

# CLIMATE RISK AND EARLY WARNING SYSTEMS

## CREWS INITIATIVE



*Building Seamless Multi-Hazard Early Warning System  
and Risk Information Capacities  
with Strengthened International Cooperation*

*September 2015*



2) *Extreme weather events: Climate-change-related risks from extreme events, such as heat waves, extreme precipitation, and coastal flooding, are already moderate (high confidence) and high with 1°C additional warming (medium confidence). Risks associated with some types of extreme events (e.g., extreme heat) increase further at higher temperatures (high confidence).*

IPCC, 2014: AR5, ,Adaptation, and Vulnerability, Summary for policymakers Impacts

*That's why I want to call, here in Sendai, the international community to act to support, as soon as possible, the deployment of climate risk early warning system in the most vulnerable countries.*

*(...)*

*This will require the support for acquiring computers and network to access the data and to diffuse it. This will also require capacity building to use those dates, and to support the deployment of system to effectively warn the communities . This effort is realistic, and France is ready to take its part of it.*

Laurent Fabius,  
Foreign Affairs Minister of France  
incoming COP21 President  
Sendai, Japan  
March 14, 2015

*To this end, we will:*

*a) Intensify our support particularly for vulnerable countries' own efforts to manage climate change related disaster risk and to build resilience. We will aim to increase by up to 400 million the number of people in the most vulnerable developing countries who have access to direct or indirect insurance coverage against the negative impact of climate change related hazards by 2020 and support the development of early warning systems in the most vulnerable countries. To do so we will learn from and build on already existing risk insurance facilities such as the African Risk Capacity, the Caribbean Catastrophe Risk Insurance Facility and other efforts to develop insurance solutions and markets in vulnerable regions, including in small islands developing states, Africa, Asia and Pacific, Latin America and the Caribbean as set out in the annex.*

G-7 Leaders' Declaration  
Schloss Elmau, Germany  
June 8, 2015

## Foreword

Since the UN World Conference on Disaster Risk Reduction in Sendai, Japan, there have been many climate events all over the world. We all remember tropical cyclone Pam, which hit Vanuatu in the middle of the Sendai Conference. I have since learnt that the death toll following Pam was considerably reduced as a result of an effective early warning system. Since then, there have been heatwaves in India, with over 2,000 deaths according to media reports, and Pakistan, where the death toll was also high. Georgia was hit by devastating flooding. And although they receive less media coverage, many African countries have also experienced extreme climate events. Last April, I travelled to Tanzania, a few days after the floods which left many dead.

You do not need me to demonstrate to you the importance of early warning systems in dealing with our numerous climate events. I am aware that we must be cautious, as it is difficult to link these extreme events to climate disruption. But like me, you know that the scientists are warning that these events are merely a foretaste of what could become a disaster scenario for the planet.

At the Sendai Conference, to enhance discussions on the adopted Framework, France proposed a simple target: to mobilize the international community to help the most vulnerable countries, particularly the Small Island Developing States (SIDS) and Least Developed Countries (LDCs), to set up Climate Risk Early Warning Systems (CREWS). France considers it a responsibility to share our skills and expertise with the countries most exposed to climate disruption.

International support for EWS already has a lot of work underway. But we still have a long way to go, because based on the documents which will be presented later, the LDCs and SIDS currently do not all have effective early warning systems. In our preparatory work for this meeting, we learnt that over 80% of the LDCs have only a basic early warning system. In 15 countries, no such system even exists. In the island states, we found similar figures, with only four or five out of 40 having an effective system.

We now know that early warning systems save lives and significantly reduce the economic impact of disasters. Yet in over half of Africa, there is no weather observation. According to the WMO, 54% of surface stations and 71% of atmospheric weather stations emit no data.

It is for this reason that France, in collaboration with Norway, the WMO, UNISDR and the World Bank/ GFDRR (Global Facility for Disaster Reduction and Recovery), launched this coalition known as CREWS (Climate Risk Early Warning Systems). The aim is simple: to strengthen and broaden the work of the international community in supporting early warning systems in vulnerable countries, and to mobilize additional financing to support and enhance the actions which we are currently implementing, in order to try to fully cover the global population exposed to extreme climate events by 2020.

The aim of this initiative is not to create a new institution, but mainly to have an operational objective. I have a deep respect for the people who have been working on these issues for many years, such as the WMO with Michel Jarraud, who was behind this idea, Margareta Wahlström's teams at the UNISDR who have been providing daily coordination for the risk prevention community, and the World Bank and Rachel Kytes' teams, which, through the Global Facility for Disaster Reduction and Recovery (GFDRR), have developed many programmes to strengthen weather infrastructure. I would also like to commend the work carried out by Norway on the Global Framework for Climate Services, which has mobilized the international community around a series of activities, ranging from early warning systems to modelling climate change.

France's aim in this initiative is use COP21 as an opportunity to mobilize the international community to meet the needs of the most vulnerable countries. Such countries have made adaptation a priority. And yet without weather information, without early warning systems, adaptation cannot be considered. How can farmers in the Sahel have access to insurance if the risks are unknown and there

are no early warning systems? How can investors commit to financing a project in a region vulnerable to cyclones if they are not confident that they will be warned in the event of a storm?

We now have a clear picture of the needs. Now it is time to meet them. This is why France has proposed that CREWS be a coalition based around a trust fund – I will return to this point – hosted by the GFDRR, and with a light secretariat, based in Geneva at the WMO and UNISDR, so that this coalition can acquire the means to achieve its ambitions.

The aim is to mobilize contributions to fill in the gaps, to enable the actors on the ground at regional, national and local level to have the best possible working conditions. In this way, populations, who nowadays nearly all own mobile phones and other modern communication devices, can be alerted to an impending climate disaster before it occurs.

So where do we stand at the moment?

First, the needs. We have a reasonably clear idea of what must be done. All partners have worked together to identify the actions to be carried out. They will be presented to you in detail this afternoon, and must be fine-tuned by September in order to gain a complete picture of the situation.

Then, there is the question of resources. They are within our means. By mobilizing about US\$100 million by 2020, we should be able to make a real difference in most countries. On this point, once we have explained the initiative to you in detail this afternoon, France is ready to commit. Now it expects its partners to follow suit. By September, I would like us to have pooled our resources to raise that amount. Real interest has also been shown by countries like Mexico, Cuba and others, which have experience that they are willing to share, e.g. at regional level. As regards resources, I also want to mobilize businesses in the fields of insurance and new technologies as they can play a major role in early warning systems.

COP21 is a major step in the fight against climate disruption. It aims to build an ambitious, universal and binding agreement. France, jointly with Peru, has proposed supplementing the international climate negotiations with what is known as the Agenda of Solutions or the Lima-Paris Action Plan. This is a space for mobilization, built around the Lima-Paris Action Plan, which aims to



mobilize all actors and the international community to provide immediate and concrete solutions to populations. Naturally, early warning systems are part of this.

The G7 recently stressed the importance of this initiative and of strengthening insurance systems in order to tackle climate risks in the poorest countries. I am convinced that it is our responsibility to provide the citizens of the Indian Ocean, the Pacific, the Caribbean, Africa and all those who are prone to climate disasters, with life-saving early warning systems.

Annick GIRARDIN,

French State Minister For  
Development and French Speaking communities

*Opening allocution at the 2<sup>nd</sup> partners meeting  
Paris, September 8<sup>th</sup> 2015*

# 1. State of play

## 1.1. Context

Every year, disasters caused by weather, water and climate extremes – such as tropical cyclone and severe storms, floods, heat waves and droughts - lead to significant loss of life and socio-economic impacts, significantly compromising socio-economic development and growth, particularly in countries with least resources (GFDRR 2012). From 1970-2012, close to 2 million deaths and US\$ 2.4 trillion of economic losses were reported globally as a result of droughts, floods, windstorms, tropical cyclones, storm surges and extreme temperatures alone (WMO-CRED 2014). According to the Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC Working Group I), the frequency and severity of such hazards is increasing, exacerbating risks to lives and livelihoods around the world, particularly in developing and least developed countries. Investing in disaster risk reduction through early warning systems has shown reduction in losses after major disaster and beneficial returns on investment (GAR, 2015).

To address the drivers of risk, countries need access to reliable risk information and ability to use this information in making sound investments to manage and reduce their risks (i.e., land zoning, structural measures such as retrofitting or building infrastructure per code), while also strengthening the effectiveness of their preparedness for saving of lives and livelihoods through well-deployed early warning systems

Investments in strengthened weather, climate and water information services are highly cost efficient for improving societal welfare, with economic assessment indicating benefits generated worth at least three times, and often much higher, that of investments costs (WMO, WBG, GFDRR & USAID 2015).

International attention to the need for strengthened early warning increased after the Indian Ocean Tsunami in December 2004 and the subsequent adoption of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities. At the request of the UN Secretary-General, a global survey of Early Warning System - EWS was published in 2005 and helped mobilize international and regional actors towards development of comprehensive EWS for all types of natural hazard. However, assessments have pointed to a number of persisting gaps and/or redundancies in this. In March 2015, in the Sendai Framework for Disaster Risk Reduction 2015-2030, the international community committed to redouble its actions in order to achieve the following early warning related target: *“Substantially increase the availability of and access to multi-hazard Early Warning Systems - MHEWS and disaster risk information and assessments to the people by 2030.”*

MHEWS have been demonstrated to reduce loss of life caused by hydro-meteorological hazards such as tropical cyclones, floods, severe storms, forest fires, heat waves (and tsunamis). Four elements have to be present to ensure effective MHEWS. These are: (1) monitoring, detection and forecasting of hydro-meteorological hazards providing lead-times for action; combined with (2) analysis of risks; (3) dissemination of timely and authoritative warnings; and, (4) activation of emergency plans to prepare and respond. Analysis of good practices in MHEWS has confirmed that for the system to work, these four components must be underpinned by appropriate policies, legislation and legal frameworks, with coordination across many agencies at national to local levels.

Over the last few decades, investment in supercomputers, weather nowcasting and forecasting technologies has led to improved accuracy and timeliness – achieving lead times that are measured in minutes to hours for flash floods or tornados, or days for tropical cyclones and riverine floods – resulting in significant improvements for preparedness. This is particularly true in the case of early warnings for tropical cyclones, thanks to which local authorities have been able to evacuate large numbers of people to safer locations (or to protect them in place in the case of big cities). These forecasts have become increasingly accurate and available as a result of international co-operation, facilitated by the WMO.

Beyond forecasting weather, advancements with new climate forecasting technologies (e.g., drought forecasts with a season lead-time) have led to unprecedented opportunities to provide longer lead times enabling people and authorities to protect property and infrastructure. This is the underpinning driver for the development of the Global Framework for Climate Services (GFCS). The GFCS aims to supply climate services (data, forecasts and analysis), expand the globally coordinated network of WMO to other global producing centers, and establish a network of regional climate centers to enable cascading of climate technologies through provision of relevant and useful climate services to National Meteorological and Hydrological Services (NMHSs).

## **Global Frame for Climate Services (GFCS)**

- **Vision**
  - To enable better management of the risks of climate variability and change and adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale
- **Creation**
  - Established during the third World Climate Conference in 2009
- **Mandate**
  - Deal with past, current and future climate and its impacts on natural and human systems on global, regional and national scales
  - Cover immense user needs for Climate services, through unprecedented collaboration among institutions across political, functional and disciplinary boundaries
  - Facilitate, coordinate and try to avoid duplication, through international arrangements building upon the established global observations and research programs as well as operational structures into an end to end product generation, service provision and application system.

Box 1

## **1.2. Lessons Learned**

Many countries have recognized the need to strengthen MHEWS by enhancing their hydro-meteorological warning services combined with improving their emergency plans and operations, to better prepare for hydro-meteorological and climate-related hazards. Those countries that have successfully built these systems have benefited from dramatic reduction in deaths related to weather extremes, as well as various additional benefits to their economies. Unfortunately, analysis shows that the countries that are most vulnerable to the impact of climate and weather extremes often have the lowest early warning capabilities, due to poorly functioning NMHS, weak or non-existent dissemination systems, and lack of effective emergency planning and preparedness that can be activated based on the impact-based alerts and warning information (Box 2). Over the past 20-30 years, underfunding, low visibility, and in some instances military conflict, among other factors, have significantly compromised development and sustainability capacities in developing countries. Overall, observation networks have deteriorated, technology is outdated, modern equipment and forecasting methods are lacking, the quality of services is poor, support for research and development is insufficient, and workforces of trained specialists have been eroded.

The capacities of implementing early warning systems in different countries and regions remain highly varied, within Least Developed Countries (LDC) and Small Island Developing States (SIDS), particularly susceptible to weaknesses in their ability to issue critical warnings to the national and

local authorities and residents quickly, reliably and accurately. In LDCs, a preliminary review of NMHS points to the need to significantly upgrade hazard data archiving systems and observation networks, build capacity of government professionals, and integrate NMHS into national disaster risk management systems. SIDS face many of the same issues, including need to improve network equipment, information technology infrastructure, and professional staff capacity, as well as prepare for hazards beyond tropical cyclones (see Map1).

