CONCEPT NOTE PROPOSAL FOR SINGLE COUNTRY

PART I: PROJECT INFORMATION

Title of Project: Strengthening Meteorological Services and Establishing a Multi-Hazard Early Warning System to Enhance the Climate Resilience of Local Communities in Benin

Country: Benin

Thematic Focal Area: Early Warning System (EWS)

Type of Implementing Entity: National Implementing Entity

Implementing Entity: Fonds National pour l'Environnement et le Climat (FNEC)

Executing Entity: National Meteorological Agency (METEO BENIN)

Amount of Financing Requested: 4.149.946 (in U.S Dollars Equivalent)

Project Formulation Grant Request (available to NIEs only): Yes ☒ No ☐

Amount of Requested financing for PFG: 50,000 (in U.S Dollars Equivalent)

Letter of Endorsement (LOE) signed: Yes ☒ No ☐

NOTE: LOEs should be signed by the Designated Authority (DA). The signatory DA must be on file with the Adaptation Fund. To find the DA currently on file check this page: https://www.adaptation-fund.org/apply-funding/designated-authorities

Stage of Submission:

☐ This concept has been submitted before

☒ This is the first submission ever of the concept proposal

In case of a resubmission, please indicate the last submission date: Click or tap to enter a date.

Please note that concept note documents should not exceed 50 pages, including annexes.

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List of Acronyms

Acronyms	Meaning
AFD	French Development Agency
ABPC	Benin Agency for Civil Protection
CAP	Common Alert Protocol

CLP	Local Project Committee
CPS	Project Monitoring Committee
DGEau	Directorate General for Water
DGEC	Directorate General of Environment and Climate
EE	Executing Entity
EIA	Environmental Impact Assessment
EU	European Union
EWS	Early Warning Systems
FAO	Food and Agriculture Organization.
FNEC	National Fund for the Environment and Climate
GIZ	Deutsche Gesellschaft für International Zusammenarbeit
HPI	Human Poverty Index
IE	Implementing Entity
IFDC	International Fertilizer Development Center
IGN	National Geographic Institute
INStaD	National Institute of Statistics and Demographics
IRHOB	Institute of Research in Horticulture and Botany
MAEP	Ministry of Agriculture, Livestock, and Fisheries
MEEM	Ministry of Energy, Water, and Mines
METEO BENIN	National Meteorological Agency
MS	Ministry of Health
NAP	National Climate Change Adaptation Plan
NDC	Nationally Determined Contributions
NDP	National Development Plan
NFCS	National Framework for Climate Services
PNS	National Health Policy
RNA	National Agricultural Census
SDGs	Sustainable Development Goals
SIHAM	Hydro-Agro-Meteorological Information System
SNRRC	National Strategy for Disaster Risk Reduction
SPI	Standardized Precipitation Index
TFPs	Technical and Financial Partners
WRF	Weather Research and Forecasting

A. Project Background and Context

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline the economic social, development and environmental context in which the project would operate.

1 – Context of Benin

Climate change is one of the greatest challenges to nations' socio-economic development[1]. It has caused significant harm and increasingly irreversible losses to terrestrial, aquatic, cryospheric, coastal, and oceanic ecosystems. Additionally, it has threatened food security and disrupted water resource management, hindering efforts to achieve sustainable development goals[2].

West Africa, including Benin, is experiencing heightened vulnerability to climate change, facing its impacts at a rate faster than the global average[3]. Like other countries in the region, Benin is enduring climate variability and change that disrupt various key sectors[4]. These disruptions are evident in intensifying climate variability and an increase in the frequency of extreme events, particularly heavy rains, flooding, prolonged droughts, and heat waves[5]. In 2019, the losses and damages from floods to the Beninese economy were estimated at USD 91,103 million. The sectors most affected include agriculture, livestock, fisheries, industry, trade, and other services. The agricultural subsector bore the brunt of the impact, with 4,899.1 hectares of crops destroyed across all types. Besides affecting livelihoods, the floods also led to loss of life[6].

In this context, implementing adaptation measures is crucial. Among these measures, particularly in the short term, is the establishment of Early Warning Systems (EWS)[7]. Recognized by the Paris Agreement as a key tool for enhancing adaptive capacity, strengthening resilience to climate change, and reducing vulnerability to climate risks, these systems play a vital role in preventing human losses and represent a strategic and cost-effective investment[8]. Given the losses and damages caused by extreme climatic events, deploying such systems is essential, especially for developing countries like Benin.

1.1 – Geographical, socioeconomic, and climatic profile of Benin

1.1.1 – Geographical profile of Benin

The Republic of Benin, a country in West Africa, is situated between latitudes 6°30' and 12°30' North and longitudes 1° and 3°40' East, covering an area of 114,763 square kilometers[9]. It shares its northern borders with Niger and Burkina Faso, the southern boundary with the Atlantic Ocean, the western border with Togo, and the eastern border with Nigeria. Benin is organized into 12

1 IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. https://doi.org/10.1017/9781009157988.001.

2 IPCC (2023). Synthesis report of the IPCC sixth Assessment Report (AR6): summary for policymakers. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 36 p.

3 https://pscc.fes.de/fileadmin/user_upload/images/publications/2023/FES-ReportClimate-A4-FR-MedRes.pdf, accessed January 12, 2025.

4 MCVDD (2022), Plan national d'adaptation aux changements climatiques du Bénin, Direction Générale de l'Environnement et du Climat (DGEC), Cotonou, Bénin, 175p.

5 Akponikpè et al. (2019). Etude de Vulnérabilité aux changements climatiques du Secteur Agriculture au Bénin. Report produced under the project "Projet d'Appui Scientifique aux processus de Plans Nationaux d'Adaptation dans les pays francophones les moins avancés d'Afrique subsaharienne", Climate Analytics gGmbH, Berlin.

6 ANPC (2020) Inondations de 2019 au Bénin : rapport d'évaluation des besoins post catastrophe, Cotonou, Bénin, 133p.

7 IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. https://doi.org/10.1017/9781009157988.001.

8 GCF et CREWS (2023) GCF- SAP CREWS scaling up framework for early warning, 20 p.

9 MCVDD (2022), Communication relative à l'adaptation du Bénin au titre de la Convention-cadre des Nations unies sur les changements climatiques (CCNUCC), Direction Générale de l'Environnement et du Climat (DGEC), Cotonou, Bénin, 131 p.

departments, which are further subdivided into 77 communes, 546 arrondissements, and 5,290 villages or city districts[10]. Map 1 below shows the geographical location of Benin, highlighting the beneficiary communes of the project.

Map 1: Geographical location of Benin
Source: National Geographic Institute (IGN), 2018.

1.1.2 – Socioeconomic profile of Benin

In 2024, Benin's population is estimated at 12,910,087 inhabitants, with 50.21% women and 17.24% of children under five years old[11]. The demographic distribution across the country is uneven, with an average density of 119.82 inhabitants per km² and the highest population concentration in the southern region. The rural population decreased from 55.4% in 2013 to 47.45% in 2024, while the fertility rate fell from 7.1 to 5.7 children per woman between 1982 and 2017-2018[12].

Since July 2020, Benin has been categorized as a lower-middle-income country, with its Gross National Income per capita (GNI/capita) rising from USD 870 in 2018 to USD 1,250 in 2019[13]. Despite this advancement, the structure of Benin's economy has remained relatively stable between 1990 and 2024, with agriculture serving as the primary source of livelihood for over 54.8% of the population[14]. In the second quarter of 2024, the primary, secondary, and tertiary sectors contributed to GDP growth rates of 1.3%, 1.4%, and 3.1%, respectively. Their respective shares in GDP formation for that period were 23.5% for the primary sector, 17.9% for the secondary sector, and 48.4% for the tertiary sector[15].

After a performance of 6.3% in 2022, Benin's economy has continued its strong growth trajectory,

10 Loi N° 2013-05 du 27 mai 2013 portant création, organisation, attributions et fonctionnement des unités administratives locales en République du Bénin.
11 INStaD (2022). Projections démographiques de 2014 à 2063 et perspectives de la demande sociale de 2014 à 2030 au Bénin, Direction des Statistiques Démographiques et Sociales, Cotonou, Bénin, 137 p.
12 INSAE et ICF (2019). Enquête Démographique et de Santé au Bénin, 2017-2018. Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF, Cotonou, Bénin et Rockville, Maryland, USA, 675 p.
13 https://blogs.worldbank.org/fr/opendata/nouvelle-classification-des-pays-en-fonction-de-leur-revenu-2020-2021, consulté le 06 janvier 2025.
14 DSA-Bénin (2021). Le Recensement National de l'Agriculture 2019, volume 2, principaux résultats du module de base, Cotonou, Bénin, 229 p.
15 Institut National de la Statistique et de la Démographie (INStaD-Bénin), Comptes nationaux trimestriels : Note de publication, Cotonou, septembre 2024, 11 p.

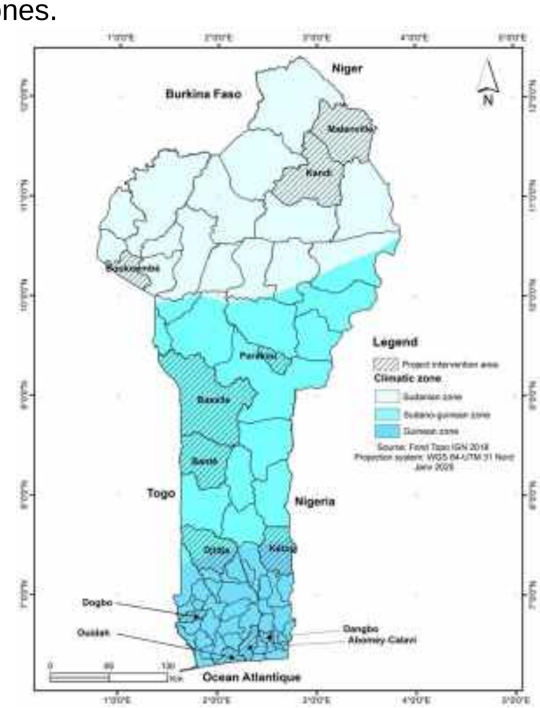
reaching 6.4% in 2023. Real GDP growth is projected to reach 6.5% in 2024 and then 6.2% in 2025[16]. However, these economic performances have not led to improved income distribution, revealing the limited inclusiveness of growth. National poverty stood at 36.2% in 2022, down from 38.5% in 2019, representing a slight decrease of 2.3 percentage points. Furthermore, rural poverty remains high, estimated at 40.6%, which is 9.8 percentage points higher than urban poverty in 2022[17].

Benin's Human Development Index (HDI) stands at 0.504 in 2022, placing the country 173rd out of 193, with a life expectancy at birth of 60 years. Consequently, previous development policies have not significantly reduced poverty levels, which have been further worsened by various shocks, including the negative impacts of climate change. Thus, strengthening Benin's economic resilience also requires decisive action on climate adaptation and resilience[18].

1.1.3 – Climatic profile of Benin

Benin has two main climate types. The southern part of the country features an equatorial climate characterized by high humidity. There are two dry seasons (November to March and mid-July to mid-September) and two rainy seasons (April to mid-July and mid-September to October). In the central and northern regions, the climate is tropical, with a dry season lasting from November to April and a rainy season from June to September.

This climatic diversity has resulted in the identification of three major climatic zones that extend from south to north: the Guinean zone, the Sudano-Guinean zone, and the Sudanian zone. Map 2 illustrates these three zones.



Map 2: Climatic zone of Benin
Source: National Geographic Institute (IGN), 2018.

The Guinean zone is in the southern part of the country, situated between 10°00' and 12°20' north latitude and between 1°00' and 3°50' east longitude. This region experiences four seasons and has an average annual rainfall of 1,217.1 mm, occurring over approximately 87 days. Precipitation varies by 260.6 mm between the driest and wettest months. The average annual

16 BAD (2024). Rapport pays 2024 – Bénin : Impulser la transformation du Bénin par la réforme de l'architecture financière mondiale, Abidjan, Côte d'Ivoire, 42 p.
17 INStaD (2023). Note sur la pauvreté en 2022, Cotonou, Bénin, 4 p.
18 BAD (2024). Perspectives économiques en Afrique 2024 : Impulser la transformation de l'Afrique par la réforme de l'architecture financière mondiale. Banque Africaine de Développement (BAD), Abidjan, Côte d'Ivoire, 290 p.

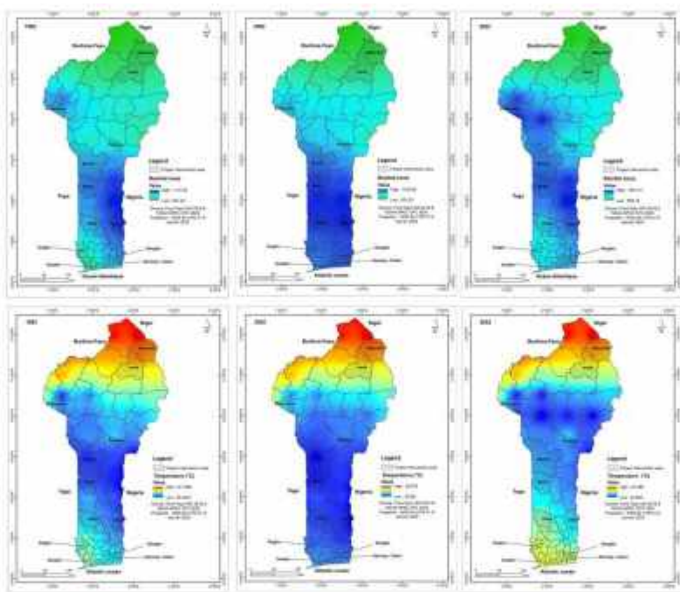
temperature is 27.4°C, with a temperature range of 3.7°C. The main rainy season extends from April to July, followed by a shorter rainy season from September to mid-November. These are interspersed with two dry seasons: a long dry season from mid-November to mid-March and a shorter dry season from August to September. The average daily temperature ranges from 25°C to 29°C, while relative humidity varies between 69% and 97%[19].

The Sudano-Guinean zone, situated in the central part of the country between 8°00' and 10°00' North latitude and 1°40' and 3°50' East longitude, experiences a precipitation regime that is intermediate between bimodal and unimodal. The average annual rainfall ranges from 900 mm to 1,110 mm, typically spread over 75 days. Relative humidity fluctuates between 31% and 98%, while temperatures range from 25°C to 29°C throughout the year.

The Sudanian zone is in the northern part of the country, situated between 10°00' and 12°20' North latitude and 1°00' and 3°50' East longitude. It receives an average annual rainfall between 900 mm and 1,100 mm, distributed over approximately 71 days. The relative humidity varies significantly, ranging from 18% during the Harmattan (December to February) to 99% in August, during the rainy season. The average monthly temperatures in this region fluctuate between 24°C and 31°C[20].

1.1.4 – Past and current climate variability of Benin

The analysis of past and current spatial variability in Benin involved studying rainfall, temperature, and wind speed over 40 years (1982 to 2022). Map 3 below illustrates the spatial evolution of rainfall (upper part of the map) and temperature (lower part) during this period, with a particular focus on the project intervention areas.



Map 3: Spatial evolution of rainfall (upper) and temperature (lower) from 1982 to 2022
Source: METEO BENIN, 2025.

- ***Spatial evolution of rainfall***

The examination of the upper section of map 3 reveals that:

- In 1992, rainfall was highest in the southern part of Benin, gradually decreasing toward the country's northern regions Coastal areas, particularly Cotonou and Abomey-Calavi, recorded the highest precipitation levels.

19 MCVDD (2022), Plan national d'adaptation aux changements climatiques du Bénin, Cotonou, Bénin, 175p.
20 MCVDD (2022), Plan national d'adaptation aux changements climatiques du Bénin, Cotonou, Bénin, 175p.

- In 2002, a slight reduction in rainfall was observed compared to 1992, particularly in the central and northern regions. The south still receives relatively high rainfall.
- In 2022, a significant decrease in rainfall was observed in most regions, especially in the north. While the south still experiences relatively high rainfall, there is a general decline in rainfall nationwide.

