



# ANNUAL REPORT

2018





# CREWS ANNUAL REPORT 2018

## CREWS Report Series Annual Report 2

© World Meteorological Organization, 2019, on behalf of Climate Risk and Early Warning Systems

The right of publication in print, electronic and any other form and in any language is reserved by WMO. Short extracts from WMO publications may be reproduced without authorization, provided that the complete source is clearly indicated. Editorial correspondence and requests to publish, reproduce or translate this publication in part or in whole should be addressed to:

Chairperson, Publications Board World Meteorological Organization (WMO)  
7 bis, avenue de la Paix      Tel.: +41 (0) 22 730 84 03  
P.O. Box 2300      Fax: +41 (0) 22 730 81 17  
CH-1211 Geneva 2, Switzerland      E-mail: [publications@wmo.int](mailto:publications@wmo.int)

### NOTE

The designations employed in WMO publications and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of WMO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products does not imply that they are endorsed or recommended by WMO in preference to others of a similar nature which are not mentioned or advertised. The findings, interpretations and conclusions expressed in WMO publications with named authors are those of the authors alone and do not necessarily reflect those of WMO or its Members.

This publication has been issued without formal editing.

Cover photo: Burkina Faso meteorological service, ANAM.

# CONTENTS

Foreword	5
About CREWS	6
At a Glance	8
Projects 2018	10
Results 2018	12
CREWS Impact and Early Warning Effectiveness	28
Caribbean Post-Disaster Early Warning Assessment Following the 2017 Hurricane Season	31
Finances 2018	32
Scaling Up Action	34

## Foreword

Two years from the debut of its operational experience, the Climate Risk and Early Warning Systems (CREWS) initiative has made important progress in supporting Least Developed Countries and Small Island Developing States to strengthen their early warning systems. Yet much remains to be done. Extreme weather affected 60 million people across the globe in 2018. Around 16 000 of those affected live in Kinshasa, Democratic Republic of Congo, and withstood floods in January that also caused 51 deaths. Had an effective early warning system been in place lives might have been spared and losses minimized. In response to Kinshasa's recurrent flooding, CREWS is supporting the design and installation of a flood early warning system in vulnerable areas of the city in partnership with the national meteorological service, leveraging resources through the World Bank and its partners.

This is but one example of how in 2018 CREWS deepened and broadened its support. Through its national investments, CREWS supported country partners to improve their weather forecasting and climate prediction capacities, strengthen institutional collaboration among early warning agencies, engage communities to map flood risk and advise farmers on crop selection for a rainier season. 2018 also saw the launch of two regional projects to support West Africa and the Caribbean, as well as the completion of an assessment of early warning systems in a post-disaster environment in 2017 in the Caribbean.

Through these regional and country-driven initiatives, CREWS contributes to the disaster risk reduction and climate change adaptation objectives of its partner countries. Since its launch in 2015, CREWS has directly invested US\$ 32 million, an amount that can be added to the US\$ 118 million of aligned public funded investment, in people-centered early warning systems to protect the lives and livelihoods of the most vulnerable. The activities highlighted in this report showcase concrete climate change action to achieve the Paris Agreement's adaptation objective.

The principles guiding CREWS include gender-sensitive programming, such as the consultations carried out with women farmers in Burkina Faso to understand the agro-meteorological information they need and how best to deliver it. In response, CREWS delivers—through its seminars, radio announcements and in partnership with agricultural extension workers—specific planting guidance for higher altitude, less fertile plots, often cultivated by women farmers.

Support for investment in early warning systems also grew in 2018. In November, Switzerland joined CREWS contributing partners Australia, France, Germany, Luxembourg and the Netherlands with a generous financial contribution. The continued and growing support for CREWS demonstrates partners' confidence in the CREWS approach: its focus on strengthening institutional capacity among national early warning agencies to promote coherence, and influencing larger investments through coordination with national, regional and international partners.

In December 2018, Luxembourg proudly took on the chairing of the CREWS Steering Committee. Until then France had ably guided CREWS from its launch to implementation in countries. Luxembourg is pleased to lead the Steering Committee to expand the reach of CREWS by promoting increased investment to support the most vulnerable populations from climate impacts.



**Carole Dieschbourg**

Minister for the Environment, Climate and Sustainable Development  
Government of the Grand Duchy of Luxembourg



© SIP/Yves Kortum

## About CREWS

The Climate Risk and Early Warning Systems (CREWS) initiative saves lives, assets and livelihoods in Least Developed Countries (LDCs) and Small Island Developing States (SIDS). CREWS is a financing mechanism driven by the expertise and specialist networks of its partners the World Bank, the Global Facility for Disaster Reduction and Recovery (GFDRR), the World Meteorological Organization (WMO) and the United Nations Office for Disaster Risk Reduction (UNISDR).

Australia, France, Germany, Luxembourg, the Netherlands and Switzerland contribute to the pooled Trust Fund and provide oversight to CREWS operations through the CREWS Steering Committee. Canada supports CREWS objectives through funds provided directly to WMO.

CREWS contributes to global efforts toward accelerated action for climate change adaptation.

### In 2018

**32** USD million directly invested by CREWS since 2015 launch

**118** USD million additional funds leveraged by CREWS since 2015 launch

**41** Countries benefited from CREWS national and regional support

**19** International institutions provided expert support to CREWS projects

**8** Country and regional projects underway

**182** Experts from national institutions trained

**2** Regional disaster risk reduction platforms engaged 350 participants in early warning discussions in the Africa-Arab region and Latin America and the Caribbean region

**6** Partners contributed financially including continued financial supporters—France and Luxembourg—and Switzerland—a new contributor

**312** New Twitter followers

**9,470** New website visitors

**1** Publication identified CREWS as a good climate change adaptation practice—disseminated at the G20 in Argentina

**1** Checklist on Multi-Hazard Early Warning Systems published

**1** Post-disaster risk assessment on early warning system effectiveness in the Caribbean published

**1** Study on measuring early warning systems and implications for reporting on Sendai Target G contributed to Global Assessment Report on DRR

## CREWS Value Proposition

### Drivers of CREWS country operations



#### › UNIQUE

A financing mechanism that builds sustained institutional capacity driven by countries and supported by the expertise and specialist networks of its partners.

#### › PEOPLE-CENTRED

Local organizations are listened to and engaged so that investments are driven by the needs of end-users.



#### › SOLUTION-ORIENTED

Good and innovative practices are applied and shared continuously across national and regional projects.

#### › MULTIPLIER

Country portfolios promote a favorable environment for, and leveraging of, effective additional financing.



#### › GENDER-SENSITIVE

CREWS recognizes women's empowerment as fundamental for building resilience, and that gender influences the way people access, process, and respond to information and warnings.

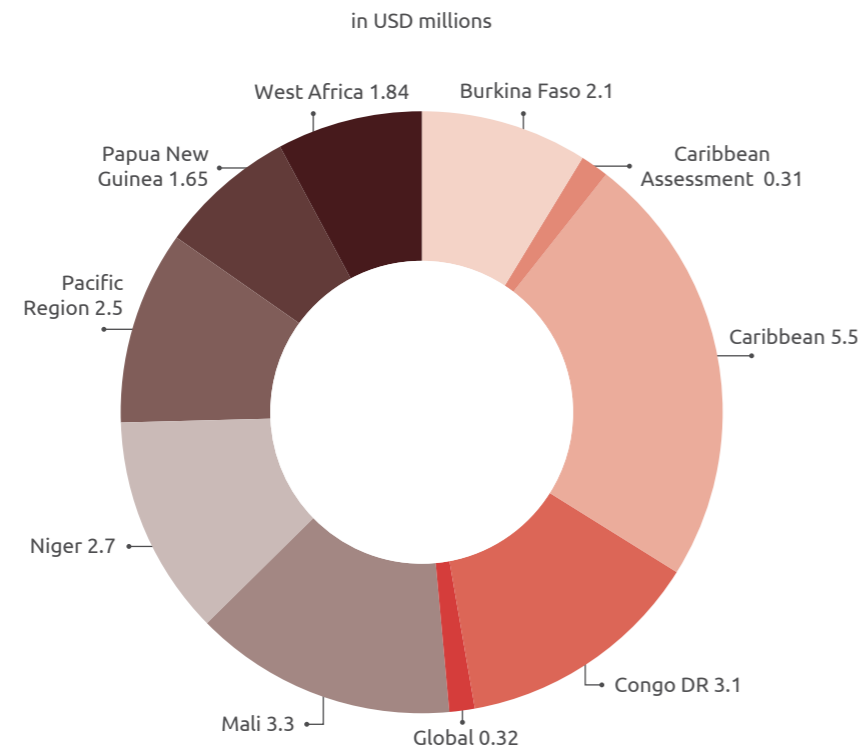
#### › PROMOTE COHERENCE

Programming considers existing projects and other international partner initiatives to ensure value-added to the national context and needs.

