
Implementing Entity Fee[17]		**260.025**
SOFF peer advisory services		**430,000**
Total funding request		**4,404,671**

Budget breakdown by UNDG category (Excluding SOFF peer advisory services)[18]	USD
Staff and personnel costs	**177,000**
Supplies, Commodities and Materials	**240,000**
Equipment, Vehicles, Furniture and Depreciation	**1,807,000**
Contractual Services Expenses	**827,500**
Travel	**462,493**
Transfers and Grants	**-**
General Operating Costs	**200,653**

[17] The implementation fee cannot exceed 7% of the total Investment Phase funding request.

[18] The total budget (excluding the budget for the SOFF peer advisory services) is expected to be disaggregated by UNDG category. It includes direct and indirect costs of the Implementing Entity and beneficiary countries to establish a fully operational observation network, collecting and internationally exchanging data according to GBON requirements. Eligible expenditures are any type of expenditure required to implement the GBON National Contribution Plan, including the requirements of the beneficiary country to manage and administer the day-to-day activities of the Investment Phase. It also includes the budget required for the operation and maintenance of the observing network.

5. Investment Phase Implementation Arrangements

Execution model and implementation arrangements	IMPLEMENTATION Project Organization and Institutional Analysis Implementing Entity: The African Development Bank (AfDB) is the SOFF Implementing Entity. AfDB will build on its experience in delivering country projects in Africa to oversee appropriate implementation of the SOFF support in line with the Bank's procedures and standards, and specific requirements in the Legal Agreement that will be signed by the Bank and the UNMDTF acting on behalf of SOFF as well as the provisions in the SOFF Operational Manual. The AFDB's technical and fiduciary teams shall conduct supervisory missions at least twice a year during the project implementation period. In addition, the AfDB shall provide constant advice and guidance to the entities that will implement the Project in terms of technical aspects, fiduciary requirements including prohibited practices, environmental & social aspects, and monitoring & evaluation. ***Executing Entity:*** The DGM will execute this project and manage other partnerships in the execution, with fiduciary responsibility to the AfDB. The project shall form a Project Coordination Team (PCT) to support overall implementation of the project. Members of PCT shall include the Ministry of Transport, DGM, Civil aviation Ministry of Water, SADC, Madagascar ministries utilizing weather data, representative of international organization implementing similar activities in Madagascar. The presence of the PCT shall help to create awareness and support advocacy of the projects activities and raise the profile of DGM as an essential ingredient for Madagascar's planning and development agenda. The PCT will support project's overall policy, review development of work plans and coordination of project activities in line with the Funding Agreement between AfDB and the Madagascar The PCT will provide technical inputs in reviewing work plans and progress reports and support in addressing issues that affect the smooth implementation of activities. The AfDB will retain the overall responsibility for effective coordination, execution and management of the project including budget and financial management, procurement, progress reporting and monitoring. ***Peer advisor:*** The Peer Advisor for this project is the Deutscher Wetterdienst (DWD). The DWD is the German National Hydro-meteorological Service, based in Offenbach am Main, Germany. It is mandated by the government of