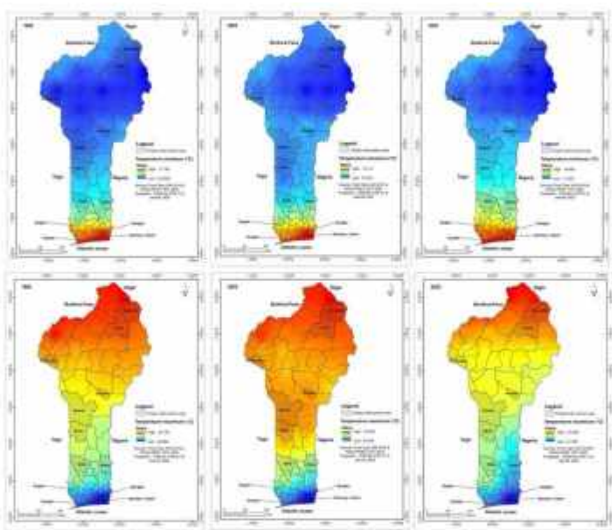
In conclusion, the overall trend indicates a decrease in rainfall over the past three decades, particularly noticeable in the northern regions.

- ***Spatial temperature trends***

Map 4 below shows the spatial evolution of minimum temperatures (upper section) and maximum temperatures (lower section). Analyzing the three maps in the lower section highlights that:

- in 1992, the highest temperatures were recorded in northern Benin, while more moderate values were observed in the southern regions. This distribution indicates a typical pattern, as the north is generally warmer due to its geographical position.
- In 2002, temperatures increased across nearly all regions, with the north recording the highest level values.
- In 2022, a significant rise in temperatures was observed nationwide, with the most pronounced peaks in the North. The South also shows a significant increase compared to 1992 and 2002.

In conclusion, the data highlights a steady rise in temperatures over the past three decades period.



Map 4: Spatial evolution of minimum temperatures (upper) and maximum temperatures (lower) from 1982 to 2022
Source: METEO BENIN, 2025.

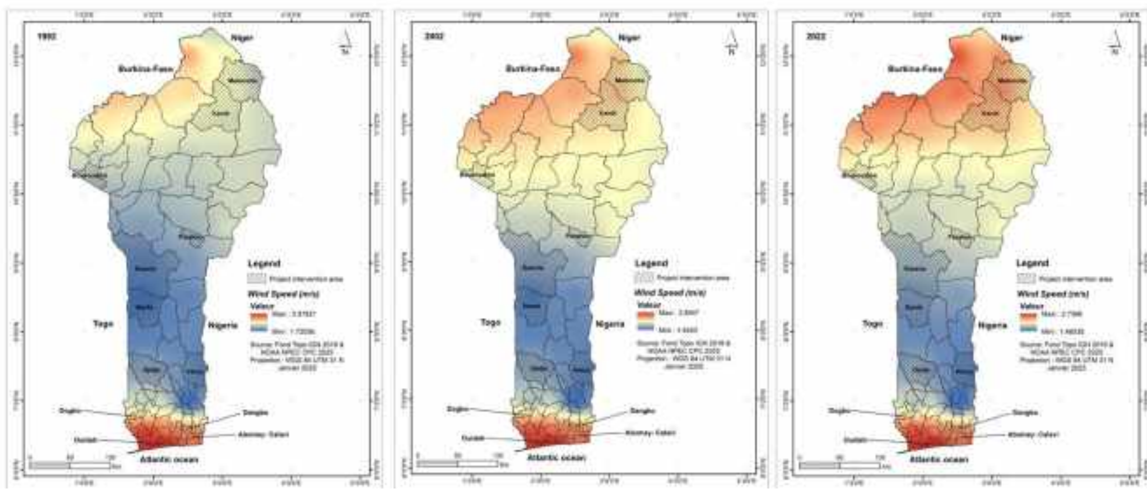
The analysis of Map 4 (lower part) indicates that in 1992, minimum temperatures were the lowest in the country's northern regions, gradually increasing toward the south. In 2002, a slight increase in minimum temperatures was observed, particularly in the south, a trend that has continued into 2022, signaling nationwide warming.

By 2002, a slight increase in minimum temperatures was observed, particularly in the south, a trend that continued into 2022, indicating nationwide warming. Maximum temperatures, on the other hand, are higher in northern Benin and decrease toward the south. In 2002, an increase in maximum temperatures was recorded, extending southward (a trend that became more pronounced in 2022), signaling a significant rise in maximum temperatures at the national level.

Both maps reveal a clear warming trend impacting minimum and maximum temperatures as well as Benin's rainfall patterns. This climate change adversely affects key development sectors, including agriculture, water resources, energy, health, infrastructure, urban planning, tourism, forestry, and coastal management.

- ***Wind Speed in Benin (1992, 2002, 2022)***

Map 5 illustrates the evolution of wind speed in Benin over the past 40 years, highlighting regional variations, particularly in areas targeted by the project. The analysis indicates that in 1992, wind speeds were higher in the northern part of the country, especially around the communes of Malanville and Kandi. In the south, communes such as Dogbo, Ouidah, and Abomey-Calavi also recorded significant wind speeds. By 2002, a decrease in wind speed was observed in some northern areas compared to 1992, while wind speeds remained elevated in the three southern communes (Dogbo, Ouidah, and Abomey-Calavi). In 2022, a slight decline in wind speed was noted in the north compared to 2002, although the values continued to be higher than those observed in the south.



Map 5: Spatial evolution of wind speed from 1982 to 2022
Source: METEO BENIN, 2025.

1.1.5 – Future climate variability in Benin

With a global temperature increase of 1.1°C between 2011 and 2020, the country is expected to face more severe and unpredictable weather disruptions. Regarding temperature variability, deviations from normal annual averages (1981-2010) generally range from -0.7°C to +1.3°C. However, projections indicate an overall warming trend by 2030 and 2050, with deviations from the norm anticipated to be between 0.8°C and 2.3°C. Future climate projections based on representative concentration pathways (RCP2.6, RCP4.5, and RCP8.5) suggest that annual precipitation could either decrease or increase depending on the model and time frame considered (2030, 2050). Nonetheless, projections using the CSIRO and CCCMA models primarily show a downward trend. Figure 1 illustrates these different dynamics associated with climate warming.

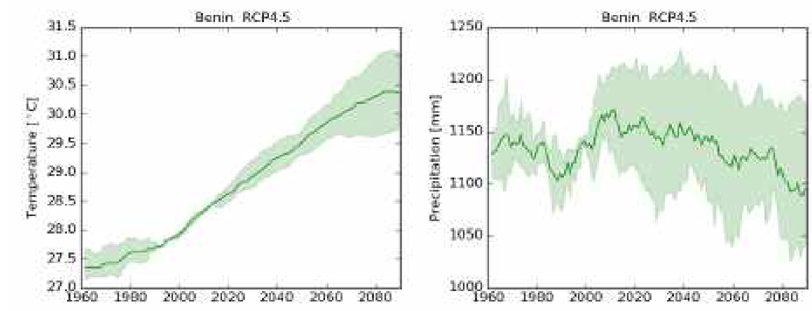


Figure 1: Regional climate model projections for annual rainfall (left) and temperature (right) displayed as a 20-year moving average for Benin.

The line represents the ensemble mean, while the shaded area represents the model spread. The projections are based on the emission scenario RCP4.5.

Source: Climate Analytics' RegioClim plateforme[21].

This overall warming trend is confirmed under the SSP5-8.5 scenario. Under this scenario, Benin will experience an increase in mean surface air temperature, reaching 33.34°C (± 1.36), while rainfall will not only vary but is expected to rise to 1,211.52 mm (± 94.26) by the end of the century (figure 2).

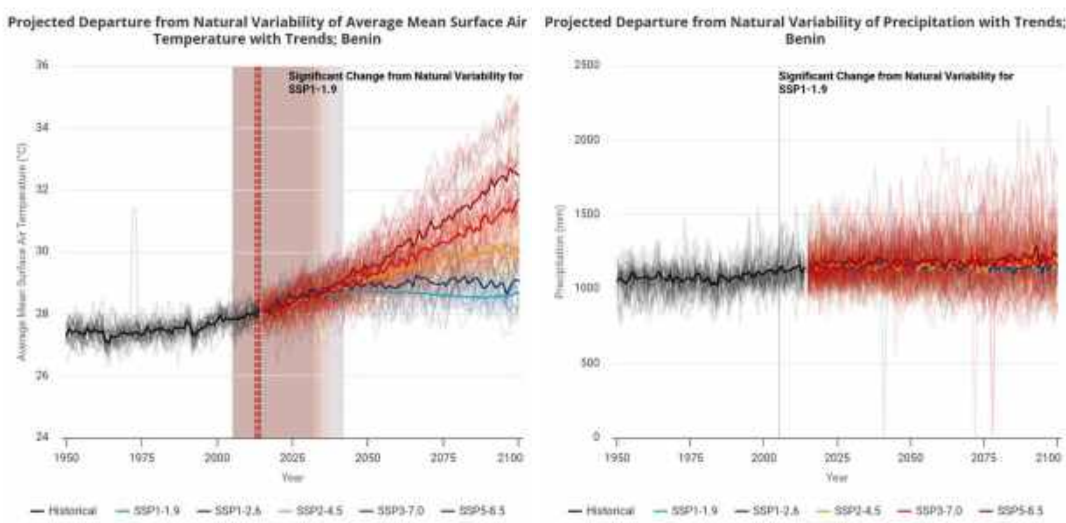


Figure 2: Projected departure from natural variability of average mean surface air temperature (left) and of precipitation (right) with Trends.

Source: Climate Change Knowledge Portal[22].

1.2 – Benin's vulnerability to climate change and section of project intervention areas

1.2.1 – Benin's vulnerability to climate change

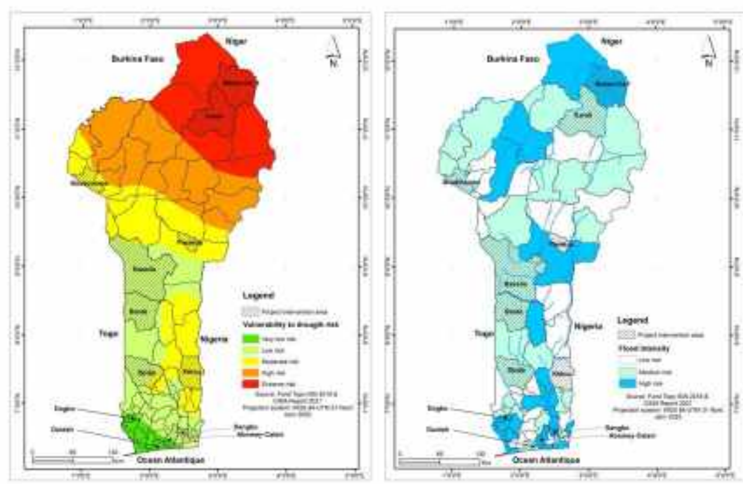
Benin ranks among the countries most vulnerable to climate change, experiencing negative impacts on all socio-economic sectors and geographical areas. The National Adaptation Plan (NAP) of Benin has identified seven (7) priority sectors: agriculture, water resources, energy, health, infrastructure and urban development, tourism, forestry, and the coast. Various vulnerability studies indicate that drought, flooding, strong winds, extreme heat waves, and rising sea levels are the main climate risks facing Benin. These hazards have significant consequences, leading to the degradation of natural resources, displacement of populations, increased coastal erosion, and considerable disruption of economic activities, particularly in the

[21] https://regioclim.climateanalytics.org/choices, consulted on 13 January 2025.
22 https://climateknowledgeportal.worldbank.org/country/benin/trends-variability-projections, consulted on 13 January 2025.

agricultural sector, which results in escalating economic and social costs[23].

With an ND-GAIN Index of 38.3[24], Benin ranks 159th out of 185 countries. Its high vulnerability score (0.572) and low preparedness score (0.338) underscore significant climate risks. Consequently, Benin is the 17th most vulnerable country in the world and ranks 135th in its preparedness to address climate change. These indicators emphasize the urgent need for substantial investments and innovations to enhance the adaptive capacity of Benin's population. Future projections indicate that dry and wet seasons will become more extreme, heightening the risk of flooding. Under a business-as-usual scenario, by 2070, 98% of Benin's territory would be exposed to extreme temperatures, making it one of the most affected countries globally in terms of land area impacted.

Map 6 below illustrates Benin's vulnerability to drought and the associated risk of flooding.



Map 6: Benin's vulnerability to drought and flood risks
Source: Report on the national consultation in Benin, CIMA (2021)[25]

The left side of Map 6 depicts the drought risk in Benin based on precipitation patterns. Analysis indicates that Alibori and the far northeast are the most vulnerable areas, facing an extreme risk of drought. Moving southward, vulnerability gradually decreases, with risks ranging from low to moderate. The right side of Map 6 illustrates the flooding in Benin's municipalities during October 2010. It shows that southern regions face a high risk of flooding, while the north, although also impacted, experiences less intense flooding overall. Low to moderate flood-risk areas are primarily located in central Benin. Map 6 emphasizes that the project's target areas are exposed to at least one of these risks, highlighting the need for region-specific adaptation strategies.

1.3.1 – Choice of project intervention areas

The project will benefit twelve (12) municipalities in eight (8) departments of Benin: ***Abomey-Calavi***, ***Ouidah*** (Atlantique department), ***Dangbo*** (Ouémé department), ***Kétou*** (Plateau department), ***Dogbo*** (Couffo department), ***Djidja*** (Zou department), ***Bantè*** (Collines department), ***Bassila*** (Donga department), ***Boukoumbé*** (Atacora department), ***Malanville***, ***Kandi*** (Alibori department), and ***Parakou*** (Borgou department). These municipalities were chosen due to their high vulnerability to climate hazards, including floods, droughts, delayed rainfall, strong winds, and lightning. The selection process also considered the presence and coverage of meteorological stations in these areas.

23 MCVDD (2022), Plan national d'adaptation aux changements climatiques du Bénin, Cotonou, Bénin, 175p.
24 https://gain-new.crc.nd.edu/country/benin, consulted on 24 December 2024.
[25]https://www.floodmanagement.info/floodmanagement/wp-content/uploads/2021/02/Rapport_National_BN_reviewCIMA_17Jan2021_clean.pdf, consulted on 13 January 2025.

1.3.1.1 – Climate change vulnerability in targeted municipalities

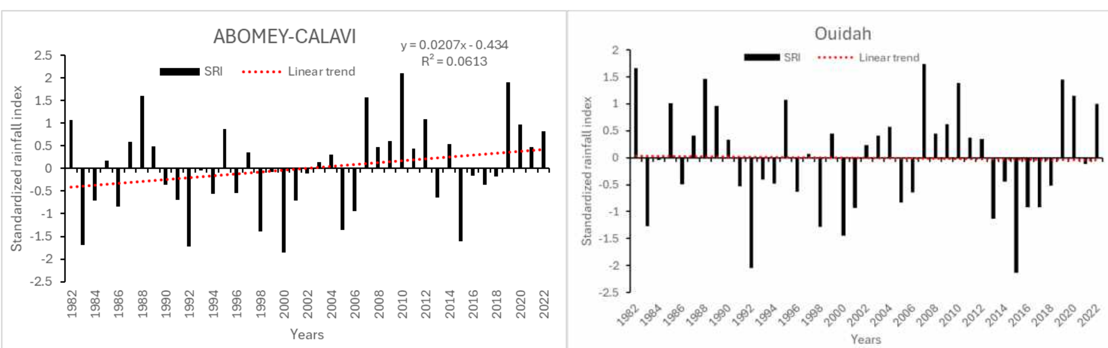
To analyze the evolution and variability of precipitation in the project's beneficiary areas and assess their vulnerability to climate hazards, particularly drought, we used the Standardized Precipitation Index (SPI). This tool, developed by McKee et al. (1993, 1995)[26], enables monitoring of meteorological drought at various temporal scales. The SPI is based on a local classification of recent precipitation (daily or monthly) by comparing it to historical records from a specific site. The method involves statistically classifying the volume of water accumulated over a given period against all volumes observed over similar periods, thus assigning a severity index. Using the SPI index is essential for monitoring droughts over different time scales.