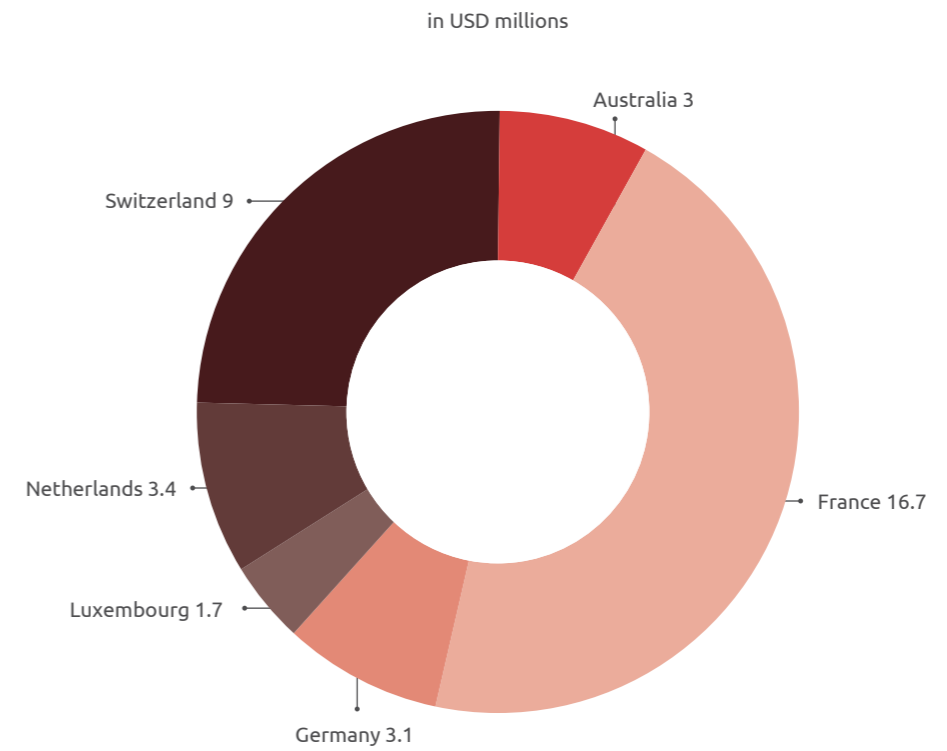


# At a Glance

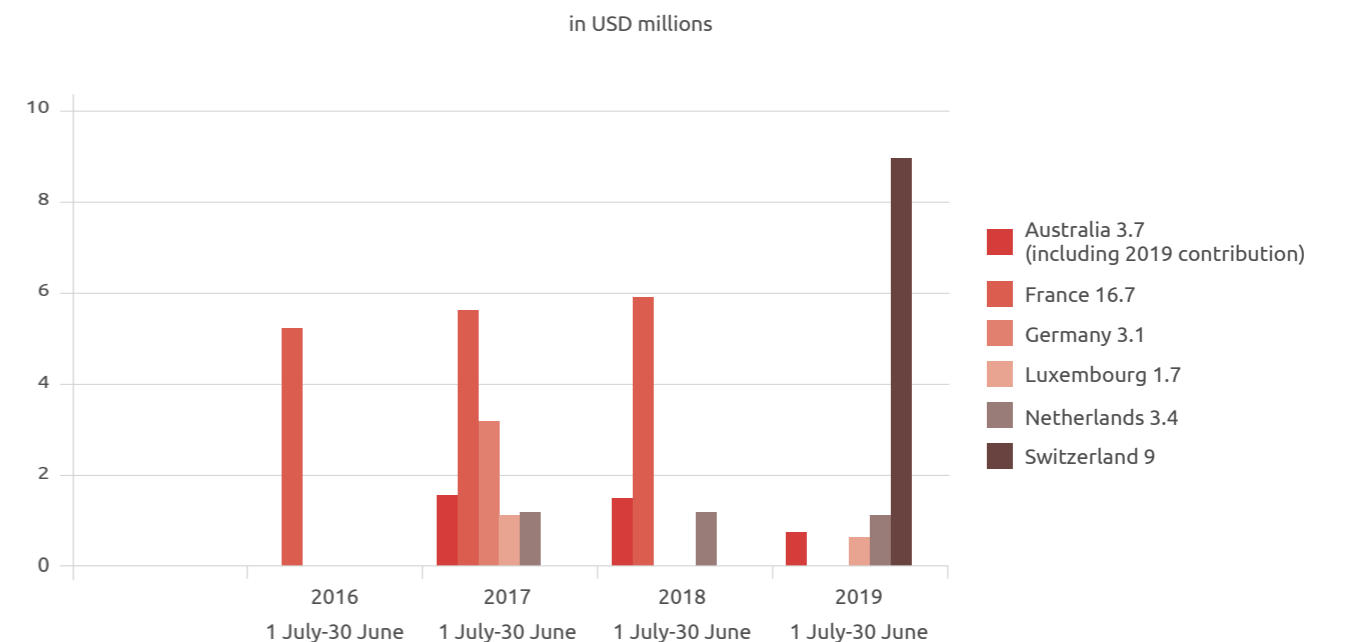
## Funding Decisions by Project as of December 2018



