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GBON National Contribution Plan of Lao PDR

Systematic Observations Financing Facility

Weather and climate data for resilience

GBON National Contribution Plan
Lao PDR

SOFF Beneficiary country focal point and institution	Outhone PHETLUANGSY, Bounteum SISOUPHANTHAVONG, Department of Meteorology and Hydrology/Ministry of Natural Resources and Environment
SOFF Peer advisor focal point and institution	Delia ARNOLD ARIAS, Andreas SCHAFFHAUSER, Giora GERHSTEIN, Gerhard WOTAWA, GeoSphere Austria – Federal Institute for Geology, Geophysics, Climatology and Meteorology, in partnership with Jianxia GUO, China Meteorological Administration

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Module 1. National Target toward GBON compliance

The national target toward GBON compliance is provided in the Table 1 below. The table is based on the WMO Global assessment (June 2023) which calls for 6 surface stations and 1 upper air sites to achieve the low-resolution GBON requirements. The country, as stated in the National Gap Analysis (NGA), has a large number of surface stations (both manual and automatic), but currently none GBON compliant. While having existing stations is potentially benefiting a cost-effective approach to the NCP, the fact that they are all from different typologies, vendors and without the right data interfaces, is a major challenge that will be addressed at least for the 6 stations selected under the SOFF initiative.

Table 1: GBON national contribution plan target.

Type of station	Baseline (Results of the GBON National Gap Analysis)				GBON National Contribution Target	
	Target (# of stations)	GBON-compliant stations (#)	Gap		To improve	New
			New	To improve		
Surface	6	0	0	6	6	0
Upper-air	1	0	1	0	0	1

The proposed surface stations to be upgraded and modified to be as consistent as possible and with the right interfaces to the data management system and internal infrastructure at the headquarters of the Lao Department of Meteorology and Hydrology (DMH) is presented in Table 2 and Figure 1.

Table 2: GBON national contribution selected stations to be upgraded and new stations to be installed for capacity development activities.

Station name	Status
VIENTIANE	Operative to upgrade
PAKSE	Operative to upgrade
LUANG NAMTHA	Operative to upgrade
SAVANNAKHET	Operative to upgrade
LUANG-PRABANG	Operative to upgrade
SAMNEUA	Operative to upgrade
National University of Lao	To purchase

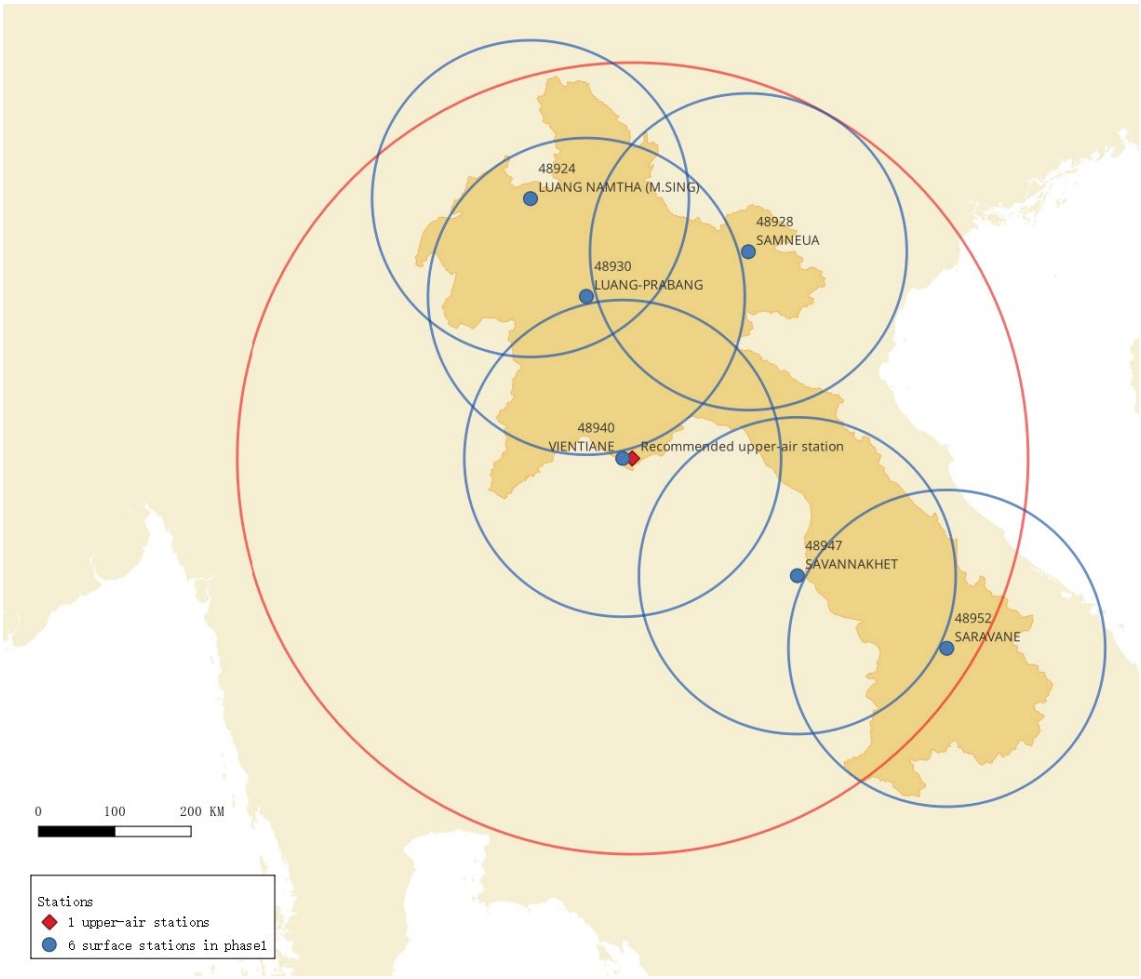

Figure 1: Map of Laos with the 1 recommended new upper-air stations (red circle) and the 6 GTS surface stations (blue dots with 200 km radius) to be improved to fulfil the standard density GBON criteria.

The selection of the stations is based on a variety of criteria but overall seeking for a uniform distribution across the country in areas with relatively easy access and already existing infrastructure and carers. This shall facilitate improved sustainability and long-term operations. Currently the stations selected have the following characteristics as described in Table 3.

Table 3: Station site and type

Station name	Station type (S/UA)	Latitude (°N)	Longitude (°E)
Recommended upper-air station (two alternative locations are also considered)	UA	17.95	102.68
VIENTIANE	S	17.95	102.57
PAKSE	S	15.12	105.77
LUANG NAMTHA	S	21.05	101.47
SAVANNAKHET	S	16.55	104.65
LUANG-PRABANG	S	19.88	102.13
SAMNEUA	S	20.41	104.06

According to GBON requirements, Lao PDR needs to operate at least a single upper-air station. Since there currently is no upper air station, a completely new infrastructure to build and operate it should be arranged. This would require the corresponding hydrogen production facilities and human capacity activities for the personnel operating the station. The recommended location for this station (Figure 1) would be at the compound of the Vientiane international airport or at the DMH headquarters. Alternatively, depending on security and space constrains at the airport or DMH facilities, a third alternative is proposed at the National University Campus. In addition, the corresponding **SOPs should be developed** in accordance with the aviation authorities to prevent flight disruption. This may require the **generation of a MoU** with the corresponding aviation authorities.

Module 2. GBON Business Model and Institutional Development

This document will describe all the activities considering a **fully public business model**, which is the current recommended approach to enhance the observational capacity of Lao PDR to meet GBON compliance. Owing in part to the structure of government and administration in Lao PDR, it is not realistic or useful to consider any other business model of operation. Private sector firms are active as contractors in providing equipment and resources to DMH, but largely through project-based capital funding provided by donor / development agencies.