- ***1982–2022 Standardized Precipitation Index for southern Benin's beneficiary communes***

    - ***Abomey-Calavi and Ouidah***

A time series analysis of the Standardized Precipitation Index, utilizing precipitation data from Abomey-Calavi (Figure 3a), reveals a linear upward trend over the study period from 1982 to 2022. Severe droughts were recorded in 1983, 1992, 1998, 2000, 2005, and 2015, while 1988, 2007, 2010, and 2019 were the wettest years. The period between 1992 and 2006 experienced more frequent droughts in this region of southern Benin. However, from 2006 to 2022, precipitation patterns became more stable, showing a balanced alternation of wet periods and relatively consistent rainfall levels.

From 1982 to 2022, Ouidah's SPI exhibits strong fluctuations around a nearly zero trend, indicating no clear movement toward either flooding or drought. The period from 1980 to 1990 is characterized by several distinctly positive values (SPI > +1), suggesting wet seasons, as well as negative values (SPI < –1), indicating occasional droughts. From the late 1990s to 2020, there is a clear alternation between precipitation deficits and surpluses (SPI falling to -1.5 or rising above +1) (Figure 3b), reflecting significant interannual variability. The nearly flat trend line indicates no notable long-term change in precipitation, evidenced by a very low R^2 value. Despite this apparent stagnation, Ouidah continues to experience climatic extremes, with very dry periods occurring alongside very wet years, sometimes leading to flooding or water stress risks. Effective water management and Early Warning Systems are crucial to address both droughts and heavy rainfall events.



(a) (b)

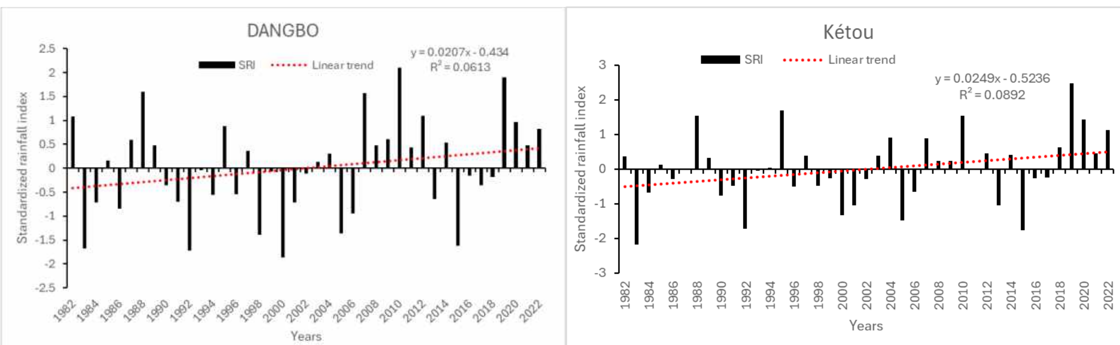
Figure 3: 1982–2022 Standardized Precipitation Index for Abomey-Calavi and Ouidah (Atlantique Department)
Source: METEO BENIN, 2025.

26 McKee, T.B., N.J. Doesken et J. Kleist (1993). The relationship of drought frequency and duration to time scale. In: *Proceedings of the Eighth Conference on Applied Climatology*, Anaheim, California, du 17 au 22 janvier 1993. Boston, American Meteorological Society, 179–184.

- ***Dangbo and Kétou***

The Standardized Precipitation Index for Dangbo during the study period from 1982 to 2022 indicates an upward trend. The years 1984, 1992, 1998, 2000, 2005, and 2015 were particularly dry, characterized by scarce rainfall (Figure 4a). In contrast, 1998, 2008, 2010, and 2019 experienced heavy rainfall in this southern region. From 1982 to 2008, droughts alternated with some wet years. From 2008 to 2022, a regular alternation of wet years was observed; however, between 2016 and 2018, there was an irregularity in rainfall, leading to a slight drought.

Between 1982 and 2022, the Standardized Precipitation Index (SPI) for Kétou (Figure 4b) generally fluctuates between slightly negative values and positive peaks, reaching or exceeding +1, highlighting significant inter-annual variability. The period from 1980 to 1990 shows several negative indices (SPI < -1), indicating moments of moderate rainfall deficit, balanced by wet periods (SPI > +1) during the same timeframe. From the 2000s onward, there is a consistent alternation between slightly negative SPI values and positive ones, with some exceeding +1, indicating wetter periods. Despite a slight increase in the average, inter-annual variability remains high, suggesting the potential for both droughts and occasional heavy rainfall events, underscoring the need for adaptive strategies and effective water resource management to address these issues fluctuations.



(a) (b)

Figure 4: 1982–2022 Standardized Precipitation Index for Dangbo (Ouémé department) and Kétou (Plateau department)
Source: METEO BENIN, 2025.

- ***Dogbo***

From 1982 to 2022, the Dogbo Standardized Precipitation Index (SPI) (Figure 5) fluctuated around zero, exhibiting both negative values (indicating rainfall deficits) and positive peaks (indicating excess rainfall). The linear trend reveals a very slight negative slope with a low coefficient of determination, meaning that only 2% of the variability is explained by this trend. The 1980s and 1990s show a series of negative indices approaching -1 (indicating moderate droughts) and a few positive peaks above +1 (indicating wet periods). From 2000 to 2020, this alternation continues without any strong indication of a trend toward wetter or drier conditions. Overall, Dogbo exhibits significant interannual variability but no considerable long-term climatic change, though occasional droughts or excessive rainfall events remain possible.

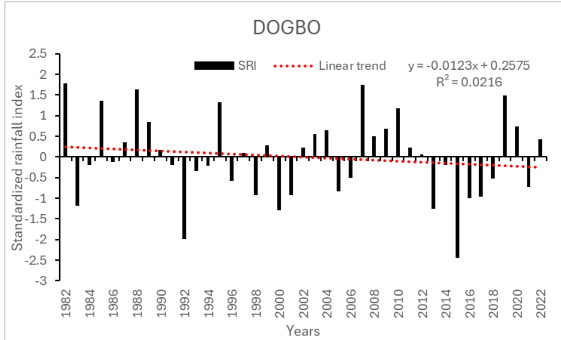
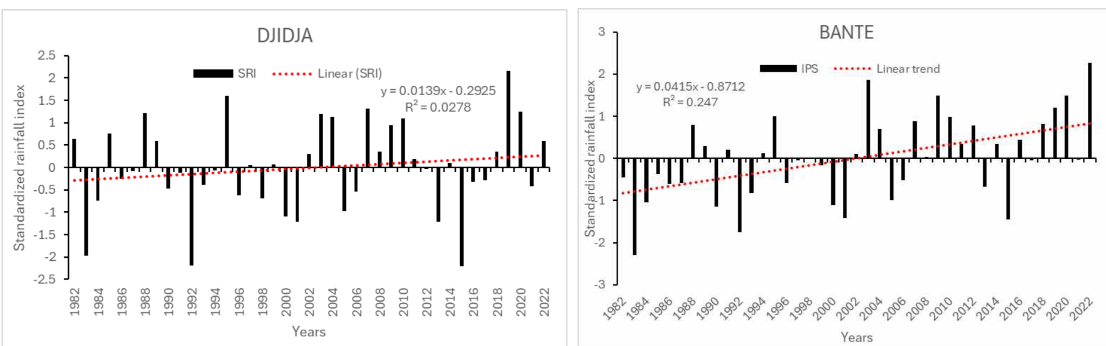


Figure 5: 1982–2022 Standardized Precipitation Index for Dogbo (Couffo department)
Source: METEO BENIN, 2025.

- ***1982–2022 Standardized Precipitation Index for Central Benin's beneficiary communes***
  - ***Djidja and Bantè***

Time series analysis of Djidja's Standardized Precipitation Index (SPI) (Figure 6a) reveals a slightly increasing linear trend over the study period from 1982 to 2022. Severe droughts occurred in 1983, 1992, and 2015, while 1995 and 2019 saw exceptionally high rainfall in this central region. Four key periods emerge: 1982-2003, marked by persistent droughts; 2004-2012, characterized by stable precipitation; 2012-2019, with a return of drought; and 2020-2022, featuring alternating wet and dry years.



(a) (b)

Figure 6: 1982–2022 Standardized Precipitation Index for Djidja (Abomey department) and Bantè (Collines department)
Source: METEO BENIN, 2025.

In Bantè, the analysis indicates a steeper slope and a higher coefficient of determination, suggesting a significant shift towards wetter conditions, although interannual variability remains high. The period from 1980 to 1990 is marked by negative SPI values (often below -1), followed by a more balanced alternation in the 2000s (Figure 6b). Since 2010, the frequency of wet years has increased, with 2022 recording an SPI close to +3, categorizing it among the "extremely wet" episodes. This trend confirms an increased risk of flooding, while moderate droughts may still occur, emphasizing the need for adaptation strategies and integrated water management.

- ***1982–2022 Standardized Precipitation Index for northern Benin's beneficiary communes***
  - ***Bassila***

From 1982 to 2022, the Standardized Precipitation Index (SPI) at Bassila indicates a slight trend toward wetter conditions (positive slope of 0.0331), yet it is characterized by significant interannual variability (Figure 7). The period from 1980 to 1990 shows several negative indices (SPI < -1), linked to instances of moderate to severe drought. In the 2000s, the SPI fluctuated between negative values and positive peaks. Starting in 2010, this variability continues, with an SPI of about +2.5 in 2022, indicating a highly rainy episode. Despite an overall trend toward increased humidity, these fluctuations leave the commune susceptible to both water shortages and flood risks.

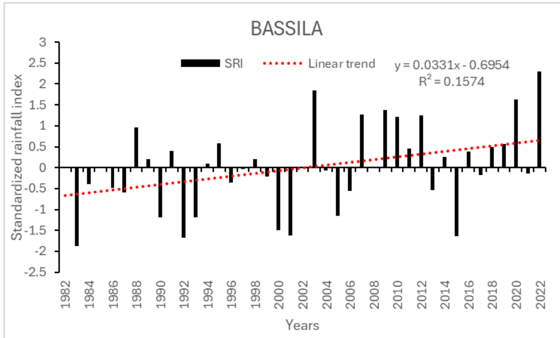
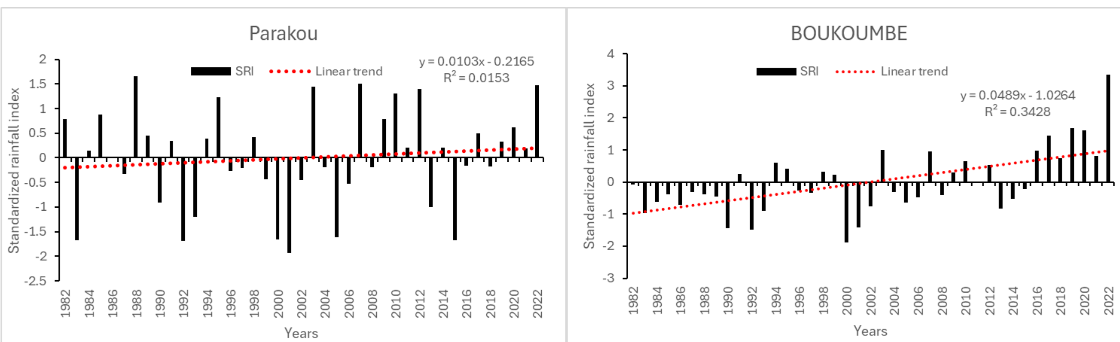


Figure 7: 1982–2022 Standardized Precipitation Index for Bassila (Donga department)
Source: METEO BENIN, 2025.

- ***Parakou and Boukoumbé***

In Parakou, extremely high precipitation indices were recorded in 1988 (SPI > 1.5), with positive and significant indices noted in 1995, 2003, 2007, 2010, 2012, and 2022 (Figure 9a). Conversely, very dry years (SPI between -1.5 and -1.99) were noted in 1983, 1992, 2000, 2001, and 2015.



(a) (b)

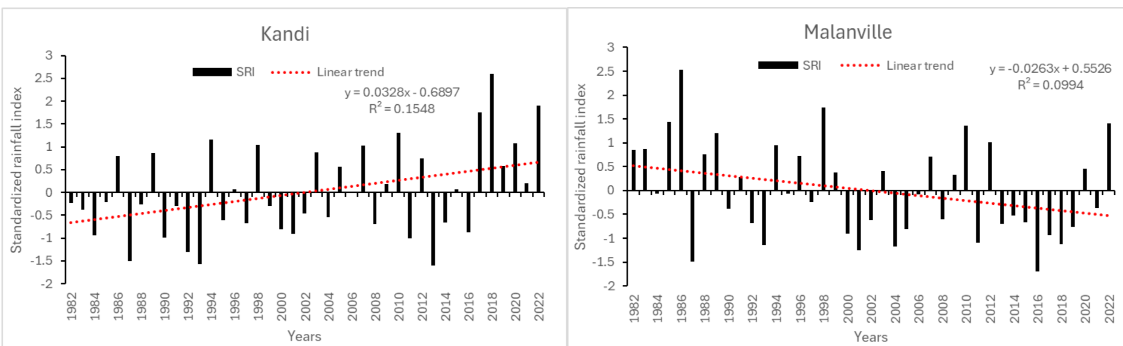
Figure 8: 1982–2022 Standardized Precipitation Index for Parakou (Borgou department) and Boukoumbé (Atacora department)
Source: METEO BENIN, 2025.

Boukoumbé is in a region characterized by significant rainfall variability. An analysis of the Standardized Precipitation Index (SPI) from 1982 to 2022 reveals important trends that warrant the implementation of an adaptation and resilience project in response to climate change. Between 1980 and 1990, several negative SPI values (below -1) indicate periods of precipitation deficit, ranging from moderate drought (-1.0 to -1.49) to very severe drought (-1.5 to -1.99). Precipitation during this time is generally below normal (see Figure 9b), underscoring a predominantly dry and irregular pattern. Since the 2000s, SPI values have fluctuated more frequently between near zero (normal) and positive SPIs, occasionally reaching +1 or +1.5. These values reflect “moderately wet” episodes and signal a gradual return to more favorable precipitation conditions. From the 2010s onward, positive SPI values have become more common, sometimes exceeding +2.0. In 2022, the SPI surpasses +2, classifying this year as “extremely wet,” with exceptional rainfall events likely leading to flooding, landslides, and infrastructure damage. These extreme conditions underscore the necessity of effective water management strategies to address both excessive rainfall and potential droughts.

- ***Kandi and Malanville***

Analysis of the SPI index for Kandi from 1992 to 2022 reveals that 2018 is marked by a significant surplus (SPI > 2.5). This reflects the extremely wet periods recorded. Additionally, in 2017 and 2022, indices of ≥ 1.5 were noted (Figure 9a), indicating continued flooding and excessively wet conditions. However, severe drought periods were recorded in 1987, 1993, and 2013 (SPI ≤ -1.5). These varying indices highlight the commune of Kandi's exposure to both flooding and drought risks.

The SPI curve for Malanville reveals significant interannual variability from 1982 to 2022 (Figure 9b). The year 1986 is notable as an exceptionally wet year (SPI > 2). The years 1985, 1988, 2010, 2012, and 2022 also experienced significantly positive indices (SPI ≥ 1). In contrast, the years 1987 and 2016 are marked by episodes of severe drought (SPI ≤ -1.5). Additionally, the primary hydroclimatic risks faced by the residents of the Malanville commune include floods (92.33%), erosion (89.64%), drought (57.11%), excessive heat (40.21%), and violent winds (33.22%). Specifically, in the agricultural sector, onion farmers in Malanville are particularly vulnerable to excessive heat, which affects around 88% of them. Droughts and dry spells impact approximately 80% of farmers, leading to reduced agricultural output.