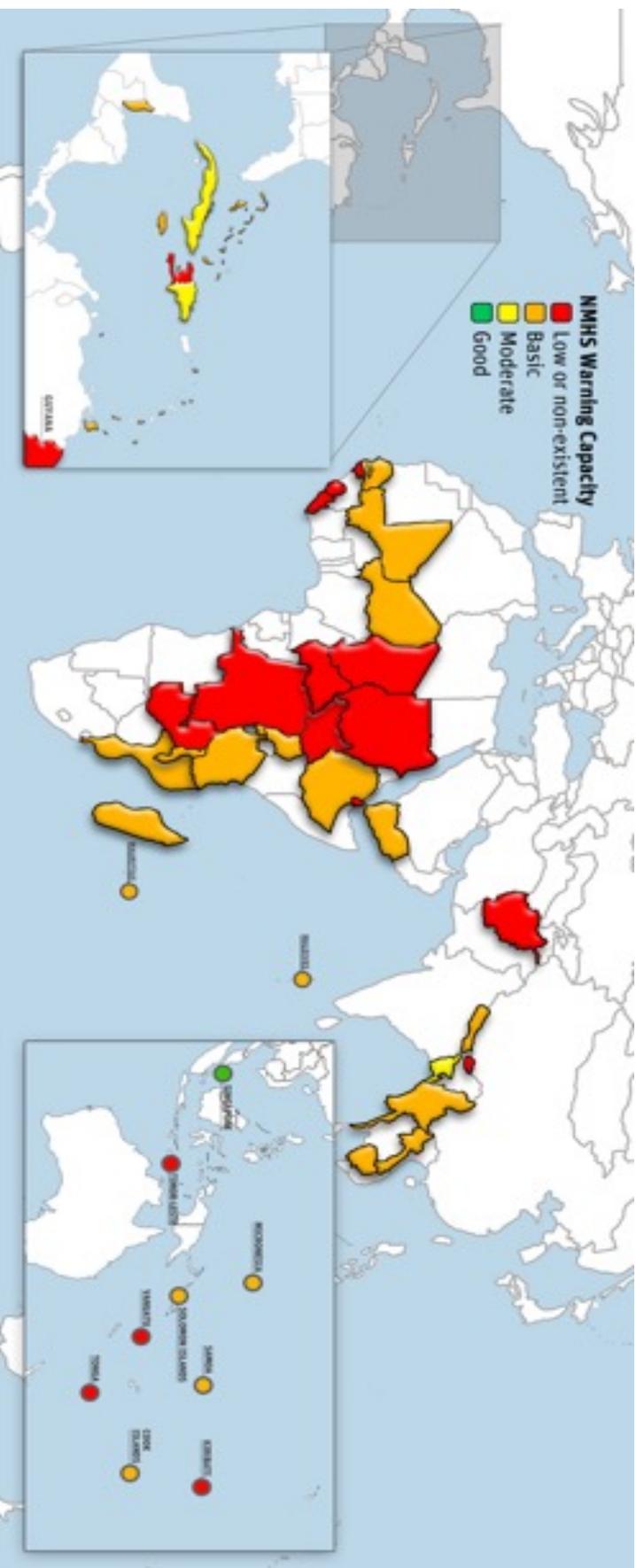
Many investments in NMHSs have failed to make significant impacts because they focused on providing equipment rather than considering the overall institutional reform, capacity building and infrastructure modernization necessary to provide a better level of operational warning services. Other projects have not taken operating and maintenance costs of new equipment, and infrastructure into account, leading to unattractive or unworkable business models for governments and ultimately failure of the systems due to lack of any sustainability plan. NMHSs also frequently face criticism from users that warning information provided is not easily understood and not necessary actionable that little care has been given to making the warning products and services targeted to user needs. The more available and accessible NMHSs' products are, combined with increased capacity of users to interpret the information for decision-making, the more the NMHSs will generate benefits for society (WMO, WBG, GFDRR & USAID 2015).

A sound risk reduction strategy for investments should include ensuring the capacity of the regional network of WMO specialized centers to effectively produce the guidance, know-how and products that could be channeled through these centers to support NMHSs. This support to the regional network should include (a) access to high quality national observations, (b) access to forecast products and analytical tools, (c) on-demand human operational guidance in case of high-impact events, (d) on-the-job training in all aspects of the operations, and (e) institutional "twinning" that pairs more advanced NMHSs with developing and sustaining the NMHSs in LDCs and SIDs over a long period. In many developing and least developed countries, this type of overhaul is a major undertaking (GFDRR publication "Weather and Climate Resilience: Effective Preparedness through NMHS" 2013).

## **Key Gaps and Challenges in EWS**

- **Risk Knowledge**
  - Not enough national disaster information is publicly available
  - Need for quality controlled historical time-series on magnitude, location, duration, and timing of hazards and extremes
  - SIDS and LDCs do not secure enough risk knowledge resources
- **Monitoring and Warning Service**
  - Lack of policy and legal frameworks to ascertain authority and accountability
  - Overall lack of resources for sustainable operation of public meteorological, hydrological and DRM agencies
  - Not enough transboundary information sharing
  - Need for continuously updated data for hazard modeling and recording of associated losses and damage
- **Dissemination and Communication**
  - Warning services either: does not exist; exists but people have limited access; exists and accessible but messages not understood/trusted
  - Coverage not well coordinated (local to national level and of multi-agency coordination)
  - Weak feedback and verification mechanisms
- **Emergency Response Capability**
  - Few countries consistently review, update or practice preparedness plans linked to warning systems
  - Need for specific information tailored for supporting decisions in specific contexts (e.g. emergency planning, risk management in sensitive sectors)
  - Define roles and responsibilities of EWS stakeholders

**EWS current status in selected SIDS and LDCs**  
*based on the capacity of Hydrometeorological services to provide warning*



In LDCs and SIDS :

- About ¾ of countries have low or non-existent or basic capacity to provide early warning
- Only 4-5 countries have good capacity to provide early warning
- *(source GFDRR based on WMO data)*

## 2. The CREWS initiative in the context of COP 21

### 2.1. EWS as a component of INDCs

In the context of the COP21 in Paris the mandate of which to “develop a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties, which is to be completed no later than 2015 in order for it to be adopted at the twenty-first session of the Conference of the Parties (COP) and for it to come into effect and be implemented from 2020.” decision 1/CP.19 adopted in Warsaw, 2013, invited all Parties to initiate or intensify domestic preparations for their Intended Nationally Determined Contributions (INDCs) towards achieving the objective of the Convention as set out in its Article 2. In decision 1/CP.20, adopted in Lima (2014) the COP also invited all Parties to consider communicating their undertakings in adaptation planning or consider including an adaptation component in their intended nationally determined contributions.

By mid-September 2015, about 60 countries presented their INDC. Most of developing countries and in Particular SIDS, LDCs and African countries presented a contribution which includes both adaptation and mitigation. The overwhelming majority of these countries define early warning systems as a priority for adaptation (see Map 2 below).

### 2.2. The Lima Paris Action Agenda and international collaborative actions

#### 2.2.1. *Presentation of the LPAA*

The Lima-Paris Action Agenda capitalizes on the invitation to the incoming Presidencies of the COP to enhance the implementation of climate action. The purpose of this paper, authored by the COP20/CMP10 Peruvian Presidency, the incoming COP 21/CMP 11 French Presidency, the UNFCCC Secretariat and the Executive Office of the Secretary-General of the United Nations, is to complement the “Lima-Paris Action Agenda” declaration of December 13th, 2014

The Lima-Paris Action Agenda is a joint undertaking of the Peruvian and French COP presidencies, the Office of the Secretary-General of the United Nations and the UNFCCC Secretariat. It aims to strengthen climate action throughout 2015, in Paris in December and well beyond through:

- mobilizing robust global action towards low carbon and resilient societies;
- providing enhanced support to existing initiatives, such as those launched during the NY SG Climate summit in September 2014; and
- mobilizing new partners and providing a platform for the visibility of their actions, commitments and results in the run up to COP21.

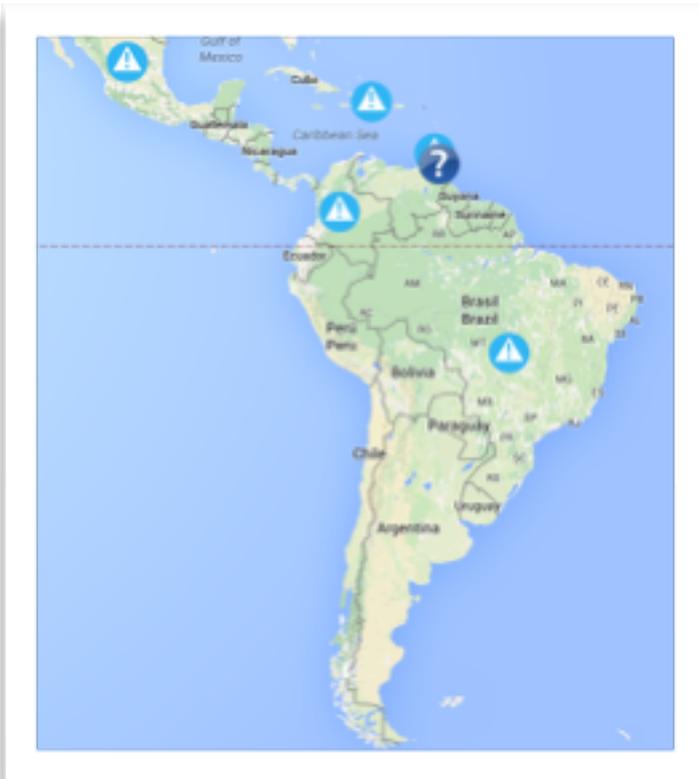
During COP21, the four partners will respond to the Lima Call for Climate Action by convening a series of Action Days as well as a High Level Meeting on Climate Action, i.e. the ‘Action Day’ which will take place on December 5th.

The Action Day will be supported by a sequence of ‘Thematic Action Days’ (or LPAA focus: cities and sub-national, energy access & efficiency, renewable energy, transport, innovation, agriculture, forests, private finance, resilience, buildings, business, short-lived climate pollutants). They will consist of high level official events that will highlight all the cooperative and individual commitments per sector or themes. The ‘Thematic Action Days’ will enable the stakeholders to present issues and existing solution pathways for each of the main action areas of the Agenda.

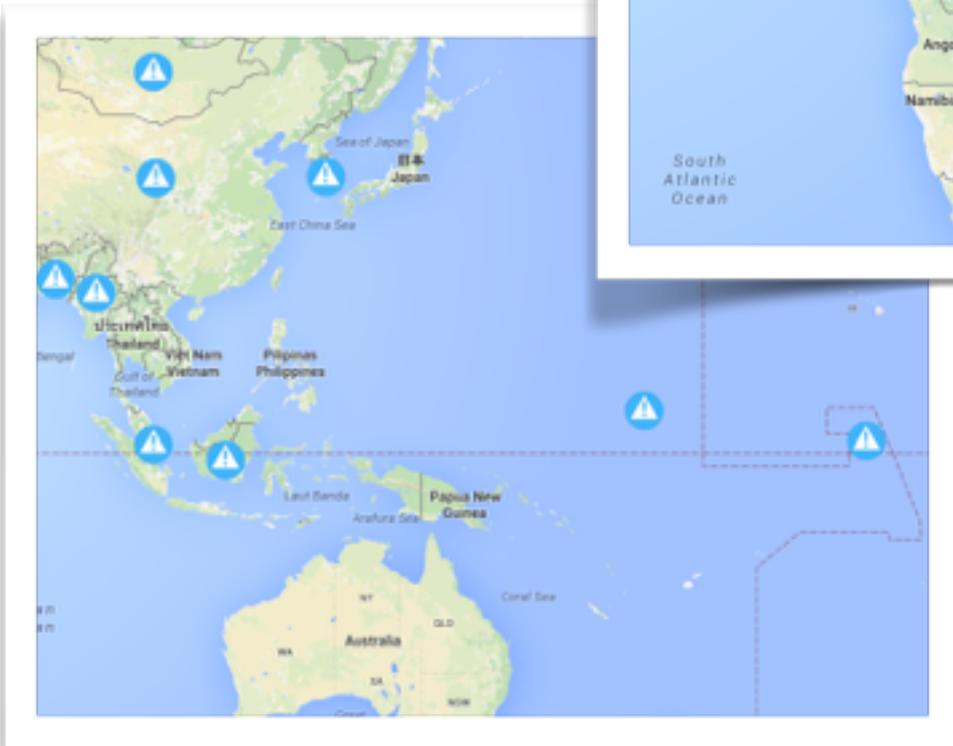
As a whole, these days will showcase the magnitude of mobilization and the credibility of corresponding commitments. In this way, it will contribute positively to the implementation of the new climate agreement beyond 2015.