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

DMH is under the **Ministry of Natural Resources and Environment (MONRE)** (See http://www.monre.gov.la/) since 2011, and its provincial branches are under the **Provincial Office of Natural Resources and Environment (PONRE)**. MONRE is the responsible ministry for the country's natural resources and environment. MONRE's activities in relation to DMH include the establishment of effective early warning systems for hydrometeorological and geological hazards, the improvement and creation of corresponding monitoring stations for aviation, agriculture and food security sectors, and the dissemination and management of data and information on natural resources and environment. Very importantly, the Ministry oversees the management of assets, finance and DMH budgets and staffing, as well as the collection of fees, service charges and income from natural resource and environmental activities including meteorology and hydrology. MONRE possesses the authority to formulate amendments, laws, technical services and to sign treaties, protocols and MoUs (Memorandum of Understanding) in relation to natural disasters, climate change, meteorology and hydrology.

In additional to MONRE and PONRE at provincial level, there is already an additional smaller structure called **District Office of Natural Resources and Environment (DONRE).** PONRE and DONRE have staff assigned to perform basic maintenance and care of the observational sites. It is to be noted, however, that these personnel do require additional training (see Module 4). It should be understood that PONRE and DONRE are effectively part of the regional and local authority governance structures in Lao PDR.

The **Ministry of Agriculture and Forestry (MAF)** is one of the stakeholders of DMH having been in the past the Ministry where DMH was located. While DMH provides climatological information and forecasts to this ministry, additional agro-meteorological services and more tailored products are desired.

DMH operates and maintains 126 automatic water level stations and 147 manual hydrological stations, and provides standard hydrological data (water level and rainfall) to the **Mekong River Commission**

(MRC), the Ministry of Water Resources, and the dam handling institution. DMH has an operational exchange of water level monitoring data with the **Ministry of Water Resources**.

The **Ministry of Labor and Social Welfare (MLSW)** has the **National Disaster Management Office (NDMO),** which is responsible for the national emergency response activities. DMH has a close cooperation with the NDMO. Through the Emergency Operations Center, EOC, NDMO is responsible to host meetings between the vice minister, as the chair, and hydrologists, forestry managers and other stakeholders to collectively decide on response to hydrometeorological hazards. DMH is participative and informing in these meetings.

It is clear that DMH largely relies on **capacity development entities and development agency funding schemes** to purchase, install and deploy observational capacity. All those are to be considered as relevant organizations for the operation and maintenance of GBON assets however with a limited sustainability component, since such funding and activities is always project-based, not enabling for suitable source of sustained operation and maintenance funding. This large number of players in the country, of course due to their scope of action and aim, has generated a very diverse network that is extremely hard to maintain and operate in a sustainable manner. Especially with the very limited staff capacity existing at DMH and in the corresponding DONRE/PONRE areas. All these actors (UN organizations, Banks, NGOs, etc.) should be considered as key players and seek for a coordination activity to facilitate sustainable approaches.

The role of the Academy is critical as well. There is close collaboration with the **National University of Lao PDR**, which established a Faculty of Water Resources with sub-units and specialization in meteorology and hydrology. The collaboration includes that DMH staff contribute to some of the courses. In addition, the university operates a weather station where students can be trained first-hand. Unfortunately, the station is hardly updated and is not aligned with those most frequently used by DMH.

Given the array of governmental and other organizations relevant for maintaining a used and usable GBON compliant network, the preceding information yields four primary recommendations leveraging already existing international actions in the country:

1. It is critical that additional national effort is invested in **improving the legislative framework enabling larger flexibility to DMH to approach other sources of funding, commercial activities and a general cost-recovery approach.** This action would gear DMH towards more robust and sustained capacity, with enhanced recruitment processes and adequately staffed structure. An update in the legislative framework may initiate as well future discussions with the private sector. To this aim the following action is proposed:
    a. **Advocacy workshop [1 at the start of the investment phase and 1 in the third year]** led by the EW4ALL initiative, as EW4ALL is a government endorsed activity, bringing in the high level national actors (ministerial and department level) and strong international actors, in particular the World Bank (WB), World Meteorological Organisation (WMO), SOFF, and (Climate Risk and Early Warning Systems) CREWS, aiming at positioning the weather service and potentially facilitating modifications in legislative aspects.
2. As also depicted in the sections below, **stakeholder** (those that can benefit from the services, contribute to the services as well as the government structures that should provide the framework for the DMH operations) **and end-user engagement** coordinated activities should occur and are essential to ensure sustainability of the stations and the DMH as a whole. This engagement should include the following specific actions:

a. **Annual stakeholder workshop** (possibly after or consecutively with the aforementioned advocacy workshop), in coordination with existing activities (CREWS; EW4ALL, capacity development projects) if possible, facilitated by the international Development Agency community as a formal catalyzer of the activity with CREWS as main organizer. This workshop should gather key government institutions, intergovernmental agencies and regional economic commissions and UN Agencies and Programmes, aviation sector, dam operators, road and river transport companies and all the potential stakeholders of DMH services. Not only would this workshop serve to strengthen the business model taken and explore usability of the data in the value chain, but it would also: a) open the possibility to explore other potential approaches while in turn explore additional sources of revenue that may add to the long-term sustainability of the network, and b) try to act as a coordination platform among capacity development actors. These workshops can also trigger regional capitalization and act as a platform for engagements of CSOs.

   Therefore, the aim of the multi-day workshop will be a) *engagement of stakeholders national and international*, b) *coordination/capitalization actions of actors and capacity development projects*, c) *engagement with CSOs*.

b. **Bi-lateral discussions** with the other relevant implementing entities in the region, specifically those with projects and/or activities that could be synergized and lead to enhanced optimization of resources.

3. Building on already existing relationships, the establishment of a long-term **formal cooperation with The National University of Lao (MoU) with** additional curricula and international exchanges to potentially attract new students (the recent quota is extremely low) who could be then absorbed by the DMH. This would be supported by the purchasing of an automatic weather station as close as possible as those sustained by SOFF.
4. As result of the first stakeholder workshop, to establish an **internal strategic plan on absorbing projects and infrastructure.** The plan should provide a set of overall strategic guidelines (technical, staff, scope) on projects to be accepted and minimum conditions for those projects to be implemented. This document should be distributed across the actors in the country for awareness. It is critical for sustainability, that station networks are as interoperable, consistent and as harmonic as possible.

2.2. Assessment of potential GBON sub-regional collaboration

Lao PDR and many of the neighboring countries have numerous development activities running each with their specific scope and aims. Therefore, one to one regional coordination is a challenge. Hence, we suggest using existing umbrella activities that will enable the right interfacing to provide, promote and foster regional collaboration. Among them, the following actions are proposed:

1. As stated in section 2.1, **WMO through CREWS** is going to act as coordinator of the annual stakeholders workshop and will as well participate in the high level advocacy workshops. It is suggested that **at least one of these workshops considers the regional components,** bringing in the Mekong River Authority for example, and other international key players that are relevant regionally, as well as the neighboring countries also targeted by SOFF (Cambodia). In addition, the regional CREWS project and the WB as the implementing entity shall interface between Lao PDR and Cambodia activities and, whenever possible, **initiate similar training actions to capitalize effort**.

2. Through the **WMO regional (RA II) office** in Singapore distribution of the activities of SOFF in Lao would be performed to try to establish regional synergies along the way and as the project progresses. This is also particularly relevant in coordination with the EW4ALL initiative, which will have a very similar timeline as the SOFF investment phase activities in Lao. The regional office may serve as high-level facilitator in the planned workshops and collaboration with regional centres including the Tokyo Global Information System Centre, Regional Forecasting Support Centre Ha Noi, ASEAN Specialised Meteorological Centre, Hong Kong Observatory (HKO), Regional Training Centres etc.
3. **WMO Regional Instrument Center at Beijing, CMA**, will be explored to be used as the calibration hub and know-how exchange at the initiation of the project. A cooperation activity will take place to support both the calibration, and the trainings related to calibration and instrumentation. The EW4ALL action plan for Lao includes the generation of a national calibration lab, building on already existing investments performed by FAO on basic calibration equipment (for temperature and pressure). Depending on the evolution of this activity, coordination with Beijing RIC and EW4ALL shall be fostered through SOFF and calibration activities then transferred nationally as appropriate. Should the lab become operational and sufficiently staffed, it could become a regional hub for calibration.
4. **UN permanent representative and coordination office**. Already in the Readiness Phase for SOFF, a visit to the UN permanent representative office was performed. In that occasion, the possibility was offered that the Office could act as liaison with the different UN organizations. Such an action may be beneficial at the time of preparing both the advocacy workshops, where the high-level engagement is key, but also when organising the annual stakeholder workshops.
5. **UN Disaster Risk Reduction Agency.** UNDRR are very active in Lao PDR with a member of staff permanently situated there, and they have led the development of the EW4ALL roadmap in the country. There is close collaboration with the EW4ALL process in neighbouring Cambodia, where it is being led by the World Food Programme.
6. **Mekong River Commission**. Whereas the focus of the MRC work is in hydrology, and specifically the monitoring of the levels of the mainstream of the Mekong, there are close working relationships with DMH. The MRC headquarters and secretariat are located in the capita of Lao, Vientiane.

