

# Learning from Cyclone Idai and Cyclone Kenneth to Strengthen Early Warning Systems in Mozambique



This brief is based on a Zurich Flood Resilience Alliance Post Event Review Capability (PERC) study analyzing the 2019 Cyclone Idai and Cyclone Kenneth impacts in Mozambique. This brief presents a series of resilience lessons from Cyclone Idai and Cyclone Kenneth based on key informant interviews and background research, and highlights opportunities to strengthen Early Warning Systems in Mozambique. This product is accompanied by several other similar break out products as well as a longer report. An electronic copy of this brief and other materials from the study are available at: [www.i-s-e-t.org/perc-cyclone-idai-2019](http://www.i-s-e-t.org/perc-cyclone-idai-2019). Additional information about the PERC can be found at [www.floodresilience.net/perc](http://www.floodresilience.net/perc) and additional information about flood resilience at [www.floodresilience.net](http://www.floodresilience.net)\*

\*We define (disaster) resilience as the ability of a system, community, or society to pursue its social, ecological, and economic development and growth objectives, while managing its (disaster) risk over time, in a mutually reinforcing way, outlining the multi-faceted and interdisciplinary approach to resilience.

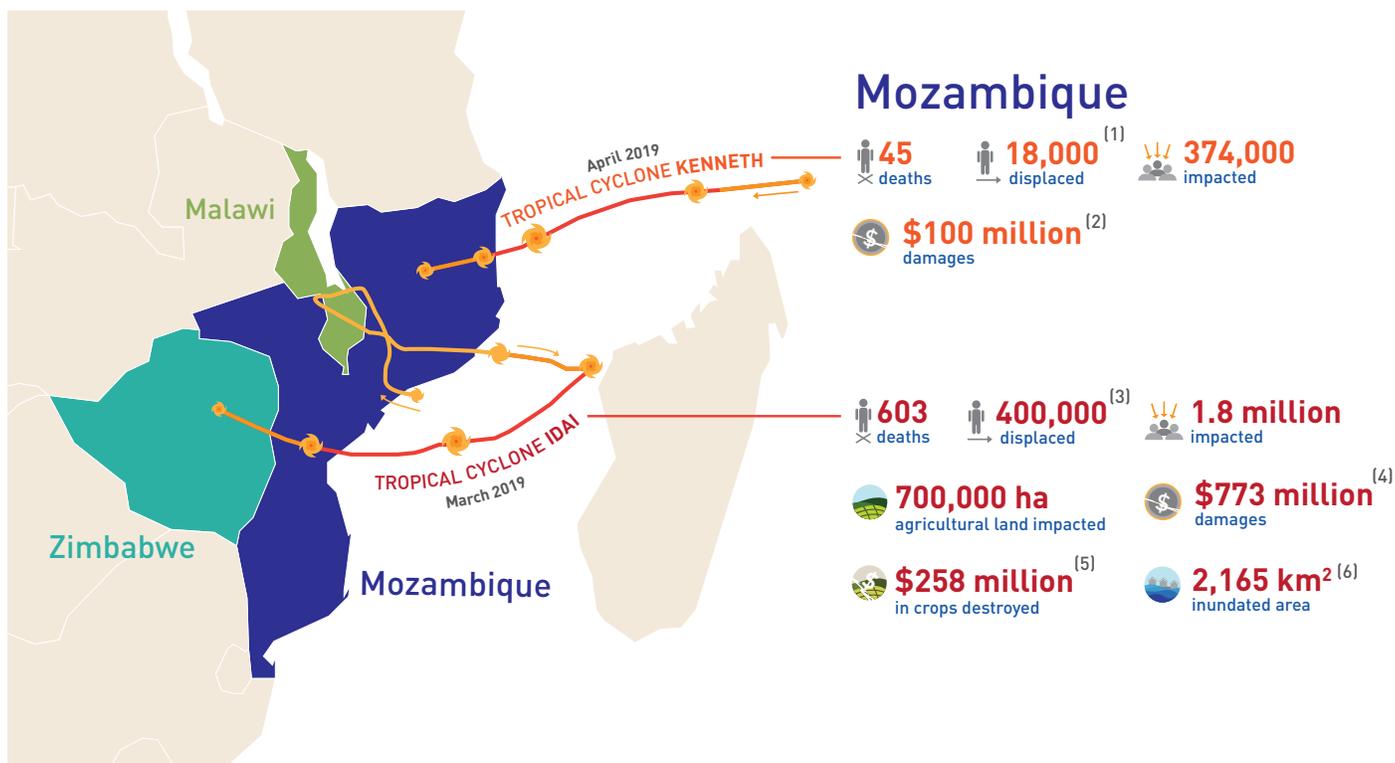
## Introduction

The impacts of cyclones Idai and Kenneth highlighted the need for far greater investment in Early Warning Systems in Mozambique. In March and April of 2019, the two cyclones made landfall in central and northern Mozambique causing widespread destruction, damage, and loss of life from strong winds, rainfall, and ensuing flooding. Cyclone Idai, a category 2 cyclone when it made landfall, was the deadliest storm ever to hit Africa and the largest humanitarian disaster of 2019, causing 1,300 deaths across southeastern Africa<sup>1</sup>. Cyclone Kenneth, which made landfall a month later as a category 4 cyclone with wind gusts of

<sup>1</sup> Aon. (2019). *Weather, Climate & Catastrophe Insight 2019 Annual Report*. <https://reliefweb.int/sites/reliefweb.int/files/resources/20200122-if-natcat2020.pdf>