## Funds Contributed to the Trust Fund as of December 2018



## Funding Progress

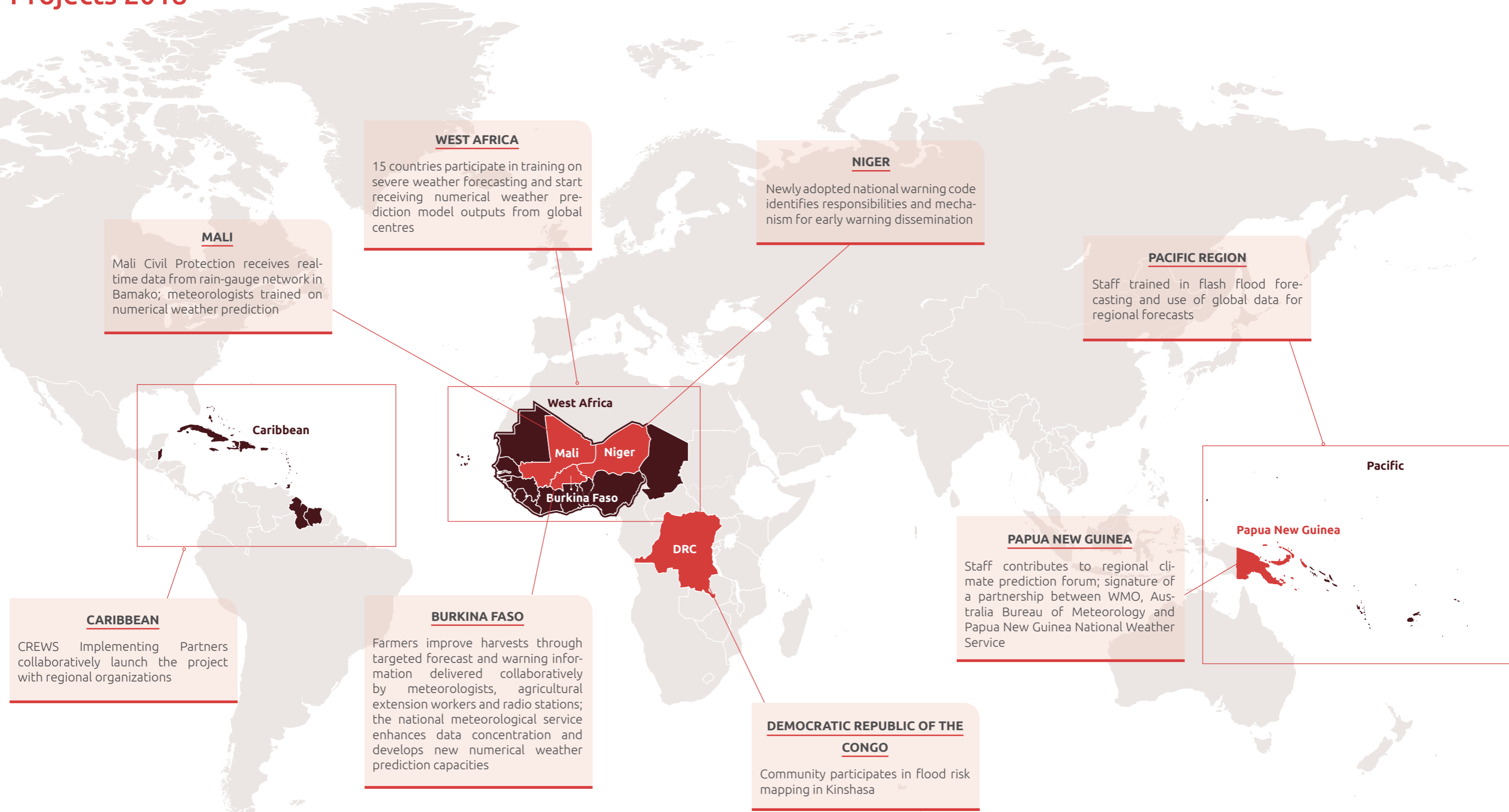


*The CREWS initiative provides an important means to ensure that early warning systems for the most vulnerable are both comprehensive and inclusive. In the Caribbean, for example, a recently launched CREWS project will ensure that groups like women, children, the poor, the elderly, and the disabled play an active role in crisis preparedness and risk management through capacity building and training activities. We look forward to continuing our strong collaboration with WMO, UNISDR and other CREWS partners to empower women and build broader community resilience.*

**Laura Tuck**  
Vice President for Sustainable Development  
World Bank



# Projects 2018



**CREWS Projects 2018**

- National
- Regional



# Results 2018

In order to reach its objectives, CREWS projects contribute to strengthening the four elements of people-centred early warning systems:

- Disaster risk knowledge
- Detection, monitoring, analysis and forecasting of the hazards and possible consequences
- Warning dissemination and communication
- Preparedness and response capabilities

CREWS projects provide an integrated framework addressing the complete value chain of an early warning system. Results are shown against the seven national and regional-level outputs—contained in the CREWS Monitoring and Evaluation Framework and used to monitor CREWS projects. The outputs relate to at least one of these four elements, ensuring that completed projects will have contributed to all four elements. This section highlights the year's key results in each output area.

## Disaster risk knowledge

- Output 2: Risk information to guide early warning systems and climate and weather services developed and accessible
- Regional output: Institutional and human capacities at regional WMO and intergovernmental organizations to provide regional climate/weather services to LDCs and SIDS increased



## Preparedness and response capabilities

- Output 4: Preparedness and response plans with operational procedures that outline early warning dissemination processes strengthened and accessible
- Output 5: Knowledge products and awareness programmes on early warnings developed
- Output 6: Gender-sensitive training, capacity building programmes provided

## Detection, monitoring, analysis and forecasting of the hazards and possible consequences

- Output 1: National hydrometeorological service delivery improved, including the development of long-term service delivery strategies and development plans
- Regional output: Institutional and human capacities at regional WMO and intergovernmental organizations to provide regional climate/weather services to LDCs and SIDS increased

## Warning dissemination and communication

- Output 3: Information and communication technology, including common alerting protocols, strengthened



*In 2018, we confirmed that the past four years were the warmest on record. Occurrence of extreme weather events last year was consistent with what we expect from a changing climate, affecting many countries and millions of people. This is a reality we need to confront. The CREWS initiative has allowed WMO to accelerate its support to countries that need it most, working closely with the World Bank and UNISDR while contributing to more effective actions by a large number of partners.*

**Petteri Taalas**  
Secretary-General  
World Meteorological Organization



Photo credit: GFDRL/World Bank



Training on downloading global and regional weather prediction data and developing value added products at Fiji Meteorological Service, Nadi, Fiji (Photo credit: BMKG)

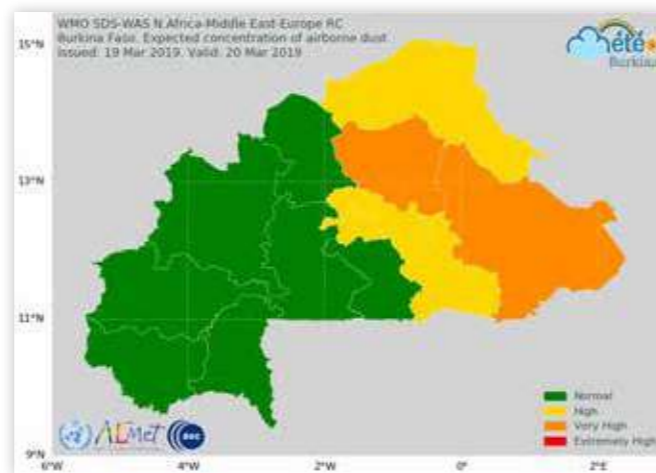


## Output 1: Hydrometeorological service delivery improved

Through national-level output 1, CREWS supports improvements to the service delivery of national meteorological and hydrological entities, including their development of long-term service delivery strategies and plans to meet the needs of end users. This output addresses the early warning element “Detection, monitoring, analysis and forecasting of the hazards and possible consequences”.

### Burkina Faso capacities for sand and dust storm forecasting, weather and agro-meteorological prediction strengthened

Through staff training and a partnership agreement between the national meteorological agency, ANAM, and Spain’s National Meteorological Agency Barcelona Super-computing Center, the project established a warning advisory system for sand and dust storm. ANAM now receives and interprets daily information on sand and dust storm concentration per province. After calibration of the product in 2019, this improved capacity will enable ANAM to tailor forecasts and issue advisories, for example, to anticipate bacterial meningitis outbreaks, which is correlated to sand and dust concentration, among other parameters. ANAM staff also received training in Togo and Germany, as well as access to numerical weather prediction outputs, and will soon be able to run their own limited area model with assimilation of precise data collected from 264 automatic weather stations. Since June, ANAM receives weekly inputs from Météo-France for seasonal prediction based on global models. Climate analysis tools have also been installed to relate the forecast to historical climate.



Burkina Faso advisory on expected concentration of airborne dust (Photo credit: ANAM)

### Democratic Republic of the Congo meteorologists trained to support aviation requirements

24 MettelSat staff received training during two workshops to support the elaboration of quality management systems for air navigation meteorological services. This activity was identified as a priority by national institutions. To ensure sustainable funding sources for its air navigation meteorological services, MettelSat is also developing a guideline and methodology for estimating the re-distribution of air navigation revenues between the National Airways Management Agency (RVA) and MettelSat. Enhanced MettelSat capacity will enable the Democratic Republic of the Congo to meet the International Civil Aviation Organization requirements related to staffing and control procedures for the quality of air navigation meteorological services. Non-conformity with this international regulation entails risk of air traffic accidents and reduces the country’s attractiveness as a destination for international airlines. In collaboration with WMO, MettelSat is also developing its strategic, action and business plan to be ready within a year and serve as basis for improving MettelSat’s services to clients such as airlines, farmers, and populations exposed to climatic risk such as flooding.