The CREWS initiative will be fully integrated to the Lima Paris Action Agenda, and will be showcased during the Resilience day and the Action Day in COP21.

## MAPS of EWS in the Intended Nationally Determined Contribution (INDC)



Maps of countries with EWS identify as an adaptation priority in their INDC



Countries with explicit reference to EWS in the adaptation part of the INDC



Countries without explicit reference to EWS in the adaptation part of the INDC

### 2.2.2. *The G7 commitments*

The G7 Initiative on climate risk insurance – InsuResilience – was adopted at the G7 Summit in Elmau/Germany in June 2015. Rapid action is required to achieve the ambitious goal of insuring up to 400 million additional people by 2020. A set of key measures for rapid action are described below and in more detail in the document. This set of rapid action shall be prepared within the next months to be publicly announced before or at UNFCCC COP21 in Paris.

Lead by Germany, the current G7 presidency, InsuResilience aims to mobilize donor countries and the private sector to enhance climate risk insurance access in LDC and low income countries. As specified in the G7 leader’s declaration, InsuResilience and CREWS will work closely to provide meaningful means of adaptation to the most vulnerable countries.

## 3. CREWS Initiative concept

### 3.1. Rationale

Extreme weather events are among the most harmful impacts of climate change. Disaster risk reduction (DRR) is an essential element of resilience and adaptation for communities and societies facing climate disruption. Multiple studies and analyses clearly demonstrate that prevention, alert with Early Warning Systems (EWS) and risk information are key elements for managing of disaster risk and among the best options to mitigate the impacts and costs of such events. Further, the World Bank estimates that because some of the most expensive components of EWS have already been built (e.g., earth observation satellites, global weather forecasting system), the needed investments are relatively modest and would globally deliver benefits 4 to 36 times the investment costs (Hallegatte 2012).

The Sendai Framework for Disaster Risk Reduction 2015-2030 recognized the need to strengthen Multi-Hazard Early Warning Systems (MHEWS), especially by enhancing their hydrometeorological warning services combined with improving their emergency preparedness and response plans and operations to better prepare for hydrometeorological and climate-related hazards. The Sendai Framework also recognizes the need to develop, periodically update and disseminate risk information to decision makers, the general public and communities at risk and to systematically evaluate, record, share and publicly account for disaster losses.

Unfortunately, over the past 20-30 years, underfunding and low visibility, among other factors, have significantly compromised the effectiveness of National Meteorological and Hydrological Services (NMHSs) and disaster risk management in developing countries. COP21 and the Paris Alliance offer a unique opportunity to progress in the deployment of risk information and seamless EWS i.e. encompassing weather, water and climate-related risks and addressing them over the short, medium and longer term with a multi-hazard approach.

The capacities of NMHSs and disaster risk management related agencies in different regions remain highly uneven, with Least Developed Countries (LDCs) and Small Island Developing States (SIDS) facing particular capacity shortfalls. In LDCs, a preliminary review of NMHSs points to the need to significantly upgrade observation networks, build capacity of government professionals, and integrate NMHSs into national disaster risk reduction plans and strategies. SIDS face many of the same issues, including the need to improve network equipment, information technology infrastructure, and professional staff capacity, as well as prepare for hazards beyond tropical cyclones. Links to global and regional centers supporting national agencies also need to be strengthened.

As part of the Lima-Paris Action Agenda, the Climate Risk and Early Warning Systems (CREWS) initiative will show that, notwithstanding its efforts to reduce greenhouse gas emissions, the international community is committed to improving adaptation to extreme weather and hydrological events and tackling the immediate consequences of climate change, in the LDCs and SIDS in particular.

### **CREWS as important building block for strengthening resilience**

- Program funding will contribute to narrowing the gap between priority needs in the developing countries and available funding.
- Implementing parties (WMO, GFCS, UNISDR, WBG/GFDRR) have complementary strengths and breadth of analytical, technical and operational knowledge.
- Proposed integrated approach by focusing on the MHEWS will help to address key systemic deficiencies including building long-term capacity and sustainability.
- Proposed partnership will improve donors coordination on the ground, ensure complementarity and avoid overlap with other existing or future initiatives.

Box 3

## **3.2. Concept and implementation**

### *3.2.1. Objective*

The objective of the CREWS initiative is to significantly increase the capacity for seamless MHEWS, to generate and communicate effective impact-based early warnings, and risk information for hazardous hydro-meteorological and climate events to protect lives, livelihoods, and property in LDC and SIDS.

### *3.2.2. Strategic links*

The CREWS initiative is a direct contribution to the target 7<sup>1</sup> of the recently adopted Sendai Framework for Disaster Risk Reduction 2015-2030. It will contribute to the Disaster Risk Reduction priority area of the Global Framework for Climate Services (GFCS) and will support the International Network on Multi-Hazard Early Systems (IN-MHEWS), a multi-stakeholder partnership proposed at the Third United Nations World Conference on DRR (WCDRR).

### *3.2.3. Institutional arrangement and governance*

The CREWS initiative will be operationalized through multiple partners, including the World Bank Group/Global Facility for Disaster Reduction and Recovery (GFDRR); the World Meteorological Organization (WMO) and the United Nations Office for Disaster Risk Reduction (UNISDR).

The Initiative foresees the establishment of a basket fund hosted by the WB to channel funding to the existing and relevant programmes and actions supported by the trust funds of these three main partners:

- GFCS Trust Fund to support WMO global and regional centers, to promote coordination and alignment and to provide technical advisory services for identification, design and implementation with national initiatives;
- UNISDR Trust Fund for ensuring policy coherence, and adherence to the United Nations Plan of Action on DRR for Resilience and the global targets of the Sendai Framework for Disaster Risk Reduction 2015-2030;

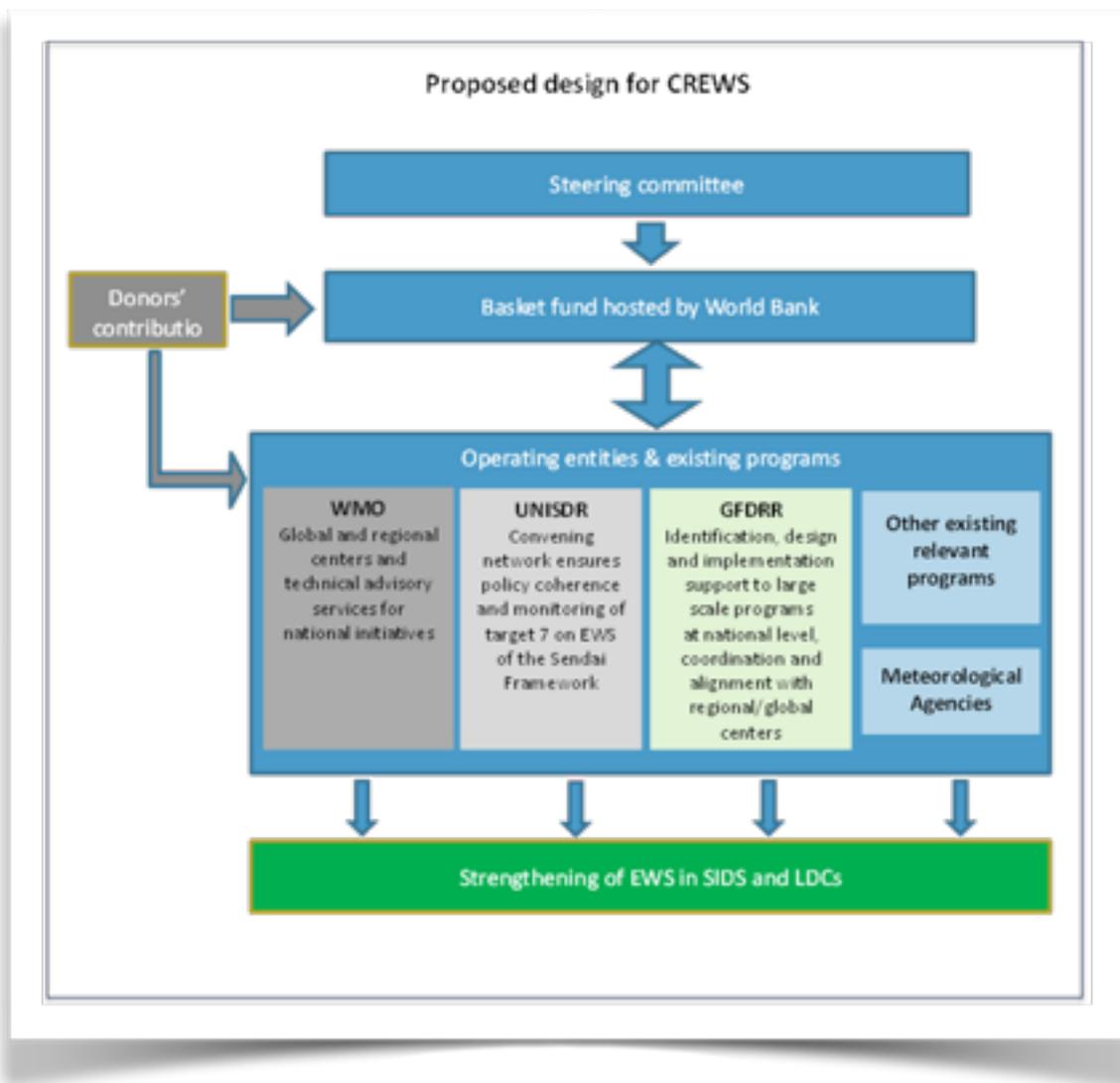
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<sup>1</sup> Sendai Framework for Disaster Risk Reduction 2015-2030 - target 7 : “substantially increase the availability and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030”

- GFDRR Trust fund for the identification, design and implementation support to large scale programs at national level, as well as coordination and alignment of these programs with regional and global centers.

The governance of the CREWS initiative will be assumed through a steering committee (priorities, funds allocation, planning) supported by a light secretariat (coordination, reporting, monitoring and evaluation) relying on WMO-UNISDR-GFCS-WB/GFDRR expertise. Projects will be implemented in strong coordination with other actions related to NMHSs (e.g. the African Ministerial Conference on Meteorology Integrated African Strategy for Meteorology (Weather and Climate Services) and the WMO-AfDB-WB/GFDRR joint initiative strengthening Climate and Disaster Resilience in Sub-Saharan Africa Regional Framework Program to Improve Hydromet Services). The governance structure to be put in place will ensure synergies and complementarities and avoid duplication of actions.

The first phase of the CREWS initiative will be implemented over a period of eight years (with five years for project commitments and allowing three years for project completion) with an expected total financial contribution of US\$100 million from multiple donors.



### 3.3. Main components and activities

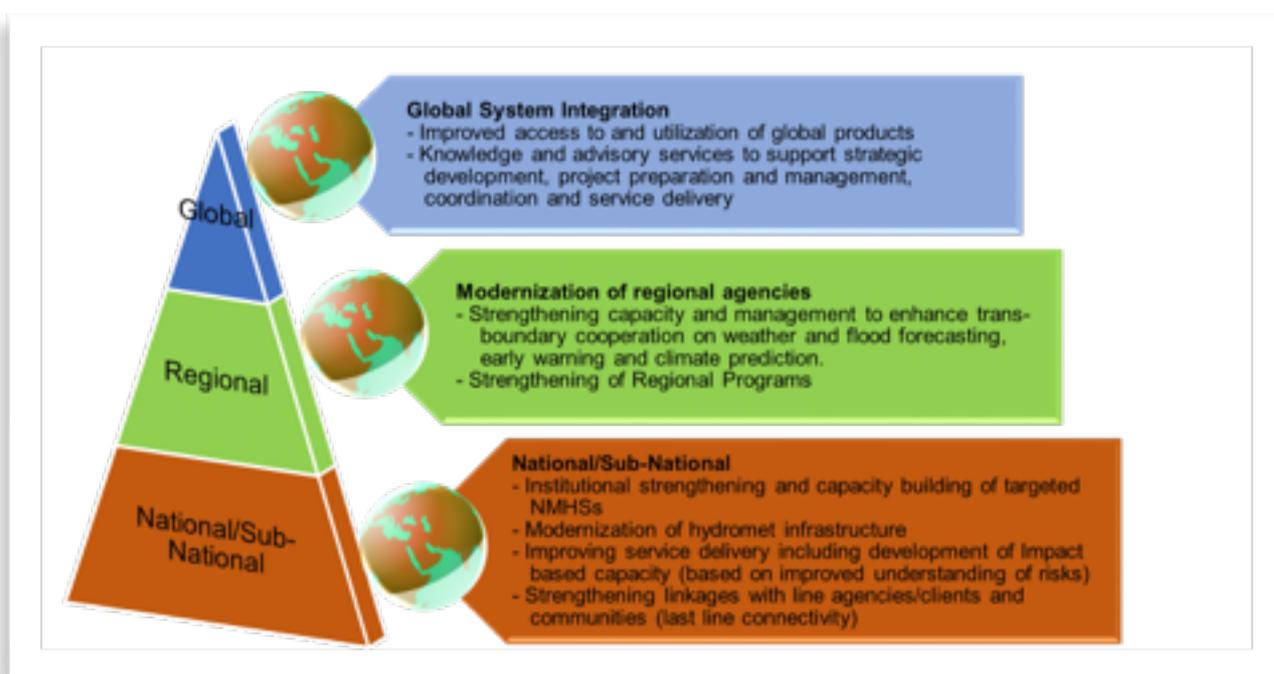
The CREWS initiative will strive to leverage and enable major investments to (i) strengthen the linkages between WMO global and regional centers for enhanced provision of technical and operational support to NMHSs and national early warning services and risk information; (ii) strengthen the NMHSs and their capacity to provide warnings and services and risk information<sup>2</sup>; and (iii) improve the linkage between warning services and effective emergency management including local and national emergency plans and the use of risk information for risk reduction.

