

SOFF Readiness Funding Request

Systematic Observations
Financing Facility

**Weather
and climate
data for
resilience**



SOFF Readiness Funding Request

The SOFF Readiness Funding Request template includes the following sections:

1. Basic information
2. SOFF Programming criteria
3. Readiness phase outputs, timeline and budget
4. Monitoring
5. Readiness Phase Risk Management Framework

The Assignment Terms of Reference are included in Annex 1.

1. Basic information

SOFF Beneficiary Country	Bhutan
Country Focal Point	National Centre for Hydrology and Meteorology (NCHM) Royal Government of Bhutan Post Box: 207, Thimphu, Bhutan Focal Person: Mr. Karma Duphu email: kduphu@nchm.gov.bt
Peer advisor	Finnish Meteorological Institute (FMI)
Peer advisor Focal Point	Mr. Sami Kiesiläinen mobile: +358 50 367 5888, email: sami.kiesilainen@fmi.fi
Prospective Implementing Entity	UNEP
Prospective Implementing Entity Focal Point	Mr. Jochem Zoetelief, mobile: +254709023986, email: jochem.zoetelief@un.org
Total budget USD	80 000
Delivery timeframe	6 months after approval of funding request
Date of approval	
Signature SOFF Steering Committee co-chairs (after Steering Committee approval of the funding request)	

2. SOFF Programming criteria

Table 1: Programming criteria

<p>Close the most significant data gaps</p>	<p>Bhutan is a small, landlocked country in the Himalayas, covering ca 38 000 km² and extending ca 300 km on East – West and ca 150 on North – South directions.</p> <p>Currently Bhutan operates only 1 surface observation station (Tsampa) that is recognized by WMO/WDQMS and connected to GTS. However, it doesn't report every hour (on average 20 times per day). Moreover, there seems to be an issue with the station information or some other metadata since the expectation in Wigos is 0. In theory, this one station located to mid-north of Bhutan would be fulfilling GBON regulation on horizontal resolution, but due to the missing observation stations in the nearby areas and complex terrain of Bhutan, better data coverage using existing stations could be studied during readiness phase. The Tsampa station observations includes temperature, humidity, rainfall, pressure, wind speed and direction but no snow depth.</p> <p>For domestic purposes, Bhutan operates 20 Agrometeorological, 63 climatological stations and 18 snow depth measurement stations. Both agrometeorological and climatological stations are manual. The agrometeorological stations report twice a day, at 9 a.m. and 3 p.m, Bhutan Standard Time (BST UTC +6) to headquarters office in Thimphu and climatological stations' data is sent to Thimphu monthly. In addition, NCHM operates 75 AWS-stations (Tsampa included) which are reporting in real time (every 15 minutes) to headquarters. Observations from these stations are not delivered to GTS/WIS. Agrometeorological stations record temperature, rainfall, relative humidity, wind speed and direction, soil temperature (5cm, 15cm & 30 cm), sunshine duration and evaporation. Climatological stations measure temperature, rainfall and relative humidity and the AWS network temperature, rainfall, relative humidity, wind speed and wind direction, solar radiation and pressure.</p> <p>Only a few stations in the AWS network are located in the northern part of Bhutan and there is a huge gap in terms of representative coverage. Although the GBON requirements don't take into account the variability in terrain, it must be noted that the area of North Bhutan is extremely mountainous and therefore the observation network could be denser than on the average in the flat terrain. From the few AWS's in Bhutan doesn't report in real time due to challenges associated with spare parts, connectivity and resources for maintenance. Detailed needs and acquisitions of connecting existing additional stations to GTS/WIS will be studied during the implementation of the readiness phase.</p> <p>Neighbouring or nearby countries (India, China, Nepal) have some GBON-stations in the vicinity of Bhutan, especially India with some 5 stations closer than 50 km from the Bhutanese border. However, none</p>
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	<p>of the stations are fulfilling the GBON reporting requirements. The observation network in WIGOS is especially sparse in China, North of Bhutan.</p> <p>NCHM does not operate any sounding station to make the upper air observations. As a pilot program, NCHM installed a sounding station in Paro international airport in 2016. The main objective of the program was to collect the upper-sounding data for the pre-monsoon season (April, May and June) for three years. The sounding accessories were acquired by assistance of an external project (SAARC STORM). However, NCHM had to arrange the hydrogen gas supply. With limited capacity and funding for hydrogen gas, the upper air observation was carried out only for 1 year.</p> <p>Nearest sounding stations are located at Siliguri and Guwahati, in India. Both are located under 100 km from border of Bhutan but they both are lacking data. In north the nearest station is about 200 km from Bhutan, in Lhasa, China, but it has lack in variables and temporal resolution of the data.</p>
<p>Target easy fixes</p>	<p>Main gap for the surface observation stations is the data delivery process to GTS/WIS -networks. At the moment, only one station is sending data and it is not complete, with some hourly observations missing on average. Enabling international delivery, by developing the data management and dissemination systems, would provide more observation stations which would be eligible to GBON. This would require advance capacity building of the members at NCHM on operating the GTS/WIS and probably some acquisitions and improvements in the data management systems.</p> <p>Most of the operational AWS's doesn't report data in real time due to issues related to communication methods, connectivity, lack of spare parts and lack of resources for maintenance. Also, lack of laboratory facilities and human capacity with NCHM to operate these facilities is a challenge for station maintenance and data quality. Only the stations which form a part of the early warning network (have satellite based communications as back up) have stable connections.</p> <p>Restoring the existing sounding station in Paro would help to fill the gap with upper air soundings. Bhutan has operated soundings for a 1-year period, so expertise to make soundings has been established and the main challenge is operation costs and availability of hydrogen.</p>
<p>Maximize delivery capacity</p>	<p>FMI has worked with NCHM in the Finnish funded ODA-project SHSB and follow-up project for implementing Smartmet weather information and production system funded by World Bank and UNDP some years ago. Additional training activities for the SmartMet and NWP (Numerical Weather Prediction) are planned for H1/2023. Thus, FMI has a good understanding of NCHM systems, capacity and overall situation. Based on the previous cooperation and projects as well as activities conducted worldwide, the peer advisor has an extensive knowledge in all relevant fields needed for the successful</p>