(a) (b)

Figure 9: 1982–2022 Standardized Precipitation Index for Kandi and Malanville (Alibori department)
Source: METEO BENIN, 2025.

All target municipalities experience significant climate variability, with occasional droughts (SPI < -1) and intense rainfall periods (SPI > +1 or even +2). This irregular alternation between dry and wet conditions underscores the unpredictability of the local climate. Although some linear trends are positive, they remain moderate and account for only a small portion of the variability. This highlights the need for adaptation initiatives to prepare for extreme weather risks and enhance the resilience of local communities in the face of climate change.

1.3.1.2 – Future climate trends in targeted communes

In the absence of specific climate projections for the beneficiary municipalities, the future climate analysis relied on available projections at the departmental level.

- o ***Future climate of beneficiary communes in southern Benin***

As mentioned earlier, five municipalities in southern Benin, spanning four departments, will benefit from this project. These municipalities are ***Abomey-Calavi*** and ***Ouidah*** (Atlantique department), ***Dangbo*** (Ouémé department), ***Kétou*** (Plateau department), and ***Dogbo*** (Couffo department). Figure 10 displays the projected variability of precipitation throughout the seasonal cycle, while Figure 11 illustrates the projected deviation from the natural variability of the average mean surface air temperature for the four beneficiary departments in southern Benin.

Climate projections for southern Benin indicate an earlier onset of the rainy season in April and a substantial increase in precipitation during the peak months of June and September. While rainfall is expected to rise slightly between 2020 and 2039, the most significant intensification is anticipated for the periods of 2040-2059 and 2080-2099, with rainfall in June and July potentially reaching up to 400 mm, double the historical average of 200 mm. This increase could elevate the risk of flash floods and flooding, particularly in June and July. Precipitation is also projected to rise in September and October, extending the rainy season. In the departments of Mono and Atlantique, the two rainy seasons will remain distinct, whereas in Plateau and Couffo, the distinction between the seasons will become less clear, accompanied by frequent rainfall throughout the year. The main dry season remains relatively unchanged in the projections, with minimal rainfall during this period; however, light rains could begin in March during the 2040-2059 and 2080-2099 periods.

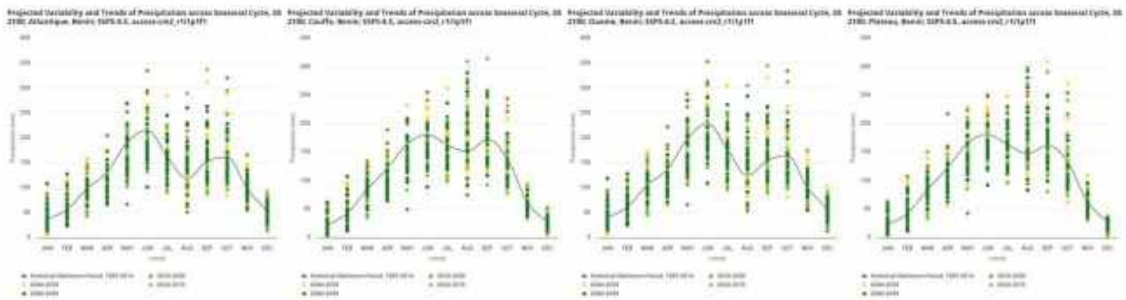


Figure 10: Projected variability of precipitation across the seasonal cycle for Atlantique, Couffo, Ouémé, and Plateau departments

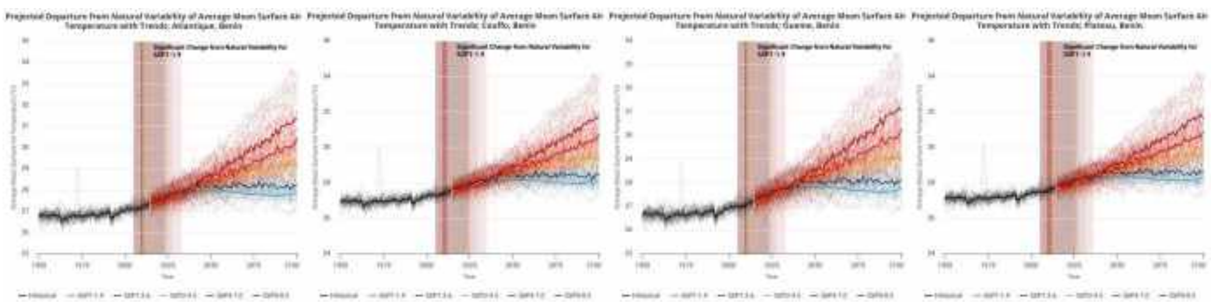


Figure 11: Projected departure from natural variability of average mean surface air temperature for Atlantique, du Couffo, Ouémé, and Plateau departments.
Source: Climate Change Knowledge Portal[27]

- ***Future climate of beneficiary communes in central Benin***

In the central region, the project targets the communes of ***Djidja*** (Zou department) and ***Bantè*** (Collines department). Figure 12 below displays the projected variability of precipitation throughout the seasonal cycle (left) and the anticipated departure from the natural variability of the average surface air temperature (right) for the Zou and Collines departments.

In the Collines, climate projections indicate a single rainy season, concentrated from May to October, with a distinct peak in June and July. Unlike other regions of Benin, there is no second rainy season. Precipitation progressively increases over the 2040-2059 and 2080-2099 periods, reaching as much as 350 mm during the peak time. The main dry season (December to March) remains unchanged. These trends indicate an intensification of rainfall during the rainy season, heightening the risk of flash floods and erosion, particularly in June and July.

For the Zou region, climate projections confirm the presence of two rainy seasons: the first, from May to mid-July, peaks notably in June (up to 300 mm by 2080-2099), followed by a dry spell in August. The second season occurs from September to October, which is evident but less intense. The main dry season, lasting from December to March, remains unchanged. Future projections suggest an intensification of rainfall, particularly during the peak in June, elevating the risk of

27 https://climateknowledgeportal.worldbank.org/country/benin/trends-variability-projections, consulted on 13 January 2025.

flash floods and surface runoff, while the distinction between the two rainy seasons stays clear.

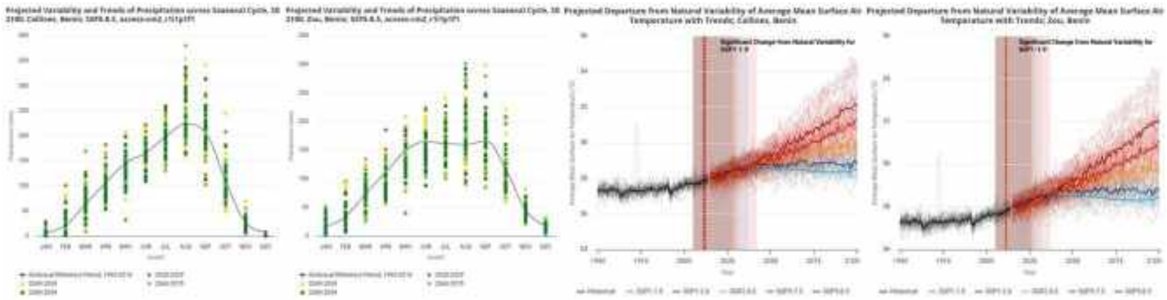


Figure 12: Projected variability of precipitation across the seasonal cycle (left) and the projected departure from the natural variability of the average mean surface air temperature (right) for the departments of Zou and Collines.
Source: Climate Change Knowledge Portal[28]

- ***Future climate of beneficiary communes in northern Benin***

Like the South, five municipalities across four northern departments will benefit from this project. They are ***Bassila*** (Donga Department), ***Boukoumbé*** (Atacora Department), ***Malanville*** and ***Kandi*** (Alibori Department), and ***Parakou*** (Borgou Department).

Figures 13 and 14 illustrate the projected variability of precipitation throughout the seasonal cycle (top) and the projected deviation from the natural variability of the average mean surface air temperature (bottom) for the four beneficiary departments in northern Benin.

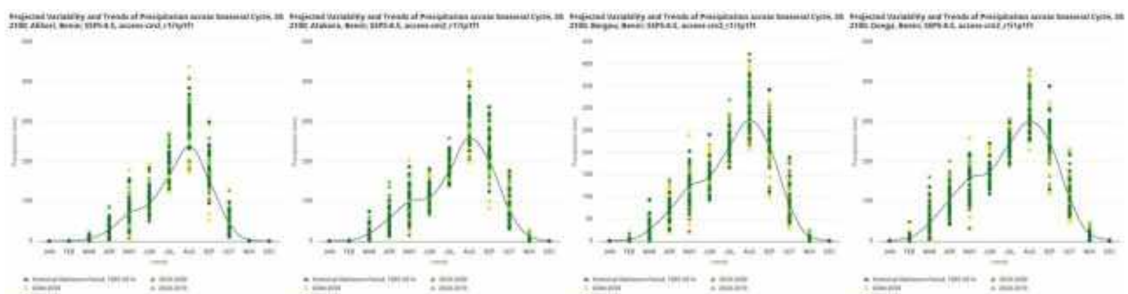


Figure 13: Projected variability of precipitation across the seasonal cycle for Alibori, Atacora, Borgou, and Donga departments.

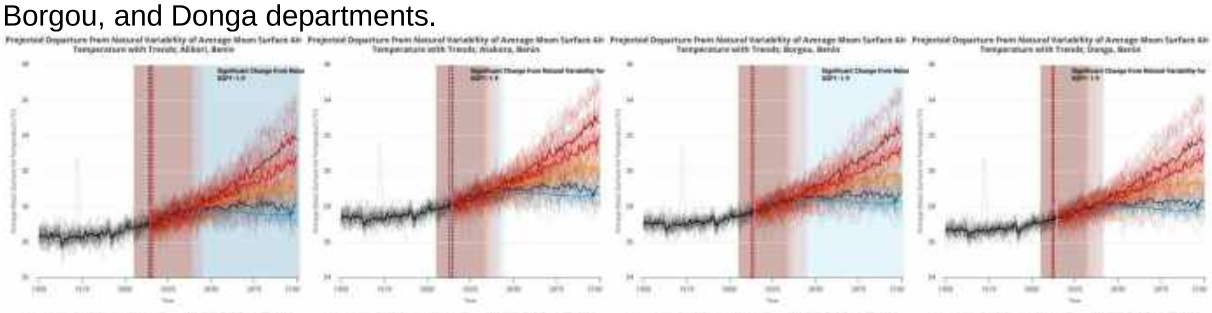


Figure 14: Projected departure from natural variability of average mean surface air temperature for Alibori, Atacora, Borgou, and Donga departments
Source: Climate Change Knowledge Portal[29]

In northern Benin, rainfall remains scarce from December to February in all future periods (2020-2039, 2040-2059, etc.). The rainy season remains well-defined, peaking between July and August, as it has in the historical period. This peak continues across all three future scenarios

28 https://climateknowledgeportal.worldbank.org/country/benin/trends-variability-projections, consulted on 13 January 2025.
29 https://climateknowledgeportal.worldbank.org/country/benin/trends-variability-projections, consulted on 13 January 2025.

before tapering off toward October. However, rainfall intensity is expected to increase from 2040-2059, reaching its peak around 2080-2099, with peak precipitation exceeding 400 mm. Future projections also indicate significant intra-seasonal variability, featuring more irregular rainfall patterns. While overall trends are consistent across the four departments, Atacora and Alibori may experience slightly higher peaks than Borgou and Donga.

Furthermore, projections suggest that the start of the rainy season will be slightly earlier starting in 2040, with a notable rise in precipitation as soon as April by the 2080-2099 timeframe. Simultaneously, the rainy season is anticipated to last longer, with ongoing rainfall extending into October and, in some instances, early November. These alterations lead to increased intra-seasonal variability and a greater risk of extreme weather events, highlighting the need for improved adaptation strategies and climate risk management measures.

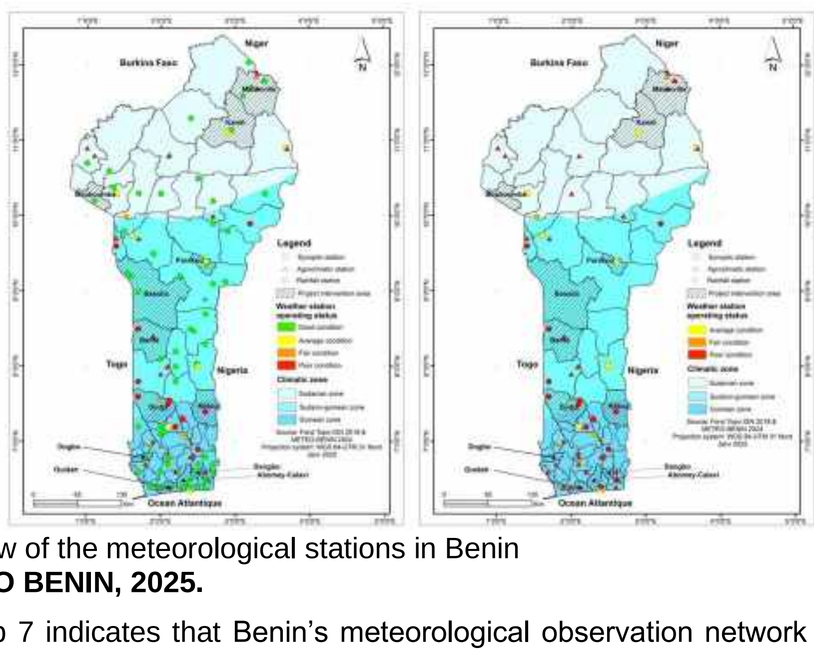
Climate variability analyses indicate that the population in the twelve (12) target communes is already suffering from the negative impacts of climate change. Climate projections suggest that these impacts will worsen unless appropriate adaptation measures are implemented. With more frequent and severe floods, strong winds, increasing unpredictability of rainfall, and prolonged droughts, it is critical to:

- o Establish early warning systems through regular monitoring of the SPI index and other climate indicators to anticipate extremes.
- o Strengthen local governance by ensuring effective coordination among key stakeholders (local authorities, technical services, and farmers) and promoting the sharing of relevant climate information.

The success of these actions depends on identifying, modernizing, and optimizing the network for observing and monitoring extreme weather and climate events.

1.3.1.2 – Overview of the Meteorological Stations in Benin

The map below illustrates the location of meteorological stations in Benin. The left side displays the overall condition of the weather stations based on their typology and functionality within the country's three climatic zones. The right side emphasizes the necessity to rehabilitate dilapidated weather stations across the nation.



Map 7: Overview of the meteorological stations in Benin
Source: METEO BENIN, 2025.

Analysis of Map 7 indicates that Benin's meteorological observation network includes various types of stations spread across the national territory, such as synoptic, climatological, agro-meteorological, and rainfall stations. This infrastructure is essential for climate monitoring, weather forecasting, and Early Warning Systems. However, an examination of this network uncovers several significant deficiencies in terms of coverage, geographical distribution, and station diversity (left side of the map).

The network coverage is uneven, with a higher concentration of stations in the south while the center and north are underserved, preventing full territorial coverage. Rainfall stations predominate, whereas agro-meteorological and climatological stations, essential for early warning systems, agriculture, and long-term climate monitoring, are scarce. Moreover, the absence of weather radars and marine meteorological stations is a significant deficiency, impacting the accuracy of short-term forecasts and the safety of maritime activities. Many stations are outdated or non-functional (see map on the right) and need rehabilitation and modernization to provide reliable and continuous data. Lastly, the network lacks regional and global integration, with limited interoperability, as only data from six (6) primary synoptic stations are transmitted to regional modeling centers, diminishing the effectiveness of forecasts and climate products.

