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GBON National Contribution Plan of (*Dominican Republic*)

Systematic Observations Financing Facility

Weather and climate data for resilience

GBON National Contribution Plan
[Dominican Republic]

SOFF beneficiary country focal point and institution	ING. Gloria Ceballos, Dominican Republic Meteorology National Institute (INDOMET, former ONAMET)
SOFF peer advisor focal point and institution	Dr. Fernando Belda, Agencia Estatal de Meteorología (AEMET)

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Module 1. National Target toward GBON Compliance

The results of the initial GBON gap analysis indicated the need to maintain 1 upper-air station (radiosonde), to meet the GBON network standard density requirement and thus contribute to the international exchange of surface data with hourly observations and altitude data 2 times a day.

Also, the final technical assessment conducted revealed the need to include four surface stations (Table 1). Of these four, two need to be partially upgraded to meet GBON requirements due to equipment obsolescence, along with the upgrading of an automatic aviation weather station (AWOS) and the installation of a new station. In the case of the altitude station, the current agreement between INDOMET[1] and NOAA should be maintained.Although this radiosonde station is not currently affiliated with the GBON network, it meets its requirements and will therefore be included. It should be noted that when there is a tropical cyclone threat, on the recommendation of NOAA, special radiosonde launch schedules are made every six hours.

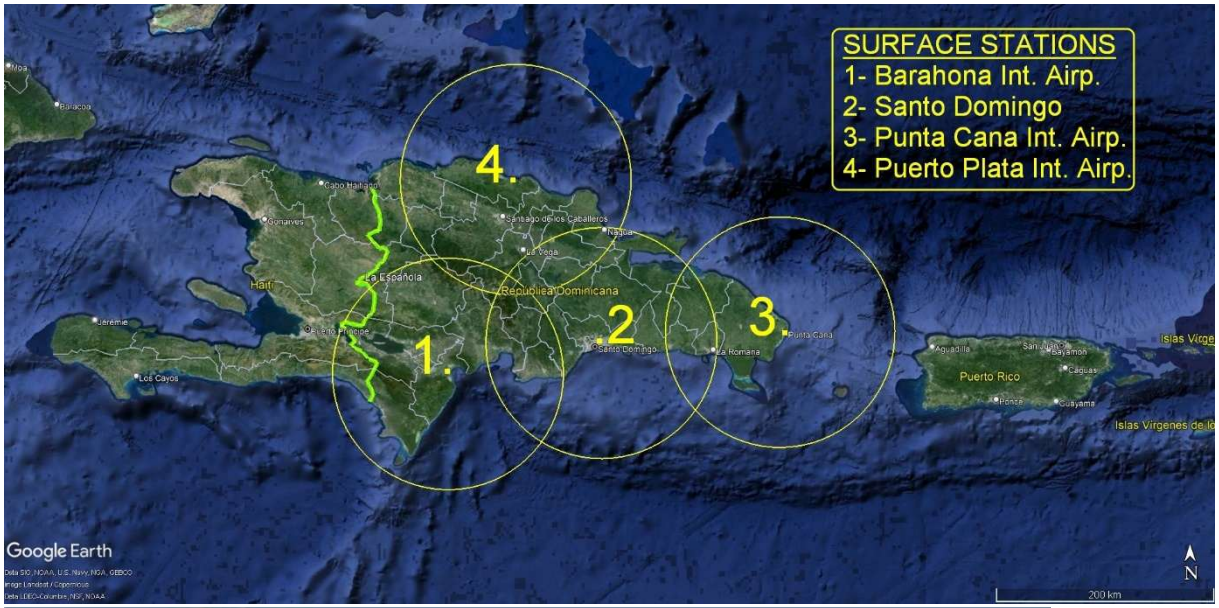
Table 1. GBON National Contribution Target

Type of station	WMO GBON Global Gap Analysis, June 2023				GBON National Contribution Target	
	Target	Reporting	Gap		To improve	New
			To improve	New		
	[# of stations]				[# of stations]	
Surface	2	0	2	0	4	0
Upper-air	1	1	0	0	0	0
Marine	*when applicable					

(Add here a map of existing and proposed surface and upper-air stations with 200km/500 (**diameter**) km circles (500km/1000 km for SIDS) to indicate the coverage of the stations and provide the explanation as needed [1])

Figure 1 and 1bis. Map of existing and proposed surface and upper-air stations. Please use horizontal resolution as diameter = radius is half the horizontal resolution.

[1] Former ONAMET is now called INDOMET


SURFACE STATIONS
1- Barahona Int. Airp.
2- Santo Domingo
3- Punta Cana Int. Airp.
4- Puerto Plata Int. Airp.
4.
1.
2
3.
Haití
La Española
República Dominicana
Puerto Rico
Google Earth
200 km
N


UPPER-AIR STATION
SANTO DOMINGO radius 250 Km

Module 2. GBON Business Model and Institutional Development

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

The Dominican Republic has two governmental institutions that handle hydrometeorological data, the National Meteorological Office (INDOMET) and the Dominican Institute of Hydraulic Resources (INDRHI). For the time being, INDOMET will be directly responsible for the development of this project; INDRHI will participate in the design and subsequent phases.

INDOMET has contact with private sector weather stations, but they are not currently certified by the institution, so their data are not yet officialized by the meteorological service as their quality has not been validated.

Existing partners and relationships

INDOMET is the governing body in meteorological matters in the Dominican Republic. Any publication of information from a private institution is not officially endorsed. In hydrological matters, INDRHI is the governing body. There are collaboration and meteorological data exchange agreements with INDRHI, universities and other private institutions that have installed meteorological stations. There are also collaboration and service agreements with other public and private institutions, such as:

- Ministry of Defense
- Ministry of Agriculture
- Ministry of Public Health
- Ministry of Environment
- Dominican Institute of Civil Aviation
- National Climate Change Council
- Airport Department
- Dominican Institute for Agroforestry Research
- National Botanical Garden
- Mayor's Office of the National District

These government partners constantly make use of meteorological data; some of these institutions have installed meteorological stations or lend their facilities to house INDOMET stations. Regarding the implementation plan, especially the Civil Aviation Institute will be a strategic partner for the installation and monitoring of two of the points identified as potential for the GBON network in the Dominican Republic. Likewise, institutions such as the Climate Change Council and the Ministry of Environment will be part of the processes of capacity building and sustainability of the network, the former for its role and involvement in the promotion of early warning initiatives and the latter for being the government agency to which INDOMET.

Potential new partners and their roles

INDOMET is in permanent conversation with public and private institutions to strengthen collaboration and information exchange. A working protocol/agreement is currently being designed in order to maintain a legally sound structure to maintain relations and cooperation over time with the institutions and companies that have meteorological stations.

Law 19-24, which creates the Dominican Institute of Meteorology (INDOMET), was recently approved. This law requires those who generate meteorological information of any kind to provide it to INDOMET on a regular basis, according to the possibilities of the equipment installed. In this sense, all public, private and private institutions are included. To this end, the agreement being designed proposes to provide technical assistance to the owners of

automatic weather stations and certify them in accordance with the regulations in force, and they commit to provide the data to the meteorological service on a daily basis, through a joint communication protocol and system.

2.2. Assessment of potential GBON sub-regional collaboration

Throughout its history, INDOMET has maintained close relations with countries in the region, especially Cuba, Haiti, Puerto Rico, Barbados, Curacao, the United States of America, Costa Rica, Colombia and Argentina, among others.

There are negotiations between INDOMET and several countries to strengthen relations and *benchmarking* with those that have more experience and are more advanced in some processes, such as the implementation of WIS 2.0 or the calibration of equipment with the INSMET of Cuba or the SMN of Argentina.

The country is a member of several associations, committees, and international organizations through INDOMET and INDRHI, which contribute to the development of Hydrometeorological Services. In this sense, the establishment of agreements with other countries and organizations is very important for the meteorological service, for which reason we will continue to strengthen existing relations in the region and establish new ones. Likewise, it will be necessary to continue expanding contacts, especially with organizations that provide supportto the countries to improve the human capital of the institutions. The States of the region must join efforts and coordinate agreements that allow for the common development of the nations.

Caribbean countries close to the Dominican Republic, such as Cuba and Haiti, should coordinate especially to present joint projects that contribute to the improvement of their meteorological and climate services.

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

INDOMET has an annual budget allocated by the Central Government of the Dominican Republic.

In this sense, the Meteorological Service does not have other sources of resource generation to cover all of the institution's needs.

INDOMET will be in charge of everything related to the operations and maintenance of the GBON stations and infrastructure, and is currently in talks with Central Government authorities to request financial support to guarantee the continuity of the project in the long term.