One aspect to be considered in terms of resource optimization is the costing of the purchase and maintenance of the stations. While this has not been yet explored in detail with all its potential, through the Implementing Entity, a dialogue with the neighboring SOFF countries may occur. Similarly, maintenance and spares could be jointly addressed with adaptations to the established plan. This is however, a challenge since usually procurement is performed at country level, and there are also considerations of compatibility of new equipment with existing data collection and management systems operating in each country. There would be a potential benefit to centralizing this action via the SOFF secretariat or under a WMO initiative as a single PoC with the vendors.

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

Given the country situation, the legislative framework DMH sits in and the funding approaches currently existing for the institution, it is **at this stage advisable and pragmatic to operate under a fully public business model** and therefore the government having full control of the services, observational capacity and operations. While the establishment of cooperation with the private sector, in the form of partnerships, is very interesting, it should be considered at later stages, when DMH has a more consistent and robust operational system that enables it to offer potential benefits and services

for the private sector as well as for DMH itself. Currently, sustainability is better guaranteed if a continuation of the current business model is maintained, with the provision that increased government funding for O&M will be imperative. In such an approach, the DMH would be responsible for the operations, maintenance and replacement of the equipment throughout the life cycle of the stations. The option of outsourcing the operation and maintenance of the GBON network will only be viable long as external funding is available to support this; DMH have almost no budget for O&M activities, and certainly no budget to purchase data under a private-sector supply business model. Without continued external funding for O&M activities connected to the GBON, from SOFF or other development agency sources, it is unlikely that the network operation can be sustained in accordance with WMO's specifications.

The current legislation under which DMH operates makes no allowance for private-sector engagement. Also, any income which is received in respect of meteorological services (e.g. from civil aviation) goes straight back to the central government and is not retained within DMH. Any move towards meaningful public-private engagement in meteorology in Lao, or even the commencement of commercially-based activities by DMH, will need to be preceded by developments to the legislative framework under which it operates. The NCP includes provision for lobbying activities to explore, with government officials, the possibilities of evolving towards a more public-private partnership approach, but this will need to be done with the full approval of the government of Lao and is not expected to be something that can be achieved quickly.

However, it is well recognized, that the existing legal framework, limiting severely cost-recovery approaches and revenue from external sources, and at the same time fully controlling budget and personnel, adds an extra level of risk to this business model approach that needs careful consideration (Table 4).

Table 4: Risks of the proposed business model

Risk	**Impact**	**Likelihood**
Financial risk – changing funding based on political governance changes, leading to limited or discontinued budget and resources	High	Low to Medium. Government funding is already very low and effectively restricted to payment of staff salaries.
Sustainability challenges – low flexibility on adapting to changing circumstances or if political forces drive into other directions	High	Medium – due to full control by government sources.
Market competition – potential competition with the private sector and leading to distorted markets	Low	Low – since DMH is still the mandated institution providing weather information to the main government stakeholders and there is no private sector operating weather information in the region.
Inadequate quality of the services – due to limited resources	High	Medium to high due to lack of Human resources (both in terms of staff numbers and staff capabilities) and extremely diverse infrastructure.

Low management competence – due to lack of personnel or corresponding training to manage a larger and more complex service	High	Medium. Currently significant lack of qualified personnel with too few senior managers carrying too many responsibilities.
Limited legal frameworks and data policies in place that limit the exploitation of the new capacities	High	High – there is already a limitation on how third-party funding can be used.
Data gaps usually due to "operate to fail" approach triggered by constrained resources	Medium	Medium – no assurance of sustained funding from the government to ensure adequate staff for maintenance and operations.
Ineffective monitoring and tracking of the network and its related purchases etc.	Medium	Low – the peer advisor will act as a supporting entity to these matters.
Continuation of installation and operation of diverse non-harmonized and non-interfaced networks	High	High – this risk already exists and the public business model, unless there is an internal strategic plan aiming at future harmonization and limitation of deployment of diverse stations, does not prevent this risk.

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

There are many projects operating in the country (Table 5) that relate directly or indirectly to observational capacity.

There is a multi-year activity by the WB that is worth mentioning further in detail since it will be used for capitalization and enhanced cost-benefit approaches. The Southeast Asia Disaster Risk Management project, of **SEADRM**, project, initiated in 2017 and concluding in 2025, includes a component on Hydromet Modernization and Early Warning Systems (EWSs). In this activity, delivery of weather data is included.

In addition, the project *Reinforcing the capacities of meteorological and hydrological services and enhancing the early warning systems in Cambodia and Lao People's Democratic Republic* (**CREWS** Cambodia and Lao PDR) should as well cater for enhancing the capacities of national and regional stakeholders and institutions to provide hydromet, early action, and response services to ensure that vulnerable populations in Cambodia and Lao PDR are reached through effective and inclusive risk-informed early warning services. Coordination with CREWS is already considered in SOFF to capitalize in any further activities (link to workshops as described above).

From the WB activities in the country, SOFF will be able to benefit from the following:

1. **Data Collection and Management** - the data collection ad management system from MESSIR-NEO software, provided by Corobor/Campbell Scientific France (CSF) will be used as interfacing with the SOFF stations and will make use if needed of the Climate Database installed, MESSIR-CLIM, from the same provided - No additional costed action will be performed on this topic.

2. **Training activities** will as well occur. However, trainings will be coordinated also with CREWS and EW4ALL in a synergetic approach to optimize resources. SOFF will partially cost the trainings, with special focus on QA/QC

The **EW4All** Action Plan has several actions related to observational capacity and the required surrounding infrastructure and human capacity development under Pillar 2. Cooperation with EW4All is envisaged as detailed above and in section 2.1 and 2.2. Similarly, CREWS is a key component of this investment plan, with participation and coordination of workshops and training activities.

It is to be noted that the stations selected all come from different capacity development projects. Therefore, this investment plan de facto capitalizes already on existing infrastructure and investment through other activities in the country.

As noted earlier in the NCP, the provision of observing network infrastructure to DMH through many different development agency projects has led to a challenge in integrating data from all of these different networks and the SEADRM project has a special focus on addressing these challenges. DMH lack a clear strategy on how to incorporate infrastructure provided from many different projects into an integrated meteorological and hydrological observing network. For that reason, the work envisaged under the NCP include an explicit activity to develop a Strategic Plan on sustainably absorbing new infrastructure into DMH operations.

Table 5: ongoing and past projects that relate to capacity building.