### Mali strengthened weather forecasting and project procurement capacities

Mali Meteorological Service identified the need to improve its weather forecasting services, and in response, CREWS supported the participation of two staff members in a training on meteorological warning and emergency response. Mali improved its project procurement capacity to support the USD 33.5 million Mali Hydrological and Meteorological Modernization Services project, co-funded by the World Bank and CREWS. As the project is managed through the collaboration of four early warning entities (the Meteorological Agency, the Water Directorate, the Food Security Commission and the Civil Protection Directorate), a representative from each agency in addition to the project manager were trained on project procurement in Togo. As a result, the trainees prepared the project procurement strategy—a task often undertaken by consultants—as a cross-ministerial collaborative effort.







Community flood mapping in Kinshasa, Democratic Republic of the Congo. (Photo credit: GFDRR/World Bank)

## Output 2: Risk information generated for early warnings

Through national-level output 2, CREWS supports improvements to risk information to guide early warning systems and increased accessibility of climate and weather services. This output contributes to the “disaster risk knowledge” element of early warning systems.

### In the Democratic Republic of the Congo, community volunteers verified flood maps for Kinshasa neighborhoods

In the first phase of this activity, 77 local women and men were trained in 3 community workshops to use aerial imagery, Global Positioning System (GPS) devices, and low-tech field maps to verify map accuracy and collect additional data from populations exposed to floods on historic patterns of flooding in the surveyed areas. The Open Street Map community—a global volunteer network—mapped flood-prone areas and areas at risk of erosion in the Kinshasa neighborhoods of Kisenso and Matete. The results of the verifications carried out by community members will be used to inform flood risk assessments, which are necessary to develop impact-based forecasting models. In the second phase, the exercise will be repeated in other Kinshasa neighborhoods.

### Mali rainfall over Bamako estimated for flood risk management

With the installation of a new computer, Mali Civil Protection now receives data in real time from a rain-gauge network connected in Bamako city. Based on an urban hydrological model, the computer produces a model that estimates the quantity of surface runoff in the city that could lead to flooding. In the near future, the Raincell pilot project in Bamako will use rainfall data estimated through the Orange Mali antenna network. The Raincell project uses the fluctuations in signal transmission and reception between relay antennas of the telecom company to compute rainfall amount, as rain attenuates the microwave signals. With these measurements it is possible to deduce the amount of rain that has fallen in any point of the network.

### Papua New Guinea begins targeted capacity development

Papua New Guinea National Weather Service staff participated in the Fourth Pacific Island Climate Outlook Forum and in the Training Session on Social Media and Communication in Fiji.

CREWS brings decisive support to the Democratic Republic of Congo Hydromet Project. The total project amount is USD 10.5 million and the CREWS funds of USD 2.5 million thus have a substantial leverage to prevent and reduce negative socio-economic effects of flooding and other extreme weather events.

Jean-Pierre Mpundu Elonga  
Director-General of the National Meteorological Agency, Mettelsat  
Democratic Republic of the Congo



## Output 3: Information and communication technology strengthened

Through national-level output 3, CREWS strengthens information and communication technology, including through the adoption of common alerting protocols. This output contributes to the “warning dissemination and communication” element of early warning systems.

### Burkina Faso meteorological agency receives hardware, software and training to improve data transmission

ANAM installed 14 computers, a server, an external disk, broadband devices and customized Climsoft software to optimize and accelerate the transmission of data from weather observing stations (264 automatic stations and 10 synoptic stations) into a central data concentration hub and database. Staff also received training in the use of the software, the equipment and internet connectivity provided.

The CREWS projects in Burkina Faso and West Africa aim to strengthen forecasting and service delivery capacities with a seamless approach, for all timescales, from a few hours lead time (nowcasting) to decades ahead (climate projections). Specific user requirements have been identified under the National Framework for Climate Services, established by the Government with support from a previous WMO-led project. Institutions are working together, in line with their respective mandates and comparative advantages, to enhance benefits to end-users. Specific services in pilot zones have already benefitted farmers and herders, men and women, and intermediaries, such as agricultural extension agents, local government service providers and community radio operators. The important progress we have made through CREWS support will provide the building blocks and lessons for the USD 33 million GCF-IDA investment for strengthening early warning systems, which will become effective in 2019.

Ernest Ouedraogo  
Director-General of Burkina Faso Meteorological Service (ANAM) and  
Co-chair of the WMO CREWS West Africa Projects Steering Committee





MettelSat Director speaking at University of Kinshasa workshop on flood risk reduction, Democratic Republic of the Congo. (Photo credit: GFDRR/World Bank)

*“The training we received was useful because we were informed that the rains would be abundant this year. Based on that, I planted corn instead of millet as I usually do. And it’s been raining as predicted!”*

*Farmer from Batondo village, Tenado, Burkina Faso*

*“We were advised not to plant sorghum in low-land plots but I don’t have another plot and I don’t consume rice. Also last year the season was very rainy. So I decided to plant sorghum anyway and now half of my plot is flooded and I have nothing to harvest. From now on I will listen to the recommendations of the forecast.”*

*Farmer from Tiebo village, Tenado, Burkina Faso*



## Output 4: Preparedness and response plans strengthened and accessible

*Through national-level output 4, CREWS supports the strengthening of early warning preparedness and disaster response plans that detail operational procedures for early warning dissemination. This output contributes to the “preparedness and response capabilities” element of early warning systems.*

### Niger adopted new warning legislation

The national alert code was adopted by Presidential Decree and provides the legal mandate required to issue warnings in Niger. The code empowers the minister responsible for civil protection to issue warnings at national level and identifies the chain of command to ensure actors take action at each level. The code also specifies the content requirements of warning messages, including the use of color-coding to indicate threat level, and mandates public use of all communication channels for the dissemination of warnings. Two ministries led the drafting of the code in consultation with 12 additional ministries. CREWS supported through consultation and validation workshops. Four applied decrees of the national alert code are under preparation and receiving CREWS support for the consultative process.

## Output 5: Awareness on early warning improved

*Through national-level output 5, CREWS supports the development of knowledge products and awareness programmes on early warnings and contributes to the “preparedness and response capabilities” element of early warning systems.*

### Burkina Faso farmers benefitted from successful harvest in response to early warnings

Over 1000 farmers in three rural areas—Titao, Tenado and Niangoloko—benefitted from targeted agro-meteorological information to guide planting, farming and harvesting decisions. The sites were selected for their diversity in cropping patterns, altitude and climate. The national meteorological agency, ANAM, provided guidance to farmers, through 5 field visits and through the continuous support of local extension agents and intermediaries, to around 40 villages about the characteristics of the upcoming rainy season and trained a representative from each village to use a rain gauge as a reference for the village. ANAM shared information with the villagers about climate change and the types of seeds adapted to expected rain patterns. It recommended that farmers listen to a locally tailored daily forecast on the

radio and check with the reference farmer about rain records before planting. ANAM partnered with local extension workers and authorities to support farmers in following the recommendations and signed agreements with three community radios to deliver a bulletin twice a day with agricultural advice in local languages.



Nofesso village, Niangoloko, follow-up meeting with farmers (Photo credit: ANAM)

Just before the planting season, ANAM convened the villagers again to recommend specific crops and dates for planting based on the forecast for the locale. The guidance was specific to low, middle and high altitude soils, as in some cases women farmers have access to less fertile, higher altitude plots. ANAM returned after the harvest to check the results. The forecasts had been very accurate: the rainy season started late in all 3 regions and rainfall was higher than average. Farmers who followed the rec-

ommendations of the radio forecasts on the type of crops and days for planting had successful harvests. Those who did not follow the recommendations and planted as they did last year lost the seeds or part of the harvest.