Benin's meteorological observation network has an uneven and insufficient distribution, especially in rural and northern areas. Although the World Meteorological Organization (WMO) does not impose strict standards for station spacing, it encourages each country to design its network based on specific goals, geographic limitations, and its ability to maintain equipment. Nonetheless, established practices and studies provide guidance for network planning. A fundamental principle is that station density should be tailored to user needs and align with the geographic and climatic characteristics of the region. For instance, WMO recommendations advise placing one station per 100 km² in plains, with denser concentrations in complex areas like mountainous or coastal regions.

For an effective Early Warning System (EWS), it is typically advised that synoptic stations be positioned 30 to 60 km apart. This arrangement provides extensive regional coverage while considering local climatic variations. A notable example is the Oklahoma Mesonet network, which maintains an average station spacing of 30 km to ensure thorough data collection and monitoring[30].

For agricultural monitoring, the recommended distance between stations can vary, but a widely accepted standard is a separation of 5 to 10 km. This configuration enables the detection of microclimatic variations that can significantly influence crop conditions on a localized scale. Research shows that stations within a 5 km radius can provide data with sufficient accuracy for crop insurance assessments.

These examples illustrate the necessity of enhancing Benin's meteorological network, especially to boost extreme weather monitoring and forecasting at the community level. Considering the vital role of rainfall in agriculture, a sparse network compromises the reliability of early warning systems and localized forecasts.

2 – Project selection

Benin, a developing country characterized by significant climatic diversity, faces increasing vulnerability to both the current and future impacts of climate change and extreme weather events. Principal risks include water stress, intensified flooding, heatwaves, and extreme precipitation, which directly affect populations, livelihoods, ecosystems, and infrastructure. Communities in the twelve targeted communes are especially at risk due to their heightened sensitivity to climate variability, recurrent flooding, prolonged droughts, heatwaves, strong winds, wildfires, and erosion (including both runoff and coastal erosion).

Given their heightened vulnerability, Benin has identified several sectors as priorities for climate change adaptation, including agriculture, water resources, energy, health, infrastructure, urban development, tourism, forestry, and coastal zone management. Rising temperatures are anticipated to directly affect the livelihoods of local communities, with disproportionate impacts on women and girls. Additionally, climate change is worsening ecosystem degradation, loss of

30 https://www.campbellsci.fr/mesonets/mesonet-design, consulted on 28 January 2025.

biodiversity, and the spread of climate-sensitive diseases, adversely affecting community well-being.

To build climate resilience and mitigate risks, Benin must ensure access to accurate, timely meteorological data and people-centered, impact-based Early Warning Systems. Strengthening and modernizing the national observation network while enhancing stakeholder capacities will improve climate services. These efforts will assist vulnerable communities in making informed decisions, managing climate risks, and adapting effectively while protecting lives and livelihoods.

Benin's hydrometeorological observation network faces significant limitations, including **inadequate geographic coverage**, **outdated** and **non-automated stations**, the **lack of marine meteorological** and **radar systems**, and **insufficient telemetry infrastructure**. The country does not have **impact-based forecasting** or **advanced hydrological modeling for extreme weather events**, both of which are vital for climate resilience and essential for managing the worsening effects of climate change. Additionally, there is an absence of an institutional framework that connects climate information producers (METEO BENIN, DGEau, IRHOB) and intermediate users (ABPC, MAEP, MS, MEEM, etc.) to create forecasting and warning products based on the impacts of extreme weather and climate phenomena. Furthermore, the existing processes for producing and sharing climate services are inefficient, obstructing rapid and widespread access to critical information.

Regarding Early Warning Systems (EWS), Benin faces considerable fragmentation. Existing EWS operate in isolation, failing to coordinate and integrate across various sectors and stakeholders. This lack of synergy restricts their ability to provide consolidated, timely, and relevant information vital for anticipating risks and responding effectively to disasters. Moreover, none of the EWS in Benin comply with international standards such as the Common Alert Protocol (CAP), which is essential for issuing, ensuring interoperability, and distributing multi-hazard alerts. The absence of a CAP-compliant EWS substantially diminishes the effectiveness of alerts both nationally and internationally, impeding Benin's ability to align with global best practices.

These vulnerabilities jeopardize lives, livelihoods, ecosystems, and infrastructure. To tackle these issues, it's crucial to set up a national, integrated, multi-hazard Early Warning System that complies with Common Alert Protocol (CAP) standards.

B. Project Objectives

List the main objectives of the project/programme.

This project aims to improve meteorological services and establish an impact-based, multi-hazard Early Warning System (EWS) tailored to the specific needs of vulnerable populations, enhancing the climate resilience of local communities in Benin.

This project specifically seeks to:

- strengthen and modernize the weather observation system while establishing a multi-hazard Early Warning System (EWS) to enhance the dissemination and utilization of weather forecasts;
- Enhance skills for producing, sharing, and adopting meteorological and climatological services;
- ensure the sustainability of the project's results and oversee knowledge management.

C. Project Components and Financing

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

For the case of a programme, individual components are likely to refer to specific sub- sets of stakeholders, regions and/or sectors that can be addressed through a set of well defined interventions / projects.

Table 1: Components of the project

Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
Component 1: Enhancing and modernizing the observation network to improve weather and climate services	**Output 1.1.1:** 10 synoptic weather stations, 12 agroclimatic stations, 60 rain gauges stations, 2 marine stations, and 3 hydrometric stations have been installed	**Outcome 1.1:** High-quality, impact-based weather and climate forecasts are available in a changing environment.	2,645,000
	Output 1.1.2: 5 synoptic weather stations, 1 agrometeorological station, and 6 precipitation monitoring stations have been rehabilitated		
	Output 1.1.3: The IT equipment is acquired		
	Output 1.1.4: The server and calibration rooms at METEO BENIN are upgraded to meet standards		
	Output 1.1.5: Weather forecasting models tailored to the specific needs of local communities are developed		
	Output 1.1.6: Multi-risk forecasting tools and capabilities based on risk impacts are available		
	Output 1.1.7: Sector-specific climate analyses and differentiated meteorological services for public and private sectors are co-produced		
	Output 1.1.8: A multi-risk Early Warning System based on impacts is established, operational, and accessible to a broad public, including vulnerable populations	**Outcome 1.2:** Specific meteorological and climatological services are available to local communities to enhance their adaptive capacity	
	Output 1.1.9: The channels for producing and disseminating various existing Early Warning Systems (EWS) are aligned with those of the newly developed multi-risk EWS.		
	Output 1.1.10: A national strategy for the production and dissemination of meteorological and climatological information is developed		
	Output 1.1.1: Web and mobile applications for real-time early warning dissemination are developed and operational		
	Output 1.1.12: Local communities have access to reliable meteorological and climatological services and use them to enhance their resilience.		
	Output 1.1.13: The partnership between municipalities and local media is strengthened for the rapid and reliable dissemination of information and early warnings		
	Output 1.1.14: Early warning protocols based on impacts and utilizing collaborative methods tailored to specific needs are developed and operational		

Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
Component 2: Strengthening capacity for the production, dissemination, and adoption of meteorological and climate information	**Output 2.1.1:** The capacity of METEO BENIN's specialized staff on forecasting models tailored to the specific needs developed is strengthened	**Outcome 2.1:** The technical and organizational capacity of stakeholders is strengthened to enable the effective implementation of a multi-risk early warning system tailored to local needs	698,000
	Output 2.1.2: All stakeholders involved in the existing Early Warning Systems (EWS) are trained on the newly developed multi-risk EWS		
	Output 2.2.1: Local communities are sensitized and trained on climate risks, the multi-risk EWS and risk management to strengthen their resilience	**Outcome 2.2:** Local communities have the necessary knowledge to better understand climate risks, use the multi-risk early warning system, and strengthen their resilience to the impacts of climate change	
	Output 2.2.2: Community leaders are trained in climate risk preparedness and response		
Component 3: Sustainability of project results and knowledge management	**Output 3.1.1:** An operational maintenance and upkeep plan for all acquired infrastructure and equipment is developed and implemented	**Outcome 3.1:** Meteorological and climatological infrastructure and equipment are sustainably maintained and preserved through an effective operational plan, ensuring their long-term functionality	150,000
	Output 3.1.2: A public-private partnership plan for the sustainability of meteorological and climatological services is developed		
	Output 3.2.1: A toolkit summarizing the best practices and successes of the project is developed	**Outcome 3.2:** The best practices and successes of the project are capitalized and made available in the form of practical tools, facilitating their dissemination and replication	
	Output 3.2.2: Facilities for knowledge sharing and management are established		
6. Project Execution cost			**3,493,000**
7. Total Project Cost			3,824,835
8. Project Cycle Management Fee charged by the Implementing Entity (9.5% of **execution cost**)			**331,835**
9. FNEC management cost (8.5% implementation cost)			**325,111**
Amount of Financing Requested			4,149,946

D. Projected Calendar

Indicate the dates of the following milestones for the proposed project/programme

Table 2: Projected Calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	2026
Mid-term Review (if planned)	2029
Project/Programme Closing	2030
Terminal Evaluation	2030

PART II: PROJECT JUSTIFICATION

A – Project Components

Describe the project/programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.

This project aims to improve meteorological services and establish an impact-based, multi-hazard Early Warning System (EWS) tailored to the specific needs of vulnerable populations, enhancing the climate resilience of local communities in Benin. For this purpose, these adaptation activities are described below.

Component 1: Enhancing and modernizing the observation network to improve weather and climate services

The first component of the project focuses on enhancing and distributing weather and climate forecasts by strengthening infrastructure and improving national expertise in detecting, observing, monitoring, and modeling extreme meteorological and climatological events. It will also include establishing a multi-risk Early Warning System (EWS). The aim is to provide reliable meteorological and climatological services through investments in meteorological infrastructure and advanced digital technologies while developing an integrated platform that consolidates real-time data, forecasts, and alerts to ensure differentiated access for users. Additionally, the project aims to enhance modeling capabilities for meteorological, hydrological, and climatic phenomena to fully operationalize the Global Framework for Climate Services (GFCS) and the Benin National Framework for Climate Services (NFCS) at the national level.

Outcome 1.1: *High-quality, impact-based weather and climate forecasts are available in a changing environment*

- **Output 1.1: The capacity to detect, observe, monitor, and model extreme meteorological, hydrological, and climatological events is strengthened in the target municipalities**

Output 1.1 emphasizes the critical need to improve coverage and modernize of the observation and monitoring network for extreme meteorological and climatological events at the national level. This enhancement will provide reliable and tailored data for localized forecasts that address the needs of local communities. The proposed investments will support the creation of precise forecasts and warnings, climate risk alerts, and relevant climate analyses for key adaptation sectors in Benin, including agriculture, water resources, energy, health, tourism, forestry, infrastructure, urban planning, and coastal management.

Additionally, this output will allow Benin to develop national models and tools for multi-hazard weather forecasting based on impact. This approach clearly highlights the necessity of transitioning from deterministic forecasting techniques to probabilistic methods, which not only identify the most likely impacts but also outline reasonable worst-case scenarios that often result in avoidable disasters. Adopting a probabilistic approach instead of the traditional deterministic model improves forecast reliability and provides timely warnings for effective disaster risk reduction.

This outcome will also further scientific understanding of various climate risks, as well as the exposure and vulnerability of local communities. Scientific information on meteorological and climate risks will be co-produced, facilitating the creation of accurate, specific, and impact-based forecasting and warning products, which are essential for establishing an effective multi-hazard early warning system.

This result will be achieved through the following two activities:

- ***Activity 1.1.1:*** *Acquisition and installation of automatic stations, including 10 synoptic weather stations, 12 agroclimatic stations, rain gauges, 2 marine stations, and 3 hydrometric stations*

This activity aims to expand the hydrometeorological and oceanographic observation and monitoring network, enabling accurate real-time data collection and improving its spatial coverage.

- ***Activity 1.1.2:*** *5 synoptic weather stations, 1 agrometeorological station, 6 precipitation monitoring stations, and 13 hydrometric stations have been rehabilitated*

This activity involves replacing outdated instruments in existing stations and setting up a remote transmission system in traditional stations. These measures will improve the quality of the collected data and optimize monitoring operations.

- ***Activity 1.1.3:*** *Development of nationwide numerical weather prediction models tailored to the specific needs of local communities and enhance multi-hazard forecasting capabilities based on risk impact*

Activity 1.1.3 aims to develop high-resolution meteorological models that can capture hydrometeorological, oceanographic, and local microclimatic phenomena (fine-mesh models with a final resolution of 3 km). These models will incorporate specific data such as land use, local vegetation, and geographic features. They will also integrate data from local weather stations and satellites to connect short-term (3 to 7 days) hydrometeorological and oceanographic forecasts with seasonal climate trends, thereby facilitating better planning of local economic activities. This activity will implement a fine-scale modeling system based on the Weather Research and Forecasting (WRF) model, consisting of four (4) subcomponents for applications in general weather forecasting, hydrology, oceanography, and climate.

This activity also aims to create a multi-hazard database that centralizes data on natural hazards (high winds, heavy rains, floods and flash floods, droughts and late rains, heat waves, earthquakes, etc.) and their historical impacts. This database will integrate socio-economic data, including population density, critical infrastructure, and livelihoods. Digital early warning platforms will be developed to provide an accessible interface that consolidates multi-hazard forecasts and their likely impacts. The system will include interactive maps and personalized alerts. Tools will also be developed to visualize potential impacts on communities, infrastructure, and ecosystems.

- ***Activity 1.1.4:*** *Co-production of sector-specific climate analyses and tailored* *meteorological services for both public and private sectors*

Based on the outcomes of stakeholder consultations and existing documents such as the National Framework for Climate Services (CNSC), vulnerability profiles for each sector will be refined in collaboration with stakeholders to identify the types of hydrometeorological and climate information needed, including short-term forecasts, seasonal analyses, and long-term climate scenarios. Workshops will be organized to bring together public and private sector actors to collaboratively design relevant meteorological and climate analyses and services, integrating local and sector-specific knowledge whenever possible. Following these workshops, multidisciplinary working groups will be established to ensure the joint development and validation of impact-based forecasts and warnings for extreme hydrometeorological and oceanographic phenomena at the sectoral level throughout the project.

Outcome 1.2: ***Specific meteorological and climatological services are available to local communities to enhance their adaptive capacity***

- **Result 1.2: A multi-hazard Early Warning System is designed and operationalized**

The project will establish a multi-hazard Early Warning System tailored to the specific needs of local communities and focused on reducing disaster risks. It will ensure the efficient and coordinated implementation of hydrometeorological and climatological data production and dissemination at the national level by strengthening the organizational and decision-making processes of all stakeholders. Furthermore, the project will seek to harmonize and align existing EWS with international standards to optimize resource allocation for early warning production and dissemination. Additionally, a national strategy will be developed to coordinate, facilitate, and enhance collaboration among national institutions, thereby improving access to and effective utilization of meteorological and climatological services.

To achieve these objectives, three main activities will be implemented:

- ***Activity 1.2.1:*** *Implementation of an impact-based multi-hazard Early Warning System (EWS)*

All forecasting tools and capabilities developed in activities 1.1.3 and 1.1.4 will facilitate the creation of an integrated platform that consolidates real-time data, forecasts, and warnings. This platform, designed with a community-based information dissemination approach, will offer differentiated access to users, including local authorities, NGOs, and communities.

- ***Activity 1.2.2:*** *Harmonizing the production and dissemination channels of existing Early Warning Systems (EWS) with those of the newly developed multi-hazard EWS*

To achieve its objective, this activity aims to:

- Identify existing Early Warning Systems (EWS) in Benin (floods, droughts, wildfires, epidemics, etc.), inventory their Standard Operating Procedures (SOPs), and assess their compatibility with the Common Alerting Protocol (CAP);
- Evaluate these systems to identify redundancies, inconsistencies, or gaps in the production and dissemination processes;
- Integrate the forecasting models of existing EWS into a unified framework tailored for multi-hazard approaches to develop harmonized models that account for the interconnected impacts of multiple risks;
- Develop a single interface to enable simultaneous and standardized dissemination across all communication channels.