	<p>implementation of the project, including required capacity development in institutional, procedural areas and human resources in accordance with the different phases of SOFF.</p> <p>UNEP has strong expertise and experience support observing systems in developing countries. It is currently working on implementing a GCF-funded 5-year project "Enhancing Early Warning Systems to build greater resilience to hydro-meteorological hazards in Timor-Leste" and a GCF-funded 5-year programme "Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean", where strengthening observational capacity is one of the key components. UNEP is also co-leading Pillar 2 of Early Warnings for All Initiative (Observations & Forecasting).</p> <p>UNEP capacity to deliver SOFF support efficiently in Bhutan is strengthened through its partnership with Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES), which has been previously working on strengthening observational capacity in Bhutan (Project "Development of Bhutan's national weather and flood forecasting and warning center").</p>
Create leverage	<p>Most of the AWS stations in Bhutan were installed in 2016 with the support of the NAPA project funded by GEF. They can be considered modern and potential additions to the international data delivery of Bhutan.</p> <p>Under the JICA TCP Project for Capacity Development of GLOF and Rainstorm Flood Forecasting and Early Warning (2013-2016), Global Telecommunication System and Message Switching System (GTS-MSS) was installed at the National Centre for Hydrology and Meteorology (NCHM). Four Automatic Water Level Stations (AWLS) and one Automatic Weather Station (AWS) are connected to the GTS for domestic Flood Forecasting and Warning System. Only one AWS data (Tsampa) is transmitted to the GTS network through regional telecommunications hubs, New Delhi and Bangkok.</p> <p>With support of JICA, NCHM has plans to connect 5 more synop stations (Babesa, Blur, Gasa, Kanglung, Chamkhar) into the GTS/WIS system. Frequency of reporting is still under discussion and JICA will provide no support in terms of hardware, spare parts, maintenance and capacity building for operation of stations. All these five stations are considered for SOFF support.</p> <p>As an accredited entity to GCF, UNEP could facilitate in the future to mobilise GCF funding to further strengthen hydrometeorological capacity in Bhutan based on the needs identified through Country Hydromet Diagnostics. If desired by the country, UNEP will also leverage its existing partnerships such as one with RIMES.</p>
Sub-regional gains	<p>Himalayan area is challenging as landscape changes from large plateaus on the Indian side and Himalayan mountains.</p>