The farmers have expressed a keen interest in continuing to receive targeted forecasts and identified aspects that needed improvement, such as intermittent radio transmissions, no radio access for some women, lack of communication of rain-gauge readings and interest in mobile phone alerts. To face the challenges of the 2019 and 2020 rainy seasons, CREWS will address each of the concerns raised. The local support provided was based upon detailed analysis of the local dynamics of the rainy season and crop modeling. In 2019 the project will be followed up with an analysis of the value-added of agro-meteorological services and the inclusion of enhanced forecasting outputs.

### In the Democratic Republic of the Congo community flood mapping was explained to large university audience

The Faculty of Science of the University of Kinshasa, MettelSat, the Civil Protection Agency and the World Bank presented a well-attended event on disaster risk management at the University. Academics and students listened to experts from entities working together on risk exposure mapping and community mapping. Presenters explained that exposure maps, developed through geographic information system technology, are then verified through community mapping, to establish a flood early warning system for Kinshasa.



Farmer in Tenado, Burkina Faso; CREWS project beneficiary (Photo credit: ANAM)

## Output 6: Gender-sensitive capacity-building programmes initiated

Through national-level output 6, CREWS supports gender-sensitive training and the provision of capacity building programmes for women, as gender influences the way people access, process and respond to information and warnings. CREWS recognizes that women's empowerment is fundamental for building resilience and through this output contributes to the "preparedness and response capabilities" element of early warning systems.

CREWS projects made progress in 2018 to ensure women benefit equally from early warning systems:

- **Burkina Faso:** Through targeted outreach, 501 women farmers participated in agro-meteorological trainings, benefitting from tailored planting guidance for high-land plots, in response to needs expressed in the 2017 gender-specific consultations.
- **Niger and Mali:** in collaboration with the Ministry for Humanitarian Action and Disaster Management, the terms of reference to train 500 women in six regions of Niger were completed. Based on their knowledge of past disasters and current hazard exposure, the women will map their communities' vulnerabilities to

disasters and capacities to manage risk. The women will also receive training to respond to warnings and to take specific risk reduction actions. In Mali, recruitment has been completed to offer a similar training to 500 women focused on flood risk prevention and management.

- **Democratic Republic of the Congo:** 17 women took part in flood risk mapping in Kinshasa.
- **Caribbean Post-Disaster Early Warning Systems Assessment:** As the assessment applied a gender lens, the report's gender findings were discussed in a public webinar that included participants from 17 countries, and national Gender Bureau representatives participated in the report's regional validation workshop.
- **Pacific region:** the terms of reference for an evaluation of the capacities and needs of meteorological services in the region were completed. The assessment will identify the role of women's organizations in early warning system decision making, as well as the effectiveness of warning services in reaching and preparing women and girls to respond to warnings.



Photo credit: Carlos Uribe

The CREWS initiative stimulated inter-ministerial work, contributed to the sharing of experience and enabled the discovery of good practices in the areas of early warning through a study trip especially. It also contributed to strengthening the legal framework of early warning in general and in particular that related to floods in the country.

Colonel Major Bako Boubacar  
General Director of Civil Protection  
Niger



Cap Haitian, Haiti. (Photo credit: Carlos Uribe)

## Regional output: Regional capacities for early warning strengthened

Through its regional output, CREWS supports increased institutional and human capacities at regional WMO and intergovernmental organizations to provide regional climate and weather services to LDCs and SIDS. This output addresses the early warning elements “detection, monitoring, analysis and forecasting of the hazards and possible consequences” and “disaster risk knowledge”.

Two regional projects began implementation in 2018: “West Africa Region: Seamless Operational Forecast Systems and Technical Assistance for Capacity Building” and “Caribbean: Strengthening Hydro-Meteorological and Early Warning Services”. They join the “Pacific: Strengthening Hydro-Meteorological and Early Warning Services” project in providing regional support.

## West Africa

### Region endorsed West Africa project work plan and launched community of practice

At the Hydromet Forum in Abidjan, Côte d’Ivoire, project implementers consulted 15 Member States and regional organizations on the CREWS West Africa project work plan. CREWS also presented a session on current hydrometeorological initiatives in the region and proposed the launch of a community of practice among CREWS beneficiary countries in West Africa. Participants endorsed the proposal and recommended inviting other francophone countries benefiting from large hydrometeorological investments, as well as close coordination between national and regional projects to ensure optimal use of funding earmarked for severe weather, climate, civil protection and food security.

### West Africa project supports new regional climate centre

The CREWS West Africa project is working closely with AGRHYMET to guide the development of specific capacities needed for its future role as West African Regional Climate Centre. Through CREWS support, the Netherlands meteorological institute KNMI provides guidance for climate data management, and the German meteorological office DWD provides guidance for climate watch, in line with its mandate in the European Regional Climate Network. In addition, the project contributes West Africa experience and expertise from the United Kingdom, France and United States of America to ensure optimal use of an €8 million grant from the African, Caribbean and Pacific region - European Commission (ACP-EU), which will be managed by AGRHYMET to fulfil its upcoming mandate as regional climate centre.



## Caribbean

### “Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean” project launched

The Caribbean project is the first regional project in the CREWS portfolio in which all three Implementing Partners are actively involved. The project is carried out in close collaboration with three regional partners—the Caribbean Disaster Emergency Management Agency, Caribbean Institute of Meteorology and Hydrology, and Caribbean Meteorological Organization (CMO)—and was launched in Barbados in late 2018, as part of the Caribbean Climate Outlook Forum. More than 65 representatives from 20 countries and territories, including 12 regional organizations, joined the launch to learn of the project’s objectives and work plan. The project is currently developing a regional strategy to strengthen and streamline hydrometeorological and early warning services, incorporating recommendations from the CREWS post-disaster assessment of early warning systems in the Caribbean and addressing gender and social inclusion aspects. The regional strategy will inform capacity strengthening in participating countries (component II) and national level pilots for the development of end-to-end early warning systems (component III). While CARICOM countries are directly targeted in the project, all islands and territories need to be considered in a regional strategy and strengthening effort, and will therefore benefit from regional knowledge sharing and training opportunities that are provided by the project.

The CREWS Caribbean initiative brings the comparative advantage of all agencies together. It provides an opportunity to increase the knowledge base to ultimately strengthen resilience of the Caribbean in the face of extreme weather and climate-related hazards.

Honorable Edmund G. Hinkson  
Minister of Home Affairs, Barbados



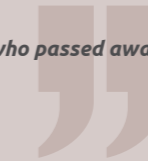


Flash Flood Guidance System for Fiji workshop, Nadi, Fiji. From left to right: WMO, information technology experts, hydrologist, FFGS developer, radar expert and meteorologists. (Photo credit: WMO)



*The Flash Flood Guidance System will supplement existing systems for monitoring and early warning for floods in the Fiji Islands. The FijiFFGS will provide guidance to the Fiji Meteorological Service's weather experts to generate and issue operational flash flood forecasts and warnings with improved lead-time and sites' specific.*

**Ravind Kumar**  
 Director of Fiji Meteorological Service who passed away on 18 November 2018



## Pacific

### Meteorological service strategic plans advanced in the Pacific region

The Fiji Meteorological Service/Regional Specialized Meteorological Centre completed its long-term strategic plan, while the meteorological services of Kiribati and Tuvalu have started developing their strategic plans, and Tonga and Republic of Marshall Islands have advanced the necessary terms of reference. The CREWS Project Steering Committee agreed that the Federated States of Micronesia, Nauru, Samoa, Palau and Tokelau should receive support to develop plans as well. Strategic plans aid meteorological services to articulate objectives, identify specific strategies and outputs, and develop an action plan to deliver services over the next five to ten years. Crucially, strategic plans enable the allocation of resources from the national budget and demonstrate the value of investment. The strategic plans also serve as a guide for external cooperation to align support with nationally agreed priorities and support coordination among externally funded initiatives in line with well-articulated national priorities.