	German to monitor and provide climate information services in Germany, including for the general public and for nautical, aviation, hydrometeorological or agricultural purposes. DWD will provide technical support and contribute to supervision for the implementation of the project as well as support AfDB and contribute in providing regular feedback to the SOFF secretariat on the evolution of the Investment Phase activities. In addition, the Peer Advisor will: • General technical advisory to support the beneficiary country and the implementing entity in the implementation of the National Contribution Plan and agreed activities for the Investment Phase (bidding documents development, bid assessment and/or evaluation, ensuring the correct commissioning and initial operation of equipment, supporting dispute resolution with suppliers on technical matters)Support exploration of synergies with ongoing complementary activities and facilitate stakeholder engagement in coordination with the Beneficiary Country and Implementing Entity. • Contribute and provide recommendations and guidance on reporting. • Provide technical support and review of the AWS and upper air station tender process (incl. technical specifications) • Provide support on Metadata Management mechanisms • Coordination with SOFF secretariat and WMO technical units • Project coordination with DGM, AfDB, TAHMO and GIZ through by-weekly (adjustable) project management meetings. • Technical support on management, IT and communication tenders and purchasing processes.
Private sector involvement	For Madagascar and its specific country context, we propose to apply a fully public business model. This means that full ownership and control of the observing system, operations and services is with the government and therefore with the NMHS. Although there is a private partner involved in operations in Madagascar (ASECNA), data exchange between the two parties is free of charge and a good partnership exists. Therefore, we would still consider it a fully public business model. The private partner's four stations are already GBON compliant and therefore do not require further SOFF support. The remaining 11 stations to be made GBON compliant with the support of SOFF will be fully owned and operated by the NMHS. Although the public business model carries some risks, we believe that strengthening the public sector is the most sustainable model at this point in time. As described in the CHD, the DGM has a solid organizational structure supporting the chosen business model. There is currently no private service provider that could take over. In addition, most of the

	actors in the country are from the public sector, with whom close cooperation is explicitly desired (e.g. GIZ, UN, etc.). In order to become more financially independent of the funds provided by the Ministry, the possibility of a cost recovery mechanism is currently being examined. The DGM has a memorandum of understanding with mobile operators working within Madagascar. These operators include Orange Madagascar, Telma and Airtel Madagascar. They support the cost of sim card for AWS data transmission and other specific needs of DGM such as laptops, motor bike, civil work for AWS installation, wifi boxes etc. For each mobile firm company, the yearly in-kind counterpart amount is 7 200 000 Ariary.
Civil society participation	SOFF operations will include a strong focus on community engagement, through site selection, security arrangement and use of equipment. This will elevate understanding of climate risks and achieve sustainable change in behaviour among local communities. The population of Madagascar approximately 28,812,195 million people (2023) who mainly live in rural areas will greatly benefit from improved climate information services through the provision of timely early warning hydro hydrometallurgical information. Participation of other partners (e.g., NGOs, private sector, and academic institutions) will further promote the long-term sustainability of results. The project expects that CSO will be brought in through collaborative processes, specifically relevant during the stakeholder engagement workshops, where specific vulnerabilities and gender aspects will be addressed. The CSO will also be crucial play a critical role especially in sustainability of this project. They'll play a critical role in preparing the government and communities to eventually manage and implement government projects by themselves.
Fiduciary systems	Under this arrangement, the AfDB as SOFF implementing Entity will provide fiduciary oversight of the project, including those pertaining to procurement and financial management, in accordance with the AfDB's regulations and rules, policies and procedures. as per the project work plan approved by the Bank. The AFDB has a national office in Madagascar, which is backed up by regional office based in Pretoria, South Africa. These two officers are strongly supported by the AFDB's headquarter staff best in Abidjan Ivory coast. This arrangement will provide sufficient fiduciary backstop to the project.

	The AFDB's fiduciary teams shall conduct supervisory missions during the project implementation period. In addition, the AfDB shall provide constant advice and guidance to the Project in terms of fiduciary requirements including prohibited practices, environmental & social aspects, and monitoring & evaluation. The SOFF Secretariat will transfer the project funds to the AfDB upon the approval and signing of the Fund Request; and meeting necessary condition(s) and submitting the required documentations for disbursement. Using the necessary AFDB's project management rules and regulations, the AfDB will then sign a grant agreement ("Grant Agreement") with the Government of Madagascar (The Ministry of Finance), representing the DGM. The AfDB will create a special account for SOFF proceeds to undertake this funded activity as approved by the SOFF Secretariat. Disbursement of the proceeds for the project will be done according to the terms and conditions of the Financing agreement as well as provisions of the Disbursement Handbook in force at the AfDB. The Bank will use the following disbursement methods (a) the special account method (for operating expenses, payment of project staff, and certain workshop related expenses) and (b) the direct payment method for the payment of works, goods and service contracts. Large procurements such as the acquisition of automatic weather stations will be made directly by AfDB to suppliers and service providers upon submission of relevant completion documents. Procurement will follow AfDB procurement procedures. **Procurement and financial management arrangements** All procurement of goods, works, and related services and acquisition of consulting services will be in accordance with the Bank's Rules and Procedures for Procurement of Goods, Works and Services using the relevant Bank Standard Bidding Documents, and the provisions stipulated in the Financing Agreement. The AFDB's fiduciary teams consisting of procurement and financial management officers will carry out assessment of procurement risks at the Country, Sector, and Project and Executing Entity levels. This will inform the choice on the procurement regimes applicable for specific transactions or groups of similar transactions under the project. Appropriate mitigation measures will be identified. The AfDB will support the DGM in procurement using the Bank's procurement rules and