	<p>Increased observations are very important to regional scale modelling in addition to global models but also for the downstream riparian states. Since all the rivers from Bhutan flow to India, Bhutan also exchanges hydro-met and flood data with Indian States of Assam and West Bengal for forecasting and warning. Also sharing of data amongst the regional partners helps in providing early warning services. NCHM has MoU with Regional Integrated Multi-Hazard Early Warning System for Asia and Africa (RIMES) and currently they have technical co-operation South Asian Hydromet Forum (SAHF) promoted by the World Bank. The project is focusing on regional collaboration and technical support on development of flood Decision Support System (FDSS), verification of numerical weather models and capacity building. In case Bhutan will be exchanging data with RIMES, strengthening observational capacity in Bhutan would enable it to provide better data also to RIMES. This data would then lead to sub-regional gains. Bhutan as a member of BIMSTEC, NCHM is closely working with BIMSTEC Centre for Weather and Climate (BCWC).</p>
<p>Ensure country balance</p>	<p>Bhutan is an ODA-recipient country, categorized in the group of least developed countries (LDC)</p>

3. Readiness phase outputs, timeline and budget

The Terms of Reference for the development of the SOFF Readiness phase outputs (see Annex I) provide more detailed information. They also summarise the roles and responsibilities, as stated in the [SOFF Operational Manual](#), of the beneficiary country, the peer advisor, the prospective Implementing Entity and WMO Technical Authority for the delivery of the Readiness phase outputs.

The budget for the development of the SOFF Readiness phase outputs by the SOFF peer advisor shall be a lump-sum, fixed cost amount. It shall be calculated using a cost-recovery approach based on the peer advisors' standard cost recovery rates.

Table 2: outputs, timeline and budget

Outputs	Timeline					
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6 ¹
National GBON Gap Analysis						

¹It is expected that the assignment is completed within six months. If more time is required for exceptional circumstances, please add additional months to the table.

GBON National Contribution Plan						
Country Hydromet Diagnostic (on demand)						
Total budget USD ²	80 000					

²Eligible expenditures are limited to: Staff and consultants; Consultations, national technical workshops, and communications; Travel and transportation costs; Other incidental expenditures.

4. Monitoring

The beneficiary country and peer advisor shall notify the SOFF Secretariat on any delays that may impede the timely delivery of the Readiness phase outputs. If the assignment takes more than six months, the SOFF peer advisor shall submit semi-annual progress reports to the SOFF Secretariat (form to be provided by the SOFF Secretariat) stating the delivery status of the outputs.

The Readiness phase completion will be monitored by the peer advisor and the SOFF Secretariat using the following country-level Results Framework for the Readiness phase.

Table 3: Result framework

Outputs	Indicator	Target
1. GBON National Gap Analysis	GBON gap established and reviewed (Y/N)	GBON gap analysed and reviewed by WMO Technical Authority
2. GBON National Contribution Plan	GBON national contribution plan developed (Y/N)	GBON national contribution plan developed and reviewed by WMO Technical Authority
	GBON National Contribution Plan includes gender considerations (Y/N)	GBON National Contribution Plan includes gender considerations
3. Country Hydromet Diagnostic (on demand)	Country Hydromet Diagnostic developed (Y/N)	Country Hydromet Diagnostic developed

5. Evaluation

An evaluation from both, the beneficiary country and the prospective Implementing Entity on the quality of support received by the peer advisor will be conducted at the end of the Readiness phase and the peer advisor's assignment (form to be provided upon completion of the Readiness phase by the SOFF Secretariat).

6. Readiness Phase Risk Management Framework

The major risks in the implementation of the readiness phase are related to the natural disasters or global pandemics and related travel restrictions. These may cause delay in the implementation. Moreover, the adequacy of the beneficiary staff resources to support the implementation forms risks to producing the needed reports.