The CREWS initiative will optimize its actions by using the outcomes of other programmes in the areas of risk information and risk assessment, including linking hazard information to exposure and vulnerability information and tracking associated damages and losses.

The CREWS initiative will facilitate exchanges of experience, with relevant forums and partners, and support the development of a community of practice, namely based on the backbone provided by WMO's institutional infrastructures at all levels. To ensure connection with the broader DRM community, CREWS members would meet in alternative years at the Global Platform for Disaster Risk Reduction arranged by UNISDR and the Understanding Risk Forum arranged by WB/GFDRR.

Broad stakeholder participation, including engagement of the private sector will be ensured through active communication and contacts set up by the partner institutions, and specific events organized on the occasion of thematic fora or regional platforms. Representatives of stakeholders will also be part of the steering committee.

#### CREWS action plan in a nutshell



<sup>2</sup> Information on hazards and extreme events and tailored hydrometeorological and climate information for risk management in climate-sensitive sectors.

### 3.4. Geographical scope

The CREWS initiative will be primarily focused on low income countries and small island developing states, while also leveraging resources to strengthen the cascading system of WMO global and regional centres that support them. An initial focus (2016) will be given to selected high risk countries to be identified by the CREWS Partners to build upon ongoing efforts and provide replicable methods and results to expand the initiative in order to cover all LDCs and SIDS with no effective (MH)EWS by 2020.

## 4. **Mobilization of relevant international organizations**

The CREWS Initiative relies on the mobilization of the three main international organization specialized in DRR and EWS and risk information: WB/GFDRR, UNISDR and WMO. CREWS aims to act as a catalyzer for the already existing programs of these three institutions which rely on more than 20 years of experience in the support of vulnerable countries to build resilience.

### 4.1. WMO

The World Meteorological Organization (WMO) is a specialized agency of the United Nations. It is the United Nations system's authoritative voice on the state and behavior of the Earth's atmosphere, its interaction with the oceans, the climate it produces, and the resulting distribution of water resources. WMO was founded in 1873 as the International Meteorological Organization and joined the United Nations in 1951. It has a membership of 191 Member States and Territories. As weather, climate and the water cycle know no national boundaries, through WMO these Members achieve the international cooperation essential for the development and application of meteorology. WMO National Meteorological and Hydrological Services, supported by WMO Regional and Global centers, provide operational weather, water and climate services worldwide. WMO technical commissions, regional associations, and programmes engage hundreds of institutions and thousands of experts in a common global agenda. This agenda includes the protection of life and property against natural disasters, as well as safeguarding the environment and enhancing the economic and social well-being of all sectors of society, in areas such as food security, water resources and transport. Through the efforts of these actors, WMO promotes cooperation in the establishment of networks for making meteorological, climatological, hydrological and geophysical observations, as well as the exchange, processing and standardization of related data, and in technology transfer, training and research.

WMO operates a large number of programmes relevant to the CREWS initiative. These support implementation of early warning systems for everything from flash floods, coastal inundation, riverine floods, tropical cyclones, severe weather, drought, and seasonal climate anomalies to long range climate changes. Additional programmes address the observing systems and data management systems for implementing not only early warning systems but also for anticipating the duration, location, magnitude and timing of hazard events and for recording and analyzing associated losses. In addition to providing hands on support for implementation of these measures at country and regional levels, WMO's programmes and technical commissions create the guidelines, norms and standards for the implementation of such systems globally.

### 4.2. World Bank/GFDRR

The World Bank has played a key role in recent years to bring attention to the economic benefits of hydromet services and need to scale up investment in this area. Since the mid-1990s, the World Bank's support has expanded in volume and scope. Projects have increasingly adopted a comprehensive, NMHS systems approach – encompassing equipment, capacity building,

observational infrastructure, and links with end users – in order to build institutions that are effective and valued.

In spring 2011, GFDRR launched a Hydromet Program. The Program, implemented in close collaboration with the World Bank and WMO is currently active in more than 40 countries. It aims to help developing countries by: (i) providing analytical support and knowledge management concerning weather and climate information systems and services; (ii) building capacity and providing technical assistance to World Bank teams through workshops, training sessions, and advisory services; and (iii) facilitating portfolio development and operations in priority countries.

The World Bank engagement in Hydromet, which received support from GFDRR technical team is currently estimated at \$400 million. To support these engagements, the World Bank through GFDRR maintains close collaborations with WMO, as well as with a number of NHMSs in advanced economies.

Two recently launched programs are also of relevance to this initiative. The WMO, the World Bank and the African Development Bank (AfDB) have jointly launched in July 2015 the Africa Regional Framework Program to Improve Hydromet Services to help address critical capacity bottlenecks in Africa. The World Bank is also scaling up its programs in support of Small Island Developing States (SIDS), and is working on a new initiative to strengthen resilience to natural disaster and climate change.

The WBG/GFDRR will bring its operational experience as a grant making facility; its ability to effectively link the grant funding with broader development support, mostly through IDA funding, thus scaling up the development impact of donor funds and ensuring long-term sustainability.

#### 4.3. UNISDR

UNISDR will be supporting the CREWS initiative in several ways. UNISDR will monitor the Sendai Framework for Disaster Risk Reduction 2015-2030 including the target on multi-hazard early warning systems. Such information will be useful to identify gaps and to course correct the implementation of CREWS in the future. UNISDR is the secretariat for the Open Ended Intergovernmental Expert Working Group on Indicators and Terminology related to disaster risk reduction. The Working Group will be developing indicators and updating terminology on early warning systems. Such work will be key to how we measure progress and have clearer ideas on concepts related to early warning systems projects and programmes.

UNISDR hosts the biennial Global Platform for Disaster Risk Reduction and regional meetings and platforms where updates on CREWS initiative, promotion and best practice can be shared. UNISDR has a bank of risk knowledge and information to support CREWS with the production of the Global Assessment Report and global risk analysis modelling. UNISDR also has an extensive network of stakeholders (governments, private sector, science and technology, local government, communities and practitioners, NGOs and parliamentarians) that can be brought in as partners to the CREWS as appropriate.

Finally, UNISDR has been tracking progress on early warning systems since the Hyogo Framework of Action in 2005. UNISDR provides advice on the strategic direction and policy on the priorities of CREWS. In addition, UNISDR is well-connected into relevant instruments like the SAMOA Pathways and the post-2015 development agenda (including the Sendai Framework for Disaster Risk Reduction 2015-2030; the 2030 Agenda for Sustainable Development; and the future outcomes of COP21, the World Humanitarian Summit, and HABITAT III). UNISDR is working towards better coordination and mutual reinforcement and coherency among the instruments, for example cross referencing the international agreements; developing common targets, indicators and reporting; highlighting the needs and challenges of SIDS and LDCs and promoting co-beneficial partnerships (like the CREWS) in support of the instruments.

## 5. CREWS process

### 5.1. The first two meetings (July 6 and September 8, 2015)

France and its partners organized two technical meetings associating potential donors countries to shape the initiative and mobilize international finance for the trust fund.

- The first meeting (July 6, 2015) allowed to discuss in depth the structure of the initiative, the existing needs in the most vulnerable countries, and the governance of the initiative. Support has been expressed by Norway, the European Union Commission, and Japan.
- The second meeting (September 8, 2015) helped to clarify CREWS modus operandi and has demonstrated its relevance and coherence. Support and encouragement of the initiative were made by Australia, Germany, Spain, New-Zealand and again by Japan, Norway and the European Union.

### 5.2. Next steps : tentative agenda

- New York UNGA, September 29, 2015: Side event organized by France and its partners to present the CREWS initiative
- Lima, World Bank / IMF fall meeting, October 7-9, 2015: Presentation of the CREWS initiative as part of the Cooperative actions of the climate agenda
- Paris, November 30 – December 12, 2015 : COP21
  - December 2: COP21 Resilience Day
  - December 5: COP21 Action Day
- January, 2016 : First meeting of the steering committee

## 6. Cases studies

As already mentioned, over the past 20-30 years, low visibility and underfunding, among other factors, have significantly compromised the effectiveness of National Meteorological and Hydrological Services (NMHSs) and disaster risk management in developing countries. The underfunding has led to a) a deterioration of observation and communication networks, b) a lack of modern equipment and facilities, c) poor quality of services, (d) insufficient support for research and development, and (e) an erosion of the workforce.. The capacity and technological gap between developed and many LDCs and SIDS is very significant and continues to grow. The improvement of the situation will require long-term commitment of the national governments, allocation of significant resources and effective cooperation among donors. The modernization of this sector is technically and institutionally challenging and will be impossible for most LDCs and SIDS without sustainable donor commitment.

The following section provides a brief illustration of the needs, challenges, opportunities and potential priority interventions in a few LDCs and SIDS which the proposed EWS Initiative may support. It will also illustrate and make reference to a few ongoing activities of the World Bank/GFDRR, which could benefit from the proposed initiative to achieve better development outcomes. The World Bank and other IFIs started investing in this sector relatively recently. However, development of sustainable design and implementation of hydrometeorological and EWS investments has proved to be challenging due to the relatively small size of the sector, frequent lack of visibility on the national level, significant technical complexity and weak institutional background. Some of these

challenges could be addressed with the help of targeted donor support as the proposed EWS Initiative which can complement and improve performance of traditional World Bank investments.

## 6.1. Democratic Republic of Congo (DRC)

### 6.1.1. *Background and development needs in the sector*

The Democratic Republic of Congo (DRC) is one of the poorest countries in the world where development assistance is extremely challenging. Despite its abundance in natural resources, it is ranked second last in the latest Human Development Index. DRC is Africa's third largest country. The Congo River is not only Africa's second longest (4,700 km) and the world's deepest river (over 220 m), but it also has the world's third largest flow (about 1300 km<sup>3</sup>/year). It is not surprising that the continent's biggest hydropower-potential is found in DRC. For example, the Inga hydroelectric scheme has a 40,000 MW capacity alone. The typical climate involves high rainfall (1,700 mm/year) which often leads to flooding and landslides, while the southern part of DRC is prone to droughts. The country has the highest frequency of thunderstorms in the world.

The WBG preliminary assessment of the sector undertaken in 2013 indicated that the status of national meteorological, hydrological and DRM agencies is very poor. For instance, despite significance of water resources for the country economic development there is no dedicated Hydrological Agency in DRC and no reliable data on water resources. The National Agency of Meteorology and Remote Sensing by Satellite (MettelSat) and Airways Agency (RVA) which are authorized to collect weather and climate information experience severe lack of resources. The MettelSat, for instance, has not received funding for its operations and maintenance since the early 1990s; during this period, the government budget was allocated only to support the staff costs. MettelSat has a significant workforce (about 400 staff) but more than 75 percent of the staff is at the retirement age or exceeding it. The qualification of the workforce needs significant improvement too.

As the result, there is an overall lack of reliable or sometimes any information on weather, climate and hydrology in the DRC. There is no operational early warning system in the country. There are few regular products available to the country users such as basic weather forecasts often distributed through weather studio, seasonal forecasts, and some remote sensing data. Most of this data and information is not reliable. MettelSat indicated, for instance, that accuracy of its weather forecasts (24 hours lead time) is below 60%, which is extremely low. The DRC produces neither hydrological forecasts, severe weather forecasts nor other products needed to reduce the adverse impacts of weather hazards, nor information that would improve the performance of weather dependent sectors.