	regulations. The AfDB will consider all regulations related to tax, customs or international shipping at the time of procurement or purchasing of the stations (spare parts and all related infrastructures). The Bank will properly account for the regulated taxes and potential custom fees. **Financial Management, Disbursement, and Audit** The AfDB will carry out fiduciary due diligence on the Government of Madagascar and DGM The Institutions will develop a fiduciary safeguards system arrangement with the AfDB and DGM following the conditions and terms stated in the approved fund request between the AfDB and based on its own rules, regulations and policies. *Interim and Annual Reporting*: The AfDB will require the DGM to prepare on a six-monthly basis and, interim unaudited financial reports adequate to reflect expenditures relating to the project's funding.
Social and environmental safeguards	**Environmental and Social Safeguards** Environmental and Social Categorization: In-country environmental assessment, legal and institutional framework, and the Banks Integrated Safeguards Systems Operational Safeguards (ISS, OS) are key to determining project categorization based on the level of Environmental and Social risks and impacts. The AfDB approved updates to the institution's Integrated Safeguards System (ISS) on April 12, 2023. Among other changes, included the updates aligning the bank more closely with its peers on community health and safety, gender-based violence, and stakeholder engagement in high-risk operations. Other improvements included strengthening provisions on environmental and social requirements for value chains. - African Development Bank Group's Integrated Safeguards System 2023 | African Development Bank Group (afdb.org). The Project does not present any Environmental and Social Impacts and risks. However, AfDB will carry out an environmental and social categorization for the activities in this funding request upon inception of the activities based on the AFDB's and the Madagascar's laws and regulations. The project will assess any impacts and risk associated with the project, monitor and mitigated throughout the project. **Negative Environmental and Social Negative Impacts-** The project will minimize any risk and impacts coming from infrastructure expansion wherever possible environmental considerate options chosen in accordance with bank's rules and regulation as well as the country's laws. **Involuntary Resettlement**: The project components and activities do not present any resettlement aspects The expansion is mainly concentrated on small areas and therefore social and environmental impacts are

	expected to be minor and can be kept to a minimum. Settlements or services will not be affected. **Positive social impacts**: Some of the project activities will lead to outcomes that will enhance climate preparedness capacity and the management of climate disasters through climate disaster risk insurance, thus safeguarding food security during extreme climate episodes, and improving the climate and weather observation networks and infrastructure and data processing for enhanced provision of hydro-meteorological services. Furthermore, the bank and the government of Madagascar are committed to promoting gender equality in the delivery of weather and climate services. The AfDB like other international development institutions recognises that gender equality and women and girls' empowerment is not only a critical human rights issue for women and girls, it is a prerequisite for the achievement of broader development goals, effective humanitarian response and sustainable peace and security. The AfDB's Gender Equality Strategy aims to promote gender equality and empower women across the continent. The strategy has four main objectives: (a) mainstream gender into all AfDB's operations, (b) increase women's access to productive assets, (c) improve women's access to basic services, and (d) promote women's leadership and participation in decision-making processes. To this end, the AfDB has expertise and personnel to support the analytical and implementation of project level gender mainstreaming during implementation The project will actively involve gender considerations in the implementation of the proposed activities in accordance with the law of the land**.**
Dispute resolution mechanism	The African Development Bank Group has an independent recourse mechanism in place and will apply to this project. Communities or individuals who believe that they are adversely affected by an African Development Bank Group (AfDB) supported project may submit complaints to existing project-level grievance redress mechanisms or the AfDB's Independent Recourse Mechanism (IRM). The IRM ensures project affected communities and individuals may submit their complaint to the AfDB's Independent Recourse Mechanism which determines whether harm occurred, or could occur, because of AfDB non-compliance with its policies and procedures. To submit a complaint or request further information, an email shall be sent to: IRM@afdb.org or, visiting the IRM website www.irm.afdb.org. Complaints may be submitted at any time after concerns have been brought directly to the AfDB's attention, and Bank