Project Name	Donor	Status
Improve Early Warning System for Disaster Response in Lao PDR	Korea	Ongoing
Southeast Asia Disaster Risk Management Project	WB	Ongoing
Reinforcing the capacities of hydro-meteorological services and enhancing early warning systems in Cambodia and Lao PDR	WMO, WB and UNDRR	Ongoing
Enhanced Severe Weather Response Utilizing an Integrated Typhoon Monitoring and Forecasting Platform in Lao PDR	Korea-KMA	Ongoing
Establishment of Climate Change Adaptive Flood Forecasting and Warning System (FFWS) in Xe Banghieng, Savannakhet Province, Lao PDR	Korea-MoE-K Water	Ongoing
Establishment of Effective Water Resources Management System and Enhancement of Disaster Response Capabilities for Nam Ngum	Korea-KOICA	Ongoing
Construction of Sub-Centers for the Operation and Maintenance of the Lao National Water Resources Information and Data Center Project	China	Ongoing
Lao National Earthquake Data and Information Center Project	China	Ongoing
Mekong Integrated Water Resources Management Project	WB	Completed
Master Plan on Nationwide Flood Forecasting and Early Warning System in Lao PDR	Korea	Completed
Strengthening Agro-Climate Monitoring and Information System (SAMIS) to improve adaptation to climate change and food security in Lao PDR	Food and Agriculture Organisation (FAO), GEF	Completed

The Project for Establishment of Weather Disaster Monitoring System	JICA	Completed
Lao National Water Resources Data and Information Center Project	China	Completed
Flood and Drought Risk Management and Mitigation Project	ADB	Completed

2.5. Review of the national legislation of relevance for GBON

In 2017, the Law on Meteorology and Hydrology was established (https://faolex.fao.org/docs/pdf/lao184237.pdf - in an unofficial translation) In more than 60 articles, this law delineates the basic regulations for the meteorological and hydrological activities in the country, and therefore establishes the baseline for the activities of DMH together with the Decree on the management of meteorological and hydrological stations. The law and decree outline the main national hydrometeorological strategic aspects, the relations with regional and international actors, the monitoring capacity of the country and additional relevant aspects on early warning systems. It therefore sets the mandate of DMH following the current standards of NHMS. However, while the law sets the initial steps towards the development of an actionable strategy, to date there is no coordinated action plan on the execution of the law.

In addition to the aforementioned law, there are several national policies and plans in place, especially in the area of disaster risk management and reduction that are relevant for the activities of the Lao PDR NMHS. Among them to briefly highlight:

1. Prime Minister's Decree No 158 (1999), No 373 (2011) and No 220/PM (2013) that set the ground for disaster management policies, generates the corresponding National Disaster Management Committees and National Disaster Prevention and Control Committee, and establish the Department of Disaster Management and Climate Change under MONRE.
2. Prime Minister's Decree on Climate Change 321/2019, outlining mitigation and adaptation strategies.
3. The National Strategy for Disaster Risk Reduction (NSDRR) 2021-2030 and the Five-Year Labor and Social Welfare Development Plan from 2021 to 2025 which provide the vision and the main strategies to reach the NSDRR goals and the key points to strengthen prevention control and recovery aspects.

Detailed descriptions of existing or relevant laws, policies and strategies can be found in the document "Assessment of Capacities of the Department of Meteorology and Hydrology (DMH), Lao PDR" (March 2023, CREWS Cambodia and Lao, WMO, RIMES), Appendix D.

The DMH has no strategic plan currently in place. The agency is, however, expected to work on a new strategy plan in the near future.

DMH mandate is to provide the national meteorological and hydrological services as well as the monitoring of earthquakes in the country. The main responsibilities are:

1. Assess, develop, operate and maintain monitoring stations for meteorology, hydrology, agricultural meteorology, aviation and earthquakes.
2. Monitor, collect and analyze hydro-met data, aviation meteorology and seismic data

3. Coordinate with MONRE and related sectoral agencies in drafting, updating and implementing laws, decrees, regulations, policies, strategies, guidelines and programs related to meteorology, hydrology, earthquakes and early warning systems.
4. Coordinate with relevant stakeholders in organizing workshops, seminars, training on meteorology, hydrology, earthquakes and early warning.

The current legislative framework sustains, in theory, the operations and maintenance of the observational capacity of the country; however, it lacks the flexibility in terms of staffing, and provides no funding for operation and Maintenance activities, both of which are essential components for any sustainable and robust operation of a weather and hydrological service.

The implementing Entity under SOFF for Lao PDR is the World Bank, which has long experience of supporting projects in that country, including projects in the hydro-met sphere. Under World Bank protocols and regulations, monies provided under SOFF would be managed as "Recipient-Executed Trust Funds", which means that the procurement processes would be caried out by a project management unit comprised of Lao government officials, working under the supervision of procurement and technical specialists from the World Bank. Budgets for items to be purchased internationally include the necessary shipping costs and customs charges. The team of Bank experts work to ensure that all procurement exercises are conducted in a fair, open and transparent manner, and they also keep a close watch on the budgets to ensure that all monies are properly accounted for. The experience on the bank in Lao includes supporting many multi-million dollar civil works projects as well as (generally much smaller) projects in hydro-met.

The main overall recommendation is to make all possible efforts, in coordination with the related ministries, to increase the operational funding available to DMH, either through stronger direct government support or through the establishment of greater flexibility in the potential funding sources for DMH and open the door to better engagement with third-party funding and the private sector. In addition, DMH requires better visibility and a stronger role as an essential and critical infrastructure for the country, especially in view of the challenges of more severe weather events consequent upon climate change. The strengthening of the institutional mandate will become critical for a sustainable approach to network maintenance and operation in addition to the well-being of the institution itself.

While steering the political agenda and modifying legislative frameworks as a whole is beyond the scope of SOFF, advocacy towards the role of a modern and robust NHMS should be performed. In order to inform and trigger the needed dialogues, it is recommended to make use of the planned **stakeholder engagement workshops** (as described in Module 2.1) to include an item action at policy level and advocate for a better a better positioning of DMH nationally and among the relevant stakeholders. This should be supported by bi-lateral engagements with decision-making bodies (better exploitation of the relationship with Emergency Operations Center, EOC, the National Disaster Management Office (NDMO) seems essential for positioning). The Peer Advisor shall as well facilitate interaction with the international community to identify best practices and improve the visibility of the DMH in the international community. This may as well be facilitated by close cooperation with the EW4All initiative and the permanent UN representative and roadmap (refer to specific section of the action plan)

Module 3. GBON Infrastructure Development

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

In order to achieve GBON compliance, actions will be taken to **upgrade 6 surface stations** (Figure1, Tables 2 and 3), and the deployment of **one upper air station** (manual) at the Wattay International Airport or any of the two alternative locations as stated above. It is also proposed, as a measure to improve the sustainability of the observing network, to engage with the National University of Lao. This institution provides key training in meteorology and providing support to their technical capacity and training facilities will help to ensure a pipeline of well-trained staff for DMH, and also allow the University to provide refresher training to PONRE and DONRE staff who provide "Level One" maintenance to the DMH surface observations network.

Given that many of the staff that maintain and operate the meteorological observation network in Lao are not under the direct control of DMH but are PONRE and DONRE staff, it will be critically important to develop SOPs for observational practices and for station maintenance activities, and to train the relevant staff in these SOPs. This requirement will be reflected in the budgeted activities contained in the Investment Plan Funding Request.

It is to be noted that in any of the activities the following need to be considered:

- **Security and safety** – while the political situation in Lao PDR is currently not complex, safety of the personnel to maintain those stations in a harsh climate should be contemplated. Poor quality of roads and transport infrastructure add to these issues.
- **Security of Station Infrastructure –** theft and vandalism of hydromet equipment has not been a significant problem in Lao. In any case all of the observing infrastructure at the GBON locations is protected by security fencing and some of this infrastructure in anyway situated in safe and supervised locations, such as in regional airports.
- **Maintenance and calibration** – stations outside the capital are not always easy to reach, especially when maintenance is needed that requires personnel from Vientiane headquarters to fly in. It results in costly efforts to keep the stations running.
- **Power Supply and Communications** – intermittent outages in electrical power supply are an unfortunate fact of life in Lao. All GBON stations will be provided with a battery back-up and data loggers can retain data for future downloads but continuity of observations is at risk form external factors. The addition of solar panels will be considered to mitigate this risk. Maintaining communication channels can also be a challenge; this can be addressed through the provision of back-up communication procedures but, as with the intermittent power supply, it will be necessary to build in network resilience to ensure reliability of data flow.

However, the stations for SOFF, have been selected with sustainability in mind so that, in addition to a GBON-compliant distribution across the country, they have accessibility and basic infrastructure, and maintenance personnel allocated to them via PONRE/DONRE.

It is to be noted that the budget associated to this NCP should consider not only the equipment per se but all the associated costs related to purchase, operations including data transfer and communication costs, maintenance and replacement as well as all the related indirect costs to its operability (vehicles, transport for maintenance, ICT, licensing, spare parts and common equipment, training, management and administrative workload among others) for the whole extent of the life cycle of the network (and therefore considering the life cycles of the stations themselves, which should be 12-15 years). Staff salary costs must, of course, continue to be paid directly by the Lao government.