There are a few international programs contributing to hydrometeorological data collection, but clearly they could not compensate the lack of national efforts. Among donor assistance programs in DRC are AMESD, Congo-HYCOS and SADC-HYCOS. These projects are implemented through and supported by CICOS, WMO, GIZ, and EU. Additionally, MettelSat is interacting with such regional organizations and centers as the Meteorological Association of South Africa (MASA), ACMAD and IGAD. Taking into account urgent national needs and the DRC global “footprint” there is a clear need for additional and significant donor support in this sector.

### 6.1.2. *Potential scope of intervention*

The scope of the potential intervention should be sufficient to make a difference and have some visible positive impact. After 30-40 years of neglect, the hydrometeorological /EWS sector needs considerable resources and efforts to rebuild its institutional framework, create the most basic infrastructure and develop a service delivery culture and capacity in the sector, which is now very weak. At the same time the proposed activities should be affordable to the government in order to be sustainable. Finding the appropriate balance between significant and competing development needs, and limited government resources and capacity will be one of key challenges. But this also provides additional justification for donor support taking into account significant element of global public goods, which can be generated.

In view of these considerations, the scope of interventions which can be funded by the proposed EWS initiative can include the following main activities: (a) assessment of national capacity and capabilities to improve delivery of early warnings, weather, climate and hydrological services; (b) support for high priority technical assistance activities and small scale investments; (iii) strengthen the linkages between global and regional WMO centers for enhanced provision of technical and operational support to improve national hydrometeorological and early warning services and risk information.

The **first group of activities** may include the following tasks:

- A review of the natural hazards and environmental conditions and their impact on population and economy of DRC.
- An assessment of the current status and requirements for EWS, weather, climate and hydrological information and services.
- An assessment of the institutional capacity of relevant DRC agencies including their mandates, legal basis and regulations, staffing, funding, development plans and priorities; the status of infrastructure; products and services; and international activities.
- A review of donors operations (including IFI projects) relevant to improve products and services;
- A social and economic assessment of the potential benefits of modernized early warning and hydrometeorological systems and enhanced service delivery;
- A plan for a modernization program or road map to improve EWS and hydrometeorological products and services to meet current and future requirements of DRC.

The **second group of activities** of activities may include the following tasks:

- Basic and specialized training of NMHSs and DRM staff, study tours, joint workshops with users including raising awareness and evacuation drills at the community level;
- Hiring technical experts to address priority issues such as development of technical specifications and bidding documents, development of recommendations for improvement of forecasting and early warnings including development of warning protocols;
- Development of National Framework of Climate Services, support for climate outlooks and projections;
- Supporting small-scale priority investments such as improvement of communication network, procurement of computers, specialized forecasting software, vehicles and priority consumables for essential operations such as upper air sounding.

The **third group of activities** of activities may include the following tasks:

- Strengthening the linkages between MetSat, RVA and other relevant DRC agencies with global and regional WMO centers. This may include introduction and operationalizing of the WMO Severe Weather Forecast Demonstration Project, Flash Flood Guidance and similar WMO flagship initiatives to DRC.
- Enhanced provision of technical and operational support to improve national hydrometeorological and early warning services and risk information could include ongoing support from one or several global forecasting centers such as Meteo France, ECMWF, UK Met Office or US NOAA/NWS.
- In case there will be significant investment projects funded by IFI or another donor, this activity may support g services and risk information could include ongoing support from one or several global forecasting centers such as MetSat, RVA, etc.) which would assist in implementation of the investment project.

The cost estimate for such investment should be evaluated based on a more thorough assessment, it is clear that it will be significant (above USD 10 million) and should therefore be implemented jointly with an IFI such as WBG or African Development Bank. In any event, the proposed project will be in a high risk - high reward category. Risks are attached to a challenging set of institutional, infrastructure and capacity gaps but potential success in DRC can generate significant national and regional/global benefits. In brief, **the expected results** of such a project in DRC could include:

- Timely and reliable forecasts at the national and local levels leading to a reduction of the impacts of disasters on people and property;
- Improved delivery of weather, climate, hydrological services and multi-hazard warnings to citizens and weather-dependent sectors; and,
- Improved international and cross-border collaboration, including on drought, severe weather and flood warnings.

## 6.2. Sahel: Mali and Burkina Faso

### 6.2.1. *Background*

Sahel has faced repeated droughts with the most severe ones occurring during the 1960s and the 1980s. Between 2010 and 2012, two large-scale droughts impacted up to 19 million people; hence, resilience in the Sahel over the last decades has been focusing nearly exclusively on food security, with locusts and droughts as key natural hazards. However rapid-onset hazards such as flooding, flash flooding, storms and wildfires have also becoming a threat to lives and livelihoods in the Sahel. Recorded economic losses linked to extreme hydro-meteorological events indeed have increased nearly 50 times over the past five decades. Early warning systems (EWS) are a critical life-saving and livelihood-saving tool for hydrometeorological hazards in the region.

The table below shows the status of 5 of the Sahelian countries, which indicate a sizable population is at risk from natural hazards across 5 countries, while their capacity to manage disaster risk is rather limited. Of these, the Global Facility for Disaster Reduction and Recovery (GFDRR) has provided technical assistance to Burkina Faso and Mali to identify their DRM priorities, including early warning systems. This case study is focused on these two countries.

Country	Income level	GNI per capita	Population (growth)	Agriculture in GDP	F o o d insecurity	Population at risk	DRM Capacity	Fragile States
	2012	current USD 2012	Million (%) 2012	2011	M people affected in 2013 (%)	% (rank in SSA)	Composite score (0 worst; 5 best) <sup>2</sup>	FY 14 WB
Burkina Faso	Low	670	16.5 (2.9 %)	34%	2.1 (27%)	61.7% (7)	3.2	No
Chad	Low	740	12.4 (3.0 %)	14% (2008)	3.6 (29%)	20.5% (24)	1.7	Yes
Mali	Low	660	14.9 (3.0%)	39% (2009)	4.2 (28%)	29.6% (20)	2.8	Yes
Mauritania	Lower Middle	1,110	3.8 (2.5%)	16%	0.7 (18%)	No data	2.2	No
Niger	Low	370	17.2 (3.8%)	40% (2013)	6.4 (37%)	76.4% (3)	2.2	No

### 6.2.2. *Baseline*

**Burkina Faso:** The Directorate General for Water Resources (DGRE) is responsible for surface and groundwater monitoring. However, out of 95 hydrometric monitoring stations, most discharge data is collected monthly where data transmission, validation and processing is done manually. The Directorate General for Meteorology (DGM) is responsible for weather and climate services, notably agro-climatology. DGM operates a network of 14 manual agro-meteorological stations and two

Doppler radars of which only one is operational. Currently, the DGM only serves weather modification needs as it is unable to provide mandated forecasting related to extreme, fast-onset weather events because of low capacity. The National Council for Emergency and Rehabilitation (CONASUR) is the national platform for DRM responsible for distribution of relief material, while Directorate General for Civil Protection (DGPC) is responsible for emergency response in the urban areas and for managing the national fire brigades.

**Mali:** The National Directorate of Water (DNH) is responsible for monitoring surface and ground water, including hydrological stations along Niger and Senegal Rivers. The network of hydrological and meteorological stations is deteriorated with just 100 surface and ground water stations operational, down from 231 stations in the 1980s. All stations are operated manually while discharge measurements are done infrequently. The former National Directorate for Meteorology (Meteo-Mali) was transferred into an autonomous agency responsible for meteorology two years ago however, all 16 synoptic stations of the meteorological monitoring network are still operated by ASECNA, while Meteo-Mali only focuses on the agro-meteorological monitoring and provision of agro-meteorological services. Meteo-Mali does not conduct a 24/7 operation for severe weather warnings and is equipped with three conventional weather radars out of which two are operational.

In both Burkina Faso and Mali, early warning systems exist for locust, drought, availability and price of food, all in relation with early monitoring of food insecurity. A comprehensive system for early warning and risk assessments, in particular related to rapid-onset hazards such as flood, storms and flash floods, is not yet available.

**Regional:** The national meteorological services of Burkina Faso and Mali are supported by AGRHYMET (mainly for agro-meteorological services) and ACMAD (mainly for climate services). Therefore, improved regional cooperation in early warning services within the Sahel, in close collaboration with regional centers such as ACMAD, AGRHYMET and WMO Regional Specialized Meteorological Center, is important for the development of effective risk assessment, and multi-hazard early warning. Successful operation of hydrometeorological services and early warning systems is traditionally based on international cooperation, combining local observation with global and regional scale numerical weather prediction models and satellite data. Sharing of common methodologies and good practices within the Sahel would also enable the countries to better cope with cross-border hazards.

6.2.3. *Ongoing activities*

There are a number of investments/projects currently going on aiming at strengthening early warning capacity in the region. Below are some of the representative on-going activities but the list is by no means exhaustive.

Burkina Faso	Mainstreaming Disaster Reduction	World Bank	\$ 1.26 M	(i) Strengthening CONASUR as an efficient coordinating center for DRM in Burkina, (ii) Devising an early warning system, (iii) Capacity building for response institutions, and (iv) Development of micro-projects
	Strengthening climate information and early warning systems (EWS) for climate resilient development and adaptation to climate change, and strengthening Adaptation Capacities and Reducing the Vulnerability to Climate Change in Burkina Faso	UNDP	\$ 6.9 M	Build and strengthen the observing and forecasting system. Improve communication and types/formats of available information



Burkina Faso and Mali	Enhancing National Climate Services (ENACTS)			Provide reliable and readily accessible climate data at high resolution to decision makers, through integration of local observations and global monitoring data to improve climate data coverage and spatial resolution.
A C M A D , AGRHYMET, Burkina Faso and Mali	African Monitoring of the Environment for Sustainable Development (AMESD)	EUMETSAT		AMESD aims to provide decision-makers in the RECs, the African Union Commission and at national level with full access to the environmental data and products they need to improve national and regional policy and decision-making processes.

### **Potential Initiative intervention**

Building on various ongoing efforts in the region, the proposed Initiative could potentially provide technical assistance to the region (selected countries and regional organizations) to develop and define investment-ready system-wide hydrometeorological and early warning system modernization program to leverage further financing. Such program should be developed in close coordination with the National Meteorological and Hydrological Services of Burkina Faso and Mali, and the regional centers including ACMAD, AGRHYMET and the WMO Regional Specialized Meteorological Center in Senegal. In addition, the Initiative can explore opportunities to invest in high priority areas in observation, forecasting, warning service development such as impact based warning, and early warning communication as well as to facilitate and enlarge existing/planned regional programs to strengthen the regional capacity to provide consistent early warning, including West Africa Severe Weather Forecasting Demonstration Project, Regional Climate Outlook Forums.

## **6.3. Pacific**

### *6.3.1. Background*

The Pacific Island Countries (PICs) lie in the midst of the world’s largest ocean and include some of the world’s smallest nations. The Initiative could potentially provide technical assistance to the region (selected countries and regional organizations) to develop “sea-locked” countries have small domestic markets and are characterized by low economic density as a result of their extreme remoteness, as well as high transportation and transaction costs of linking to international markets. Although absolute poverty in the region is limited, real per capita income has remained virtually unchanged since the mid-1990s and economic progress tends to be volatile and vulnerable to external shocks. PICs are also among the most physically vulnerable nations in the world. They are highly exposed to adverse effects from climate change and natural hazards (including floods, droughts, tropical cyclones, storm surges, earthquakes, volcanic eruptions, and tsunamis), which can result in disasters that affect their entire economies, human and physical capital, and impact their long-term development agendas. Since 1950, natural disasters have affected approximately 9.2 million<sup>3</sup> people in the Pacific region, causing 9,811 reported deaths. This has cost the PICs around US\$3.2 billion (in nominal terms) in associated damage costs (EM-DAT, 2010)<sup>4</sup>.

### *6.3.2. Proposed activities*

<sup>3</sup> SPC Pocket Handbook 2010.

<sup>4</sup> Source: Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI). Countries covered by PCRAFI are Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Timor-Leste is also included.

To address these issues the WB has recently prepared and approved (June 2015) the Pacific Resilience Program (PREP), which aims to contribute to the resilient and sustainable economic and social development of the participating Pacific countries and of the region as a whole. The initial participants for Phase I of the PREP include Samoa, Tonga, the Republic of Marshall Islands (RMI) and Vanuatu. The Table 1 illustrates extreme risks of natural hazards in these countries.