	Management has been given an opportunity to respond before reaching out to the IRM.
Monitoring and Evaluation	The AfDB and DGM with the support of the peer advisor will oversee and monitor the activities. The AfDB will complete the Progress Reviews (IPR) based on the Bank's IPR template twice a year to track the results specified in the projects results framework. A mid-term review and project completion report will be done mid-way and at the close of the main project. The AfDB will align reporting with the umbrella agreement signed with the UNMPTF and the reporting for DWD will be aligned with the assignment agreement signed with the WMO through the SOFF passthrough mechanism.
Gender Equality and Women's Empowerment Promotion	Climate change impacts affect men and women differently, given the different roles and responsibilities they have at the household and at the community levels. Women are particularly vulnerable to climate change; however, they play central role on climate issues- i.e. having deep understanding of their direct environment, their experience in managing natural resources (water, forests, biodiversity and soil), and their active role in climate-sensitive activities such as farming, forestry and fisheries. Women can play a role in climate change adaptation and are often natural resource managers who can help develop strategies to cope with climate-related risks. Within this context, an initial gender assessment plan will be prepared. Following the assessment, and already recognising gender balance is currently inexistent, all the staffing activities and training activities will include the recommendation of enhanced woman representation and favouring the inclusion of female staff in the DGM. The stakeholder workshops will include a specific topic on gender issue not only to allow discussions but to advocate for gender equality and empowerment with all the relevant actors in the place. From an execution perspective, gender balance will also be sought so that the related staff from AfDB and its execution party and the Peer Advisor include 50% of female staff members.

6. Investment Phase Monitoring and Reporting

Please note that the implementation will only start in November of 2024 (Year 1) due to administrative aspects and will end in November of 2027 (Year 4). Implementation will therefore take 3 years after the administrative aspects are resolved.

Output 1. GBON institutional and human capacity developed	Indicator	Target Y1 (2024)	Target Y2 (2025)	Target Y3 (2026)	Target Y4 (2027)
1.1 **National consultations** including with CSOs, and other relevant stakeholders conducted	# of stakeholder workshops and advocacy action workshops		1	1	
	# of feedback workshops on product and service quality (user feedback)		1	1	
	# of workshops on Gender mainstreaming in the provision of climate services		1		
	# percentage of female staff members	38			
	# of staff trained in senior management		10	26	
	# of staff trained in Weather monitoring and Forecasting			6	26
	# of participants Impact based Forecast and Warning Workshop			50	
	# of staff trained weather forecasting enabler			18	26
	# of RMC operational		4	1	
1.3 **NMHS human capacity** required to operate the GBON network developed	# of staff trained in surface-based station installation		10	9	
	# of staff trained in surface-based station maintenance		10	9	