**FIGURE 1**

The impacts of Cyclone Idai and Cyclone Kenneth in Mozambique



**Note:**

- (1) OCHA. (2019). *Cyclones Idai and Kenneth*. <https://www.unocha.org/southern-and-eastern-africa-rosea/cyclones-idai-and-kenneth>
- (2) Aon. (2019). *Weather, Climate & Catastrophe Insight 2019 Annual Report*. <https://reliefweb.int/sites/reliefweb.int/files/resources/20200122-if-natcat2020.pdf>
- (3) Government of Mozambique. (May 2019). *Mozambique Cyclone Idai Post Disaster Needs Assessment*.
- (4) World Vision. (2019). *2019 Cyclone Idai: Facts, FAQs, and how to help*. <https://www.worldvision.org/disaster-relief-news-stories/2019-cyclone-idai-facts>
- (5) Gulland, Anne. (7 August 2019). *Floods and drought: the challenges facing Mozambique's farmers after cyclone Idai*. The Telegraph. <https://www.telegraph.co.uk/global-health/climate-and-people/floods-drought-challenges-facing-mozambiques-farmers-cyclone/>
- (6) United Nations Institute for Training and Research. (20 March 2019). *UNOSAT MOZAMBIQUE Sofala province Imagery analysis: 19 and 20 March 2019*. [https://reliefweb.int/sites/reliefweb.int/files/resources/UNOSAT\\_A3\\_Natural\\_Portrait\\_TC20190312MOZ\\_SofalaProvince\\_20190320.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/UNOSAT_A3_Natural_Portrait_TC20190312MOZ_SofalaProvince_20190320.pdf)

220 km/h, was the strongest cyclone to ever make landfall in Africa<sup>2</sup>.

Tropical Depression 11, the precursor to Cyclone Idai, brought heavy rains to Mozambique, causing flooding in the Zambezi Valley (Tete and Zambezia Provinces) in early March. The storm however, didn't stop there. Following an unusual path, it moved

back out into the Mozambique Channel, where it rapidly intensified and then returned to land as Cyclone Idai, making landfall near the port city of Beira on March 15. Wind speeds of 180 km/h tore roofs off homes and buildings and pushed a storm surge of up to 6 meters<sup>3</sup> into low-lying

2 Government of Mozambique. (May 2019). *Mozambique Cyclone Idai Post Disaster Needs Assessment*.

3 Idai's landfall was around the same time as high tide, though fortunately, it was not a new or full moon where tides are at their highest. The Earth Observatory. (2019). *Devastation in Mozambique*.