*Table 1: Risk Profile for Tropical Cyclone (TC), Earthquake and Tsunami for Phase I countries*

		Samoa	Tonga	RMI	Vanuatu
	Average annual loss (% GDP)	1.7%	4.3%	2.0%	6.6%
Last disaster and impact	Name Date Cost % GDP	TC Evan Dec 2012 US\$210 m 30%	TC Ian Jan 2014 US\$50 m 11%	T y p h o o n Gay Nov 1992	TC Pam Mar 2015 Currently unknown
Impact of 1/50 year return period <sup>3</sup>	Cost % GDP Casualties (injuries and fatalities)	US\$110 m 19.4% 254	US\$140 m 39.2% 299	US\$34 m 21.9% 38	US\$285 m 39.1% 577
Impact of 1/100 year return period <sup>3</sup>	Cost % GDP Casualties (injuries and fatalities)	US\$153 m 27.0% 374	US\$225 m 63.0% 600	US\$67 m 43.3% 76	US\$370 m 43.6% 901

The PREP project includes the following main components on the national and regional level (Table 2). The largest among them is the Component 1: Strengthening early warning and preparedness with the estimated cost of about USD 23 million out of USD45.7M of total project cost. The objective of this component is to increase the resilience of the participating Phase I countries and the Pacific region as a whole to natural hazards such as cyclones, coastal/riverine flooding, volcanic eruptions, tsunamis and earthquakes by improving the quality of forecasting and warning services as well as disaster preparedness.

*Table 2. Main components of Pacific Resilience Program*

	National Implemented Activities	Regional Implemented Activities
<b>Component 1: Strengthening early warning and preparedness</b>	✓ 1.1 Investments in early warning and preparedness	✓ 1.2 Regional Technical Assistance (TA) to strengthen impact forecasting and preparedness
<b>Component 2: Risk Reduction and Resilient Investments</b>	✓ 2.1 Risk reduction and resilient investment planning and preparation (including entry level investments)	✓ 2.2. Regional platform to support risk reduction and resilient investment planning

<b>Component 3: Disaster Risk Financing</b>	✓ 3.1. Disaster risk financing instruments	✓ 3.2 Development of Mutual Insurance Fund
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This Component 1 has two sub-components: (i) Investments in Early Warning and Preparedness; and (ii) Regional TA to Support Impact Forecasting and Preparedness. The first sub-component will strengthen: (i) detection, forecasting and warning of the impact of natural hazards; (ii) dissemination of timely warnings to the population, including last mile communication; and (iii) emergency preparedness and response mechanisms. This will involve the introduction of an impact-based forecast and warning system, which will build on existing capabilities in meteorological, hydrological and seismological monitoring, forecasting and warning, and the PCRAFI vulnerability assessments to establish a fully functioning Multi-Hazard Early Warning System (MHEWS) for each participating country.

The second sub-component will be *regionally implemented* and will provide the Technical Assistance and advisory services required to support Early Warning and Preparedness activities under the first sub-component for the participating countries. This will be done through regional technical assistance, development of a platform to provide access to the range of knowledge, training and education material as well as tools to strengthen capacity and improve understanding of early warning and preparedness in PICs. Expected results will include: (i) increased coverage of hazard forecast and warning messages to population at risk; (ii) improved status of hazards observational network (Hydrological, Meteorological and Seismic); (iii) Multi Hazard Early warning systems are established and operating; and (iv) improved use of training opportunities on the regional level.

#### 6.3.3. *Potential intervention*

It should be noted that no one of available funding sources was sufficient to mitigate the natural hazards risks even for the first phase with rather limited set of small islands. The bulk of funding was provided by the WBG's International Development Association, with contributions from the Pilot Program for Climate Resilience, the Special Climate Change Fund, GFDRR/Japan grant and national governments. There is an ample need of additional grant funding for the preparation and implementation of the second and the subsequent stages of the PREP. The proposed EWS Initiative may help to address this need and reach significant improvement of resiliency within these highly vulnerable countries.

## 7. Financial fact sheet

For an illustrative purpose, a brief repertory of projects, already launched or near to be so in the area of EWS and NMHS modernization, has been consolidated in the Annex 1 tables. This projects collection does not pretend to be an exhaustive overview of activities in the sector. Nevertheless, it gives a sample of the diversity and various design of these projects.

Based on data communicated by partners, related to nearly 119 technical assistance and investment projects<sup>5</sup>, the yearly financial flows, supporting national hydro-meteorological services (NHMS) and multi hazards early warning systems (MH-EWS), could be estimated at around 150 million USD (median value on 2013-2016, most significant period considering the data file – see table below).

These figures try to quantify financial resources theoretically made available per year in this area of activity. They do not prejudge of the way those resources are mobilized nor of how effectively the projects are implemented.

This result (150 million USD /year) is likely to be overestimated because the full budget of the projects considered in the table has been taken into account in the calculation though some projects may have only small EWS components. It has to be considered as the upper limit of the EWS funding status.

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<sup>5</sup> Not all of these projects are contributing to EWS but all have been identified as having EWS elements. Additional bilateral projects with some EWS element may be missing.

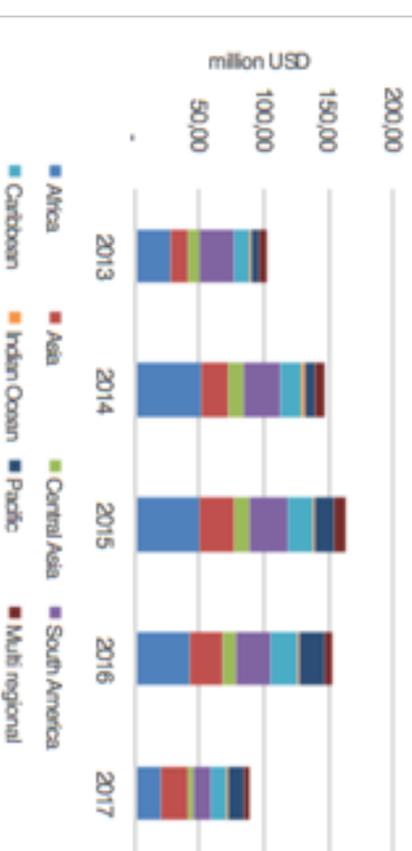
### Building Multi-hazard Early Warning System Capacities

Estimation of programmed financial flows per year and per region through technical assistance and investment projects (\*)

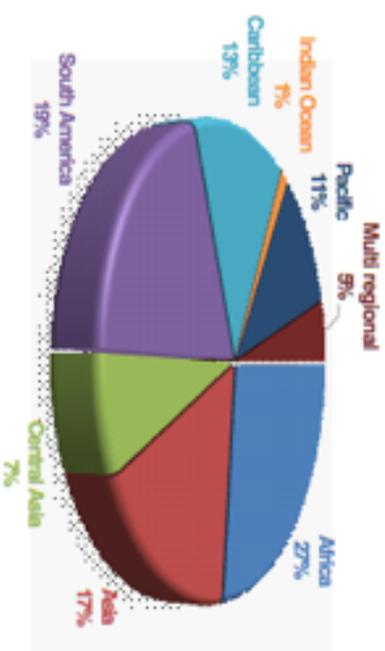
(\* million US \$)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	%
Africa	3,24	6,36	28,36	51,81	50,50	43,37	20,85	4,91	-	-	209,40	27%
Asia	0,85	4,19	12,39	21,24	26,72	24,93	20,02	13,31	5,48	1,37	130,50	17%
Central Asia	2,27	5,81	9,45	10,87	11,93	10,23	4,24	-	-	-	54,80	7%
South America	2,89	14,91	26,93	29,01	28,80	27,10	13,62	2,04	1,02	-	146,32	19%
Caribbean	6,13	9,51	11,59	15,91	19,10	20,13	12,14	5,70	3,49	2,38	106,08	13%
Indian Ocean	-	-	1,15	2,30	2,42	2,30	1,15	-	-	-	9,32	1%
Pacific	0,31	3,23	6,46	8,10	15,22	18,03	11,74	9,20	9,20	4,60	86,09	11%
Multi regional	1,51	3,02	5,49	7,97	7,89	6,12	4,38	1,90	-	-	38,28	5%
<b>Total</b>	<b>17,20</b>	<b>47,03</b>	<b>101,82</b>	<b>147,21</b>	<b>162,58</b>	<b>152,21</b>	<b>88,14</b>	<b>37,06</b>	<b>19,19</b>	<b>8,35</b>	<b>780,79</b>	

### NIMS - MHEWS - financial flows of programmed supports



### 2011-2020 - Programmed supports : 781 million USD



(\*) based on data communicated by partners

(119) selected Technical Assistance and Investment Projects supported by the International Community, NIMS of Developed Countries and WMO

## 8. ANNEX 1 : List of existing projects

Selected Technical Assistance and Investment Projects supported by the International Community, NMHSs of Developed Countries and WMO

Beneficiary Country / Region	Activity/Project	Amount	Duration	Funding Agency	Thematic Areas
Afghanistan	Strengthening Early Warning and Disaster Risk Management Capacity in Afghanistan	USD 2.5 million	2 years (2015-2017)	GFDRR, World Bank	Early Warning Systems
Afghanistan, South East Asia, South East Europe, Caribbean, Central Asia	Hydro-meteorological Disaster Impact Mitigation Projects - global	\$ 13.2 million	Sept 2011 - Sept 2017)	WMO/ United States Agency for International Development	Disaster risk reduction, early warning, capacity development
a	Reducing Risk and Building Resilience	U S D 262,000	2015	GFDRR, World Bank	Develop service delivery strategy for hydromet, strengthen disaster risk management capacity
Angola	Climate-resilient development & enhanced adaptive capacity for disaster risk in Angola's Cuvelai River Basin	8,200,000	4 8 months	GEF/LDCF	Technology transfer; capacity building for climate and environmental monitoring infrastructure; Famine and flood early warning systems - FFEWS; Sustainable rural livelihoods; Climate change adaptation; Climate-resilient development planning.

Azerbaijan	Integrating climate change risk management in Azerbaijan	2,700,000	2011-2016	GEF	Water and flood management; climate risk management; capacity building climate risk management practices for water stress and flood mitigation; community-based early warning systems to disseminate water stress and flood risk information to the local communities; Community resilience to floods and water stress.
Bangladesh, Cambodia, Federated States of Micronesia, Myanmar, Palau, Papua New Guinea, Thailand, Tuvalu and Viet Nam	Satellite receiving equipment for Himawari-8/9	C H F 750,000	O p e n ended	W M O / Japan	Early detection and response to h y d r o - meteorological hazards
Benin, Burkina Faso, Ethiopia, the Gambia, Liberia, Malawi, Sao Tome and Principe, Sierra Leone, Tanzania, Uganda and Zambia	Strengthening climate information systems and early warning systems in Eastern and Southern Africa for climate resilient development and adaptation to climate change (CIRDA)	USD 54 Million	4 Years (2013 - 2017)	GEF's Least Developed Country Fund	Access to Technology Transfer; Capacity Building to farmers, policy makers and the private sector; Mainstreaming CC in development planning (NAPs)
Benin, Burkina Faso, Cameroon, Central African Republic, Cote d' Ivoire, Chad, Gambia, Niger, Senegal	The Africa Climate Adaptation Food Security Project	4.2 Million	1 year ( July 2014 - June 2015)	Government of Japan	C l i m a t e Historical Data Rescue and Digitization; Development of Climate Services
Benin, Burkina Faso, Cameroon, Central African Republic, Cote d' Ivoire, Chad, Gambia, Niger, Senegal	The Africa Climate Adaptation Food Security Project - support to AGRHYMET	110,000	7 Months ( Nov . 2014 - Jun 2015)	Government of Japan	T e c h n i c a l capacity strengthening for better delivery of climate data and information products

Bhutan	Enhancing hydro-met data collection and flood monitoring stations 2nd LDCF project "Addressing the risk of climate induced disaster through enhanced national and local capacity for effective actions"	11.5 million	2014-2018	GEF/LDCF	Enhancing climate data collection through expansion of automatic weather stations & flood monitoring stations (nation-wide coverage)
Burundi	Community Disaster Risk Management in Burundi. The community disaster risk management project will enhance local	8,715,000	48 months	GEF/LDCF	Early warning systems; Livelihoods and infrastructure risk assessments; Climatic governance, Capacity Building of key actors; Risks management.
Cambodia	Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change (Early Warning System - EWS project)	4.9 million	2014-2018	GEF-LDCF Funds	Early Warning System; Climate Resilient Development; Climate Change adaptation
Caribbean	Program for Building Regional Climate Capacity in the Caribbean	\$5.085 million	February 2014 – Jan 2017	WMO United States Agency for International Development	Supporting adaptation to climate variability and change and enhance disaster risk reduction capacities in the Region by establishing a sustainable Regional Climate Centre (RCC) for the Caribbean
Central Africa (Angola, Burundi, Cameroon, Central African Republic, Chad, Congo Democratic Republic, Gabon, Guinea, Sao Tome and Principe)	Development of Risk Reduction Measures, Preparedness and Response to Disaster Risk in Central Africa	USD 0.3 million	2 years (2014-2016)	GFDRR, World Bank	EWS, forecasting and service delivery

Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan)	Central Asia Hydrometeorology Modernization Program	USD 27.7 million	5 years (2012-20 17)	World Bank, P P C R , GFDRR	Integrated modernization of hydromet services, improvement of EWS and climate information
Colombia	Reducing risk and vulnerability to climate change in Colombia	8,518,307	5 year	UNDP GEF TF	Strengthening of existing hydro climatological and environmental information system (HEIS); EWS, Climate Change Adaptations, Disaster Risk Reduction, Climate Risk Management
Cook Islands	Strengthening the Resilience of the Cook Islands to Climate Change	4.960.000	2012-201 7	Adaptation fund	Climate change adaptation; Disaster Risk Reduction, Climate-resilient agricultural and fisheries practices, Climate early warning and information systems, Water capture, storage and groundwater management, Coastal protection, vector-borne disease control techniques
Cuba	Strengthening of hydrometeorological EWS of Zaza and Agabama watersheds to protect the population and economic resources in areas vulnerable to flooding in the provinces of Sancti Spiritus and Villa Clara, Cuba	941,166	1 8 months	ECHO	EWS; Livelihoods; Capacity building.
Cuba	Cuba Country Pilot Partnership on Sustainable Land Management	10,000,000	10 years Prodoc Signature : 17 - Nov-200 8	GEF TF LD window	Sustainable Land Management- Water Management; EWS in the agriculture sector (droughts/water stress in particular)

Cuba	Reduction of Vulnerability to Coastal Flooding through Ecosystem-based Adaptation in the South of Artemisa and Mayabeque provinces	5,592,000	5 years Prodoc Signature : 19 - Jun-2014	Adaptation Fund	Tidal waves, coastal erosion and floods protection, protection of livelihoods and agriculture production, EWS collaboration with Civil Protection
Cuba	Enhancing the prevention, control, and management of Invasive Alien Species in vulnerable ecosystems in Cuba	5,018,182	5 years Prodoc Signed on 14- Jun-2011	GEF TF BD window	Prevention Control and management on invasive species affecting key productive sectors (forestry- agriculture- fisheries, tourism); EWS based on hydromet data
Dominican Republic	Disaster preparedness and seismic and tsunami risk reduction in the south coast of San Cristóbal province, Dominican Republic	1,203,663 (total in euros) 978,679 (amount in euros requested from ECHO)		ECHO	Disaster preparedness; EWS; Risk reduction
Dominica, Grenada, St. Vincent and the Grenadines	Community Alerts Project	695,800	Mid 2013 - Dec 2014	ECHO UNDP	Disaster Risk Reduction; Disaster Preparedness; EWS and community alerting
Dominica, Barbados, St. Vincent and the Grenadines, Saint Lucia	Strengthening Resilience and Coping Strategies in the Caribbean through Integrated Early Warning Systems	809,000	Mid 2015 - Nov 2016	ECHO UNDP	Disaster Risk Reduction; Disaster Preparedness; EWS
Dominican Republic	Caribbean Risk Management Initiative, Phase II: Pilot project of a Disaster Management Center and Early Warning Point in the La Victoria Municipal District	25,000	February 2013 February 2014	CRMI	Environmental Sustainability and Integrated Disaster Risk Management (EWS)
Dominican Republic	Disaster preparedness and seismic and tsunami risk reduction in the southern coast	969,493	May 2015 October 2016	ECHO (UE)	Environmental sustainability and Integrated Disaster Risk Management (Resilience); EWS

Dominican Republic	Demonstrating Sustainable Land Management in the Upper Sabana Yegua Watershed System	4,434,695	5 years Prodoc Signed: 01 - Feb-2006	GEF TF LD window	Watershed management; Drought monitoring; EWS
Dominican Republic	Third Phase Disaster Vulnerability Reduction APL	USD 39.5 million. For design and d	6 years	World Bank	Hydro meteorological and climate data management, Disaster Risk Reduction
Egypt	Strengthening Disaster Risk Management in Egypt	USD 0.50 million	1 years (2014-2015)	GFDRR, World Bank	Early Warning Systems
Ethiopia	Improvement of Agrometeorological information for small-scale agricultural production in Tigray, Ethiopia	EUR 400,000 (spent EUR 200k)	2013-2016	WMO/ Irish Aid	Improving agricultural production and food security through improved weather, climate and agrometeorological services
Fiji	Development of an Integrated Coastal Inundation Forecasting System in Fiji – Phase I	USD 0.20 million	2 years (2012-2014)	WMO Government of Korea ((KOICA))	Climate information services at national and regional, Weather and climate monitoring, Weather forecasting for the health sector
Gambia	Strengthening Climate Information and Early Warning Systems in Gambia	1.028,500	July 2011 – July 2014	GEF/LDCF	Infrastructure, technologies, equipment and human resources requirements to enable EWS functionality and sustainability; Climate information integrated into development plans and early warning systems.
Georgia	Developing Climate Resilient Flood Management Practices to Protect Vulnerable Communities.	5,060,000	2014 - 2017	Adaptation Fund	Emergency management, Hydrometeorology, local authorities, environmental protection.

Ghana	Strengthening Flood Management in Ghana	USD 1.50 million	1 years (2015-2016)	G F D R R , World Bank	Early Warning Systems
Guyana	Support to the alignment of Guyana's National Action Plan to the UNCCD's 10-Year (2008-2018) Strategic Plan.	13,160 (for the Activity Consultancy and cost) 129,667 (for overall project)	3 months 1 8 months (ongoing to 15 December 2015)	GEF	Update the national early warning system protocol to include a component on drought warning
Guyana	Strengthening National and Local Capacities for Disaster Response and Risk Reduction	540,000 (for overall project)	Six years (ended December 2014)	UNDP	Strengthened Early Warning System for Floods and Droughts
Haiti	Haiti Strengthening Hydromet Services	USD 5.5 million	5 years (2015-2020)	P P C R , World Bank	Improvement of hydromet and EWS services
Haiti	Increasing resilience of ecosystems and vulnerable communities to CC and anthropic threats through a ridge to reef approach to BD conservation and watershed management	9,135,068	5 years Approved by donor. Pending Prodoc Signature .	GEFTF (BD window) and LDCF	Watershed management upstream and coastal protected areas downstream – EWS for Droughts, Floods, Fires and Landslides
Haiti	Strengthening adaptive capacities to address climate change threats on sustainable development strategies for coastal communities in Haiti	3,500,000	4 years Prodoc Signature : 18-Apr-2011	L D C F / CIDA	EWS for floods, extreme climate events; DRR coordination with local committees
Haiti	Haiti Weather Systems Programme – Climate Services to Reduce Vulnerability	CAD 6.5 million	Dec 2012 – Mar 2017	W M O / Environment Canada	Re-establishment of hydro-meteorological services in Haiti; Capacity Development; EWS and DRR
Honduras	Provide assistance for the coordination and monitoring of early recovery, and National criteria for declaring of drought / Early recovery from drought in Honduras	133,844 (Project total amount)	Nov. 2014 - Nov. 2015	U N D P / BCPR	Drought monitoring; Early recovery; EWS

India	Support to India's National Cyclone Risk Mitigation Program	USD 0.27 million	4 years (2011-2015)	G F D R R , World Bank	Early Warning Systems
India	The Uttarakhand Disaster Recovery Project	about USD 10 million of a larger investment	4 years (2013-2017)	G F D R R , World Bank	Strengthening Early Warning Systems and Impact forecasting
Kazakhstan	Kazakhstan Wheat Sector Adaptation project	2 million.	2013 - 2016	USAID	Emergency Management, Agriculture, Hydrometeorology.
Kazakhstan, Uzbekistan, Turkmenistan, Kyrgyzstan, Tajikistan	Climate Risk Management for Central Asia	3,000.000	2012 - 2015	BCPR	Emergency Management, Hydrometeorology, Agriculture, Environment.
Kiribati	Enhancing national food security in the context of global climate change	300,000	2015-2020	GEF- LDCF	Climate Change resilience, food security, capacity building
Lao PDR	Integrated Disaster and Climate Risk Management	710,000	2013-2015	U N D P / BCPR	Institutional and Legal capacities strengthened for effective disaster risk management; strengthening of disaster preparedness and response systems to coordinate and manage information; risk assessment and identification; Establish Early Warning System in 2 of the 4 target Provinces.

Lao PDR	Lao PDR: Building Resilience to Natural Disasters	USD 0.64 million	3 years (2013-2016)	G F D R R , World Bank	Forecasting and service delivery
Lebanon and Jordan	Blue Peace: Phase 2 –Water Security ‘in the Middle East	C H F 633,630	F e b 2 0 1 4 - D e c 2015	WMO/ SDC	Strengthening the delivery of weather, water and climate services in Jordan and Lebanon, to support economic development and disaster risk management.
Lesotho	Climate Risk Analysis and Early Warning System Information Management for Lesotho	USD 1.00 million	2 years (2013-2015)	G F D R R , World Bank	Forecasting and service delivery
Lesotho	Climate, Water and Early Warning Systems	USD 1.00 million	2 years (2013-2015)	G F D R R , World Bank	Early Warning Systems
Liberia	Strengthening Liberia's Climate Information and Services to Enhance Climate Resilient Development and Adaptation	6,730,000	2 0 1 3 – 2017	GEF/LDCF	I n c r e a s e d capacity of h y d r o - meteorological services and associated networks to monitor and predict extreme weather, climate-related hazards and climate trends ; Information management of climate , environmental a n d socioeconomic data; Climate change awareness raising.

Malawi	Disaster Risk Management in Malawi - Country Plan Phase II	USD 1.00 million	3 years (2013-2016)	G F D R R , World Bank	Early Warning Systems and forecasting
Malawi and Tanzania	Global Framework for Climate Services (GFCS) – Adaptation Programme in Africa (Norway 2)	N O K 60,000,000 (@ USD 10,000,000)	3 years (2014-2016)	W M O Government of Norway (NORAD)	G F C S , Adaptation, Food Security, Nutrition and Health
Mexico	Strategic Plan for development of the National Meteorological Service of Mexico	USD 14.00 million	Since 2010	Government of Mexico	Institutional development, Meteorological observing networks, Development of products
Mexico	Strengthening management effectiveness and resilience of protected areas to protect biodiversity under conditions of climate change	10,172,727	5 years Prodoc Signed: 26 - Mar-2014	GEF TF	C l i m a t e Resilience, climate change adaptation, endangered species conservation, movement of species, EWS; Installation hydromet stations.
Mexico	Enhancing National Capacities to manage Invasive Alien Species (IAS) by implementing the National Strategy on IAS	5,354,545	4 years	Mexico	P r e v e n t i o n Control and management on invasive species affecting key productive sectors (forestry-agriculture-fisheries, tourism)including vulnerable islands and Protected Areas; Early Warning systems based on hydromet data

Mexico	Modernizing the National Meteorological Service to Address Variability and Climate Change in the Water Sector in Mexico (MoMet)	USD 105 million	5 years (2012-2017)	World Bank	Integrated NMS modernization and improvement of hydromet and ERWS services
Moldova	Disaster and Climate Risk Management Project	USD 12 million	2010-2016	World Bank	Strengthen capacity in severe weather forecasting, early warning, disaster management and use of agromet information.
Moldova	Disaster and Climate Risk Reduction	400,000	2014 - 2016	BCPR	Emergency Management, Hydrometeorology, Local Authorities.
Mongolia	Improving community resilience to climate and disaster risks in Mongolia	200,000	01 Jan – 31 Dec 2014	CRMF	Improvement of hydro meteorological service; EWS
Mongolia	Strengthening local level capacities for disaster risk reduction, management and coordination in Mongolia" project	1.5 million	2013 -2016	e Government of Luxembourg/ UNDP	Disaster risk reduction at the local level; Early Warning System
Mongolia	Mongolia - Modernization of Aviation Meteorological Center of Mongolia	\$430,000	Open ended	WMO / Korea Meteorological Administration	Timely and accurate aviation meteorological service through improved data sharing, data processing system and trainings
Mozambique	Programmatic Support to Disaster Risk Management in Mozambique: Phase I	USD 1.40 million	3 years (2011-2014)	GFDRR, World Bank	Early Warning Systems
Mozambique	Climate-Resilient Growth: Transforming Hydro-Meteorological Services	USD 21 million	5.5 years (2013 -2018)	PPCR, World Bank, Nordic Development Fund	Strengthening weather, climate, hydrological systems and Early Warning Systems and forecasting