It will be suggested that the **following recruitments are made by DMH and MONRE** to ensure sustainability of the GBON and the associated technology:

1. Technical and maintenance staff for station maintenance – 3
2. ICT personnel take care of the newly installed ICT infrastructure -2
3. Data scientist to exploit data management system – 2
4. Forecasters –the number of forecasting staff should be increased from 10 to 15-20 to ensure that there is an appropriate level of human resources to provide warning services at night and truly achieve 24/7.

This national contribution plan considers a period of 4 years with the following activities:

YEAR 1

Aim: the aim of the first year is to perform the upgrade of the 6 GBON compliant stations with new and harmonized dataloggers. This phase should ensure that the stations all operate with a full complement of sensors, and are able to communicate to headquarters. Another aim for the first year is the positioning and advocacy of DMH and signature of MoUs as required. During this phase, the following actions will be necessary:

<u>Technical components:</u>

1. Procure update of the stations – revision of real status of the stations, technical specifications of the data loggers, procure of the data loggers under IE and peer advisor supervision.
2. Procure one complete station for the university
3. Purchase of a generator for the server
4. Feasibility and technical study for the upper air station – requirements, energy production, etc.
5. Initiate discussions on a calibration-training plan with the RIC from Beijing.

<u>Human capacity development:</u>

1. Initiate a training collaboration between the National University of Lao specially related to the new station to be deployed there. Generation of the MoU.
2. Coordinate with CREWS, WB and EW4ALL – the training plan following module.
3. Establish a training plan on calibration and instrumentation with Beijing RIC.

<u>Governance and stakeholder engagement:</u>

1. MoU with the university
2. MoU with the Wattay International Airport authorities (if this is the selected location of the three).
3. First advocacy workshop – generation of an internal strategy of capacity development projects, concept note of “role of the NHMS and their basic needs” and if possible a roadmap for utilization of CSO capabilities.
4. First stakeholder workshop.
5. Gender plan

YEAR 2

Aim: The primary objective of this year is to ensure all the 6 surface stations are operationally transmitting to headquarters and internationally. At the same time, the activities for the human capacity development should also be initiated. Last, but not least, the work for the upper air station, including procurement, should be commenced. During this phase, the following actions are envisaged:

Technical components:

1. Revision of operations of the operating AWS so far, manuals for operation, checklists etc. *Milestone – stations operating and transmitting for one year.*
2. Installation and crosscheck of the generator for the server for data exchange and data collection.
3. Preparation of the location and infrastructure for the upper air stations.
4. Initiation of the procurement for upper air.

Human capacity development:

1. Perform first tranche of trainings at headquarters.
2. Perform the first instrumentation training at RIC in Beijing with a maximum of 5 attendees – generation of outcome material and SOPs + Checklists

Governance and stakeholder engagement:

1. Stakeholder engagement – build on the value chain concept. Initiate more discussions on data usability and data needs.

YEAR 3

Aim: This year should focus on the installation of all the upper air system and initiate tests. In addition, this year should be a crosscheck of data-transfer of the six stations and the human capacity development activities. It is critical in this year that the advocacy workshop brings a focus to the upcoming evolution to the compliance phase and that the role of NHMS is strengthened in preparation for this. The following activities are envisaged:

Technical components:

1. Revision of operations of AWS so far with the inclusion of a calibration approach with the manual data, revision and formalisation of all SOPs.
2. Maintenance as appropriate of the existing 6 sites and that for the university.
3. Acquisition of spare parts required for a full capacity network with a life cycle of 10 years.
4. Installation of upper air infrastructure and perform first tests also on data acquisition

Human capacity development:

1. Perform training activities at a selected north and south locations for PONRE/DONRE staff that are in charge of the stations. Focus on level 1 maintenance. SOPs, Checklists generated.
2. Perform management training with visits to WMO, GeoSphere and CMA.

Governance and stakeholder engagement:

3. Try to establish a long-term cooperation plan with IEs, UN actors and other stakeholders to maintain sustained third-party funding for operations or further development.
4. Engage internationally and seek interest from the private sector to aim at initiating PPE approaches.
5. Second advocacy workshop – tracking of legislative situation, option to flexibilise procurement and cost-recovery approaches, preparation for compliance phase.
6. Third stakeholder workshop – aiming at strengthening cooperation and boost sustainability of the stations by data usage and exploitation.

YEAR 4

Aim: This year should serve to ensure all the stations, including upper air, are operating normally and exchanging the data internationally while having, at the same time, staff capacity (both numbers of staff and their training) at the appropriate technical levels. Last, but not least, this year should see the performance of all the actions needed to enter the compliance phase.

Technical components:

1. Revision of operations all the sites and adaptations of SOPs as needed.
2. Maintenance as appropriate.
3. Technical and budgeted roadmap for compliance phase
4. Purchase spare parts as required.

Human capacity development:

1. Continue with human capacity trainings as planned.

Governance and stakeholder engagement:

1. Stakeholder workshop - Joint plan with stakeholders on entering compliance phase
2. Further explore PPE.
3. Revision of gender plan.
4. Revision of the implementation strategy for coordinated capacity development projects.

Summary - the investments should include:

- Upgrading of 6 stations – in particular data logger that interface properly with the existing ICT and data management infrastructure
- 1 complete new station to be installed at the National University of Lao for training and educational purposes.
- 1 complete upper air station and all the related infrastructure. This includes: building near the airport or the alternative location (DMH facilities or University campus) and related work, hydrogen generation and storage equipment, ground ICT infrastructure at the DMH offices at the international airport, all consumable parts (sondes, balloons, etc.)
- 1 power generator for the servers to ensure robust data collection and transmission following the GBON requirements.

All procurement should follow the technical specifications as specified in the GBON Tender Specifications for AWS (TT_GBON Deliverable 6.1, V1.1.9.VI.2022, TT_GBON Operating Plan)

3.2. Design of the ICT infrastructure and services

The Information and Communication technology (ICT) infrastructure for a meteorological observational network is crucial for its operation and usability. It is also important for sustainability, that ICT is not changed or varied frequently unless updates are required for enhanced operations. Structure and design should be as robust as possible and as constant as possible to prevent discontinuation of data exchange, data usage and, in brief, prevent the normal and continuous operations of the weather service.

In the proposed NCP it is recommended that the already existing ICT infrastructure implemented recently at DMH (Figure 2) under the SEADRM project is further capitalized in SOFF. The infrastructure is organized around the Corobor/Campbell Scientific France (CSF) systems which are widely used by the international community. The system is already able to operate in WIS and will likely be updated to WIS2 soon. While an early implementation of WIS2 (or WIS2 in a box) would be the ideal approach,

it is currently better to use an existing system and wait for WIS2 to be included than deploy a complete new and parallel ICT infrastructure; however if necessary the "WIS2 in a box" solution can be added as a bolt-on to the existing system in the short term pending the full integration of WIS2 capabilities within the CSF software. In addition, should WIS2 become an absolute must, through CREWS an interface could be attempted. The system relies on a local cluster and updated connectivity to facilitate usage. However, reliability of power is a big issue since the back-up generators for the server room are not working adequately. It is recommended that an action of **refurbishing the generators is performed under the SOFF umbrella.**