	# of staff trained in surface-based station operationalization		3	3	
	# of staff trained in surface-based station field checks, hand-helds		7	9	3
	# of staff trained in surface-based station calibration		2	4	
	# of engineers/ technicians trained in UA installation, maintenance, operation, radio sonde operation			4	
	# of engineers send to factory training (e.g. France) for UA			2	
Output 2. GBON infrastructure in place	**Indicator**	**Target Y1 (2024)**	**Target Y2 (2025)**	**Target Y3 (2026)**	**Target Y4 (2027)**
2.1 **New land-based** stations and related equipment, ICT systems, data management systems and standard operating practices in place	# stations as per the GBON National Contribution Plan		2		
2.2 **Improved land-based** stations and related equipment, ICT systems, data management systems and standard operating practices in place	# stations as per the GBON National Contribution Plan		3	6	
2.3 **New upper-air** stations and related equipment, ICT systems, data management systems and standard operating practices in place	# stations as per the GBON National Contribution Plan			1	
2.4 **Improved upper-air** stations, related equipment, ICT systems, data management systems and standard operating practices in place	# stations as per the GBON National Contribution Plan				
Outcome: Sustained compliance with GBON	**Indicator**	**Target Y1**	**Target Y2**	**Target Y3**	**Target Y4**
3.1 **GBON land-based stations'** commissioning period[19] completed, country-specific standard cost for operations and maintenance established, and data sharing verified by WMO Technical Authority	# stations as per the GBON National Contribution Plan			5	11
3.2 **GBON upper air stations'** commissioning period completed, country-specific standard cost for operations and maintenance established, and data sharing verified by WMO Technical Authority	# stations as per the GBON National Contribution Plan				1

[19] The commissioning period is the last year of the Investment Phase. The beneficiary country, supported by the Implementing Entity, must demonstrate the sustained operation of all the SOFF-supported stations according to the GBON compliance.

The implementing entity is expected to report on progress as described below.

- **Quarterly updates** to the SOFF Secretariat: A simple standardized form providing a progress update against the Investment Phase Outputs' indicators (and Outcome, where applicable[20]) and flagging major issues that are delaying implementation, if any.
- **Annual narrative and financial reports** according to the UNMPTF reporting requirements indicated in the legal agreements. The annual narrative report reports on progress on the delivery of the Investment Phase Outputs, measured by the Investment Phase Indicators. It includes also a review of the Investment Phase risks and an update on environmental and social safeguards, including gender.
- **Final narrative and financial reports** according to the UNMPTF reporting requirements indicated in the legal agreements. The final narrative report confirms the completion of all the activities and report on the number of stations that have completed the commissioning period (outcome). The WMO technical authority verifies GBON compliance of the indicated stations and provides a verification report to the SOFF Secretariat. Upon WMO verification, the Investment Phase can be considered completed. The Final Report should describe the Investment Phase results achieved and lessons learned; and it should also specify the long-term institutional arrangements to secure sustained GBON compliance with SOFF Compliance Phase support.

[20] The quarterly reports should also include, when applicable, progress achieved in terms of new or rehabilitated stations that have become operational and are already sharing the data into the WIS 2.0 system as confirmed through the WIGOS Data Quality Monitoring System (WDQMS) web tool.

7. Investment Phase Risk Management Framework

The Investment Phase Risk Management Framework should be based on the SOFF Risk Management Framework, incorporating relevant programmatic risks and including additional country-specific risks. Please follow the methodology established by the Multi-Partner Trust Fund Office (MPTFO) presented below.

		Impact				
		Insignificant (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Extreme (5)**
Likelihood	**Very Likely (5)**	Medium (5)	High (10)	High (15)	Very High (20)	Very High (25)
	Likely (4)	Medium (4)	Medium (8)	High (12)	High (16)	Very High (20)
	Possible (3)	Low (3)	Medium (6)	High (9)	High (12)	High (15)
	Unlikely (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
	Rare (1)	Low (1)	Low (2)	Medium (3)	Medium (4)	High (5)

Risk	**Risk level**	**Likelihood**	**Impact**	**Risk Mitigation Measures**
Non-compliance with fiduciary and procurement standards in some SOFF activities	Medium	Rare	Major	The AFDB will undertake fiduciary assessment on the government of Madagascar and DGM to identify risk elements and prepare appropriate mitigation measures. The AfDB will also undertake close supervision and monitoring of the project implementation through its

				country, regional and project teams from the Department of climate change and green growth.
SOFF-funded investments cause environmental or social impacts	Medium	Unlikely	Minor	The Project activities are not expected to present any Environmental and Social Impacts and risks. However, AfDB will carry out an environmental and social assessment for the activities in this funding request upon inception of the activities
NMHS staff depart after being trained	High	Likely	Major	SOFF Support will be used to build the capacity of DGM to manage its own budget and activities, including provision of information and services as well as better working conditions for staff i.e. Adequate equipment and working space