Adequate receptivity, complacency and interest in collaborating with INDOMET has been identified from institutions such as: Ministry of the Presidency, Ministry of the Environment, National Council on Climate Change, the Civil Aviation Institute (IDAC), among others.
INDOMET's Meteorological Technical Assistance Department has established a plan for the operation, modernization and security of the technological infrastructure of the sensors of the automatic stations. For this purpose, it has included in the Institutional Strategic Plan 2024-2027, as well as in the Annual OperationalPlan 2025, the necessary equipment and tools to provide support and continuity to the stations to be upgradedor acquired through SOFF.

At the strategic level, work will be done to maintain and strengthen relations and agreements with NOAA for the radiosonde station and with the IDAC for the automatic surface station located in Punta Cana planned for this project.

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

INDOMET's Institutional Strategic Plan (PEI) foresees the strengthening of the National Observation Network, with a four-year projection, in order to guarantee the growth of the network of stations, while providing stability, security and quality of the meteorological stations and, therefore, of the meteorological data collected.

For the meteorological service, it will be a priority to guarantee the sustainability of the automatic stations installed, in order to consolidate systematic observations, which will serve as a basis for the development of climate services for the different sectors of interest in the country.

Through agreements with public and private institutions and the humanitarian sector, automatic stations have been obtained as part of the government's commitment to strengthen the early warning system and thus the development of disaster risk management and climate change in the country.

Currently, there are no plans or projects external to INDOMET, apart from SOFF, but rather all efforts are being made within the meteorological service itself.

The institutional commitment assumed by INDOMET in its plans and projects, as well as the willingness and dedication of its officials and servants, is aligned with GBON's objectives.

2.5. Review of the national legislation of relevance for GBON

The functions of the National Meteorological Office are regulated by Decree number 1838 of 1984, which confers INDOMET the steering role in meteorological matters in the country, granting it the authority to operatein related matters with total freedom, and in accordance with the other legal guidelines of the Dominican State.

The NORTIC A3 standard of the Dominican Republic establishes the necessary guidelines for the correct implementation of the open data policy.

The National Congress of the Dominican Republic recently approved a bill to convert the institution into the Dominican Institute of Meteorology (INDOMET), a new legal framework that provides the entity with legal and budgetary autonomy to operate with greater freedom and independence. The meteorological service has operated with customs and import legislation for many years without major complications. Items have been received through purchases and donations and the procedures have been fast,both when they are tax exempt and in cases where the institution has had to cover the cost of the items. It is understood that there will be no major problems or obstacles regarding Dominican legislation, but in the event of unexpected situations, INDOMET authorities will make the necessary arrangements with higher authorities to resolve any adverse scenario that may arise.

There is a Civil Aviation Law 491-06 that regulates Civil Aviation in the Dominican Republic and creates the IDAC, which has the Dominican Aeronautical Regulation of meteorological service for international air navigation (RAD 3).

Module 3. GBON Infrastructure Development

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

The National Meteorological Office (INDOMET) is responsible for operating and maintaining 68 surface weather stations deployed throughout the country. The network of meteorological observations is comprised of manual and automatic stations. Manual observations are carried out by observers every three hours at the synoptic stations, every hour at the aeronautical stations, once a day at the climatological stations and every ten minutes at the automatic weather stations.

INDOMET stations are classified as follows:

- 9 aeronautical and synoptic,
- 6 synoptic,
- 25 climatic (thermo-pluviometric)
- 5 agrometeorological
- 23 automatic

In addition, INDOMET has an atmospheric observation station at altitude.

The following table provides details of INDOMET's network of surface and high-altitude observing stations. Fifteen stations have been declared in OSCAR, of which eight are integrated in the WIGOS system.

INDOMET plans to implement the WIS2.0 system, which will facilitate the dissemination of information from the stations that will be included in GBON.

Station type	Total stations	OSCAR/Surface		WIS 2.0 (Stations with interchange)	WDQMS
		Declared status	Evaluated status		
Surface	68	15	8	0	8
Upper-air	1	0	0	0	0

Table 2: Details of the network of surface and upper-air observation stations

3.1.a. Surface and height observation network and list of new or rehabilitated stations.

The following table shows the surface stations planned for the GBON network in the Dominican Republic.

Station name	WIGOS-ID	Station type (S/UA)	Owner (NMHS/ 3rd party)	Funding source	GBON Compliant (Y/N)	Type	Instalatio n Date	Required
Santo Domingo 18.473400°N, 69.870500°W	0-20000-0-78486	S	NMHS	INDOMET	N	AWS	2012	Improvement
Punta Cana 18.575191°N, 68.369281°W	0-20000-0-78479	S	IDAC	IDAC	N	AWS	2012	Improvement
Puerto Plata 19.754108°N, 70.563116°W	0-20000-0-78458	S	NMHS	INDOMET	N	AWS	2002	Improvement
Barahona 18.248662°N, 71.122837°W	n/a	S	NMHS	SOFF	N	AWS	TBD	Improvement

Table 3: List of new or improved surface observation stations.

At present, INDOMET has an operational station at high altitude (radiosonde) in Santo Domingo which, according to a previous study, should be incorporated into GBON. NOAA's support continues to be essential. It is convenient to improve the sustainability of the hydrogen generation room to continue guaranteeing the efficiency of the service.

Station name	**WIGOS-ID**	**Station type (S/UA)**	**Owner (NMHS/ 3rd party)**	**Cantidad de reportes (diarios/anuales)**	**Required**
Santo Domingo 18.474319°N, 69.870125°W	0-20000-0-78486	UA	NMHS	2/732	GBON incorporation

Table 4: Cycles and number of planned reports for the upper-air observation stations of the GBON network

3.1.b. List of instruments and observation systems by site

The technical evaluation of GBON's surface station network indicated that 3 of the automatic stations should be upgraded and 1 station (Barahona) should be acquired and installed, including infrastructure and civil works.

Station name	Pressure	T/H	Wind (direction and intensity)	Precipitation (amount and Intensity)	Datalogger	Communications protocol
Punta Cana	✓	✓	✓	✓	✓	*TCP/IP
Santo Domingo	X	X	X	X	X	** UHF Radio
Puerto Plata	X	X	X	X	X	** UHF Radio
Barahona	X	X	X	X	X	New (GSM)

Leyenda: ✓: Working X: Renew/New Acquisition

Table 5: Current status of the instrumentation that makes up the EMA observation systems by site

**It is necessary to use the BUFR format in the data files.*

***These stations are currently transmitting over the UHF radio band, with the raw data message being received by a receiver at INDOMET headquarters.*

The technical evaluation also included an analysis of other important components that make up the observation system at each of the stations that will make up the GBON network, as shown in the following tables.

Stations name	AWS	Power supply	Solar panels	Battery	Lightning rod	Grounding system	Terminal and junction box
Punta Cana	✓	✓	✓	✓	✓	✓	✓
Santo Domingo	✓	✓	✓	✓	✓	✓	✓
Puerto Plata	✓	✓	✓	✓	✓	✓	✓
Barahona	X	X	X	X	X	X	X

Caption: ✓: In good or functional condition X: Does not currently exist.

Table 6: Current status of other components (I) that make up the observing systems per site

Stations name	AWS Mast	Bracket T/H	Support for the Pluviometer	Perimeter fence	Support of the solar panel	Cabin for the batteries	AWS Mast and Accessories
Punta Cana	✓	✓	✓	✓	✓	✓	✓
Santo Domingo	✓	✓	✓	✓	✓	✓	✓
Puerto Plata	✓	✓	✓	✓	✓	✓	✓
Barahona	X	X	X	X	X	X	X

Legend: ✓: In good or functional condition X: Deteriorated or does not currently exist.

Table 7: Current status of other components (II) that make up the observing systems.

3.1.c. Investments and activities necessary for the installation of new stations and the improvement of existing stations.

In order to explain clearly and thus achieve a better understanding of the process designed for the implementation of the investments and activities necessary for the installation and rehabilitation of the new and existing stations that will make up the GBON network, it is necessary to divide the observation network into several systems, adapting them to the specific needs of each of the surface stations. The aforementioned systems are:

- ✓ Sensor system.
- ✓ Power supply system.
- ✓ Communications system.
- ✓ Infrastructure.

- **Sensor system**

The technical evaluation of the sensors indicated that in 2 of the 4 stations, the useful life of some of the sensors is almost at its maximum and INDOMET does not have spare parts.