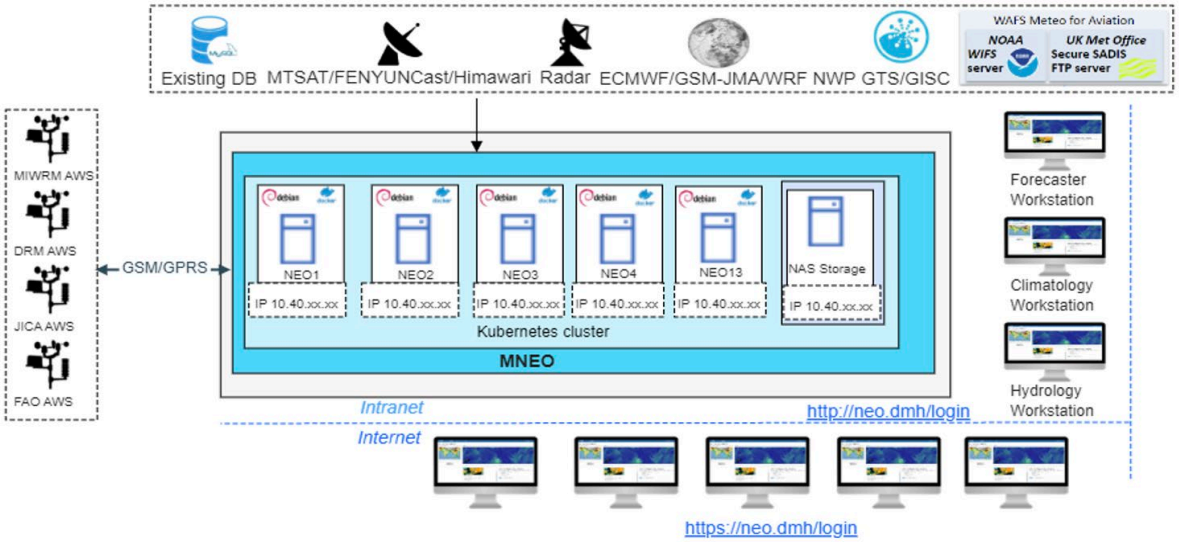

Figure 2: ICT architecture at DMH

3.3. Design the data management system

Similarly to the ICT infrastructure. It is advisable to capitalize on existing initiatives to facilitate interoperability, robustness and, above all, sustainability. Campbell Scientific France (formerly Corobor) is installing a full data integration system for DMH Lao, again under the World Bank's SEA DRM programme, scheduled for completion in June 2025. This system consists of the following six modules (Figure 3):

- **Automatic Message Switching System (Neo-DPS).** This is the module that manages all of the data collection, conversions to WMO-standard formats, and switching of messages to relevant other sites and systems. It also manages the connection to the GTS/WIS.
- **Central Data Hub.** This part of the integration system provides the forecasting sub-systems access to all required data sources, including but not limited to point observations, satellite data, radar data and numerical weather prediction data from WMO centers. All the data will be collected, quality controlled and stored in CDH. Inputs to the forecasting sub-systems are read from the CDH and outputs of the systems will be stored in CDH.
- **Forecasting Support Systems (Neo-WFS).** This system supports meteorological forecasting by automatic processing of model data, and also by providing the meteorologists access to all required data, analytical and diagnostic tools and functionalities to create synoptic maps and weather forecasts.
- **Online Platform for Production and Dissemination.** This component of the integration system provides configurable dashboards for forecasters to follow their forecasting procedures, to

create, approve and manage bulletins and other forecast and warning products. It also provides publicly accessible endpoints to external users for data dissemination.

- **Climate Data Management System (Neo-CLIM).** The Climate Data Management System shall ensure collection and centralized storage of big amount of climate data, data quality control and easy data management. It includes tools for climate data analysis and statistics in order to create customized climate products for internal and external use.
- **Central Authentication and Authorisation System.** This provides the facility for the system administrator to authorize each user and to control to access each system module or data type based on the user's role.

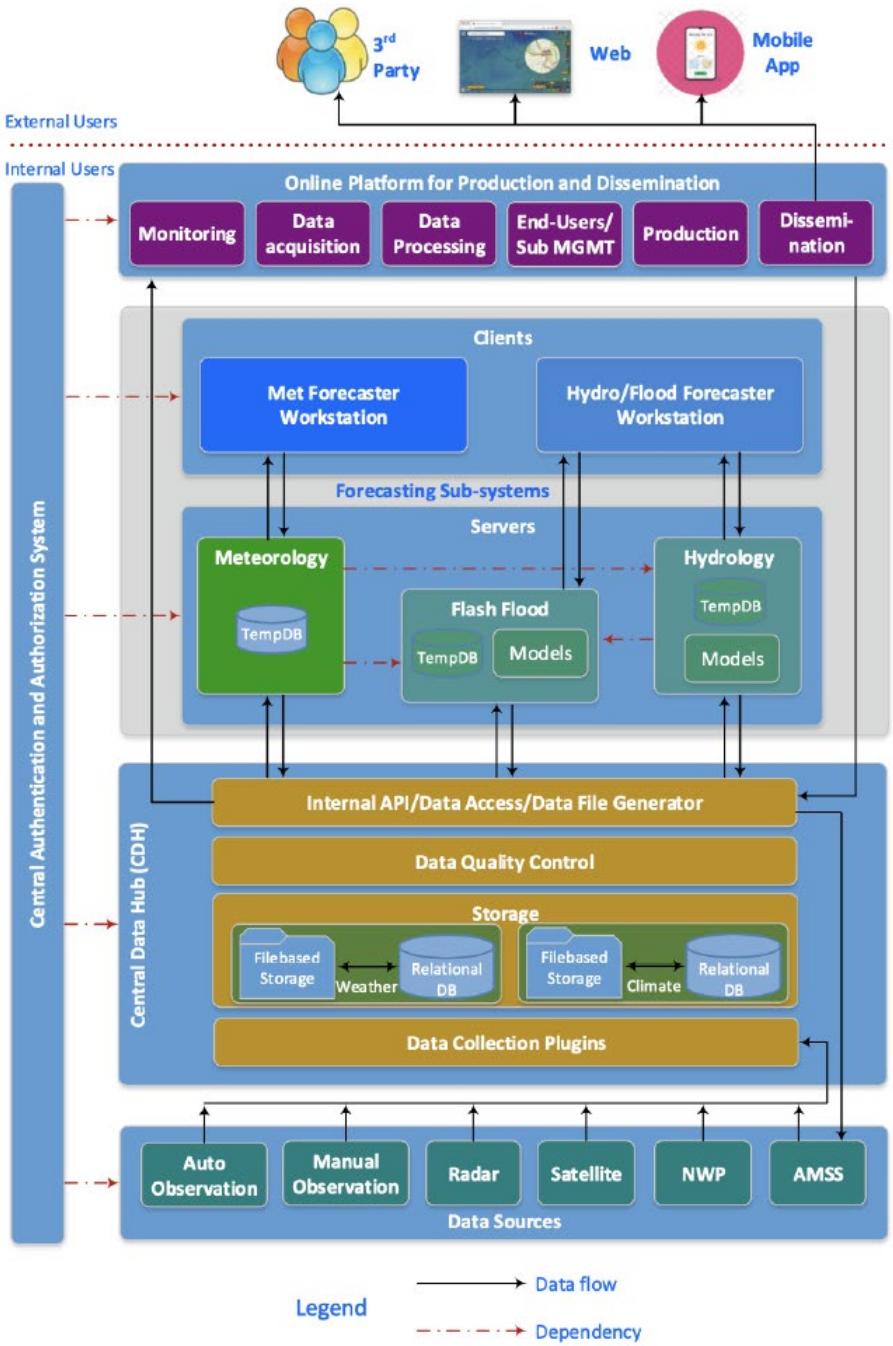

Figure 3: software system for data integration and forecasting as being implemented in the SEADRM project.

3.4. Environmental and sustainability considerations

Environmental considerations will be included in the procurement process, as a selection criterion for suppliers. Moreover, the local caretakers, using basic tools, will perform the basic and continuous maintenance of the surface stations. It will allow minimizing the need for visits of the technical staff. Should the training and human capacity development plan be successful, then there may be a minimization of the technical visits to the stations, with the two-level approach to maintenance, therefore reducing the environmental effects of trips to remote stations (likely including an internal flight).

Module 4. GBON Human Capacity Development Module

4.1. Assessment of human capacity gaps

DMH has 56 employees across its headquarters and the office at the international airport (Figure 4). While this may seem like a substantial number, it is insufficient to manage all the needed activities of a functioning NHMS and its value chain, including climate services, weather and hydrologic monitoring, and specialized services for specific users. Most staff members hold a BA/BS degree and require further capacity building. For the successful implementation of SOFF activities, the workforce must expand, should the quotas by the government flexibilise and a comprehensive training and development plan is needed to strengthen the skills of staff, enhancing their technical expertise to meet operational demands.