### Fiji completed work plan to strengthen flash flood forecasting capacities

Following an initial planning meeting for the Fiji Flash Flood Guidance System (FijiFFGS), nine experts and staff from the Fiji Meteorological Service and the National Disaster Management Office developed a joint work plan with WMO and the Hydrologic Research Center for the development and implementation of the FFGS. Trainers identified the necessary data required for developing the system and its products. The National Disaster Management Office was invited to participate in the training to strengthen collaboration with the meteorological and hydrological services and to enhance the development of a flood response plan. Outputs of the FFGS products and the experience gained by Fiji in the implementation of the FijiFFGS will enable the Fiji Regional Specialized Meteorological Centre to support other CREWS Pacific partners in flash flood monitoring and forecasting.



### Fiji meteorologists received training to use data from global models to improve forecasting for Pacific region

Ten staff members, including three forecasters and seven IT staff and programmers, of the Fiji Meteorological Service/Regional Specialized Meteorological Centre received training to access and use data from global and regional models. Using the global models' data, the staff can develop tailored forecasting products that enable the forecaster to issue severe weather warnings for other meteorological services in the Pacific region. The training follows an assessment earlier in the year that identified the need for the Centre to produce meteorological information for the region, as well as flash flood forecasts for Fiji, by improving staff capacity in the use and interpretation of global models. Two experts from the Indonesian Meteorological, Climatological and Geophysical Agency (BMKG) contributed to the training as resource persons. BMKG is providing access and support for high-resolution numerical weather prediction data to support capacity strengthening at the Regional Specialized Meteorological Centre. The Australian Bureau of Meteorology is also committed to providing similar support for the Fiji Meteorological Service and the Papua New Guinea National Weather Service.

### Pacific needs assessments for technology upgrades completed

Experts identified needs and capacities for the installation of high-performance computers and to upgrade the communication system between the Regional Specialized Meteorological Centre Nadi and Pacific meteorological services.



## Connecting LDCs and SIDS to regional and global initiatives and expertise

The **Severe Weather Forecasting Demonstration Project (SWFDP)** makes global-scale numerical weather prediction models available to regional meteorological specialized centres, which enhance regional weather forecasting, and through sharing of high value information, build the capacity of national meteorological services to anticipate severe weather phenomena. The information can be easily downloaded even by national services with limited bandwidth to issue severe weather warnings to civil protection and disaster risk management authorities and to the public at risk, with improved accuracy and longer lead-times. Because meteorological services in a region typically need similar products, SWFDP results in efficiency gains by coordinating countries' requirements. It also gives forecasters access to newly developed products and procedures that might be otherwise inaccessible to under-resourced national meteorological services.

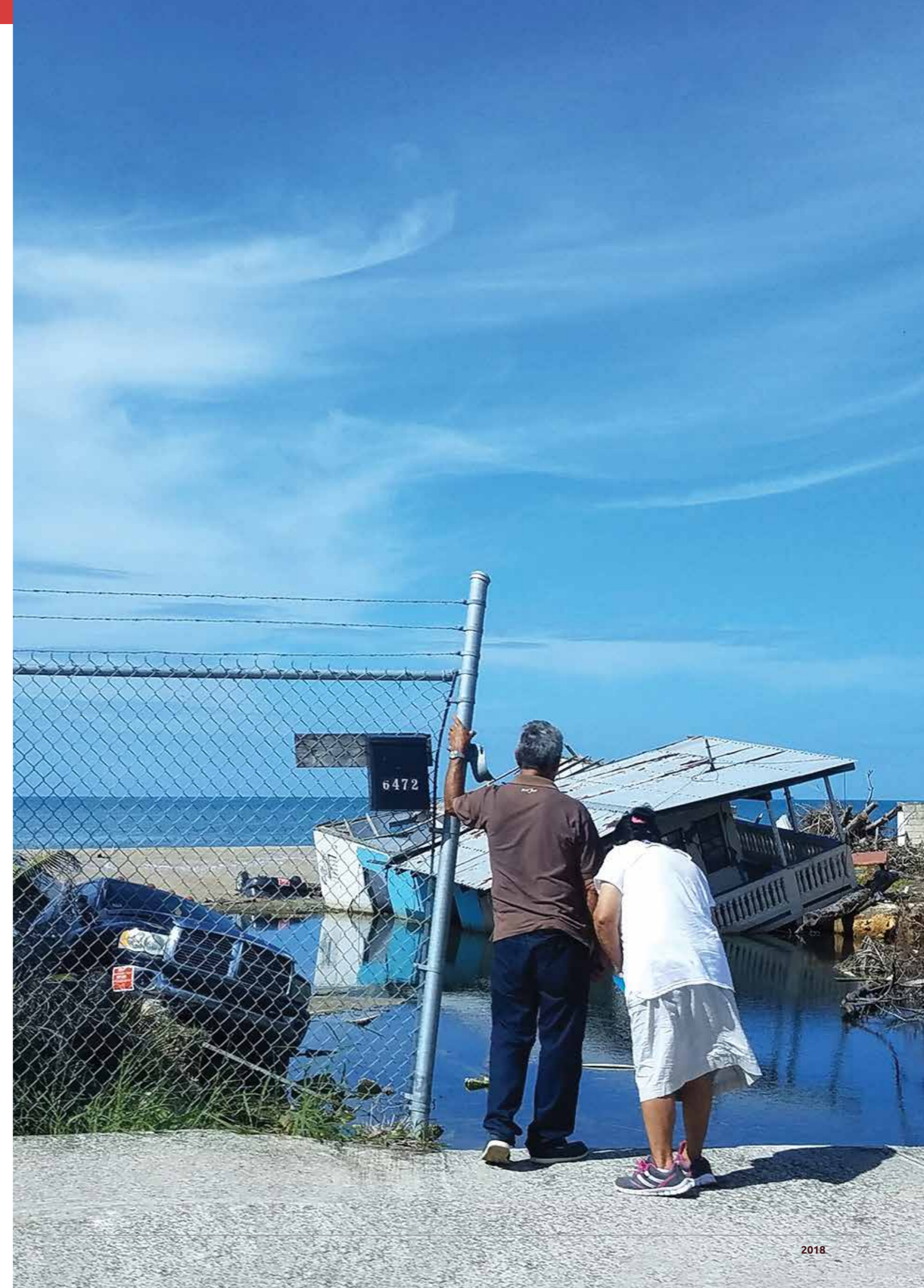
- In the Pacific, CREWS co-funded the Regional Subproject Management Team meeting in Noumea, New Caledonia, of the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project. CREWS also co-funded the Pacific Island Climate Outlook Forum in Fiji in October.
- In West Africa, 15 countries participated in a SWFDP training workshop in Lomé, Togo, on the interpretation of numerical weather prediction and the use of the Common Alert Protocol for warning dissemination. Through the training and purchase of a license to access global forecast products, national meteorological services in the region now receive weather prediction information through the Regional Specialized Meteorological Centre Dakar.

The **Coastal Inundation Forecasting Demonstration Project (CIFDP)** supports capacity improvements in operational forecasts and warning capability for coastal inundation that can be sustained by national agencies. The CIFDP builds on existing models, modeling capabilities, access to real-time data and forecast data, and communications. The project integrates forecasting models already in use and develops modelling components adapted to fit in an open, flexible and easily extendable forecasting system. National forecast agencies lead the process in collaboration with national authorities for coastal disaster risk and emergency management. CIFDP shares all data and information relevant to the inundation forecast process.

- In the Pacific, Fiji will complete its CIFDP project before CIFDP development starts in Tuvalu and Kiribati.