Stations name	Atmospheric pressure	Temperature/ Humidity	Wind speed/ direction	Precipitation: Amount/ Intensity	Datalogger
	600-1060 hPa	-40 °C +60 °C/ 0-100 %	0-75 m/s / 0-360 °	0-500mm/h	
Punta Cana	X	X	X	X	X
Santo Domingo	✓	✓	✓	✓	✓
Puerto Plata	✓	✓	✓	✓	✓
Barahona*	n/a	n/a	n/a	n/a	n/a

Caption: ✓: Needs immediate rehabilitation X: Does not need immediate

Table 8: Instrumentation system upgrade

**The Barahona station is a new acquisition.*

- **Power supply system**

All surface stations are currently solar powered. The equipment is in good working order and only the acquisition of the power system for the new Barahona station is contemplated.

- **Communications system**

INDOMET will need to acquire two computer servers that will be required to host any applications related to the project, such as data retrieval, management and dissemination. One of these servers will mirror the other ensuring the system's operation at all times. One of the servers would be housed at INDOMET Headquarters and the other at the Punta Cana Airport meteorological office.

INDOMET's own weather stations will have a GSM 3G/4G modem, depending on coverage or availability.

For the Punta Cana station (IDAC), INDOMET will develop an application to capture hourly data via FTP from the server, from where it will be disseminated in BUFR format.

It should also be noted that none of the 3 existing stations chosen for the GBON network are currently exchanging data through WIS 2.0. It is expected that in the near future all GBON stations in the Dominican Republic will be using WIS 2.0 technology.

- **Infrastructure**

The infrastructure of the existing stations is in good condition and only the infrastructure for the new station in Barahona would need to be acquired.

- **Investment Proposal**

Taking into account the necessary components previously analyzed and detailed, the investment proposal for the rehabilitation of the selected stations and the acquisition of the new station that will make up the GBON surface network is presented below, considering that the estimated prices included in the following table are those corresponding to factory costs as of July 2024. Customs, taxes, operational expenses, etc., should be considered.

Objectives	Component	Quantity	Unit Price USD	Cost (USD)

Instrumentation system	Atmospheric pressure	6	1176	7056
	Air temperature/humidity (TH)	6	1176	7056
	TH Radiation Shelter (for two probes)	4	1428	5712
	TH Radiation shelter support arm	4	420	1680
	Wind direction/speed	6	2072	12432
	Precipitation: quantity/intensity	6	1008	6048
	Datalogger	5	3108	15540
	Client/server software	1	1776	1776
	Network monitoring software	1	31600	31600
	Installation accessory kit	1	1480	1480
	Solar Kit (solar panel, voltage controller, battery, cabinet)	2	2664	5328
	Solar Beacon light	6	672	4032
Communications system	Communications Kit	4	1680	6720
	SIM Card	3	672	2016
Infrastructure	AWS Mast	1	4140	4140
	Cabin for AWS	1	690	690
	Lightning arrester installation kit	2	414	828
Installation of new station	Civil works and assembly Barahona	1	10000	10000
			TOTAL	**124,134**

Table 9: Investment proposal for the improvement of existing facilities, acquisition of spare parts and installation of the new station.

Activities required for the installation and improvement of meteorological stations

All actions described in the following table that do not fall under the direct responsibility of INDOMET will be accompanied, monitored and validated by INDOMET.

Activities	Actions
1. Re-evaluation of field conditions at project start date.	1.1 Review visit of the conditions/condition of the equipment to be refurbished and survey of the area for the installation.
2. Procurement of materials and equipment	2.1 Procurement Process by the Implementing Entity
3. Station identification, evaluation and preparation	3.1 Field visit to plan the design of the installation of thedifferent systems
	3.2 Execution of the required basic civil works
4. Equipment installation	Installation of meteorological instrumentationInstallation of communications systems Installation of the Solar Energy Kit Assembly and certification of the grounding system andlightning arrester acquired. Sensor and communications testing

Table 10: Phases of distribution of the actions to be carried out for the fulfillment of the planned activities in the installation of the surface observation networks (new and rehabilitated).

3.1.d. Observational practices for the observation network.

The optimal performance of a surface observation network depends on the skills, training and competencies of the technical personnel responsible for the network. The main tasks include installation of instrumentation and communication systems, maintenance of instruments and other systems, as well as fault diagnosis, repair of defective systems and monitoring of the performance of communication and instrumentation systems.

Equally important, understanding the operation of meteorological sensors and observation methods, classifying sites for specific variables, performing preventive and corrective maintenance of sensors, and other systems in accordance with Standard Operating Procedures (SOPs) to ensure the quality and availability of observations, as well as sensor calibration and metadata management.

INDOMET ensures that the personnel of the stations where AWS are installed or rehabilitated are responsible for the first level of maintenance. To this end, they will receive training on the operation and maintenance of automatic weather stations. It is also very important the availability of an instruction manual for these same personnel, which must be in tune with the standard operating procedures (SOP) to guarantee the quality and availability of the observations, as well as the minimum GBON requirements.

3.1.e- Preliminary maintenance plan for existing stations and new upgrades, including calibration practices

To ensure that the quality of observations from the automatic weather stations is maintained at the level required throughout their useful life by the standards established by the World Meteorological Organization (WMO), a specific maintenance plan will be developed for the ground-based surface observation stations that will make up INDOMET's GBON network. Efficiency in the maintenance of the meteorological stations will depend to a large extent on the existence and availability of spare parts accessories.

INDOMET has been managing the current observation network since its foundation, thus ensuring the availability of data for national and international exchange, with limited resources. The country is continuously affected by extreme natural phenomena, which, added to the deficit of sensors and spare materials needed due to the low institutional budget, hinders the stable operation of the surface observation networks.

GBON imposes strict data availability and quality requirements that are very difficult to maintain stable with current resources. It is recommended that during this process the capacity of the Meteorological Technical Assistance Department be improved, as well as the collaboration with other meteorological services in the region that have a Calibration Laboratory, which will allow the calibration of the semi-patterns used in the calibration of the stations. In order to guarantee compliance with the minimum requirements demanded by the GBON network, as well as the stability in the operation of said network.

On the other hand, the very organization of the surface meteorological observation system in the Dominican Republic means that the response time for the restoration and maintenance activities of the surface stations in the face of all types of threats or extreme situations is short, as long as the necessary resources are available for their mitigation.

The specialized technical part is currently concentrated at the Institution's Headquarters, located in Santo Domingo, with the Meteorological Technical Assistance Department, which is responsible for the Telemetric Stations Division, which is in charge of the surface stations.

- **Maintenance**

INDOMET's planned maintenance intervals and activities are defined for each observing system independently, all in accordance with WMO manuals, guidelines and SOPs and as recommended by equipment manufacturers or suppliers.

It would be necessary to contemplate in this system the possibility of having additional spare parts for each ofthe installed stations (whether or not they need immediate rehabilitation), in order to facilitate subsequent calibration, maintenance and breakdown cycles, thus making these processes feasible and optimizing them and reducing response times. This would also provide a great solution to the main sustainability problem of the institution, which is the acquisition of spare parts.

For a correct explanation of the design of the maintenance plan, which is composed of two fundamental stages: corrective maintenance and preventive maintenance.

INDOMET performs station inspections twice a year, in which data and instruments are validated. If necessary and possible, the calibration of any sensor with problems will be performed in the field. When the problem cannot be solved in situ, the sensor is removed so that it can be replaced.

INDOMET plans to implement a daily first echelon monitoring schedule, as well as preventive maintenance every 90 days (3 months) for GBON stations according to their national operation and available resources. Corrective maintenance activities are performed to address technical or communication failures of GBON stations. Network failures are expected to be attended to within no more than three days to ensure that the station meets the WMO's and the country's monthly data availability performance target.

Currently, all installation and maintenance activities are performed by the technical team located at INDOMET's headquarters in Santo Domingo, but the implementation of the maintenance plan is subject to the availability

of the field test equipment, transportation, and human resources.

Items	Number of visits per year	Number of stations	Total visits per year	Annual cost (USD)	Total Cost (4 years) (USD)
Preventive maintenance. Calibration	4	4	16	9600	38400
Corrective maintenance	1	4	4	4000	16000
Rain gauge calibration kit (2 units)	n/a				600
			Totals	8400	**55000**

Table 11: Estimation of operating maintenance costs

The expenses considered in the above table contain prices corresponding to factory costs as of July 2024, and/or without taxes, operating expenses, etc., which should be taken into account.

Calibration will also be performed throughout the year. Corrective maintenance will be performed as needed. For the maintenance and calibration of the station located in Punta Cana, INDOMET experts will accompany IDAC personnel.