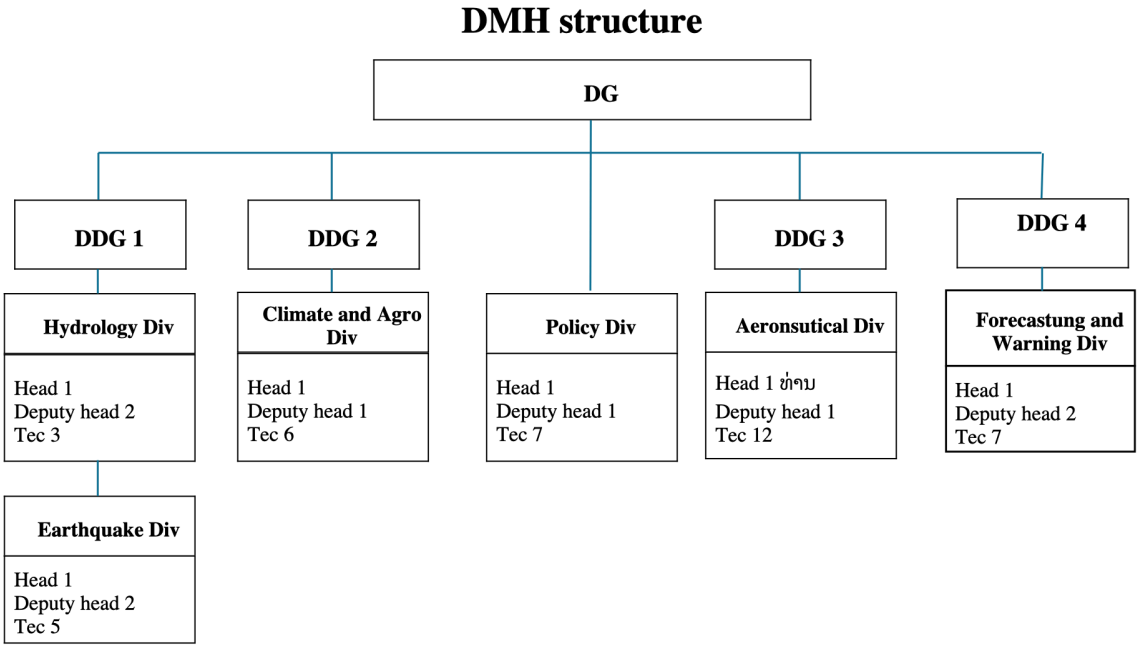

Figure 4: current diagram and staff personnel of DMH

Table 6. DMH staff educational levels

Level of Education	Male	Female	Total
PhD	2	1	3
MS/MA Graduate	8	1	9
BS/BA Graduate	9	15	24
Diploma	5	8	13
Certificate	4	2	6

While the university may be a source of additional staff members, the limited quotas and the lack of attractive salaries do not facilitate an inflow of qualified personnel. In addition, there is no organized exchange program in place to facilitate external training of the staff members. Finally, the numerous projects, funded by international development agencies and similar, which are offered to the DMH would require the right managerial strength not only from a technical point of view but also strategically to guide those capacity development projects to what is really needed in the context of an integrated operational system.

4.2. Design capacity development activities for technical staff

The training for technical capacity development of the staff needs to be properly planned with existing initiatives and, specially, should aim at coordination with the regional CREWS-funded project as much as possible. While many of the ongoing initiatives focus on steps further along the value chain (from warnings, to impact based forecasting, etc.) SOFF should reinforce the following areas of knowledge:

- **Weather observations and weather parameters:** this training should offer the fundamentals to move towards well-maintained and sustainable station operations. It should provide a basic understanding of the siting criteria for observing stations, including WMO CIMO standards, and give a basic understanding of the parameters that are critical, their interrelations and basic meteorological background information with a focus on observations and guidelines, functionality and fundamental principles, maintenance of mechanical and electronic components (rules and procedures), data collection, storage (data logger) and general concepts of data transfer.
- **Station components and maintenance:** conducting weather observations, maintenance and operations of stations both manual and automatic. These trainings should also be offered to those individuals located at or near the station location for easier maintenance and operations. Additional technicians should be recruited based on this training, with a minimum of 2 to cover the 6 stations targeted in GBON. The operations and maintenance should also include the managerial aspects on generation of SOPs and checklists. It will be very important to highlight and focus on in-situ maintenance, and routine maintenance of mechanic and electronic components. On this regard, it is very important to initiate **a two-level maintenance approach** whereby basic maintenance (Level 1) can be performed on-site by the operators and caretakers of the sites locally. Level 2 would require personnel from headquarters to travel to that specific site. – *Therefore the trainings should not only be performed in Vientiane but at least in two additional sites one in the north and one in the south.*
- **Calibration:** it is important to train the technicians in this technical field as well. Considering that some conventional weather stations still are in use, the training should cover the

calibration of both traditional (manual) instruments and electronic-based instruments and sensors. This training should be performed in cooperation with the WMO Regional Instrument Centre of Beijing (CMA) and should include a visit to this center. It is particularly relevant that the role of calibration is explained and embedded into procedures downstream and in all maintenance aspects that will require this knowledge.

- **IT, ICT and potentially HPC or cloud services**: It is crucial in SOFF that data is exchanged internationally on a routine hourly basis. This requires that the servers operate properly and that all related to ICT infrastructure is resourced to be as operationally robust as possible. For this, additional trained ICT personnel will be needed. In any case, training on all aspects related to communication, server operations and similar services is needed. This training should based on the data management and ICT infrastructure organized by the SEADRM project but should as well include the fundamentals of Ubuntu (Linux), Docker and Python. The training should work on configuration and administration of hardware (server, networks, clients) and software (operative systems, databases, communication)
- **Data transfer, WIS1 and WIS2** Specific training should be performed as well on this aspect, following the current data management system but also generally on WIS2 in a box, possibly through the CREWS-funded project.
- **Best practices in data quality and quality management:** This should support the ICT training to enable is the development of a quality management system in-house that can be used operationally, making use of the implemented tools. It should include the generation of specific data management QA/QC protocols.

Note that the training should consider as well the following:

1. The link with the National University of Lao and joint courses especially in view of the station funded by SOFF.
2. The training should be offered as well to the DONRE/PONRE members that should operate and maintain the GBON stations specially for level 1 maintenance. Level 2 is to be performed by staff based at DMH headquarters.
3. The training should capitalize on regional approaches as much as possible.
4. The training should be provided in Lao and in some instances in English. Translation services will need to be included
5. All training should result in material and checklists to be used upon completion of the courses.

4.3. Design capacity development activities for senior management

Strong management is essential in all NMHSs, especially in those NHMSs that are the target of various international projects and initiatives. In such a complex environment it is necessary that management is supported and that delegation and empowerment of staff at all levels is fostered and encouraged for better distribution of the managerial workload. As stated elsewhere in this document, it is important to have internal strategic goals so that senior management would be able to provide clear direction and lead effectively without losing focus among the many tasks and stakeholders. It is also important to take a realistic approach to adapt to the real needs, current and future, of the institution and provide DMH management with the right managerial tools and training to succeed. The capacity development activities at this stage should focus on:

- Developing leadership skills, including strategic thinking, decision-making and communication.
- Change management, especially in the evolving nature of SOFF, it is important to gather the skills to lead and manage change within the organization and its staff members.

- Financial training and financial management and budgeting. Managers need to familiarize themselves with financial statements, resource allocation and the financial implications of the decisions taken.
- Project management training, measurement and evaluation through the definition of key performance indicators to assess effectiveness of the activities.
- Strategic planning and regional networking, especially within the UN arena to develop action plans that have cross-sectorial approaches and support the optimization of networks to achieve strategic national objectives.
- Enhancement of communication skills to become effective spokespersons for the organization, establish the high-level dialogues required, and drive decisions towards the organization's strategies.
- Technology and digital literacy, to leverage technologies as required.
- Language training of lower levels may also be needed. Empowering the staff at the second and third levels below senior management, in such a landscape of international organisations, requires a good level of the English language.