- ***Activity 1.2.3:*** *Development of a national strategy for producing and sharing meteorological and climatological information*

This activity will allow Benin to establish a clear vision for producing and disseminating meteorological and climatological information while setting objectives that align with national priorities (food security, climate resilience, and disaster risk reduction). It will also ensure that the strategy supports the Sustainable Development Goals (SDGs) and Benin's climate commitments.

Result 1.3: Local communities benefit from better access to improved meteorological and climatological services

The three activities to be implemented here will enhance communities' access to meteorological and climatological services by developing web and mobile applications designed to automate the distribution of weather forecasts and communicate alerts. By improving existing dissemination platforms, the project will deliver risk-specific, geographically targeted alerts for each area impacted by a particular hazard.

- ***Activity 1.3.1:*** *Development of web and mobile applications for the real-time dissemination of early warning alerts*

Activity 1.3.1 aims to:

- Design a robust and secure system to host applications using modern technologies for real-time alert transmission;
- Develop an application compatible with both Android and iOS platforms, incorporating key features such as push notifications for urgent alerts, geolocation for sending location-specific alerts, and multilingual options to include local languages;
- Create an intuitive web user interface that allows users to access alerts, risk maps, and practical advice, while integrating dashboards for local authorities to monitor and manage the alerts.

- ***Activity 1.3.2:*** *Strengthening the partnership between municipalities and local media for the swift and dependable dissemination of information and early warnings*

- ***Activity 1.3.3:*** *Developing early warning protocols by transitioning from a hazard-based approach to an impact-based approach, employing collaborative methods tailored to specific needs*

Component 2: Strengthening capacity for the production, dissemination, and adoption of meteorological and climate information

The second component focuses on strengthening the technical capacities of stakeholders involved in the production, dissemination, and use of meteorological services. It is based on two primary outcomes.

Outcome 2.1: ***The technical and organizational capacity of stakeholders is strengthened to enable the effective implementation of a multi-risk early warning system tailored to local needs***

Result 2.1: Enhancing the technical and organizational capabilities of the actors in the meteorological services production chain

The goal of this output from Component 2 is to enhance the modeling capabilities of meteorological, hydrological, and oceanographic phenomena for METEO BENIN, DGEau, and IRHOB to improve the accuracy of forecasts using an impact-based approach. Reliable modeling indeed enables more effective anticipation of environmental risks and optimizes resource and infrastructure management in the face of increasingly severe climate challenges. To achieve this outcome, the following two activities will be undertaken:

- ***Activity* 2.1.1:** *Strengthen the capabilities of specialized staff at METEO BENIN, DGEau, and IRHOB regarding the forecasting models developed in Activity 1.1.3, as well as the* *maintenance processes for installed stations and for data collection and processing*

- **Activity 2.1.2:** *Strengthen the capacities of decentralized governmental services as intermediary users to facilitate the adoption, use, and communication of impact-based forecasting and early warning products developed through the Multi-Hazard Early Warning System (EWS)*

Outcome 2.2: ***Local communities have the necessary knowledge to better understand climate risks, use the multi-risk early warning system, and strengthen their resilience to the impacts of climate change***

Result 2.2: Enhancing the technical capacity of local communities to adopt improved meteorological services

This output emphasizes enhancing the technical capacity of local communities to adopt improved meteorological services. By implementing specific actions such as increasing awareness of climate risks and training community leaders in risk management and crisis preparedness, this initiative aims to bolster the resilience of local communities. The outlined activities will enhance their ability to anticipate and respond effectively to extreme climate events, supported by the Multi-Hazard Early Warning System.

- ***Activity 2.2.1:*** *Enhancing awareness and education of local communities on climate risks, Early Warning Systems, and risk management to strengthen their resilience*
- ***Activity 2.2.2:*** *Training community leaders on preparedness and responses to climate risks*

Component 3: Sustainability of project results and knowledge management

The third component focuses on ensuring the sustainability of project results and knowledge management. Its aim is to guarantee the long-term viability of the results achieved while facilitating the sharing and dissemination of the generated knowledge. It is based on two main outcomes.

Outcome 3.1: ***Meteorological and climatological infrastructure and equipment are sustainably maintained and preserved through an effective operational plan, ensuring their long-term functionality***

Result 3.1: A strategy is developed and implemented to ensure the sustainability of the project's outcomes

As a result, the sustainability of the project results will be ensured through the durability of the infrastructure and services that are essential for the optimal climate risk management. Developing and implementing an operational plan for equipment maintenance will ensure the necessary tools for detecting, observing, and monitoring extreme weather events. Furthermore, fostering the establishment of a public-private partnership will enhance the sustainability of meteorological and climatological services, thereby reinforcing the longevity of the Early Warning System (EWS). This will guarantee its long-term effectiveness and promote a rapid, coordinated response to multi-hazard threats. The following activities are outlined to achieve this objective:

- ***Activity 3.1.1:*** *Develop and implement an operational plan for the maintenance and upkeep of all acquired infrastructure and equipment*
- ***Activity 3.1.2:*** *Support in establishing a public-private partnership to ensure the sustainability of meteorological and climatological services*

Outcome 3.2: ***The best practices and successes of the project are capitalized and made available in the form of practical tools, facilitating their dissemination and replication***

- **Result 3.2: Knowledge management and experience sharing at the national level**

Result 3.2 highlights the significance of knowledge management and experience sharing at the national level. Developing a toolkit that compiles best practices and successes from the project enables the capitalization of lessons learned to optimize risk management and response to climate threats. Moreover, establishing facilities for knowledge sharing and management will promote the smooth flow of information between beneficiary and non-beneficiary local communities, thereby ensuring strengthened coordination and continuous improvement of the Early Warning System (EWS) at the national level. To achieve this, the following activities are defined:

- ***Activity 3.2.1:*** *Development of a toolkit synthesizing all the best practices and successes from the project*
- ***Activity 3.2.2:*** *Establishment of facilities for knowledge sharing and management*

By integrating these three components, the project aims to establish reliable and cohesive national meteorological and climate services capable of effectively tackling the challenges posed by climate change. The first component will not only deliver high-quality meteorological and climate forecasts but also ensure their optimal utilization to protect lives, infrastructure, and livelihoods. The second component will enhance technical capacities and guarantee the sustainable use of meteorological and climate services, while the third component will concentrate on ensuring the long-term viability of the project's accomplishments. These integrated services will empower Benin to anticipate, prevent, and respond effectively to climate risks while fostering sustainable and inclusive development.

B – Economic, social, and environmental benefits

Describe how the project would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

Economic benefits: Implementing the project will yield substantial economic advantages for several vulnerable sectors, thus contributing to sustainable and inclusive development. In the agricultural sector, it will enhance water management efficiency and improve the forecasting of extreme climate events, particularly during rainy seasons and drought periods. This enhancement will minimize production losses caused by droughts and excessive rainfall. Consequently, more than half of the population in the study area will see an increase in their income, as over 50% of residents in the targeted communes rely on agriculture for their livelihoods.

For instance, the commune of Djidja serves as a significant agricultural hub, with food crops making up around 63% of plant production, while industrial crops such as cotton and groundnuts account for 33%. However, the absence of effective water control remains a substantial challenge. In contrast, the commune of Kétou is primarily focused on agriculture, commerce, and handicrafts, with about 50% of the workforce engaged in agriculture and 30% involved in commerce. In Dangbo, agriculture represents over 56% of the working population (56,948 individuals across 10,369 households), contributing to 87% of household income, all within a context of variable rainfall ranging from 1,000 to 1,600 mm per year. Meanwhile, in Bassila, agriculture is the leading economic activity, employing roughly 62.8% of the workforce and contributing more than 80% of the local population’s income.

The economy of the commune of Dogbo primarily relies on agriculture; however, access to land, water, and labor is crucial for the effectiveness of agricultural policies. By collecting and analyzing climatic data, the project will enable farmers to better manage their agricultural calendar, resulting in increased productivity and more stable incomes. According to the FAO, improved water management could reduce agricultural losses by 15-20%. Furthermore, the Early Warning System will assist in better managing reservoirs, dams, and irrigation systems, thereby lowering costs associated with water crises and repairs to damaged infrastructure.

In the health sector, this system will lead to a 10-15% reduction in health costs by preventing epidemics related to climate disasters and reducing mortality by 20-30%. It will also alleviate pressure on health infrastructures, decrease emergency treatment costs, and enhance economic productivity by lowering absenteeism from work, especially in rural areas. Finally, the project will optimize infrastructure management, minimizing spending on emergency repairs and ensuring preventive maintenance. These actions will strengthen the economic resilience of vulnerable communities, particularly those in rural areas, thereby promoting inclusive and sustainable development.

On a social level, the project aims to strengthen social ties within local communities by improving meteorological services and establishing a multi-hazard Early Warning System. It seeks to enhance access to essential climate information, particularly for vulnerable populations such as women and young people. By providing reliable weather services and resources to handle extreme events, the project promotes community solidarity, especially in rural areas. Particular attention will be given to gender mainstreaming, ensuring that women, who often manage agricultural and food resources within households, benefit from improved access to climate information. This approach will not only empower them to better manage climate risks but also enhance their economic autonomy while reducing gender inequalities in climate change adaptation.

Moreover, the project will provide young people, particularly young agricultural entrepreneurs, with training opportunities and access to reliable weather information, allowing them to develop specific skills and secure their professional futures. This strategy will foster a true dynamic of intergenerational and gender cooperation, which is crucial for strengthening the resilience of communities against climate crises. Additionally, through awareness-raising and capacity-building initiatives, the project will facilitate the broad sharing of knowledge on climate risk management, thereby reducing individuals' long-term vulnerability. It will also generate local employment in sectors related to climate change adaptation, helping to increase incomes and reduce food insecurity and poverty, especially for women and young people. By enhancing the resilience of communities to extreme weather events, the project promotes more inclusive and sustainable economic development while reinforcing social cohesion and local solidarity.

From an environmental perspective, implementing the project through the Multirisk Early Warning System will yield significant benefits. By providing real-time climate information, the project aims to reduce the damage caused by extreme weather events. This ability to anticipate climate phenomena will not only limit the intensity and frequency of natural disasters, but also enable a quicker and more effective response to environmental crises. Project activities will bolster community resilience against climate risks by enhancing the forecasting of extreme weather events. This involves developing more reliable forecasting models, which will contribute to better management of environmental risks. Furthermore, sharing climate information via suitable channels will help local communities become better prepared and informed to face climate change, thereby reducing their vulnerability.

To limit long-term environmental impacts, the project will establish mechanisms for sharing climate information. Providing more accurate forecasts and effectively disseminating them will enable communities to adopt better-targeted adaptation strategies in the face of extreme climatic events. This approach will reduce long-term environmental risks and contribute to the sustainable management of natural resources. At the same time, the project will incorporate environmental and social safeguards consistent with the requirements of the Adaptation Fund. These measures aim to avoid or reduce any potential negative impacts on the environment and local populations. Activities will be designed to minimize harmful effects on ecosystems and promote sustainable management of natural resources, ensuring that the principles of environmental sustainability are upheld throughout the project. This way, the implementation of the project will not only reduce the immediate environmental impacts of natural disasters but also enhance the resilience of communities to future climate challenges while ensuring the long-term sustainability of local ecosystems.

C – Cost-effectiveness analysis of the proposed project

Describe how the project would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The current project is designed to maximize economic efficiency while ensuring the long-term sustainability of its operations. It focuses on modernizing and extending the meteorological network, which enables more accurate and extensive data collection, leading to significant improvements in weather and climate services. This modernization enhances the ability to predict extreme weather events, thereby reducing potential human and economic losses.

A comprehensive assessment of the specific vulnerabilities of each beneficiary community will enable the definition of better-targeted adaptation strategies, ensuring optimal resource management and a response tailored to the needs of every community. This approach will facilitate a more efficient use of resources and contribute to the long-term reduction of environmental and climate risks. The project also strongly emphasizes making climate and weather information accessible to all segments of the population, including women, youth, the elderly, and disabled individuals. This will encourage widespread dissemination of the project's benefits and enhance the resilience of vulnerable communities. By mitigating losses caused by natural disasters, the project will also yield significant savings, particularly by lowering the costs associated with agricultural damage, directly benefiting small-scale farmers. Furthermore, anticipating climate-related disasters will cut emergency expenses by decreasing the frequency of relief and reconstruction efforts.

The project will also foster value creation by enhancing agricultural productivity and diversifying income sources, thereby bolstering household economic security. By boosting incomes and alleviating poverty, the project will aid in sustainable and inclusive economic development. Overall, the project is extremely cost-effective in upgrading meteorological infrastructure and incorporating climate risks into local planning. It guarantees broad access to information and a focused response to the needs of the most vulnerable communities while significantly minimizing economic and social losses caused by climate-related disasters.

D – Project Alignment with national or sub-national sustainable development strategies

Describe how the project is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If applicable, please refer to relevant regional plans and strategies where they exist

The project “Strengthening Meteorological Services and Establishing a Multi-Hazard Early Warning System to Enhance the Climate Resilience of Local Communities in Benin” aligns with several development plans and programs in Benin, particularly those related to climate risk management, adaptation to climate change, and the resilience of vulnerable communities. Among these strategy documents, the policy and action plan include:

- The *National Development Plan (NDP 2018-2025):* Benin’s NDP incorporates climate change considerations into both its adaptation and mitigation aspects. Paragraph 316 outlines the disaster risk management challenges in Benin. Regarding the Strategic Orientations of the Specific Objective: “to ensure better management of the environment and climate change", the NDP intends to enhance resilience to climate change and other disaster risks, as detailed in paragraphs 554 and 555. The initiative to establish a multi-hazard early warning system is rooted in these various sections of Benin's NDP.

- The *National Climate Change Adaptation Plan (NAP):* Benin's NAP serves as the country's roadmap for adapting to the impacts of climate change. It highlights the most vulnerable sectors, including agriculture, water resources, energy, health, tourism, forestry, infrastructure, and urban and coastal development, while suggesting adaptation options for each sector. The project closely aligns with this plan by enhancing early warning systems, improving climate monitoring, and increasing community awareness of climate risks.
- *Nationally Determined Contributions (NDC 2021-2030):* this project fully aligns with the implementation priorities of the Nationally Determined Contributions (NDC). By focusing on establishing an Early Warning System, it directly addresses the NDC's objectives, which aim to create information and warning systems concerning the harmful effects of climate change. Indeed, through the Early Warning System, the project enhances climate risk management, enabling communities to respond swiftly to natural disasters and minimize economic and human losses. It also bolsters food security by providing accurate meteorological data to improve agricultural planning, which aligns with Benin's commitments to promote climate-resilient agriculture. Furthermore, the project strengthens institutional and local capacities for climate risk management, aligning with the NDC's priorities of building the capacities of national and local authorities' stakeholders.
- *Strategic Plan of METEO BENIN (2022–2026):* this project aligns with the strategic priorities of METEO BENIN's 2022–2026 Strategic Plan by contributing to infrastructure modernization, enhancing forecasting capabilities, and strengthening capacities for improved climate resilience. It supports the modernization and reinforcement of the observation network through the installation and rehabilitation of meteorological and hydrological stations, thereby improving the monitoring and anticipation of extreme weather events. Additionally, the project bolsters forecasting and modeling capabilities by integrating advanced numerical models (WRF and WRF-Hydro), optimizing the accuracy of meteorological and hydrological predictions. In terms of technical and institutional capacity building, targeted training programs are implemented for METEO BENIN staff, decision-makers, and local communities, ensuring better ownership of climate services. Furthermore, the project improves the dissemination of climate services through a multi-hazard Early Warning System (EWS), digital platforms, and mobile applications, ensuring timely and targeted access to critical information. Finally, it guarantees the sustainability of achievements by developing an infrastructure maintenance plan, fostering public-private partnerships, and leveraging best practices for the continuous improvement of meteorological services. By aligning with these strategic directions, the project effectively enhances meteorological and climate services in Benin, thereby increasing resilience to climate change.
- *National Framework for Climate Services (NFCS):* the project fully aligns with the priorities of Benin's National Framework for Climate Services (NFCS), enhancing the production and delivery of climate services through high-resolution forecasting models and an impact-driven multi-hazard Early Warning System (EWS). This approach improves the anticipation of extreme weather events and supports informed decision-making. The project also enhances observation and forecasting infrastructure by installing and rehabilitating meteorological and hydrological stations, ensuring broader coverage and greater accuracy of climate data. Furthermore, it emphasizes human and institutional capacity-building by providing specialized training to METEO BENIN staff, institutional stakeholders, and local communities, fostering a better understanding and application of climate information. To ensure effective dissemination of climate services, the project plans to deploy digital platforms and mobile applications while strengthening partnerships

with media outlets and local communication networks, guaranteeing quick and equitable access to meteorological information. Finally, the project supports the establishment of a governance and coordination framework by harmonizing existing EWS systems and developing a national strategy for producing and disseminating climate services, thereby enhancing synergy among national institutions. By aligning with these priorities, the project aids in the effective implementation of the NFCS and the sustainable enhancement of climate services in Benin.