Level	Description	Surface tasks	Upper Air tasks (examples)
1	Basic tasks requiring few consumables or parts carried out by local staff every month	Clean TH Shelter. Clean the rain gauge. Check wiring, cabinets, good visual conditions of wind sensors. Check cabinet warnings Cut grass/ vegetation	Attach sondes and launch balloons. Change over hydrogen cylinders. Moderately complex tasks carried out by staff following standard operating procedures (SOPs). Tools, parts and consumables will be required. Specific instruction on hydrogen safety.
2	Technical preventive tasks carried out by staff following SOPs every three months. Tools, parts and consumables may be required. Basic meteorological technician training needed	Collect station metadata Replace sensors Verify performance of sensors	On behalf of the NOAA
3	Specialized maintenance actions carried out by trained staff every time corrective maintenance happens. Procedures are complex and Advanced meteorological technician training needed	Replace infrastructure Set up and configure new equipment and sensors. Advanced fault-finding	On behalf of the NOAA

Table 12– Typical maintenance tasks

- **Calibration**

INDOMET has mobile instrument and/or meteorological sensor calibration equipment to calibrate temperature,humidity and pressure sensors.

Calibrator	Pattern	State
Temperature, humidity and pressure	PTU digital calibrator	Good

Table 13: Current status of sensor calibration equipment

The budget in table 11 includes the acquisition of two rain gauge calibration devices.

For the calibration of wind sensors, it will be necessary to implement subregional collaboration on the NMHS that can be provided by external calibration laboratories such as Cuba INSMET of Cuba or Argentina SMN. Unless the manufacturer's specifications state otherwise, wind sensors can be calibrated every 18 months.

INDOMET proposes to carry out the activities included in the following table.

Activities	Shares
Capacity building in the different systems of the observation network	1.1 Design of procedures aimed at achieving good housekeeping practices for sensor verification and repair. 1.2 Edition of a maintenance and fault control manual 1.3 Training of personnel on the various observation network equipment
Performing maintenance	2.1 Ensuring daily monitoring (with first-level maintenance if necessary)
	2.2 Quarterly maintenance assurance (Calibration shall also be performed at the last maintenance of the year)
	2.3 Corrective maintenance assurance

Table 14: Phases of distribution of the actions to be carried out to keep the GBON stations in good condition in the Dominican R.

3.1.f. Technical specifications of new instruments and observation systems for the acquisition process.

a.- Atmospheric Pressure

ID	Requirement Heading	Requirement
27	Measurement Range	The measurement range must be 500 – 1080 hPa (for both station pressure and mean sea level pressure). [The NMHS may adapt this range in response to expected pressure range for the installation region]
29	Sensor Performance Constant	The instrument time constant, under controlled conditions must be 2 s or shorter.
31	Operational Conditions	As a minimum, the equipment installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH, Non-condensing] and Wind Speed up to 50 m/s. Resistance to (vibration) shocks must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
508 (and 40)	Achievable Sensor Uncertainty	The sensor uncertainty must be 0.15 hPa or better. For the tendency it must be equal or better than 0.2 hPa. Maximum difference: 0.3 hPa/year [Normal Use]. No more than 0.3 hPa/30 °C temperature change. For the tendency it must be equal or better than 0.2 hPa. Hysteresis less than 0.3 after change of 50 hPa and back again.
42	Static Head	To achieve the required uncertainty of the pressure measurements, a static head, should be used. If used, the static head should be located in an open environment, not affected by the proximity of buildings. The supplier should provide documentation specifying any additional uncertainty introduced by the use of their static head.
502	Sensor Type	The sensor/instrument for measuring pressure must be based on an electronic pressure sensor. However, any sensor type compliant with the requirements in this section must be considered.
524	Temperature Correction in Calibration	If the instrument is applying a correction for the ambient air temperature (measured internally or with a separate thermometer), the temperature compensation function should be fully taken into account in the calibration procedure.
28	Reporting Resolution	The resolution of reported measurement and tendency must be 0.1 hPa.
30	Sampling Frequency	The pressure should be sampled at least 4 times over the interval of the sensor time constant. For example, if the sensor time constant is 2 seconds, then there should be a sample at least every 0.5 s.
56	Units	Whatever physical quantity measured, pressure must be presented in/by the instrument/ system in hectopascals (hPa).
32	Calculated Parameters	Averages of all valid samples of pressure must be produced over 1-minute intervals. The 1-minute average must be used as the instantaneous value for pressure.
35	Rate of Change Check	After each signal measurement, the current value should be compared to the preceding one. If the difference between two samples is more than 0.3 hPa, the current sample is identified as suspect and is not used for the computation of an average.
38	Stuck Sensor	If over a 60-minute interval the value of 1-minute values of pressure have not changed by 0.1 hPa, then the data should be flagged as suspect for further investigation.
39	Jump Check	If the difference between consecutive 1-minute averages is more than 0.5 hPa, then the data should be flagged as suspect for further investigation. If

		the difference is more than 2 hPa, then the data should be flagged as erroneous for further investigation.
949	Derived Parameters	The pressure tendency should be determined using the difference between the current pressure measurement, and the pressure values over the previous 3 hours
1015	Derived Parameters 2	The NMHS may request that QFE and QNH be calculated by the sensor, as well as statistics (maximum, minimum, standard deviation) to meet local or Regional Association requirements. These should be outlined here.
1123	Derived Parameters 3	A Mean Sea Level should be determined, and WGS-84/EGM96 be applied to determine the altitude (to which the station pressure relates) with respect to Mean Sea Level

b.- Air Temperature

ID	Requirement Heading	Requirement
1	Measurement Range	The measurement range must be -80 °C to +60 °C.
4	Sensor Performance Constant	The instrument time constant under controlled conditions must be 20 s or shorter over the entire operational range. For field measurements in non-actively aspired radiation screens this may not be achievable.
6	Operational Conditions	As a minimum, the equipment installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH, Non-condensing] and Wind Speed up to 50 m/s. Resistance to (vibration) shocks must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
25	Sources of Error	The Tendered equipment must demonstrate that the following common sources of error have been adequately compensated for: a) Self heating of the thermometer element b) Inadequate compensation for lead resistance c) Inadequate compensation for non-linearities in the sensor or processing instrument d) Sudden changes in switch contact resistance.
400	Achievable Sensor Uncertainty	The sensor uncertainty must be 0.2 ºC or better.
2	Units	Whatever physical quantity is measured Air Temperature must be presented in/by the instrument/system in degrees Celsius (°C).
3	Reporting Resolution	The resolution of the reported temperature must be 0.1 °C.
5	Sampling Frequency	The air temperature should be sampled at least 4 times over the interval of the sensor time constant. For example, if the sensor time constant is 20 seconds, then there should be a sample at least every 5 seconds,
7	Calculated Parameters	Averages of all valid samples of Air Temperature must be produced over 1-minute intervals. The 1-minute average must be used as the instantaneous value for air temperature.
8	Observation Extremes	The maximum and minimum temperature 1-minute (average) temperature values measured over a 24-hour period must be determined [=daily maximum/minimum]. The time of occurrence must also be stored.
34	Rate of Change Check	After each signal measurement, the current value should be compared to the preceding one. If the difference between two samples is more than 2 °C, the current sample is identified as suspect and is not used for the computation of an average.
36	Jump Check	If the difference between consecutive 1-minute averages (calculated one minute apart) is more than 3 °C, then the data should be flagged as suspect for further

		investigation. If the difference is more than 10 °C, then the data should be flagged as erroneous for further investigation.
37	Stuck Sensor	If over a 60-minute interval the value 1-minute values of air temperature have not changed by 0.1 °C, then the data should be flagged as suspect for further investigation.
1012	NMHS Calculated Parameters	Additional Air Temperature Statistics should be requested by the NMHS, to meet local or Regional Association requirements. These should be inserted here.