Table 4: Risk Management Framework

Risk category	Description	Probability	Mitigation action
Contextual risks Risks related to conflicts, safety and political insecurity jeopardising the delivery of the Readiness phase outputs	The Covid-19 situation or new pandemic may cause delays in the project	Medium-high	New deterioration of the situation or completely new pandemic are possible. This risk will be mitigated by monitoring the situation as well as activity scheduling measures. In addition, remote activities shall be considered in case the situation requires.
	Natural disaster such as earthquakes	Low-Medium	
Institutional risks Risks related to the beneficiary country's institution's participation in the Readiness phase activities	Major flooding, earthquake etc. could hinder the DHM staff to focus and participate in project activities and/or impact the actual functioning of DHM	High	Flooding and landslides are common during monsoon season, which is why project activities avoid the main monsoon season.
	Financial year of the implementing entity differs from the Government financial (Fiscal) year	Low	Planning harmonization, Timely funds request and disbursement
Programmatic risks Risks related to country ownership of the Readiness phase outputs	NCHM moved under another Ministry	Low	The project cannot control this issue, but the possible change may affect the timetable. Up-to-date information sharing between partners on situation is important
	Limited human resources and capacity of competent staff, changes of personnel	Medium	Training is provided to the wider group of experts, technical guidance documents (SOP) and training materials are prepared and used to train new staff.

	Problems in technical systems	Medium	Repair and problem solving should be noted in the plans
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Annex 1. Assignment Terms of Reference for the development of the SOFF Readiness phase outputs

1. Purpose and scope

The purpose of this Assignment is to provide SOFF peer advisory services by Finnish Meteorological Institute to Bhutan to develop the outputs of the SOFF Readiness phase as described in section 3 of these Terms of Reference.

The provisions defined in the Terms of Reference are based on the [SOFF Operational Manual](#), in particular Section 4.4 on Operational Partners and Section 4.5.1 on the Readiness phase.

2. Roles and responsibilities

Beneficiary country National Meteorological and Hydrological Service

- Is responsible for implementing the activities of the Readiness phase with the support from the peer advisor and the prospective Implementing Entity.
- Prepares the Assignment Terms of Reference following the standard Terms of Reference provided by the SOFF Secretariat, in collaboration with the peer advisor and in coordination with the prospective Implementing Entity.
- Submits the funding request for the SOFF Readiness phase support using the standardized template provided by the SOFF Secretariat.
- Is responsible for collaborating with the peer advisor to provide all the necessary information and participate in and facilitate the national activities the peer advisor needs to conduct in order to develop the Readiness phase outputs.
- Confirms receipt of the peer advisors' report with the Readiness phase outputs and provides comments on the outputs as needed.

Peer advisor

- Is accountable to the beneficiary country.
- In dialogue with the beneficiary country, provides independent technical advice, analysis and recommendations to support the beneficiary country in implementing the activities of the Readiness phase.
- Develops the Readiness phase outputs and is responsible for their quality and timely delivery. Communicates regularly with the beneficiary country and the Implementing Entity.
- Engages with the civil society, including on the identification of stakeholders of relevance for GBON implementation.
- Submits the final report with the Readiness phase outputs to the country for comments and to the prospective Implementing Entity for feedback.
- Submits the final report including the beneficiary country's comments and the prospective Implementing Entity's feedback to the SOFF Secretariat.
- Notifies the SOFF Secretariat and the prospective Implementing Entity of any delays that may impede the timely delivery of the outputs, and for assignments for which the delivery takes more than six months submits a semi-annual progress report.

Implementing Entity

- Participates in the Readiness phase activities and collaborates with the beneficiary country and the peer advisor to ensure a common understanding of the Readiness phase outputs and that they address the technical needs for the design and implementation of the Investment phase.

- Contributes to the definition of the Terms of Reference and provides feedback on the outputs delivered by the peer advisor.
- Based on its experience in the beneficiary country, supports the work of the peer advisor, e.g. by sharing its knowledge and facilitating access to the network of relevant stakeholders.

WMO Technical Authority

- Provides basic technical support to the beneficiary country, peer advisor, and prospective Implementing Entity on GBON regulations.
- Is responsible for the technical screening of the draft GBON National Gap Analysis and the draft GBON National Contribution Plan against the GBON regulations.
- Is responsible for establishing and administering the pass-through mechanism for contracting and funding of the technical assistance provided by the peer advisors.