- The *Strategic Plan for the Development of the Agricultural Sector (PSDSA)* recognizes that the agricultural sector is particularly vulnerable to the impacts of climate change. The PSDSA aims to modernize agriculture, improve yields, and enhance producers' resilience to climatic hazards. This project supports this vision by providing farmers with better access to relevant climate information, facilitating improved management of climate risks and proactive adaptation of farming practices. Additionally, to bolster the national agricultural statistics system, this plan calls for the implementation of an Agricultural Geographic Information System, which includes the Agrometeorological and Climate Forecasting and Warning System. This initiative aligns perfectly with the activities of this project.
- The *National Health Policy (PNS 2018-2030)*: the health policy statement emphasizes an urgent need to develop actions focused on improving health information by strengthening institutional and human capacities and coordinating the data collection process. Consequently, in its third objective, "to improve governance and resource management in the health sector," strengthening epidemiological surveillance stands as one of the main pillars. This project aligns with that objective.
- The *National Strategy for Disaster Risk Reduction 2019-2030 (SNRRC)* aims to significantly and sustainably enhance the resilience of Benin's communities, national institutions, and local authorities to disasters. Accordingly, through its first action, “Strengthening the capacities of warning production and dissemination institutions," within Axis 1: Improving the policy, institutional, legislative, and regulatory framework, the SNRRC seeks to create a national framework conducive to DRR initiatives and innovations. This includes the rehabilitation, strengthening, densification, modernization, and maintenance of the meteorological, hydrometeorological, and oceanographic observation network, as well as translating hydro-meteorological information products into a language and format accessible to end-users. Consequently, this project is fully aligned with the NTSRC in all its components.
- *Sustainable Development Goals (SDGs):* this project directly supports several SDGs, particularly SDG 13 (Climate Action), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), and SDG 11 (Sustainable Cities and Communities). Through its multi-hazard approach, the project enhances community resilience to the impacts of climate change and ensures the food security, health, and well-being of vulnerable populations, thereby aiding Benin's progress in achieving the SDGs.

E – National technical standards and environmental and social policy

Describe how the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund

The proposed project aligns with the Adaptation Fund's environmental and social policy and Benin’s environmental and social regulations. An analysis of national texts, particularly framework law no. 98-030 of February 12, 1999, concerning the environment and the principles and criteria of the Adaptation Fund, reveals that the national categorization completely reflects that of the Adaptation Fund. Assessments and feasibility studies will outline national environmental standards and demonstrate how the project will adhere to them. Additionally, these studies will explain how the project will establish an environmental and social management plan that complies with both national and Adaptation Fund standards. Controls will be implemented to ensure that the project does not worsen inequalities, negatively affect marginalized populations, or harm the environment. The main applicable national laws and regulations are as follows:

- Law no. 98-030 of February 12, 1999, the framework law on the environment in the Republic of Benin;
- Law no.2018-18 of August 06, 2018 on climate change in the Republic of Benin;
- decree n°2022-211 of March 30, 2022 approving the statutes of the National Meteorological Agency (*Agence nationale de la Météorologie*);
- Law no. 2013-01 of January 14, 2013, on the Land and Domain Code of the Republic of Benin, amended by Law No. 2017-15 of May 26, 2017;
- Act no. 87-015 of September 21, 1987 on the Public Health Code;
- Law no.2010-44 of October 21, 2010 on water management in the Republic of Benin;
- Law no. 87-015 of September 21, 1987 on the public health code;
- Law no.97-029 of January 15, 1999 on the organization of Communes in the Republic of Benin;
- Law no. 2011-26 of January 9, 2012 on the prevention and repression of violence against women;
- Law no. 98-004 of January 27, 1998 on the Labor Code in the Republic of Benin.

F – Duplication

Describe *how the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund*

During consultations with stakeholders, including technical and financial partners, as well as donors funding various projects, we identified SAP projects that have already been implemented to prevent any duplication of effort, resources, or geographical coverage, ensuring synergy between ongoing initiatives and the proposed project. Benin has established an Early Warning System (EWS), known as EWS Benin, which has facilitated the installation of 25 hydrometric stations, 20 meteorological stations, and 3 teletransmitted oceanographic stations, along with the implementation of a Standard Operating Procedure for communication, training for stakeholders at various levels, and the establishment of five visualization platforms. Additionally, a buoy has been installed for oceanographic monitoring. Meanwhile, the Ministry of Health and the Ministry of Agriculture have developed warning systems for epidemic response and food safety, respectively.

However, despite these measures, the existing EWS have several shortcomings: they are not fully operational in some intervention zones due to unreliable connectivity and a lack of continuous electrical power, which disrupts their regular functioning. Additionally, information about climate change is not systematically integrated, making it challenging to anticipate climate risks and respond quickly to extreme events. The centralization and dissemination of climate and weather data at the national level is also limited, hindering widespread communication of warnings to all stakeholders.

Furthermore, the lack of specific forecasting models for Benin undermines the reliability of information, and the consistency of warnings among the different systems is sometimes inadequate. Finally, while the SAP Benin system primarily focuses on climate and hydrometeorological alerts, it does not sufficiently incorporate health risks associated with climate events (such as vector-borne diseases, post-flood epidemics, or health crises following prolonged droughts). Thus, the proposed project will enhance existing early warning systems (EWS) by reinforcing equipment across the country, expanding platforms to inform and raise awareness of climate risks among local communities, and providing training programs and simulations to improve their ability to respond to alerts and disasters. It will also strengthen the coordination of multi-hazard warnings and integrate climate change information, enabling more robust data centralization and better dissemination through digital and community channels. Additionally, the project will broaden the scope of EWS by incorporating health alerts, particularly to mitigate the risk of diseases related to floods or droughts and will enhance collaboration with all sectors vulnerable to climate change, including Health, Agriculture, and Water, for coordinated crisis management in the aftermath of extreme climatic events.

G – Learning, knowledge management, and lessons learned

If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Effective communication, proactive knowledge management, and continuous learning are critical to the project's success, particularly in ensuring the sustainability and dissemination of best practices. These elements have been incorporated into the project design from the beginning and are considered in components 1, 2, and 3. Component 1, which facilitates the implementation of a multi-hazard Early Warning System, aims to optimize the dissemination and use of weather forecasts. It includes specific actions for: (i) developing a national strategy for the production and dissemination of weather and climate information, (ii) creating web and mobile applications for real-time distribution of early warnings, and (iii) enhancing partnerships between municipalities and local media to ensure rapid, reliable, and accessible communication. These activities will improve knowledge management by enabling information production, dissemination, and sharing through various channels, including social media and websites. Using community radios, social networks, and official METEO BENIN pages will allow for real-time sharing of project updates, success stories, and best practices in various local languages. Additionally, the establishment of a knowledge portal on the METEO BENIN website will provide centralized and quick access to project resources for both stakeholders and the public, thereby promoting knowledge management and information transparency.

Component 2, which focuses on enhancing the production and adoption capacities of weather and climate services, offers targeted training for all stakeholders involved in current early warning systems. These training sessions will raise awareness and educate local communities about climate risks and the use of Early Warning Systems and risk management. Community leaders will receive specific training designed to strengthen their ability to prepare for and respond to climate risks. These initiatives are also structured as participatory learning and knowledge-sharing activities, aimed at increasing community resilience and equipping them with swift and effective adaptation strategies for climate hazards. All training materials will be tailored to local languages and made accessible through audiovisual formats, thereby ensuring broad accessibility and improved knowledge retention among community members beneficiaries.

Finally, component 3, which ensures the sustainability of the project's achievements and knowledge management, includes the creation of a toolbox that synthesizes the project's best practices and successes, as well as establishes facilities for sharing and managing knowledge. Archives will be created to preserve a record of the project, ensuring sustainable monitoring and allowing lessons learned to be communicated to future projects and stakeholders. Thus, through these various components, the project guarantees effective knowledge management and a continuous learning process, which are essential for sustainable climate adaptation and the resilience of vulnerable communities Benin.

H – Consultative process

Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The stakeholder consultation mission took place in five communes in Benin. The team comprised four members, including two women, and represented the National Fund for the Environment and Climate (FNEC), METEO BENIN, and a consultant. The visited communes include Parakou, Bantè, Ouidah, Abomey, and Cotonou, collectively representing a total of nineteen communes from twelve departments, as shown in the table below. Each stage of the consultation was organized in three phases: (i) a meeting with local authorities, (ii) discussions with potential project beneficiaries, and (iii) a field visit. A total of 280 individuals participated in the stakeholder consultations, including 24% women and 4% people with disabilities. The lists of participants are presented in annex 2.

The stakeholder discussions provided crucial insights into the climate challenges faced by municipalities across the country. All regions reported their vulnerability to various climate events, including floods, high winds, erratic rainfall, and droughts. These events have led to crop destruction, loss of human and livestock lives, infrastructure damage, and agricultural calendar disruptions. In response to these challenges, communities recognized the value of the weather information provided by METEO BENIN but emphasized several issues. They pointed out problems with access, comprehension, and the reliability of the weather data. Additionally, communities raised concerns about the limited coverage of METEO BENIN facilities and their deteriorating condition, affecting the information's reliability. They also noted the lack of specific information tailored to the needs of various sectors, which reduces the effectiveness of climate alerts. To address this situation, it was suggested that the accessibility of weather information be enhanced by diversifying dissemination channels. Suggestions included community radios, town criers, prefectures, community relays, and social networks. Furthermore, it was recommended that adapted formats, such as videos and audio messages in local languages, be utilized to ensure better comprehension of the information by the target populations.

Table 3: Distribution of consulted stakeholders

N°	Phases	Dates	Municipalities visited	Number of individuals visited
1	Parakou	October, 28 and 29, 2024	Parakou, Malanville, Kandi, N'Dali and Boucoumbé	71
2	Bantè	October 30 and 31, 2024	Bantè, Glazoué and Bassila	61
3	Ouidah	November, 04 and 05, 2024	Ouidah, Grand-Popo and Allada	52
4	Abomey	November, 06 and 07, 2024	Abomey, Dogbo, Bohicon, Djidja and Kétou	50
5	Cotonou	November, 12, 2024	Cotonou, Abomey-Calavi and Dangbo	46
Total				**280**

The following photos highlight key moments from the stakeholder consultations.

- **Parakou phase**

- **Bantè phase**

- **Ouidah phase**

- **Abomey phase**

- **Cotonou phase**

The consultation also provided an opportunity to engage with five (5) Technical and Financial Partners (TFPs) and four (4) government entities, totaling twenty (20) participants. Among the TFPs present were the French Development Agency (AFD), the Embassy of the Netherlands, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the European Union (EU), and the International Fertilizer Development Center (IFDC). These meetings sparked discussions about ongoing projects, particularly the Hydro-Agro-Meteorological Information System (SIHAM) in Togo, an active SAP project that encouraged an in-depth exchange with METEO BENIN executives, including its General Manager. The SIHAM project, which resembles the one planned for Benin, underscored the importance of learning from the insights provided by the IFDC. Establishing a multi-risk Early Warning System (EWS) in Benin is considered essential for enhancing resilience against climate risks in the agricultural, livestock, and fisheries sectors. However, it is crucial that this system considers the existing EWS while conducting a thorough evaluation of its shortcomings. Additionally, adapting the formats and channels for disseminating meteorological information to local contexts, utilizing suitable media, and improving the technical capacities and infrastructure of METEO BENIN are priorities to ensure the accuracy and effectiveness of the EWS. A strengthened coordination framework among the various stakeholders involved, along with an optimized information distribution circuit, will ensure clear, accessible, and reliable communication to target populations.

I – Justification for funding

Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

The requested funding is vital to ensure sustainable and effective adaptation to the impacts of climate change in Benin by implementing measures to strengthen the resilience of vulnerable communities and strategic economic sectors. This funding request arises from the urgent need for the country to tackle the growing challenges related to climate change, marked by intensifying climate risks and the significant losses they entail. The funding will enable the deployment of a comprehensive adaptation strategy focused on reducing current vulnerabilities and enhancing the resilience of populations. It will also foster the creation of long-term sustainable development opportunities in alignment with the objectives of the Adaptation Fund, which seeks measurable, sustainable, and inclusive outcomes. The total project costs are justified by various interdependent factors, including the complexity of climate challenges, the increasing vulnerability of the country, and the considerable economic benefits tied to adaptation actions.

The complexity of climate risks and the diversity of impacts: Benin faces a wide array of climate risks, including prolonged droughts and areas of dryness, frequent floods, powerful winds, heat waves, and coastal erosion. These phenomena have serious consequences for communities, particularly those in rural and coastal regions, as well as for socio-economic sectors such as agriculture, livestock, and fisheries. The multiplicity and intensity of these challenges necessitate an integrated and specific approach that can simultaneously address the needs for resilience and adaptation across various sectors. This rationale for adaptation, rooted in a collective and multisectoral response, justifies significant investment to ensure comprehensive coverage of needs and a targeted response.

Increased vulnerability of populations and ecosystems: climate change is worsening Benin’s susceptibility to extreme weather events, especially for rural populations, crucial infrastructure, and delicate ecosystems. With climate events growing in intensity and frequency, the country is experiencing heightened vulnerability, particularly in regions already affected by droughts, floods, and erratic rainfall patterns. As a response, investments in adaptation and resilience are necessary to enhance the capacity of communities to anticipate, respond to, and recover from climate impacts, particularly for those most at risk, such as women and youth in rural areas.

Socio-economic costs of climate damage: extreme climate events, worsened by climate change, have significant economic consequences for Benin. For instance, the 2023 flood impacted 45.66% of municipalities, leading to human losses, widespread destruction of infrastructure (schools, health centers), and losses in agriculture and livestock. These losses result in substantial economic costs, disrupting essential services and undermining the stability of communities' livelihoods. The requested funding aims to mitigate these potential losses by enhancing the adaptive capacity of communities, infrastructure, and production systems, which will reduce the financial and human impacts of future disasters. Thus, the project's approach seeks to alleviate long-term costs by acting proactively, before these events escalate into large-scale crises.

Long-term sustainable development opportunities: in addition to minimizing climate impacts, investments in well-designed adaptation measures offer significant prospects for sustainable development. These investments yield positive effects, such as creating green jobs, promoting resilient and sustainable agricultural practices, protecting fragile ecosystems, and encouraging lifestyles that are more resistant to climate shocks. Therefore, the project aims to leverage these opportunities to foster inclusive and sustainable development, producing enduring economic and social benefits for communities and future generations.

J – Sustainability

Describe how the sustainability of the project outcomes has been taken into account when designing the project.