c.- Humidity

ID	Requirement Heading	Requirement
69	Sensor Performance Constant	The instrument time constant under controlled conditions must be 40 s or better over the entire operational range. If used for Dewpoint Temperature measurement, then the sensor time constant must be 20 s. For the field measurements in non-actively aspired radiation screens this may not be achievable.
160	Operational Conditions	As a minimum, the equipment installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH, Non-condensing] and Wind Speed up to 50 m/s. Resistance to (vibration) shocks must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
475	Sensor Type	The sensor/instrument for measuring RH should be based on an electrical capacitance measurement probes. Sensors for measuring Dew Point directly are usually based on dewpoint mirror. However, any sensor type compliant with the requirements in this section should be considered by the customer.
481	Achievable Sensor Uncertainty	The sensor measurement uncertainty must be better than 3 %RH. If the sensor reports directly a Dew Point Temperature, the sensor uncertainty must be 0.25 °C.
57	Units	Whatever physical quantity measured, humidity must be presented in/by the instrument/system in %RH.
61	Measurement Range	The maximum measurement range must be 0-100 %RH. If presented as Dew Point Temperature, the maximum temperature range must be -80 °C to +35 °C.
68	Reporting Resolution	The Reporting Resolution for humidity must be 1 %RH (or better). If reported as Dew Point Temperature, the reporting resolution must be 0.1 °C
138	Sampling Frequency	The humidity should be sampled at least 4 times over the interval of the sensor time constant.
139	Calculated Parameters	Averages of all valid samples of humidity must be produced over 1-minute intervals. The 1-minute average must be used as the instantaneous value for relative humidity
141	Rate of Change Check	After each signal measurement, the current value should be compared to the preceding one. If the difference between two samples is more than 5 %RH, the current sample is identified as suspect and is not used for the computation of an average.
142	Jump Check	If the difference between consecutive 1-minute averages if more than 10 %RH, then the data should be flagged as suspect for further investigation. If the difference is more than 15 %RH, the data should be flagged as erroneous for further investigation.
143	Stuck Sensor	if over a 60-minute interval the value of the one-minute values of RH have not changed by 1 %RH and RH < 95 %, then the data should be flagged as suspect for further investigation.
462	Dewpoint Temperature	If Dewpoint Temperature is calculated from Humidity and Air Temperature, the 1 and 10-minute averages of Dewpoint Temperature should be calculated from the

	calculations from Air Temperature and RH	instantaneous Humidity and Air Temperature measurements, after which the averages for Dewpoint Temperature can be calculated. It is not allowed to calculate averages for Dewpoint Temperature from averages of Air Temperature and Humidity.
947	Derived Parameters	If relative humidity is measured, then a Dew Point Temperature should also be calculated, using the formula from the *Guide to Instruments and Methods of Observation* (WMO-No. 8), Volume I, Chapter 4, Annex 4.B.
1014	NMHS Calculated Parameters	Additional Humidity Statistics should be requested by the NMHS, to meet local or Regional Association requirements. These should be inserted here.

d.- Horizontal Wind Direction

ID	Requirement Heading	Requirement
71	Sensor Performance Constant	For Mechanical Wind Sensors, the Sensor Damping Ratio must be > 0.3.
157	Operational Conditions	As a minimum, the equipment (and supporting infrastructure) installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH Non-condensing] and Wind Speed up to maximum wind speed required to be observed. Resistance to (vibration) shocks and lightning protection must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
650	Sensor Type	The sensor/instrument for measuring WD must be an electrical recording wind direction instrument. The most common instruments in use are vanes, combined propeller anemometers/vane and ultrasonic instruments for measuring both wind speed and wind direction. However, any sensor type compliant with the requirements in this section must be considered. [[NMHS may edit if they have a preference for a particular sensor type]]
657	Achievable Sensor Uncertainty	The sensor uncertainty must be 5°.
973	Sampling Frequency	If the sensor is to be used to report wind gust, then wind speed should be sampled at 1 Hz or greater (4 Hz is preferred).
59	Units	Whatever physical quantity measured, Wind Direction must be presented in/by the instrument/system in degrees clockwise from true north.
63	Measurement Range	The maximum measurement range must be 0-360 degrees.
66	Reporting Resolution	The Reporting Resolution for Wind Direction must be 1 degree.
651	Wind Direction Sensor Orientation	Wind direction is defined as and must be reported as the direction from which the wind blows, and it is measured clockwise from geographical north, namely, true north (referred to the World Geodetic System 1984 (WGS-84) and its Earth Geodetic Model 1996 (EGM96)).
654	Practical Range	The maximum measurement range must be 0 – 360°. If two successive samples differ by more than 180°, the difference is decreased by adding or subtracting 360° from the second sample to obtain a wind direction between 0 – 360°.
78	Vector Averaging	Vector averaging should be used for the average values of wind speed and direction.
83	Minimum Data	At least 75% of the wind direction samples should be available to enable the computation of both the 2-minute and 10-minute averages. If insufficient data, the 2-, 10-minute average should be marked as invalid/missing.

87	Stuck Sensor	If the average values of wind direction do not vary by more than 10 degrees over a 60-minute interval, the data should be flagged as suspect for further investigation.

e.- Horizontal Wind Speed

ID	Requirement Heading	Requirement
70	Sensor Performance Constant	For a mechanical wind speed sensor, the distance constant must be in the range 2-5 m. [A distant constant is not required for an ultrasonic sensor]
73	Sampling Frequency	If the sensor is to be used to report wind gust, then wind speed should be sampled at 1z or greater (4 Hz is preferred).
158	Operational Conditions	As a minimum, the equipment (and supporting infrastructure) installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH Non-condensing] and Wind Speed up to maximum wind speed required to be observed. Resistance to (vibration) shocks and lightning protection must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
613	Sensor Type	The sensor/instrument for measuring Wind Speed must be based on an electrical anemometer. The most common instruments in use are cup anemometers, propeller anemometers and ultrasonic anemometers. However, any sensor type compliant with the requirements in this section must be considered.
619	Achievable Sensor Uncertainty	The sensor uncertainty must be 0.5 m/s for Wind Speed ≤ 5 m/s and 10% > 5 m/s.
60	Units	Whatever physical quantity measured, Wind Speed and Wind Gust must be presented in/by the instrument/system in metres per second (m/s).
64	Measurement Range	The maximum measurement range must be 0-75 m/s. In regions of extremely high winds, an extended range of 0-100 m/s should be requested. Wind Gust may reach 150 m/s.
65	Reporting Resolution	The Reporting Resolution for Wind Speed must be 0.5 m/s. The Reporting Resolution for Wind Gust (if measured) must be 0.1 m/s.
72	Calculated Parameters	Averages of all valid wind speed samples over 10-minute intervals must be produced. This 10-minute average must be used as the instantaneous value for wind speed. A standard deviation of wind speed must also be calculated. If the wind sensor is in support of an aerodrome, then an additional 2-minute average must be calculated.
74	Calculated Parameters 2	If an observation of wind gust is required, then this must be the running mean of all valid wind speed samples in a 3-second period.
77	Vector Averaging	Vector averaging should be used for the average values of wind speed and direction.
82	Minimum Data	At least 75% of the wind speed samples should be available to enable the computation of both the 2-minute and 10-minute averages. If insufficient data, the 2-, 10-minute average should be marked as invalid/missing
84	Rate of Change Check	If the difference between a wind speed sample and the preceding one is more than 20 m/s, then the data should be flagged as a suspect for further investigation and not used for the calculation of the average.

85	Jump Check	If the difference between consecutive 2-minute wind speed averages is more than 10m/s the data should be flagged as a suspect for further investigation. If the difference is more than 20m/s it should be flagged as erroneous for further investigation.
86	Stuck Sensor	If the average values of wind speed do not vary by more than 0.5 m/s over a 60-minute interval, the data should be flagged as a suspect for further investigation

f.- Precipitation Amount/Intensity

ID	Requirement Heading	Requirement
559	Sensor Type (Intensity)	The sensor/instrument for measuring precipitation intensity must be based on an electronic recording instrument. Any sensor type compliant with the requirements in this section must be considered. The Precipitation Amount and Intensity Sensor should be the same piece of equipment.
110	Collecting Gauge Orifice Area	In case the sensor/instrument for measuring Precipitation is based on collection of precipitation, the area of the collector orifice must be at least 200 cm^2 and no larger than 500 cm^2. The area of the orifice must be known to the nearest 0.5%, and the construction must be such that this area remains constant while the gauge is in normal use. The construction must be such as to minimize wetting areas. The container must also have a narrow entract and be sufficiently protected from radiation to minimize the loss of water by evaporation.
159	Operational Conditions	As a minimum, the equipment (and supporting infrastructure) installed outdoors must be capable of operating in a Temperature Range [-40 °C to +55 °C], Humidity Range [0-100 %RH Non-condensing] and Wind Speed up to maximum wind speed required to be observed. Resistance to (vibration) shocks and lightning protection must be included. A NMHS may modify this requirement to meet meteorological conditions normally expected.
531	Sensor Type	The sensor/instrument for measuring Precipitation must be based on an electronic recording instrument. Any sensor type compliant with the requirements in this section must be considered.
568	Sensor Time Constant (Intensity)	The instrument time constant under controlled conditions must be better than 30 s.
538	Achievable Sensor Uncertainty	The sensor uncertainty must be the larger of 5% or 0.1 mm.
566	Achievable Sensor Uncertainty (Intensity)	The sensor uncertainty must be: • Under constant flow conditions in laboratory: ○ 5% for > 2 mm/h, ○ 2% for > 10 mm/h. • In the field: ○ 5 mm/h, ○ 5% above 100 mm/h.