The training plan should include the following specific components:

- **An exchange to benchmark with another well-established weather service:** Taking advantage of the collaboration with the Peer Advisors institution to organize a visit to WMO, GeoSphere Austria and CMA facilities to exchange best practices.
- **Exchange with WMO ETR** to identify training activities on management. Potentially participate in Senior Management Capacity Building courses.
- **Training on project management**: identify a course (remote) to establish basic knowledge of administrative skills for project management and KPIs.
- **Financing training:** to gather the expertise and tools to handle costing of projects, budgets, and basic day-to-day operations of a weather service.

4.4. Gender and CSOs Considerations

It is to be noted that DMH has already a gender quota close to 50% and even has the main role of the PR covered by a woman. This proves that, while reinforcement and positive discrimination towards improved gender balance is still required, especially in long term planning of the institution, already a good initial condition exists. **A gender plan** will be developed as an integral part of the strategy of DMH that should be considered at the time of filling in the staff quotas and procurement processes, and which will be monitored throughout the length of the investment phase. It is however to highlight that DMH currently has a good gender balance approach, and this is not expected to change

It is important to demonstrate gender balance by doing. At the time of organization of workshops, moderation and coordination, percentages of 50% will as well be always encouraged and made visible. Both at Implementing Entity and Peer Advisor levels this equity will be reinforced at all steps of SOFF related activities.

Weather and climate disasters disproportionally affect those most vulnerable groups, with gender, age, and illness as exacerbating factors to the impact. Gender perspectives and civil society involvement must be integrated across all levels and in any action performed, especially those related to government institutions such as a national meteorological and hydrological service. A participatory approach involving Civil Society Organizations (CSOs), including NGOs and community-based groups, is essential to ensure gender and vulnerability considerations are included right from the start. Moreover, the close link of the CSOs with the society makes them particularly important in weather

and disaster related information since they can act as an already functioning mechanism to reach out to those most vulnerable communities.

To this regard, Lao PDR has an established network of Civil Society Organizations (CSOs) dedicated to the promotion of sustainable development goals (SDGs) and National Socio-economic Development Plan that has previously collaborated with the DMH and collaborates as well with the Asian Disaster Preparedness Center. This network, the Lao Civil Society Organizations Platform (https://laocso.org) aims at providing a platform for collaboration and dialogue among stakeholders and to serve as a source of information for the Lao civil society. Such an organisation may become a speaker of the SOFF activities, specially to the local communities, whereas, at the same time, can as well support advocacy actions towards the importance of a weather service with robust and sustained observational capacity. To this aim, **LaoCSO and other relevant CSOs will be invited in the annual stakeholder engagement and establish a dialogue platform for the CSOs** addressing gender opportunities and vulnerable groups while at the same time advocating for the rights of marginalized groups and more vulnerable individuals. The outcomes of the **workshops will be included as formal recommendations for the SOFF activities and be used as guidelines to promote equity and equality.**

Module 5. Risk Management Framework

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

Lao does not have a risk management framework in place, but a proper management of risks is required during and after the SOFF investment phase to prevent potential setbacks and to adapt as much as possible to an emerging risk. In addition, understanding the role of the Implementing Entity, the risk management should follow the internal approaches existing at IE and that will facilitate the execution of the investment phase.

The table (Table 7) below describes the most critical risks that may be encountered to be added to those presented in the business model selection.

Table 7: Risks that may be encountered to be added to those presented in the business model selection.

Risk	***Risk level***	***Likelihood***	***Impact***	***Risk Mitigation Measures***
Non-compliance with fiduciary and procurement standards in some SOFF activities	*Medium*	*Possible*	*Major*	*Support by IE.*
SOFF-funded investments cause environmental or social impacts	*Low*	*Unlikely*	*Minor*	*No major impact expected here.*
NMHS staff depart after being trained	*High*	*Likely*	*Major*	*Adequate payment, equipment and working space needed.*

Slow implementation and delays in procurement, installation and capacity building activities	*High*	*Likely*	*Major*	*Strong support by IE, realistic planning needed.*
After the conclusion of the Investment phase, GBON data are not collected or shared or are shared of insufficient quality	*Medium*	*Possible*	*Major*	*During Investment phase to draft a compliance and sustainability plan in line with an internal strategy to approach capacity development projects*
Destruction or theft of SOFF-financed equipment and infrastructure	*High*	*Likely*	*Major*	*Station deployment close to populated areas and existing infrastructure. Ensure availability of caretakers who are paid regularly; strengthen DONRE/PONRE cooperation*
Countries cannot make optimal use of data, including accessing or using improved forecasts products from the Global Producing Centers throughout the hydromet value chain	*High*	*Possible*	*Moderate*	*Management training and training plan.*
Meteorological conditions that affect the deployment activities by limiting accessibility to sites and constructions as needed.	*Medium*	*High*	*Major*	*Adaptation of the timings and flexibility in the phased approach fulfilling the milestones consecutively. Take into account meteorological conditions in the planning phase*
Limited availability of potential staff members to be trained to ensure full operations of the network.	*High*	*Moderate*	*Major*	*Ensure a sufficient number of staff is secured and the training plan is followed; outreach to secondary schools and higher education facilities*

Module 6. Transition to SOFF investment phase

The transition to the SOFF investment phase is to be based on the Readiness Phase deliverables and, in particular, this NCP that has been drafted in coordination with the beneficiary country and the implementing entity.

Summary of GBON National Contribution Plan

Components	Recommended activities
Module 2 GBON business model and institutional development	1. 2 high level advocacy workshops coordinated by EW4All and the UN permanent representative coordinator office in collaboration with SOFF and CREWS
	2. 4 (2/3-day) stakeholder engagement workshops, coordinated by CREWS and in cooperation with SOFF and EW4ALL with the aims of a) *engagement of stakeholders national and international*, b) *coordination/capitalization actions of actors and capacity development projects*, c) *engagement with CSOs*
	3. MoU with the National University of Lao
	4. Generation of an internal strategic plan on absorbing projects and infrastructure
	5. Coordination actions – through CREWS, EW4All and the WB with the SOFF activities in Cambodia as possible and bring in regional prespectives.
Module 3 GBON infrastructure development	1. Procurement for the upgrade of 6 AWS stations and the implementation of the upgrades on-site.
	2. Feasibility costed plan for the installation and maintained sustainability of an Upper Air station
	3. Purchase and deploy of the generator for the servers.
	4. Follow a results-based approach to ensure the capacity is deployed in a sustainable manner to mitigate existing issues and to ensure the longevity of the network and its operations.
	5. Establish a calibration plan.
	6. As per Modules 2 and 4 initiate and continue with both lobbying, stakeholder engagement and training capacity activities.
	7. Preparation of infrastructure for upper air station
	8. Purchase and installation of upper air station
	9. Preparation of corresponding SOPs and checklists
	10. Purchase of spare parts as required

Module 4. GBON human capacity development	1. Through political lobbying, stakeholders engagement and exploring additional income sources, to improve the remuneration for the current and future employees of the GHS.
	2. Establish a tailored technical training plan for the current and expected staff with potential visits to the WMO calibration center and in close cooperation with the national academic sector (specifically for the National University for which a station will be procured). To consider that part of the training is performed under WB ongoing and expected activities.
	3. Initiate training on higher management aspects including an exchange visits with Peer Advisors facilities and WMO in Geneva.
	4. Generate and track a gender plan
	5. Generate sets of CSO engagement based on the workshops results.
Module 5. Risk Management	1 Through the Implementing Entity and supported by the Peer Advisory and Beneficiary Country, monitor the evolution of the investment phase through the identified risks and initiate mitigation actions as required.
	2 Inclusion of reputable institutions through coordination of the Implementing Entity to assist in the execution of the investment phase.
Module 6. Transition to SOFF investment phase	1 Transition performed in a coordinated manner with the beneficiary country, the implementing entity and the peer advisor following the agreed National Contribution Plan. The funding request will be also based on the activities agreed in this National Contribution Plan.

Report completion signatures

Peer Advisor signature	
Beneficiary Country signature	
WMO Technical Authority signature