Myanmar	Ayeyarwady Integrated River Basin Management Project	USD 30.15 million component in larger investment	5.5 years (2014-2020)	World Bank	Strengthening weather, climate, hydrological systems and Early Warning Systems and forecasting
Nepal	Building Resilience to Climate Related Hazards	USD 31.00 million	5.5 years (2013-2018)	PPCR, World Bank	Capacity building, NMHS modernization, Weather, climate and hydrological services
Nepal	Establishment of Community Based Early Warning System in the downstream of Tsho Rolpa Glacial Lake / Integrated Climate Risk Management Initiative (BCPR/BPPS and MDG TF)	200,000	2012-2015	BCPR / BPPS and MDG Trust Fund	Community Based Flood (GLOF) Early Warning System- Public Private Partnership on EWS
Nepal	Establishment of Community Based Early Warning System in Riu Khola Sub watershed, Maadi, Chitwan/ Integrated Climate Risk Management Initiative (BCPR/BPPS and MDG TF)	100,000	2013-2015	MDG Trust Fund (ROK and UNDP)	Community Based Flood Early Warning System
Nepal	Community Based Flood and Glacial Lake Outburst Risk Reduction Project	3,300,000	2013-2017	G E F / UNDP	Community based early warning systems; risk information dissemination; climate change adaptation, disaster risk reduction; transfer and adoption of adaptation technology; Development of low cost and low tech CBEWS for flash floods
Nicaragua	Strengthening Climate Information and Early Warning Systems to Support Climate-Resilient Development in Honduras and Nicaragua	USD 0.95 million	2 years (2015-2017)	G F D R R , World Bank	Early Warning Systems

Niger	Niger Technical Assistance for multi-hazard early warning system with focus on rapid-onset hazards	USD 0.30 million	2 years (2015-2017)	G F D R R , World Bank	Early Warning Systems
Niger	Integrated Information System for Flood Risk Reduction in Niger	USD 0.25 million covered by UNDP and UNITAR/UNOSAT		UNITAR/UNOSAT (DNPGCCA), Niger National Meteorological Agency, Aghrymet, Niger Basin Authority ( A B N ), N a m e y University and others	Early Warning Systems, Capacity Building
Pacific Island	Pacific Resilience Program	USD 45.7 million	5 years (2015-2020)	WBG/IDA, P P C R , Japan	Strengthening EWS and preparedness, Disaster risk reduction and financing
Pacific SIDS; Caribbean SIDS; Indian Ocean SIDS; South Asia: Primarily India, Bangladesh, Pakistan, Sri Lanka, Maldives, Bhutan, Nepal, Afghanistan and Myanmar.	Programme for Implementing the Global Framework for Climate Services (GFCS) at Regional and National Scales	CAD 6.138 million	4 years (2013-2017)	W M O / Environment Canada	GFCS, Climate resilience, Development of climate services
Pakistan	Partnership with Pakistan Met Department on Improving EW System	50,000	2014-2015	UNDP	Flood Early Warning System
Pakistan	Glacial Lake Outburst Floods Project	600,000	2011-2015	GEF	Climate Change Adaptation; EWS; Automatic weather stations, river gauges, lake monitoring sensors etc.

Papua New Guinea	Enhancing Adaptive Capacity of Communities to Climate Change-related Floods in the North Coast and Island Regions PNG	6 Million	2012-2016	Adaptation Fund / UNDP	Assessment of the Early Warning Systems for inland and coastal flooding; Establishment of the EWS systems; Strengthen community resilience; Disaster preparedness and planning support
Paraguay	Strengthening institutional and community preparedness and coordination capacities for disaster risk reduction in Paraguay	Euros 875.000	may 2015-dic 2016	ECHO	Capacity building in National Civil Protection System; Integrating disaster risks management to national policies; EWS and establishment of the Regional Alert Detection Center
Peru	Ecosystem based Adaptation in Mountain Ecosystems - Peru (EBA)	1,631,733	3 years Prodoc Signed: 27 - Sep-2013	BMUB/Gov of Germany	Glacier Lake Outburst Flood Systems (GLOF)- Altitudinal changes and fluctuation of ecosystem services - Grassland monitoring-EWS-extreme events including hydromet information management
Peru and Andean countries	Climandes – Andes-Based Climate Services for Decision Makers	CHF 3,135 million	2012-2015	WMO/ Swiss Agency for Development and Cooperation	Climate change adaptation; Enhancing climate services for Peru and capacity development (train students and professionals in meteorology and climatology)

Philippines	Enabling Regions VIII, X and XI to Cope with Climate Change (Project Climate Twin Phoenix-RAPID):.	9.3 million	2012-2017	G o v . Australian	Incorporate early warning systems as an integral component of its disaster risk reduction and management strategy; Reliable telemetered flood forecasting and warning system in the river basins of Cagayan de Oro and Mandulog; installation of hydromet stations; SMS-based disaster warning system
Philippines	Enhancing Greater Metro Manila's Institutional Capacities for Effective Disaster/Climate Risk Management towards Sustainable Development (GMMA READY Project)	2.5 million	2011-2015	Australian government	Training of Trainers on Community Based EWS on Tsunami; Deelopment of the preparedness capacities of communities in tsunami hazard prone areas
Philippines	Scaling up Risk Transfer Mechanisms for Climate Vulnerable Farming Communities in Southern Philippines	1,050,000	3 6 months	SCCF	Climate risk reduction for farming households; Innovative financial mechanisms for climate resilience; climate change adaptation; municipal Early Warning System Plans prepared along with Early warning devices installed.

Rwanda	Rwanda - Climate analysis and prediction system for capacity development	\$150,000	O p e n e n d e d	W M O / K o r e a M e t e o r o l o g i c a l A d m i n i s t r a t i o n	C l i m a t e p r e d i c t i o n a n d a d a p t a t i o n t h r o u g h e n h a n c e d w e a t h e r a n d c l i m a t e i n f o r m a t i o n a n d c a p a c i t i e s
Sahel Region	Sahel: National and Regional Disaster Response and Resilience Program	USD 0.42 million	2 years (2014-2016)	G F D R R , W o r l d B a n k	E a r l y W a r n i n g S y s t e m s
Senegal	Disaster Risk Management and Climate Change Adaptation in Senegal	USD 1.10 million	4 years (2011-2015)	G F D R R , W o r l d B a n k	E a r l y W a r n i n g S y s t e m s
South Africa	Reducing Disaster Risks from Wildfire Hazards Associated with Climate Change in South Africa	\$3,536,000	2012-2014	G E F S C C F	E a r l y w a r n i n g a n d h a z a r d r i s k i n f o r m a t i o n s y s t e m ; I n t e g r a t e d f i r e m a n a g e m e n t s y s t e m t o c o p e w i t h c l i m a t e c h a n g e - i n d u c e d f i r e h a z a r d s ; C a p a c i t y b u i l t t o m a n a g e t h e p r e d i c t e d o f f i r e ; I n n o v a t i v e r i s k r e d u c t i o n i n t e r v e n t i o n s . ; a d a p t i v e m a n a g e m e n t o f f i r e r i s k s d i s s e m i n a t e d

South East Asia	Flood Risk Management and Urban Resilience	USD 0.30 million	2 years (2012-2014)	G F D R R , World Bank	Forecasting and service delivery
Southern, Eastern and Western Africa	Global Framework for Climate Services (GFCS) – Adaptation and Disaster Risk Reduction in Africa (Norway 1)	N O K 56,800,000 (@ USD 10,000,000)	4 years (2011-2015)	WMO Gov. Norway (NORAD))	G F C S , Adaptation, DRR
Sri Lanka	Installation of 20 Automated Rain gauges in landslide risk locations five districts / Strategic Support to Comprehensive Disaster Management Program	115,000	5 months 2014-2015	U N D P / BCPR	Landslide Early Warning Systems
Sri Lanka	Installation of a Doppler Radar in Sri Lanka	\$2,884,274	May 2007 - December 2016	WMO/ Sri Lanka Government	Installing a Doppler radar system for tropical cyclones monitoring and early warning
St. Lucia	Hazard and Disaster Risk Assessment Framework in St. Lucia: Preparation of Vulnerability Reduction	USD 0.30 million	3 years (2012-2015)	G F D R R , World Bank	Forecasting and service delivery
Tajikistan	Improved Information Management in Emergencies for effective response.	344,310	2014 - 2015	SDC	Emergency management, Hydrometeorology.
Tanzania	Mobile Weather Alert Project in Tanzania	USD 0.45 million	Until June 2014	G o v . Norway	Agriculture
Timor-Leste	Strengthening Community Resilience to Climate Induced Natural Disasters in Rural Timor-Leste Outcome 2.2: Design of community to district level EWS systems for climate induced extreme events	5,250,000	2015-2016	UNDP-GEF (LDCF)	E W S Implementation and testing

Togo	Integrated Disaster and Land Management Project	USD 4.29 million	5 years (2011-2016)	G F D R R , World Bank	Early Warning Systems
Tuvalu	Effective and responsive island-level governance to secure and diversify climate resilient marine-based coastal livelihoods and enhance climate hazard response capacity	1,5 million	2014-2018	GEF-LDCF	Disaster early warning systems for people on outer islands; building community capacities, communication systems; Food Security, climate change Adaptation.
U g a n d a , T a n z a n i a , Kenya, Rwanda, B u r u n d i , Ethiopia, Eritrea	East Africa IGAD HyCOS (Phase 2)	EUR 6.6 million	3 years (2013-2016)	WMO European Union (EU/ACP)	Water resources management, Development of hydrological systems
Uganda	Uganda - analysis and prediction system for capacity development	\$150,000	O p e n e n d e d	W M O / K o r e a M e t e o r o l o g i c a l A d m i n i s t r a t i o n	C l i m a t e p r e d i c t i o n a n d a d a p t a t i o n t h r o u g h e n h a n c e d w e a t h e r a n d c l i m a t e i n f o r m a t i o n a n d c a p a c i t i e s
Uruguay	"Strengthening the National System's (SINAE) technical capacities"	T h e a m o u n t o f t h e E W S p r o j e c t i s 4 5 0 , 0 0 0	30 days (2014)	S I N A E (p r o j e c t p r e p a r a t i o n) A N I I (p r o j e c t i m p l e m e n t a t i o n i m p l e m e n t e d d i r e c t l y b y S I N A E a n d l o c a l g o v e r n m e n t s)	Risk Reduction, Early Flood Warning systems

Uzbekistan	U z b e k i s t a n Climate Data Restoration Project	\$617,000	O p e n ended	W M O / K o r e a M e t e o r o l o g i c a l A d m i n i s t r a t i o n	C l i m a t e d a t a r e s c u e f o r c l i m a t e c h a n g e r e s e a r c h , c l i m a t e r i s k m a n a g e m e n t a n d a d a p t a t i o n
Vanuatu	Increasing Resilience to Climate Change and Natural Hazards in Vanuatu	USD 3.00 million	4 years (2012-20 16)	G F D R R , World Bank	Forecasting and service delivery
Viet Nam	Strengthening institutional capacity for Disaster Risk Management in Viet Nam, including Climate Change related disasters (Phase2) Activity: Support implementation of an integrated reservoir management in information system in one river basin as a pilot to improved flood prevention and management and link flood risk maps	98,400	2013-201 5	Australian Aid, OPF	Flood and Flash Flood EWS; I n t e g r a t e d i n f o r m a t i o n m a n a g e m e n t f o r E W S s e r v i c e , m a p p i n g t o o l a n d f l o o d m a p p i n g f o r e a r l y w a r n i n g ; r i s k m a n a g e m e n t
Vietnam	Managing Natural Hazards Project	U S D 3 0 m i l l i o n c o m p o n e n t i n l a r g e r i n v e s t m e n t	5 years (2012-20 17)	World Bank	M o d e r n i z a t i o n o f N M H S , i m p r o v e m e n t o f E W S a n d h y d r o m e t i n f o r m a t i o n

West Africa Maritime Countries Emerging from Conflict and Natural Disasters Project (Guinea-Bissau, Liberia, Sierra Leone, Ivory Coast and Togo), Management	AFRIMET: Conference of Directors of the West African National Meteorological and Hydrological Services	5 M EU	Since 2007	WMO Spain	
West Africa- Regional	West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)	Up to EUR 50 Million for Research and Institutional Establishment from German Federal Ministry of Education and Research (BMBF)	4 years, started mid 2013	Coordination: Center for Development Research (ZEF, Bonn University). Universities Institutes, Ministries and National Meteorological Services of Bénin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo, etc.	Weather and Climate Related services
West Africa	Severe Weather Forecasting Demonstration Project (SWPDP) in West Africa	\$150,000	Open ended	WMO / Korea Meteorological Administration	Enhancing severe weather forecasting and warning services.

World	Thematic Hydromet Program (former title - Strengthening Global Weather and Climate Information Systems)	USD 2.7 million	4 years (2011-2015)	G F D R R , World Bank	Analytical support, Capacity Building, Investment support
Yemen	Climate Information System and Pilot Program for Climate Resilience Coordination Project	USD 1.9 million	5 years (2013-2018)	P P C R , World Bank	Integrated hydromet modernization, improvement EWS and climate information
Zambia	Adaptation to the effects of Climate Variability and Change in Agro-ecological Regions I and II in Zambia	4 Million	4 years (2010-2014)	GEF/ LDCF	EWS and Integrating climate change risks into critical decision-making processes for agricultural management at the local, sub-national and national levels