541	Heating	If appropriate for local conditions, the precipitation sensor should be equipped with rim heating and funnel heating (tipping bucket). The heating should be controlled by a thermostat and it should be switched on below an ambient temperature of 5 ºC. The heating should avoid snow and ice building up at the rim, and it should melt solid precipitation falling into the funnel. The heating should keep the rim and funnel above 0 ºC, but the heating should be as little as possible to avoid evaporation of the precipitation. For other types of instruments heating should be offered as required for the local conditions.
58	Units	Whatever physical quantity measured, Precipitation Amount must be presented in/by the instrument/system in millimetres.
561	Units (Intensity)	Precipitation intensity must be presented in mm/hour (based on a 1-minute average).
62	Measurement Range	The maximum measurement range must be 0-500 mm/day. This should be increased to meet local conditions.
562	Measurement Range (Intensity)	The maximum measurement range must be: 0.02 – 2,000 mm/hour.
67	Reporting Resolution	The Reporting Resolution for Precipitation Amount must be 0.1 mm. If reporting daily totals, 0.2 mm should be used. If reporting weekly or monthly totals, 1 mm should be used.
564	Reporting Resolution (Intensity)	The resolution of reported measurement must be: 0.1 mm/hour.
111	Calculated Parameters	The individual measurements are providing the instantaneous readings. The system must calculate/make available amounts over 1 minute, 3 hours and 24 hours.

g.- Datalogger

It would be desirable the following specifications for the datalogger.

- Operating temperature range: -55° to +85°C (-55° to +85°C)
- Maximum scanning speed: 1000 Hz
- Analog inputs: 16 in single-end mode or 8 in differential mode (configurable).
- Two analog inputs for 4 to 20 mA or 0 to 20 mA current loop.
- Four analog inputs that can provide I/O functions.
- Pulse counters: 10
- Excitation voltage terminals: 4 with maximum current ±40 mA
- Communications ports: Ethernet, USB, RS-232, RS-422 and RS-485.
- Data storage port for microSD
- 12 volt switched outputs: 2
- Digital I/O: 8 configurable terminals for digital input and output. Includes highfrequency pulse counter, UART, RS-232, RS-485, SDM, SDI-12 and I2C.
- Analog voltage accuracy (sensor and measurement noise not included)
    - ✓ - ±(0.04% of the measurement + compensation) from 0° to 40°C
    - ✓ - ±(0.06% of the measurement + compensation) from -40° to +70°C
    - ✓ - ±(0.08% of the measurement + offset) from -55° to +85°C
- 24-bit ADC converter
- Power supply 10 to 18 V DC input
- Real-time clock accuracy ±3 min. per year

- Internet Protocols Ethernet, PPP, RNDIS, ICMP/Ping, Auto-IP (APIPA), IPv4, IPv6, UDP, TCP, TLS (v1.2), DNS, DHCP, SLAAC, Telnet, HTTP(S), SFTP, FTP (S), POP3/TLS,NTP, SMTP/TLS, SNMPv3, CS IP I/O, MQTT
- CPI, PakBus, SDM, SDI-12, Modbus, TCP, DNP3, UDP, NTCIP, NMEA 0183, I2C, SPIand other communication protocols
- Data storage 4 MB SRAM + 72 MB flash
- Idle current drain, average < 1 mA (@ 12 V DC)
- Active current drainage, average
    - ✓ - 1 mA (1 Hz scan at 12 V DC)
    - ✓ - 55 mA (20 Hz scan at 12 V DC)

Reference documentation:

- ✓ Deliverable 6.1 – GBON Tender Specifications for AWSs
- ✓ Guide to Meteorological Instruments and Methods Observation. WMO No-8. Edition2018
- ✓ Guide to the Global Observing System. WMO No-488. Edition 2010. Updated in 2017
- ✓ AWS Tender Specifications.

3.2. Design of the ICT infrastructure and services

3.2.a. Detailed description of the telecommunications infrastructure and services

INDOMET's ICT infrastructure must be upgraded to meet GBON requirements. The systemmust be renewed from the stations to the INDOMET Central computer server, including the acquisition systems, database, climate data management and WIS 2.0 node.

The server, duplicated for security purposes, will be dedicated to collect information from GBON stations, to perform the data quality verification process and to be a node for sending information via WIS 2.0.

INDOMET's fundamental server room needs to be refurbished so that it is isolated and properly air-conditioned, since it currently shares space with IT personnel. These serversinclude the computer server for the collection and dissemination of data from GBON stations.

Computer equipment and works	Cost (USD)
Insulation work on the computer server room	10,000
Air-conditioning of the computer server room	5,000
2-(Rack/UPS) and accessories	6,000
2-Computer servers (INDOMET Headquarters and Punta Cana)	10,000
Toughbook Laptop	2,500
CPU network monitoring	1,000
43" Network monitoring display	500
Total:	**35,000**

Table 15: Estimated costs of computer equipment and associated works

3.2.b. Technical specifications for the data collection system from the observation station to the collection point.

The data flow of the automatic stations begins with data sampling in the datalogger, storage and statistical calculations, which is performed automatically every 10 minutes.

Automatic stations must be configured with a datalogger. Data transmission is currentlydone via UHF radio every ten minutes. The improvement of this transmission system hasbeen contemplated in the investment proposal (Table 9). The data are currently receivedon a server, then transmitted to INDOMET's MCH (Meteorology Climatology and Hydrology) system and also to an INDOMET Web site, so it is necessary to acquire a server with more features than the current one for INDOMET's headquarters, as well as a similarone as a mirror at another location.

3.2.c. Technical specifications of data services (compatible with WIS 2.0 requirements)

The following services will be provided:

- Web API (OGC-API)

- Publishing/subscription service

- File sharing/repository system

Applications used by forecasters, scientists, warning systems, and government and research organizations will access and use the data through available data services. Web-based access to the data will be guaranteed from remote locations with optional accesscontrol to designated data sets. The wide range of applications and programming languages capable of connecting to the web APIs (R, Python, Excel, etc.) will ensure a system of data processing and visualization solutions as well as graphical user interfacesin web environment. Data services should be sufficient to meet the needs of existing operational platforms through traditional data transfer, direct access to data through shared file systems or modification of existing software to access data through the WebAPI service.

3.2.d. Detailed description of measures to ensure resilience and continuity of the entire data processing chain.

To ensure the resilience and continuity of the entire data processing system, thefollowing actions will be undertaken to ensure the reliability of the data management system:

- Change from the current UHF communications system to a future one with GSM technology. This only affects two of the current INDOMET surfacestations that will be part of GBON.
- Ensure the necessary storage of data, achieving traceability of the climate database.
- Design of a data control management flow and associated manual.

3.3. Design the data management system

At present, INDOMET has the MCH (Meteorology, Climatology, Hydrology) database management system, which allows the integration of data from the stations managed byINDOMET itself.

The data from the 23 automatic stations are being developed and the integration of therest of INDOMET's stations is underway.

The ability to perform data quality control, data processing and analysis, and product generation is done in a mixed manner, since after an initial manual control before beinginserted into the database, an automatic control is subsequently performed by the MCHsystem. This option limits data quality due to human intervention when recording stationdata and entering them into the system.

In view of the existing challenges and risks related to data quality and data loss there is a need to enhance such a system with capacity for automation of all its processes, including data reception, quality control, data processing, data analysis (including big data processing and analysis) and product generation. The system will include a primary node for data collection and storage through the MCH at INDOMET headquarters, including data from GBON stations. There will be a secondary backup node at the PuntaCana airport meteorological office.

The following table provides detailed information on the tasks of each of the systems that make up the **data control system.**

Table 16:

Component	Task
Acquisition system	Perform remote communication with the stations.
Quality control system	Perform quality control through verification and monitoringof: Instrumental or physical limits. Climatological limits. Maximum time variability allowed. Consistency checks between variables.
Database System	Store measurements of meteorological variables in thedatabase server.
Monitoring system	Monitor the operational status of stations that are onlinethrough the MCH.
System configuration	Configure the monitoring system indicators.
	Configure the station metadata.
Publishing system	WIS 2.0 is in the process of becoming operational.
	Access to the MCH system by different users.
	Climate database.
	INDOMET web page.

Summary of tasks performed by the Data Management System subsystems

Furthermore, the design will ensure the implementation of the WMO Information System 2.0 (WIS 2.0) framework for the international, regional, and national exchange of data in support to the WMO Unified Data policy, the Global Basic Observing Network (GBON).