The sustainability of the project results has been carefully integrated from the design phase through the active involvement of national and local stakeholders, along with the implementation of a participatory approach. Ministries, municipalities, civil society, the private sector, and the beneficiaries themselves will be engaged at each implementation stage, ensuring that the actions undertaken meet the real needs of communities and stakeholders. The participation of central and regional directorates, in collaboration with community organizations, NGOs, and private actors, guarantees local and inclusive management of the initiatives. In particular, the regional meteorological centers will be connected to urban communities, ensuring proximity to local populations. Additionally, the network of rain gauges will be managed by the municipalities under the supervision of METEO BENIN, promoting the appropriation of the infrastructures by local actors and their sustainability. The project will also focus on building capacity for end users through training and awareness-raising actions for the better dissemination of climate products in the municipalities, as well as the popularization of agrometeorological tools for producers. Thus, the sustainability of the results will be ensured by the continued involvement of local stakeholders, decentralized management of resources, and capacity-building actions aimed at perpetuating the benefits of the project in the long term.

The project aims to enhance the resilience of local communities to climate change by providing high-quality weather services tailored to their specific needs.

K– Environmental and social impact risks

Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.

Table 4: Environmental and social impacts and risks identified

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	The proposed project has been developed in accordance with the provisions of multilateral environmental agreements and the relevant national legislation, including the environmental framework law, the climate change law, and the regulations governing climate services. Moreover, during its implementation, special attention will be given to ensuring strict compliance with decentralization laws to preserve institutional coherence and effective governance.	**Risk:** Low **Potential impact:** Low None of the components and corresponding interventions/activities of the proposed project fall under the first category of projects requiring a full Environmental Impact Assessment (EIA).
Access and Equity	The project ensures equitable access for all vulnerable groups targeted in the beneficiary districts. The climatological services provided will be available to all vulnerable segments of the beneficiary communes.	**Risk:** Low **Potential impact:** Low The project's activities will be equally accessible to the target communities without discrimination.
Marginalized and Vulnerable Groups	The project prioritizes the most vulnerable segments of the population, especially men and women whose livelihoods have been significantly impacted by climate shocks.	However, some target populations who are illiterate may not benefit from certain outputs, such as weather bulletins and forecasts. To address this challenge, the messages will be translated into local languages. Similarly, populations without radios or mobile phones may lack access to climate information. This risk will be alleviated by utilizing traditional communication methods (such as griots, etc.). **Risk:** Low **Potential impact:** Low
Human Rights		
Gender Equality and Women's Empowerment	This project fundamentally integrates gender equality and empowers women in its design.	**Risk:** Low **Potential impact:** Low The project places particular emphasis on women and youth groups, specifically addressing their unique needs in weather forecasting.
Core Labour Rights		
Indigenous Peoples		
Involuntary Resettlement		
Protection of Natural Habitats	The project aims to strengthen local communities' resilience to climate shocks and reduce the pressure of flood impacts on protected forests, thereby protecting natural habitats.	**Risk:** Low **Potential impact:** Low However, the installation of the equipment and infrastructure planned under Component 1 could result in the destruction of some natural habitats. The Environmental and Social Impact Assessment (ESIA) prepared during the project document drafting will offer enhanced documentation of these aspects.
Conservation of Biological Diversity		
Climate Change	The project aims to enhance the resilience of local communities to climate change by providing high-quality weather services tailored to their specific needs.	**Risk:** Low **Potential impact:** Low The project's activities will be developed to strengthen the resilience of ecosystems and communities to climate change, with a focus on providing flood alerts and warnings for extreme weather events.
Pollution Prevention and Resource Efficiency		
Public Health		
Physical and Cultural Heritage		
Lands and Soil Conservation		

A – Arrangements for project implementation

Describe the arrangements for project / programme management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIES), has been considered, and included in the management arragment.

The national implementing entity is the National Fund for Environment and Climate (FNEC), which oversees and coordinates project activities in the twelve beneficiary municipalities in close collaboration with METEO BENIN. The FNEC manages the financial resources allocated by the Adaptation Fund and ensures the quality of results presented to the Board of Directors of the Adaptation Fund. It will produce periodic implementation reports for the Adaptation Fund.

The physical and financial execution tasks of the project will be managed at the national level by a project management team. A Project Monitoring Committee (CSP) will oversee the management and provide guidance based on the progress of the implementation activities to meet the objectives. At the local level and in each of the twelve (12) intervention municipalities, monitoring will be conducted by a Local Project Committee (CLP) under the supervision of the Municipal Authority to facilitate the capitalization of achievements at the project's conclusion and the potential for extension or replication in other locations.

The Project Monitoring Committee (CSP), chaired by FNEC, will serve as the Steering Committee with the following mission: (i) to define the reorientations of the project activities, (ii) to ensure the execution of the entire project, (iii) to validate the annual Work Plans and Budgets, as well as the quarterly plans and budgets, and (iv) to formulate recommendations for the next stages of implementation. This committee will meet annually to evaluate and adopt the activities from the previous budget year while examining and approving the Work Plan and Budget for the coming year. The CSP will include a representative from the FNEC, one from the DGEC, one from METEO BENIN, as well as representatives from multi-sectoral actors, including the ministries and agencies responsible for agriculture, water, health, energy, public safety, research, and higher education. Additionally, there will be a representative from civil society. The committee may call on resource persons if necessary.

The project team will consist of a Project Manager, who is the General Director of METEO BENIN, three additional METEO BENIN executives, a person in charge of sustainability achievements, a Secretary-Accountant, a monitoring and evaluation officer, community facilitators serving as the Focal Points for Disaster Risk Reduction and Adaptation to Climate Change (PFRRC-ACC), and representatives from community Civil Society. The Project Manager is responsible for organizing and structuring all programmatic activities, collecting data, and preparing periodic reports. He assists other team members and collaborates with the FNEC, local authorities, and any other institutions or external collaborators to achieve results.

The Monitoring and Evaluation Officer monitors the activities of the community facilitators daily, ensures the planning of activities, and oversees the implementation and monitoring of work plans agreed upon with the coordinator. He supports the team in planning activities on an annual, quarterly, monthly, and weekly basis. Additionally, he ensures the production and documentation of the program's performance indicators.

The Sustainability Manager’s task is to capitalize on, support, and monitor studies and action research to ensure the sustainability of actions at the end of the project. He develops a sustainability plan through knowledge management and fosters rich exchanges and sharing with communities. He documents best practices and lessons learned and contributes to communication. The Secretary-Accountant is responsible for supporting the management team in preparing budgets and work plans, producing financial reports, and analyzing funding requests from all stakeholders. He reviews monthly and quarterly accounts, ensuring submissions are made within prescribed deadlines and that payments are received from all stakeholders. He effectively contributes to the project's administrative management in accordance with the lessor's procedures and those implemented by METEO BENIN.

At the local level, the Local Project Committee (CLP), chaired by the municipal authority or its representative, will facilitate and monitor activities and ensure the capitalization of all project achievements. The CLP is supported by:

- o two (02) Community Facilitators responsible for implementing and monitoring field activities to collect and report information;
- o support staff.

The General Management, the Technical Departments, and the Administration, Planning and Finance Department of METEO BENIN will work part-time on the project. They will provide supervision and quality control and ensure compliance with contractual and partnership principles, as well as the achievement of objectives and performance indicators. The FNEC will serve as the daily external monitoring and evaluation eye for cross-referencing data and information from the internal monitoring team. Joint FNEC / METEO BENIN missions will enable the proper execution of activities.

The district will designate focal points that will serve as conduits for the facilitators. They will be internal facilitators, either integrated into the groups or not; they act as vectors and guarantors of sustainability under the auspices of the key bodies groups.

B – Financial and project risk management measures

Describe the measures for financial and project / programme risk management

A comprehensive analysis of the financial framework and risk management will be conducted during the preparation phase of the final project document. This framework will be developed following the procedural and operational manuals to ensure the participation of all stakeholders. The financial management policies of the Adaptation Fund will be incorporated into the development of this framework. However, at this point, a preliminary analysis of the financial and project risk management measures is outlined below.

Types of risks and impacts on the project	Impact level on project objectives	Likelihood of occurrence	Mitigation Strategy
Financial o Exchange rate fluctuations o Delays in fund allocation ***Potential impact*** Lack of financial resources for executing certain project activities	Low	Low	o Allocate 10% of the budget for contingencies. o Ensure that each stakeholder fulfills their role fully.
Political o Shift in political regime detrimental to climate actions o Excessive politicization among local elected officials in the targeted municipalities stems from the project's failure to cover all communes and reach all districts. ***Potential impact*** o Delays in project implementation o Conflicts among local stakeholders	Medium	Low	o From the outset, ensure that convention agreements are signed between FNEC and METEO BENIN. o In the event of a regime change, notify the new authorities and create a mechanism for involvement them.

C – Alignment with the Adaptation Fund Results Framework

Project Outcomes	Project outcomes Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Outcome 1.1: High-quality, impact-based weather and climate forecasts are available in a changing environment	Relevant impact-based weather and climate forecasts generated and disseminated to stakeholders on a timely basis	**Outcome 1**: Reduced exposure to climate-related hazards and threats	**1.** Relevant threat and hazard information generated and disseminated to stakeholders on a timely basis	**2,645,000**
Outcome 1.2: Specific meteorological and climatological services are available to local communities to enhance their adaptive capacity	Multi-risk Early Warning System based on impacts established, operational and accessible		**1.2** No. of early warning systems (by scale) and no. of beneficiaries covered	
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 2.1: The technical and organizational capacity of stakeholders is strengthened to enable the effective implementation of a multi-risk early warning system tailored to local needs	Number of individuals trained on the developed numerical forecasting models	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	**2.1.** Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	**698,000**
Outcome 2.2: Local communities have the necessary knowledge to better understand climate risks, use the multi-risk early warning system, and strengthen their resilience to the impacts of climate change	Number of local communities trained on the developed multi-risk Early Warning System	**Outcome 3:** Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	**3.1.** Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 3.1: Meteorological and climatological infrastructure and equipment are sustainably maintained and preserved through an effective operational plan, ensuring their long-term functionality	Meteorological and climatological infrastructure and equipment sustainably maintained and preserved	**Outcome 8:** Support the development and diffusion of innovative adaptation practices, tools and technologies	**8.** Innovative adaptation practices are rolled out, scaled up, encouraged and/or accelerated	**150,000**
Outcome 3.2: The best practices and successes of the project are capitalized and made available in the form of practical tools, facilitating their dissemination and replication	Best practices and successes of the project scaled up			

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[2]

Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:

(AND endorsement letter attached as annex 1)

Pr Martin Pépin AÏNA, Designated National Authority, General Director for Environnement and Clinate	January, 28th, 2025

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (*National Development Plan (NDP 2018-2025), The National Climate Change Adaptation Plan (NAP)* ; *Nationally Determined Contributions (NDC 2021-2030)* ; *Strategic Plan of METEO BENIN (2022–2026), and National Framework for Climate Services (NFCS)*) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy and the Gender Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme

Name & Signature Implementing Entity Coordinator: Le Directeur Général **Dr Appolinaire D. GNANVI** General Director	
Date: *February, 24, 2025*	Tel. +229 97192464 and email: gnanviappolinaire@yahoo.fr
Project Contact Person: **Fortunée DOSSOU WOROU** Director of Financial Resource Mobilization	
Tel. +229 95966314 And Email: ellidos@yahoo.fr	

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

ANNEXES

Annex 1: AND Endorsement Letter

MINISTERE DU CADRE DE VIE
ET DES TRANSPORTS
EN CHARGE DU DEVELOPPEMENT DURABLE

REPUBLIQUE DU BENIN

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N° 0026 DGEC/MCVT/PF-CC/SD

28-01-2025

ADAPTATION FUND

Letter of Endorsement by Government

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for **strengthening meteorological services and establishing a multi-risk early warning system to improve the climate resilience of local communities in Benin.**

In my capacity as designated authority for the Adaptation Fund in Benin, I confirm that the above national project/programme proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Benin.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by FNEC and executed by METEO-BENIN.

Sincerely,

Le Directeur Général

Martin Pépin AÏNA
Designated National Authority
General Director for Environment and Climate

Annex 2: Project formulation assistance grants

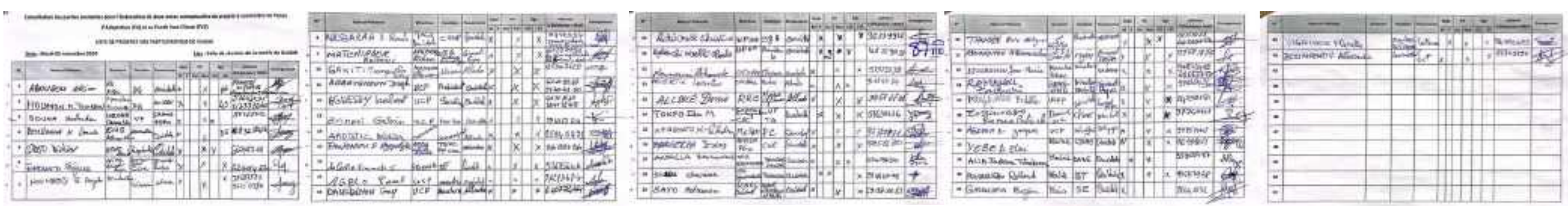
N°	Outputs and activities	Total cost (USD)	Duration	Justification
1	Social, Environmental, and Gender assessment	15,000	4 months	The objective is to assess the potential environmental and social impacts of the project's planned interventions and to establish a framework to avoid, prevent, or mitigate associated risks. This assessment will also include a gender analysis, providing recommendations to ensure effective gender mainstreaming throughout project implementation. The proposed management measures will align with Benin's environmental and social regulations, as well as the requirements of the Adaptation Fund. Additionally, the assessment will draw on existing studies regarding gender-related challenges and priorities related to access to meteorological services.
2	Feasibility studies and project design	20,000	4 months	A comprehensive assessment of the project's technical, financial, legal, and economic feasibility is essential to understand the vulnerability of local communities in the intervention area better. This study will provide a detailed analysis of climate hazards, exposure, and community vulnerabilities, alongside their livelihoods. By comparing climate scenarios with and without the project, it will estimate the project's transformational impact and assess the effects of climate change on communities and key economic sectors across the ten targeted municipalities. Observed trends and projected climate impacts on livelihoods will serve as a basis for defining and comparing impact-based forecasts. Furthermore, the feasibility study will include an operations manual outlining how the requirements of the Adaptation Fund will be met.
3	Stakeholder engagement and participatory planning	5,000	3 months	The stakeholder analysis and the development of an engagement plan will help identify the most effective strategies to mobilize potential beneficiaries, particularly focusing on the most vulnerable groups, central and local structures, as well as state institutions that ensure the project's sustainability. To achieve this, multi-stakeholder consultations will be conducted through workshops at both national and local levels to gather stakeholder insights and refine the implementation strategy in collaboration with partner entities (government institutions, local authorities, NGOs, and the private sector). Additionally, a capacity-building needs assessment for key institutions will be performed to accurately identify gaps in training and resources, thereby ensuring the project's long-term sustainability.
4	Detailed implementation plan	5,000	3 months	A comprehensive analysis of institutional roles and governance structures will be conducted to create a clear framework that improves coordination and ensures a precise allocation of responsibilities in project implementation. Additionally, an in-depth assessment of institutional needs for integrating impact-based forecasts and early warnings, along with probabilistic risk analysis, will be carried out. This approach aims to facilitate the transition from a deterministic to a probabilistic model, thereby enhancing the capacity for climate risk anticipation and management.
5	Budget refinement and financing strategy	5,000	3 months	Work sessions will be organized between IE and the EE on detailed financial planning and budget alignment to create a comprehensive financial plan that ensures optimal resource allocation and consistency with the expected outcomes. A study on co-financing opportunities will be conducted to investigate additional funding sources from development partners, thereby enhancing the financial sustainability of the project.
Total cost (USD)		**50,000**		

Annex 3: List of participants in the stakeholder consultations

Annex 3.1: List of participants in the stakeholder consultations in Parakou

Annex 3.2: List of participants in the stakeholder consultations in Bantè

Annex 3.3: List of participants in the stakeholder consultations in Ouidah



Annex 3.4: List of participants in the stakeholder consultations in Abomey

Annex 3.5: List of participants in the stakeholder consultations in Cotonou