SOFF Secretariat

- Facilitates communication, coordination and collaboration between the beneficiary country, the peer advisor, the prospective Implementing Entity and WMO Technical Authority.
- Reviews the Readiness funding request, including the Terms of Reference, for compliance and consistency with the information requirements in the template and provides feedback as needed. Transmits the funding request to the SOFF Steering Committee for its decision.
- Confirms receipt of the peer advisors' report with the Readiness phase outputs.
- Organizes exchange of knowledge and experiences and captures lessons learned.

3. Readiness phase outputs

The peer advisor should perform the following tasks following the technical guidance and using the templates provided in the [operational guidance documents](#) for each one of the outputs. A summary of the key steps and modules to be conducted for each output is presented below.

3.1 GBON National Gap Analysis

The GBON National Gap Analysis defines the gap between the mandatory requirements of the GBON regulations and the existing country surface and upper-air networks. In other words, it serves as the basis for identifying the number of observing stations that need to be installed or rehabilitated to comply with the mandatory requirements of the GBON regulations.

To develop the GBON National Gap Analysis, the following steps should be followed

- Step 1 – Country information from the GBON Global Gap Analysis
- Step 2 – Analysis of existing GBON stations and their status against GBON requirements
- Step 3 – GBON Gap Analysis results
- Step 4 – Country endorsement for integration of the GBON National Gap Analysis into the GBON National Contribution Plan

3.2 GBON National Contribution Plan

The GBON National Contribution Plan identifies the infrastructure, human and institutional capacity needed to achieve a progressive target toward GBON compliance, including the sustained operation and maintenance of the national GBON observing network.

To develop the GBON National Contribution Plan, the following modules should be completed

- Module 1. National target toward GBON compliance: Establishment of a progressive national target toward GBON compliance
- Module 2. GBON business model and institutional development: public-private business model as appropriate; partnerships, institutional and financial arrangements needed to operate and maintain the observing network
- Module 3. GBON infrastructure development: Appropriate investments needed to increase or improve the observing network and its Information and Communication Technology (ICT) infrastructure
- Module 4. GBON human capacity development: Human technical and managerial capacities required to operate and maintain the observing network
- Module 5. Risk Management: Operational risks of the observing network and required mitigation measures
- Module 6. Transition to SOFF Investment phase: Support the beneficiary country and the Implementing Entity in preparing the Investment phase funding request (template provided by the SOFF Secretariat).

3.3 Country Hydromet Diagnostics

The Country Hydromet Diagnostic (CHD) complements the GBON National Gap Analysis and the GBON National Contribution Plan. It is a standardized, integrated and operational tool and approach for diagnosing National Meteorological Services across the meteorological value chain, their operating environment, and their contribution to high-quality weather, climate, hydrological and environmental information services and warnings. Its assessment serves as a basis for investments beyond SOFF, across the whole value chain, by the SOFF Implementing Entity and other development partners.

The peer advisor should assess the 10 CHD elements with its respective indicators following the matrix provided in the CHD guidance document.

- Governance and institutional setting
- Effective partnerships to improve service delivery
- Observational infrastructure
- Data and product management and sharing policies
- Numerical model and forecasting tool application
- Warning and advisory services
- Contribution to climate services
- Contribution to hydrological services
- Product dissemination and outreach
- Use and national value of products and services

To develop the Country Hydromet Diagnostic, the following steps should be completed.

- Stage 1 – Information gathering. As input, the WMO Monitoring Evaluation Risk and Performance unit will provide available country data structured along the CHD elements and their indicators (performed remotely)
- Stage 2 – Validation and analysis (performed in-country if feasible)
- Stage 3 – Closure

4. Delivery process

The peer advisor in collaboration with the beneficiary country and in coordination with the prospective Implementing Entity should establish the specific activities and consultations needed to complete the outputs. The development of the outputs should include the following:

- Collaboration arrangements between the beneficiary country and the peer advisor, including at least one country visit, unless the country context does not allow it
 - The first mission to Bhutan in May 2023
 - Finalizing National Gap Analysis and outline the GBON National Contribution plan on second half of 2023
 - Stakeholder workshop in Bhutan during August-September 2023
 - Online collaboration environment to ensure up-to-date information and common drafts of the documents
- Coordination arrangements with the prospective Implementing Entity
Online collaboration environment to ensure up-to-date information and common drafts of the documents
- In-person or virtual consultation meetings with relevant national and international stakeholders and partners
Ministry or Energy and Natural Resources, Climate sensitive sectors (agriculture, hydro power etc), Indian Meteorological Department, RIMES, WB, JICA
- Delivery partners that support the peer advisor in the delivery of the outputs, as applicable
None
- Peer advisor delivery team and focal point
The peer advisor vocal point is:
Mr. Sami Kiesiläinen (Data management systems)

And the delivery team members are:

Mr. Matti Eerikäinen (Data management, forecasting and production systems, service delivery)

Ms. Jenni Latikka (Forecast production and service delivery)

In addition to the dedicated delivery team members, the peer advisor will utilize experts from the SOFF delivery support expert pool, depending on the gaps found and required expertise needed. The SOFF delivery support expert pool:

Name	Expertize
Mikä Hyötylä	Surface observation networks
Vilma Kangasaho	Surface observation networks
Anu Petäjä	Observation network operation and costing
Timo Laine	Upper air radio soundings
Jaakko Siltakoski	Observation equipment

Elmeri Nurmi	Data management systems
Minna Huuskonen	GBON and WIGOS compliance
Janne Kauhanen	Data management Forecast models
Harri Pietarila	Strategic planning, business model and organization Legal framework
Julia Warley	Observation equipment
Anne Hirsikko	Observation networks
Juhana Hyrkkänen	Business model and institutional development Legal framework Observation network operation design

- Timeline for the development of the outputs
 - National GBON Gap Analysis: during the implementation months 1-3. The gap analysis report will be handed over by the end of the month 3.
 - National GBON Contribution Plan: during the implementation months 2-6. The National GBON Contribution Plan will be handed over the latest during the month 6.
 - Country Hydromet Diagnostic: during the implementation months 3-6. The Country Hydromet Diagnostic will be handed over the latest during the month 6.

5. Reporting and completion

Reporting. For assignments for which the delivery of advisory services takes more than six months, the SOFF peer advisor shall submit a semi-annual progress report to the SOFF Secretariat (form to be provided by the SOFF Secretariat).

Completion

- Step 1. The peer advisor submits the draft GBON National Gap Analysis and the GBON National Contribution Plan reports to WMO Technical Authority and, as applicable, the draft Country Hydromet Diagnostics to the Monitoring Evaluation Risk and Performance unit of the WMO Secretariat. The draft reports have to follow the templates provided in the SOFF operational guidance documents.
- Step 2. WMO Technical Authority screens the draft GBON National Gap Analysis and the draft GBON National Contribution Plan to ensure consistency with the GBON regulations. The WMO Monitoring Evaluation Risk and Performance unit screens the draft Country Hydromet Diagnostics and provides feedback for revisions as needed.
- Step 3. The peer advisor submits the report with the Readiness phase outputs for beneficiary country and prospective Implementing Entity feedback.
- Step 4. The peer advisor finalizes the report for confirmation of receipt by the beneficiary country and, as needed, beneficiary country comments. Following beneficiary country receipt of the report, the peer advisor submits the report, including beneficiary country's comments and the prospective Implementing Entity's feedback, to the SOFF Secretariat.
- Step 5. The SOFF Secretariat confirms the satisfactory receipt of the report and informs the country and the prospective Implementing Entity accordingly. The SOFF Secretariat authorizes WMO to proceed with the release of the final payment, and informs the SOFF Steering Committee of the completion of the SOFF readiness phase.

5. Signatures

By signing this document, the beneficiary country, peer advisor and the prospective Implementing Entity agree with the provisions stated in this Terms of Reference.

<p>Beneficiary country</p> <p>Bhutan</p>	<p><i>Kam Lepel</i></p> <p>Director</p> <p>PR of Bhutan with WMO National Center for Hydrology & Meteorology Royal Government of Bhutan</p>
<p>Peer advisor</p> <p><i>Jussi Kaurola</i> JUSSI KAUROLA</p>	<p>Thimphu : Bhutan</p>
<p>Prospective Implementing Entity (UNEP)</p> <p><i>JZ</i></p> <p>Jochem Zoetelief, 22.02.2023</p>	