3.4. Environmental and sustainability considerations

The Dominican Republic's general environmental law 64-00 establishes the need to ensure the efficient and sustainable use of the nation's natural resources, in accordance with the need to adapt to climate change. In 2023, INDOMET approved the institution's environmental management plan establishing guidelines aimed at reducing environmental impact. Compliance with INDOMET's environmental management plan will minimize the impact of project implementation. The various components of the system will comply with the corresponding environmental regulations.

Existing infrastructure will be used as much as possible. Solar energy will be used to power the installed surface stations.

The WFP (World Food Program) also has an environmental policy that establishes mechanisms to identify, avoid, address and manage environmental risks in all interventions in which it participates. Through its actions and projects, WFP considers environmental protection by aligning its actions with international best practices and global environmental sustainability standards

Module 4. GBON Human Capacity Development Modul

4.1. Assessment of human capacity gaps

INDOMET, the national meteorological service of the Dominican Republic, is composed of a portfolio of men and women of great value who work hard for the best interests of the institution. A good range of technicians and professionals are available, but this is still not enough to meet the growing demand of the institution.

INDOMET is a national office with a vertical structure and direction, independent legal personality and its own assets. It is headed by a National Director and a Deputy Director.The National Director is the one who appoints the other officials and public servants of the institution.

Access to the institution is through the guidelines of the Ministry of Public Administration(MAP), through the Civil Service Law 41-08. In this sense, there are three ways to enter the institution. The first is by appointment by the President of the Republic for the National Director and Deputy National Director of INDOMET. The second route is for personnel of Simplified Status, belonging to occupational groups I and II, who enter through direct appointment by the Highest Authority. Finally, personnel belonging to occupational groups III, IV and V, enter through a competitive examination, administeredby the MAP, and become employees of the Administrative Career System.

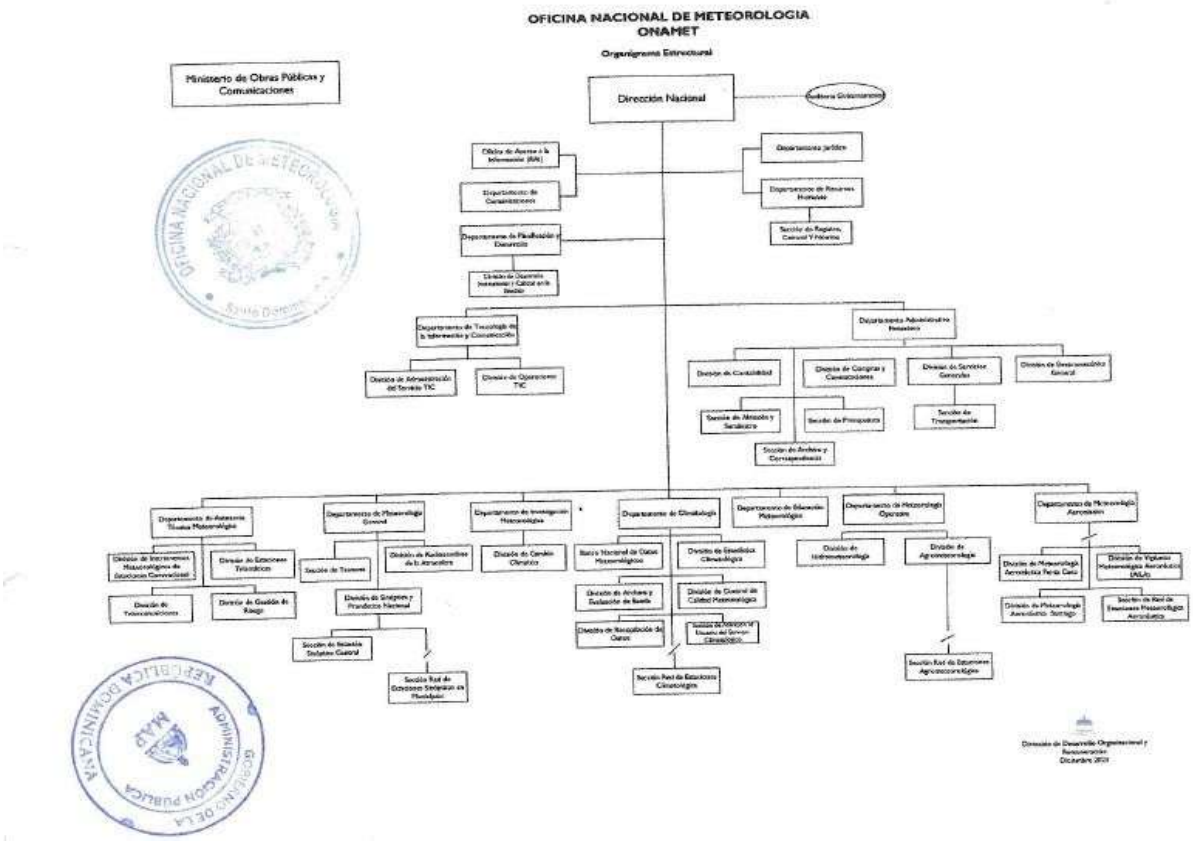


Figure 3: Distribution of INDOMET areas and personnel

MALE METEOROLOGICAL PERSONNEL	
SENIOR METEOROLOGIST	9

SENIOR METEOROLOGICAL TECHNICIAN	3
INTERMEDIATE WEATHER TECHNICIAN	58
INITIAL METEOROLOGICAL TECHNICIAN	7
WEATHER OBSERVER	18
TOTAL TECHNICIANS	**95**
FEMALE METEOROLOGICAL PERSONNEL	
SENIOR METEOROLOGIST	3
INTERMEDIATE WEATHER TECHNICIAN	46
INITIAL METEOROLOGICAL TECHNICIAN	3
WEATHER OBSERVER	27
TOTAL TECHNICIANS	**79**
GRAND TOTAL	**174**
MALE ADMINISTRATIVE STAFF	
AREA MANAGER	9
ANALYST	1
ADMINISTRATIVE TECHNICIANS	2
ADMINISTRATIVE ASSISTANT	5
DIGITATOR	13

MESSAGERS	3
PHOTOCOPIER	1
CHOFER	8
MAINTENANCE ASSISTANT	20
INTERNAL SECURITY	1
TOTAL	**63**
FEMALE ADMINISTRATIVE STAFF	
AREA MANAGER	8
ANALYST	6
ADMINISTRATIVE TECHNICIANS	6
SECRETARY	14
DIGITATOR	5
ADMINISTRATIVE ASSISTANT	28
RECEPTIONIST	2
ARCHIVIST	3
MESSAGERS	6
CONSERGE	15
TOTAL	**93**
GRAND TOTAL	**156**
MALE GENERAL MANAGERS	26
FEMALE GENERAL MANAGERS	20
TOTAL GENERAL MANAGERS	**46**
TOTAL MALE STAFF INDOMET	158
TOTAL FEMALE STAFF INDOMET	172

Table 17: Distribution of INDOMET personnel by area and gender

The institution currently has three technicians specialized in the installation, configuration and maintenance of automatic weather stations, headed by Engineer and Meteorologist Jenuel Almonte, Head of the Telemetric Stations Division.

In this regard, the institution recently trained 10 employees in the development and installation of low-cost Automatic Weather Stations. For the next year 2025, we plan to continue with the reinforcement of these servers with related training.

4.2. Design capacity development activities for technical staff

Within the Institutional Strategic Plan and the Annual Training Plan, it has been established to strengthen the capacities of employees, especially technicians and meteorologists, by training new technicians and hiring personnel.

An Intermediate Meteorological Technician course for the training of new technicians is planned for July 2024.

Steps have been taken with the Ministry of Higher Education and several universities to obtain international scholarships for training personnel in meteorology, automatic stations and meteorological instrumentation.

INDOMET technicians recently received training in low-cost telemetry stations and an instrumentation workshop was opened, but there is a real need to strengthen personnelin the management and maintenance of weather stations and their instrumentation.

In terms of ICT systems, the company has a staff that is able to meet the needs, but thereis a need to continue training employees in the new technological tools available on themarket.

The Telemetric Stations Division, together with the Technology Department, will be in charge of all the technical activities developed in the network designed to meet GBON requirements.

Considering the modernization of the equipment and the substantial changes in some of the technologies currently used, it is essential and a priority to create capacities in those in charge of sensor maintenance, repair, monitoring and maintenance of communications equipment, as well as in the updating of methods for the assembly, calibration, integration and configuration of the new technologies acquired through thisproject.

To ensure that such operations are conducted in a smooth and sustainable manner, in pursuit of GBON compliance, the project will ensure the necessary capacity building for existing experts to maintain the entire designed infrastructure.