				needed provided for by DGM and partly by the project. The DGM will offer continuing service contracts, and organize regular refresher courses for trained staff.
Slow implementation and delays in procurement, installation and capacity building activities	Low	Unlikely	Minor	Realistic planning and strong support from the AfDB's fiduciary team and Robust application of the AfDB's procurement regulations. Adapt buffer zone within the 3 years of project.
After the conclusion of the Investment phase, GBON data are not collected or shared or are shared of insufficient quality	Medium	Rare	Moderate	The investment phase includes budget for operation and maintenance of the GBON equipment. This approach will help in smooth transition to the compliance phase. The compliance face is envisaged to support the proper functioning of equipment and

				data sharing. The capacity building in the investment phase will assist the beneficiary to develop its capacity to manage the operations of the equipment and data sharing.
Destruction or theft of SOFF-financed equipment and infrastructure	Medium	Unlikely	Moderate	The project has factored in the aspect of protection of the sites. The observation sites will be fenced and guarded to minimize the risk of theft. Through advocacy work and outreach programs the project will work with the local communities to enlighten them about the importance of project equipment and consequently guard them against theft Given the location of Madagascar it is very vulnerable to the impacts of climate change

				and likely susceptible to climate related disasters, there is a risk that the equipment could be destroyed by the natural hazard like the hurricanes. To mitigate this, the project will support the Standard operating procedures (SOPs) for equipment, including early action protocols in case of climate related hazards (this includes protective covers),
Countries cannot make optimal use of data, including accessing or using improved forecasts products from the Global Producing Centers throughout the hydromet value chain	Medium	Unlikely	Moderate	To mitigate this, the project in partnership with CREWS Proposes extensive and comprehensive training for the DGM staff from the peer advisor and technical partners covering hydromet value chain. This will ensure that the country has enough capacity

				to make the optimal use of data including accessing or using improved focus products from the global producing center through the hydromet value chain

Annex 1: National Gap Analysis

The National Gap Analysis for Madagascar is available here: https://www.un-soff.org/wp-content/uploads/2024/05/Madagascar-GBON-National-Gap-Analysis.pdf

Annex 2: National Contribution Plan

The National Contribution Plan for Madagascar is available here: https://www.un-soff.org/wp-content/uploads/2024/05/Madagascar-GBON-National-Contribution-Plan.pdf

Annex 3: Country Hydromet Diagnostics

The Country Hydromet Diagnostics for Madagascar is available here: https://www.un-soff.org/wp-content/uploads/2024/04/Madagascar-CHD.pdf

Annex 4: Terms of Reference for the provision of technical advisory services during the SOFF Investment Phase

1. Purpose and scope

These Terms of Reference describe the provision of technical advisory services by DWD to Madagascar to contribute to the delivery of the SOFF Investment Phase outputs as described in Section 3.

The Terms of Reference are based on the SOFF Operational Manual, Section 4.4.3 on the Operational Partners and Section 4.5.2 on the Investment Phase; as well as on the SOFF Investment Framework, Section 4.5 on the Peer Advisors and WMO Technical Authority.

2. Roles and responsibilities

Beneficiary country National Meteorological and Hydrological Service

- Is responsible for implementing the activities of the SOFF Investment Phase activities with the support of the Implementing Entity and the peer advisor.
- Submits the SOFF Investment Phase funding request using the standardized template provided by the SOFF Secretariat, including the Terms of References for the peer advisor's technical advisory services during the Investment Phase.
- Is responsible for collaborating with the Implementing Entity to provide all the necessary information, participate in and facilitate the national activities that the Implementing Entity and peer advisor need to conduct in order to deliver the SOFF Investment Phase outputs.
- Confirms the completion of all the Investment Phase activities and provides comments as needed on the final report prepared by the Implementing Entity.