The **Flash Flood Guidance System (FFGS)** in West Africa, Pacific and Caribbean provides real-time guidance products on the threat of potential flash floods in a basin. The system products are made available to the forecasters as a diagnostic tool to analyse weather-related events that can initiate flash floods (e.g. heavy rainfall, rainfall on saturated soils) and to subsequently make a rapid evaluation of the possibility for flash flooding to occur at a location. To assess the threat of a local flash flood, the FFGS allows adjustments based on forecaster experience with local conditions, incorporation of other information (e.g., additional numerical weather prediction output) and any last-minute local observations (e.g., non-traditional rain gauge data) or local observer reports. Training is a crucial part of the FFGS to enable forecasters to use its products effectively in daily operations.

- In the Pacific, Fiji began development of the Fiji FFGS; see full story under "Pacific" subsection.



# CREWS Impact and Early Warning Effectiveness

The effectiveness of CREWS investments in each LDC and SIDS supported is ultimately measured against the number of deaths per 100,000 population attributed to extreme weather and climate events, as well as the number of people affected. These are Targets A and B of the Sendai Framework for Disaster Risk Reduction and

indicators 1.5.1 and 1.5.2 of the first Sustainable Development Goal (SDG) "End poverty in all its forms everywhere". The indicators are expected to become key metrics to measure the Paris Agreement's global goal on adaptation.

Sendai Target A	SDG 1 Indicator 1.5.1	Sendai Target B	SDG 1 Indicator 1.5.2
Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015	Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population	Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015	Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)

Quantifying the loss of lives and the number of people affected by disasters provides a baseline against which to measure progress, allowing decision makers to set goals and make political commitments.



Niger Director General of Civil Protection commits to "zero deaths for Niger due to floods".

## Measuring Progress Against Sendai Targets

Starting in 2019, CREWS will draw from the Sendai Framework Monitor and the analysis provided by UNISDR's Global Assessment Report to measure the impact of its country projects.



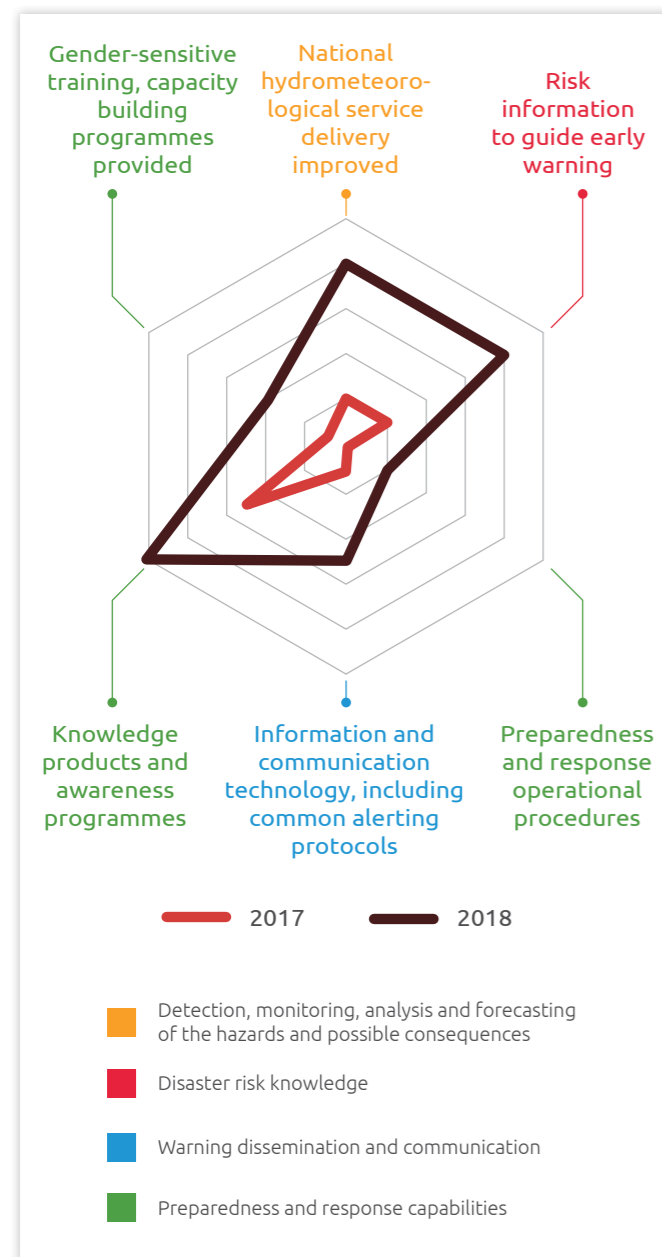
*"There is no dispute that early warning systems save lives. Ensuring that these systems are addressing multi-hazard risks, function adequately and address new and emerging risks is their center-piece role in disaster risk reduction efforts. The Sendai Framework Target (G) advocates for the increased availability of EWS worldwide. CREWS, with its growing footprint in Least Developed Countries and Small Island Developing States, is a crucial partner in supporting countries to achieve Target (G) through improving their early warning capabilities and reporting their tangible efforts to reduce the loss of life and number of disaster-affected people."*

**Mami Mizutori**  
Special Representative of the Secretary-General for Disaster Risk Reduction,  
United Nations Office for Disaster Risk Reduction



# Caribbean Post-Disaster Early Warning Assessment Following the 2017 Hurricane Season

In 2018, the impact of CREWS was measured against its programme outputs and its value proposition. The following chart reflects progress across CREWS projects against its six outputs.



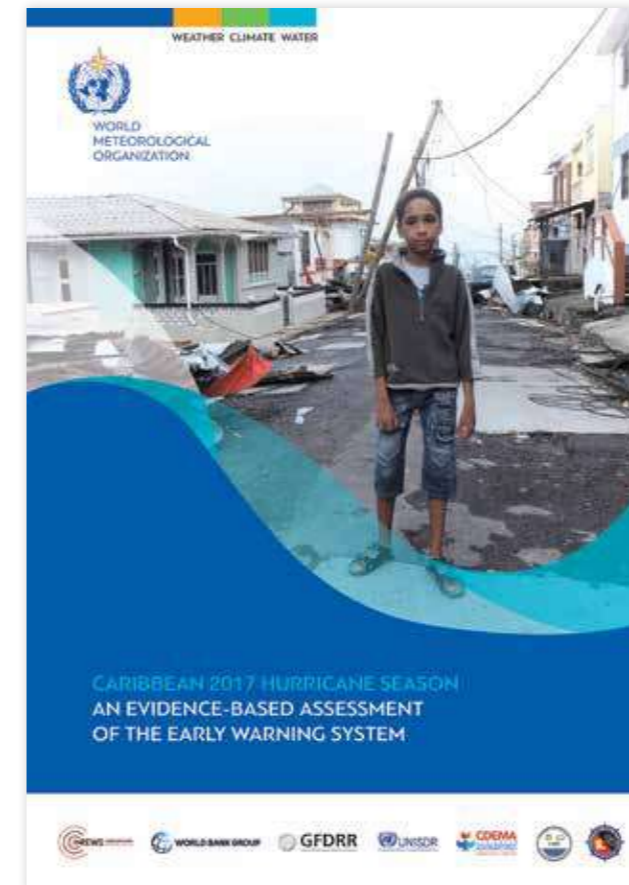
The WMO Country Profile Database provides access to information on the capacities and services of national hydrometeorological services. It includes metrics on the availability of early warning systems, use of the Common Alerting Protocol and availability of local plans to act on early warnings.



## CREWS knowledge products

In 2018, CREWS initiated two types of services to support its knowledge production and sharing.