The main thematic areas of the courses to be received for the development of the technical staff's capabilities are mainly the following:

- ✓ First-level operation and maintenance of automatic weather stations
- ✓ Assembly, integration and maintenance of automatic surface weather stations.
- ✓ Update of the state of the art of the system infrastructure observations.
- ✓ Assembly, certification, integration and maintenance of lightning protection systems.
- ✓ Assembly, certification, integration and maintenance of calibration systems.
- ✓ Update on the state of the art of calibration techniques.
- ✓ Assembly, integration and maintenance of communications equipment.
- ✓ Repair and maintenance of meteorological sensors.
- ✓ Implementation of data collection techniques using WIS 2.0 and basic programmingfor data processing.
- ✓ Real-time monitoring of weather station data.
- ✓ Update on the state of the art of data quality techniques.

Part of this training is expected to be carried out in collaboration with institutions in theregion, as well as taking advantage of the training plan of the Conference of Ibero- American NMHSs (CIMHET).

The budget shown in the table below will be available for training courses requiring funding.

Items	Total Cost(4 years) (USD)
Training of technical personnel	40,000

Table 18: Training Costs (INDOMET technical personnel)

INDOMET has the support of international organizations and the implementing entity to develop the training process.

4.3. Design capacity development activities for senior management

There are collaboration agreements with the Ministry of Higher Education, universities, the Professional Technical Institute (INFOTEP) and the National Institute of Public Administration (INAP) to strengthen the capacities of INDOMET personnel.

In addition, the Institutional Strategic Plan establishes the annual strengthening of the skills of both technical and civil servants. Each year an Annual Training Plan is prepared and submitted to INAP, detailing the courses and workshops that contribute to increasing staff competencies.

To ensure improvement in INDOMET's strategic organization, each senior executive requires superior skills to manage resources within the organization effectively. Therefore senior management must be trained primarily in the following subject areas:

- Use of strategic planning tools.
- Strategic planning.
- React effectively and quickly to technological changes within the organization.
- Risk management.
- Personnel management.
- Project management skills.
- Quality management skills.

In order to equip senior management with the necessary skills, the project will ensure that senior management is trained in the above-mentioned areas. Advantage will be taken of existing experience in the region, as well as the opportunities presented by CIMHET.

The budget shown in the table below will be available for training courses requiring funding.

Items	Total Cost(4 years) (USD)
Management training	20,000

Table 19: Training costs (INDOMET management staff)

4.4. Gender and CSOs considerations

There is a gender balance at INDOMET, with female personnel accounting for 52% of number of employees. Of the 46 managers, 26 are male and 20 are female.

Staff development opportunities are equal for both genders. Participation is given to allwithout any discrimination considering individual characteristics, only valuing their dedication, commitment and interest in institutional and professional growth.

Civil Society Organizations have always played a preponderant role in the work of the meteorological service. There is a close relationship with CSOs, working together on projects, especially linked to foundations that work hand in hand with the communities.

Both the National Meteorological Office, INDOMET, and the World Food Program, WFP, have excellent relations with different Dominican civil society organizations. In this project both institutions will work together, facilitating the involvement of other organizations in the identification of their potential to contribute to GBON and thus create awareness of the relevance of the different aspects that it comprises, having as a fundamental objective, the strengthening of partnerships with all civil society organizations and the private sector.

Through the SOFF initiative, efforts will be made to expand the partnership between INDOMET and the private sector to explore mechanisms to support the implementation of the SOFF Investment Program where appropriate.

INDOMET will continue its efforts to ensure gender equity in the promotion of meteorological and climate services. In the Dominican Republic, the empowerment of women is a premise of the government, framed and contemplated in the Constitution and through the Ministry of Women.

The meteorological service is committed in the execution of the Institutional Strategic Plan 2025-2028, to promote the participation of women in capacity building activities in the technical meteorological area, especially in the operation of automatic weather stations.

Module 5. Risk Management Framework

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

The following table associated with risk may be of interest when carrying out the projectto improve INDOMET's meteorological observation network.

Risk	Risk level	Probability	Impact	to mitigaterisk	Responsible
Inability to meet project deadlinesdue to delays in the procurementand supply processes.	Moderate	Infrequent	Medium	Conduct a market analysis prior to the local and international launchand with sufficient time in the schedule.	PMA
Gap between project approval and start of project execution phases	High	Likely	High	Prepare as much information as possible according tothe standards. Consider an additional 6 monthsat the beginning of the execution phase as a contingency.	PMA
Vandalism/theft of installed equipment	Download	Unlikely	High	Maintain surveillanceof the facilities.	INDOMET
Difficulty of maintaining weather stations	Under	Unlikely	High	Ensure periodic maintenance contracting with the supplier.	INDOMET
Failure of dataquality management system	Medium	Unlikely	Medium	Constant updating and monitoring of the quality management system.	INDOMET
Operational risks: **Errors in employee training.**	Under	Unlikely	High	Conduct effective training programs for technical staff. Monitor the use of personal protective	INDOMET

Deficiencies in Health and Safety. **Employee misconduct.**				equipment. Implement internal controls..	

Table 20: Project risk analysis

Module 6. Transition to SOFF investment phase

The transition to the investment phase of the SOFF will be based on the results and recommendations of the Preparation Phase and, in particular, on this National Contribution Plan, which has been prepared jointly with the beneficiary country (Dominican Republic), the Implementing Entity (World Food Program) and AEMET. More detailed information will be provided as needed. Upon receipt of this document, the funding request for the implementation phase of the SOFF will be initiated.

The main efforts will be focused on jointly carrying out this Contribution Plan, the preparation of a national country project that should contain all investment activities.

The four main steps are:

- Installation
- Maintenance
- Training
- Actions to ensure sustainability.

Summary of GBON National Contribution Plan

Components	Recommended activities
Module 2. GBON business model and institutional development	1. Strengthen links with national institutions and the private sector thatmay have an interest in GBON.
	2. Strengthen ties and share experiences with meteorological and hydrological services in the region.
Module 3. GBON infrastructure development	Install a new surface station and upgrade two existing stations.
	2. Guarantee the commitment to collaborate with the IDAC for the supply of data from the Punta Cana station, as well as the maintenanceof the station itself.
	3. Carry out the maintenance and calibration plan to ensure the properfunctioning of the stations over time.
	5. Register the height station (radiosonde) in GBON.
	6. Improvement of the conditions of the communications room whereINDOMET's servers are housed.
	7. Acquisition of 2 computer servers, UPS/Rack, etc., for the ingestion,processing and dissemination of data from the GBON stations.
	8. Implementation of WIS 2.0.
	9. Comply with environmental regulations
	10. Continue to maintain collaboration with NOAA for the smoothoperation of the radiosonde station.
Module 4. GBON human capacity development	1. Train technical personnel to ensure the proper operation of theGBON Network.
	2. Train senior management staff on identified needs.
	3. Take into account gender considerations, according to country andWMO policies.
	4. A module on gender balance and corporative social responsibility will be included in all training courses.
	5. Annual workshop join CSO regarding gender topics. Assessment and recommendation.
Module 5. Risk Management	1. Identify the areas that could entail risk in the execution and investment phase, and propose activities to mitigate such risks.

Module 6. Transition to SOFF investment phase	1. Prepare the application for SOFF project funding.

Table 21: Summary of National Contribution Plan Activities

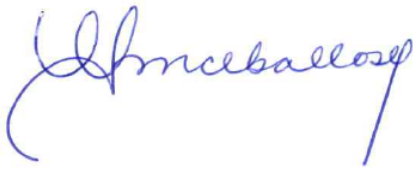
SUMMARY TABLE OF PROPOSED INVESTMENTS			
Concept	**Cost (4years). USD**	**Duties, taxes, charges, etc. USD**	**TOTAL USD**
Station infrastructures and spare parts	124,134	80,712	204,846
Maintenance	55,000	34,100	89,100
Computer equipment and works	35,000	18,200	53,200
Training of technical personnel	40,000	18,800	58,800
Management training	20,000	9,400	29,400
TOTAL	**274,134**	**161,212**	**435,346**

Table 22: Estimated summary of investments (included duties, taxes, charges, etc.)

The costs calculated in the budget projections correspond to amounts quoted as of September 2024, and may be subject to inflation variations and slight increases 3 months after issuance.

Annexes (if any)

Report completion signatures

Peer Advisor signature	FERNANDO| BELDA| ESPLUGUES Firmado digitalmente por FERNANDO| BELDA|ESPLUGUES Fecha: 2025.02.14 11:42:43 +01'00'
Beneficiary Country signature	
WMO Technical Authority signature