Peer advisor

- Is accountable to the beneficiary country and the Implementing Entity.
- Is contracted via the WMO pass-through mechanism and operates on a cost-recovery basis.
- Provides technical advisory services to support beneficiary countries and Implementing Entities in the design and implementation of the SOFF Investment Phase activities.
- Contributes to the final report of the SOFF Investment Phase.

Implementing Entity

- Prepares the Investment Phase funding request in collaboration with the beneficiary country and the peer advisor, including the Terms of References for the provision of technical advisory services during the SOFF Investment Phase.
- Manages the Investment Phase activities following the terms specified in the funding request and in collaboration with relevant national partners, including civil society organizations.

- Delivers the Investment phase outputs and is responsible for their quality and timely delivery, in coordination with the country and the peer advisor.
- Provides quarterly updates to the SOFF Secretariat according to a simple standardized form and annual reports according to the United Nations Multi-Partner Trust Fund Office's reporting requirements indicated in the legal agreements.
- Informs the SOFF Secretariat of circumstances that could materially impede the implementation of the Investment phase or any considerable deviation in the conditions of the funding request to achieve its objectives.
- Submits the final report to the SOFF Secretariat including the beneficiary country's comments and the peer advisors' feedback. The final report describes the institutional arrangements to secure sustained operation and maintenance of the investments made.

WMO Technical Authority

- Provides basic on-demand technical assistance to the beneficiary country, Implementing Entity and peer advisor on GBON regulations, including on monitoring and assessing the data-sharing status of the stations using the WDQMS web tool.[21]
- Is responsible for the verification of data sharing of the new or rehabilitated surface and upper -air stations as per GBON regulations.
- WMO provides a verification report to the SOFF Secretariat, upon which the Investment Phase can be considered completed.
- Establishes and administers the pass-through mechanism for contracting and funding of the advisory services provided by the peer advisors.

SOFF Secretariat

- Facilitates communication, coordination and collaboration between the beneficiary country, the Implementing Entity, the peer advisor and WMO Technical Authority.
- Reviews the SOFF Investment Phase funding request, including the Terms of Reference for the provision of technical advisory services and provides feedback as needed. Then transmits the funding request to the SOFF Steering Committee for their decision.
- Compiles quarterly updates and annual reports and monitors implementation based on information received from the Implementing entity, the peer advisor and the beneficiary country. Regularly informs the Steering Committee of progress.
- Coordinates regional implementation approaches to the SOFF Investment Phase.
- Confirms receipt of the final report by the Implementing Entity and completion of the Investment Phase based on WMO verification of data sharing.
- Organizes exchange of knowledge and experiences and captures lessons learned.

[21] The WDQMS web tool monitors the availability and quality of observational data based on near -real-time information from the four participating global Numerical Weather Prediction centres: the German Weather Service (DWD), the European Centre for Medium range Weather Forecasts (ECMWF), the Japan Meteorological Agency (JMA) and the United States National Centers for Environmental Pre diction (NCEP). These are four of the ten World Meteorological Centres, designated by WMO to provide global numerical weather prediction products for all WMO Members.

3. Peer advisors' activities during the SOFF Investment Phase

The DWD as peer advisor will provide:

- General technical advisory to support the beneficiary country and the implementing entity in the implementation of the National Contribution Plan and agreed activities for the Investment Phase (bidding documents development, bid assessment and/or evaluation, ensuring the correct commissioning and initial operation of equipment, supporting dispute resolution with suppliers on technical matters)Support exploration of synergies with ongoing complementary activities and facilitate stakeholder engagement in coordination with the Beneficiary Country and Implementing Entity.
- Contribute and provide recommendations and guidance on reporting.
- Provide technical support and review of the AWS and upper air station tender process (incl. technical specifications)
- Provide support on Metadata Management mechanisms in collaboration with RWC Southern Africa
- Coordination with SOFF secretariat and WMO technical units
- Project coordination with DGM, AfDB, TAHMO and GIZ through by-weekly (adjustable) project management meetings.