- **Post-Disaster Early Warning Assessments:** the occurrence of a disaster for which an early warning is issued provides a reality check on the efficiency of the system. CREWS has developed, with its partners, metrics for measuring the effectiveness of an early warning system post-event.
- **Practice Compilations:** The first set of practice compilations will be produced in 2019 and will provide an opportunity for development partners to learn from and exchange on practices that are working and can be replicated across CREWS projects and in other initiatives, as well as identify challenges that require an adapted approach. The compilations will contribute to CREWS' commitment to continuous learning and to developing feedback loops for so-called 'agile or transformative development operations'.



WMO, supported by the Caribbean Institute of Meteorology and Hydrology (CIMH) and the Caribbean Disaster Emergency Management Agency (CDEMA), completed a four-month post-disaster assessment of early warning systems in the Caribbean following the 2017 hurricane season. The assessment highlighted the need to:

- Shift from extreme event forecasts to impact-based forecasts
- Strengthen institutional cooperation between the national meteorological services and the disaster management organizations
- Disseminate gender-sensitive forecasts, services and warnings as women and men differed in their response to the warnings

As part of its efforts to promote investment coherence, CREWS is collaborating in the Caribbean with the European Commission for Humanitarian Aid and Civil Protection Department (ECHO), which finances an early warning system initiative implemented by United Nations Development Programme, CDEMA and the International Federation of Red Cross and Red Crescent Societies. The ECHO initiative adapted the *Checklist of Multi-Hazard Early Warning Systems*, published by WMO, and applied it in five islands. The exercise generated baseline data and helped to identify early warning funding priorities.



*The Caribbean possesses all the necessary skills and expertise required for the task of providing an effective and functional multi-hazard early warning system for its people; it is left only to secure the necessary funding for implementing the best solution to the problem, which is resilience building*

**Honourable Allan Chastanet**  
Prime Minister of Saint Lucia and  
CARICOM Quasi Cabinet Lead for Disaster Management, Climate Change  
and the Environment

Quote credit: CDEMA





# Finances 2018

As of 31 December 2018 in USD millions

	Total	% of Total
<b>Donor Pledges and Contributions</b>		
Contributions	37.53	100.0%
Pledges	-	0.0%
<b>Total Pledges and Contributions</b>	<b>37.53</b>	<b>100.0%</b>

## Cumulative Resources

Resources received		
Cash Receipts	35.71	94.3%
Investment Income Earned	0.34	0.9%
<b>Total Resources Received</b>	<b>36.04</b>	<b>95.2%</b>

## Resources Not Yet Received

Contributions Not Yet Received	1.83	4.8%
Pledges	-	0.0%
<b>Total Resources Not Yet Received</b>	<b>1.83</b>	<b>4.8%</b>

**Total Potential Resources (A)**  
*(in USD millions)* **37.87** **100.0%**

## Cumulative Funding Decisions

Projects	20.84	80.9%
Fees	2.64	10.2%
Administrative Budget	2.29	8.9%

**Total Funding Decisions Net of Cancellations (B)** **25.77** **100.0%**

**Total Potential Resources Net of Funding Decisions (A) - (B)** **12.10**

## Funds Available

Funds Held in Trust with No Restrictions	12.90
Approved Amounts Pending Cash Transfers	2.63

**Total Funds Available to Support Steering Committee Decisions** **10.28**

Note: sub-totals may not add up to due to rounding

In USD millions

Contributor	Currency	Pledge in Currency of Contribution	Effective (or signed) Contribution	Receipts in Currency of Contribution	Receipts in USDeq. a/
Australia	AUD	5.00	5.00	3.97	2.99
France	EUR	15.00	15.00	15.00	16.69
Germany	EUR	3.00	3.00	3.00	3.13
Luxembourg	EUR	1.50	1.50	1.50	1.65
Netherlands	USD	3.35	3.35	2.25	2.25
Switzerland	CHF	9.00	9.00	9.00	9.00

**Total Contributions Received** **35.71**

a/ Represents actual USD receipts

Note: totals may not add up due to rounding

Source: Climate Risk and Early Warning Systems Trust Fund Financial Report, Prepared by the World Bank as CREWS Trustee, 31 December 2018



Photo credit: ANAM

# Scaling Up Action

LDCs and SIDS continue to face capacity challenges to issue timely, impact-based early warnings that lead to early action. National institutions remain insufficiently equipped to adequately act on this responsibility. There is a significant gap between the expected public service for early warnings and capacity, as well as between the capacity of developed and developing countries.

An increasing amount of development and climate finance resources is invested in developing early warning systems. CREWS contributes to the effectiveness and sustainability of these investments in the countries where it is active.

In 2018, CREWS developed an investment case, outlining its value-proposition and its financing and programming targets for 2020.

## Demand for early warning systems

**40** LDCs and SIDS  
require urgent support

**88** per cent of LDCs and SIDS  
request early warning systems in their climate change  
Nationally Determined Contributions (NDCs)

## Looking ahead

**100** USD million  
CREWS Trust Fund investment target  
As of 2018, contributions amount to 40 US\$

**300** USD million  
additional financing to be leveraged through CREWS  
country projects  
Since 2015, USD 118 million was leveraged

*When we established CREWS we had one major goal in mind and that was to reach as many countries as quickly as possible as we were aware of the critical need among LDCs and SIDS to strengthen their early warning systems. We have made significant progress but meeting the demand of the most vulnerable countries requires additional resources.*

**Brigitte Collet**  
Ambassador for Climate Change Negotiations,  
Renewable Energy and Climate Risk Prevention  
France



*Switzerland is well aware – from its own experience – that early warning systems call for coordinated and integrated efforts. By supporting CREWS, Switzerland aims to strengthen early warning capacity of those needing it most and encourages partners to join the effort.*

**Regina Gujan**  
Deputy Head, Multilateral Affairs Division  
Swiss Agency for Development and Cooperation



*The country support for early warning systems provided by the Green Climate Fund aligns with CREWS objectives. Through CREWS we have an overview of who is doing what and where. Partnership with CREWS makes sense as there will be a need to upscale our interventions in an effective manner.*

**Pa Ousman Jarju**  
Director of Country Programming Division  
Green Climate Fund



## CREWS Partners Step Up



Through its Action Plan on Adaptation and Resilience, the World Bank Group has committed to substantially increase financing for quality forecasts, early warning systems and climate information services in at least 30 additional countries. In cooperation with WMO, the World Bank will launch the **Alliance for Hydromet Development**, in 2019, for development and climate finance partners to better support countries for the provision of high-quality weather, climate and hydrological data and services.



The WMO Strategic Plan 2020-2023 puts strengthening Member capacity at centre stage and sets the long-term goal to close this capacity gap. Scaling up effective partnerships for investments in sustainable and cost-efficient infrastructure and service delivery is a strategic objective to achieve this goal. WMO is developing a new **Country Support Initiative (CSI)** for hydromet-related projects based on WMO requirements, standards and good practices. WMO's engagement in CREWS projects will benefit from the CSI regarding the integration of country-level investments within WMO regional and global systems, and the integration of individual projects into broader country-led programmes to strengthen national hydromet capacity.



UNISDR developed the **Sendai Monitor** in 2018 as the tool to support countries to measure their progress against Sendai Targets, including Target G "Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030." UNISDR provides technical guidance inter alia for minimum data standards and methodologies.

For more information visit [www.crews-initiative.org](http://www.crews-initiative.org) or contact us at [crewsinfo@wmo.int](mailto:crewsinfo@wmo.int)



Follow us: @CREWSinitiative

CREWS gratefully acknowledges the contributions of its Members.

### CREWS Members



Australia



France



Germany



Luxembourg  
(Chair)



Netherlands



Switzerland

### CREWS Observers



Canada



Finland



Japan



Mexico



New Zealand



Norway



UNDP  
Empowered lives.  
Resilient nations.



USAID  
FROM THE AMERICAN PEOPLE



ACP

### CREWS Implementing Partners



WORLD BANK GROUP



GFDRR  
Global Facility for Disaster Reduction and Recovery



UNISDR  
United Nations Office for Disaster Risk Reduction