*The recent southeastern Africa droughts and the intensity and destructiveness of cyclones Idai and Kenneth are representative of the types of increasing weather challenges expected with climate change. Shifting rainfall patterns, variable temperatures, sea level rise, the intensification of extreme events, and the emergence of new weather hazards in places that were previously safe are the expected consequences of climate change. These impacts are likely to lead to an increase in disaster risk, food insecurity and water shortages, further exacerbating pre-existing vulnerabilities.*

residential and agricultural areas. Over the next several days, Idai moved inland and into Zimbabwe, where it released torrential rains that caused downstream rivers in Manica and Sofala provinces in Mozambique to overflow forming an ‘inland ocean.’ While windspeed and landfall were accurately forecasted and warnings disseminated several days ahead of the storm, there was very limited warning about the floods. As a result, the impacts to communities from floodwaters were severe, with sudden flooding forcing people into trees and onto rooftops to escape floodwaters.

On April 25, Cyclone Kenneth made landfall in the northern province of Cabo Delgado, hitting an area already suffering from protracted conflict. While Kenneth weakened as it moved inland, the storm brought high winds, storm surge, heavy rains, and flooding that damaged or destroyed homes, caused power outages, and damaged key transportation routes and bridges across the province.

Several days in advance of Idai’s second landfall, the location of landfall and expected windspeeds were accurately known and agencies and communities

in the storm path were on alert. This was supported by regional and global collaborative forecasting efforts; efforts which are well established and have been improving year on year. Cyclone Kenneth was equally well forecast. This type of technical capacity is a critical first step in early warning. While Mozambique’s National Meteorology Institute (Instituto Nacional de Meteorologia, INAM) and the National Institute of Disaster Management (Instituto Nacional de Gestão de Calamidades, INGC) issued alerts and disseminated warning messages via TV, radio, and megaphones on cars, uptake and understanding of needed actions to take, as well as flood forecasting were less successful.

## **Successes & Challenges for Early Warning and Early Action**

Cyclones Idai and Kenneth wrought havoc on lives, livelihoods, and homes in Mozambique, overwhelming local and national government response capacity and leading to the mobilization of a global humanitarian response lasting months. Nonetheless, the disasters could have been worse. Successes, including accurate cyclone forecasting and effective collaboration in the response phase, limited the impacts of the storms.

Particular successes included the performance of the INGC. Since its establishment in 1999 and immediate testing in severe flooding in February and March of 2000, the INGC has strengthened its capacity to manage and respond to disasters. While the INGC is underfunded, their collaboration with key governmental agencies and humanitarian and non-governmental organizations (NGOs) has led to clear delineation and knowledge of roles and responsibilities. With Idai and Kenneth, they utilized advance forecasts to prepare for the cyclones, and in the case of cyclone Kenneth, to evacuate 30,000 people out of hazardous areas.

However, having accurate forecasting alone is not enough. Interviewees and secondary sources



Buzi, Mozambique was one of the hardest hit districts following Cyclone Idai © IFRC

consulted for this study identified two particular challenges for early warning in the case of Idai and Kenneth:

- **Comprehension and uptake of early warning messaging.** In the case of Cyclone Idai, even with accurate forecasts and warnings, nobody expected a storm of such magnitude. Warnings are only useful if people can interpret and act on them. In the case of Idai, people understood that a cyclone was coming, but didn't take action because they believed it would be similar to cyclones they had experienced in the past. Official warnings such as 'stay safe, go to your house, close windows and doors, make sure you stay inside'<sup>4</sup>, though clear and accurate, failed to communicate the qualitative difference between winds of 60km/h such as had been experienced in previous cyclones and Idai's 180km/h winds. Consequently, those receiving
- **Flood forecasting.** Though early warnings about Idai and Kenneth's landfall and winds were disseminated, particularly for Idai there were, at best, limited warnings regarding potential flooding. In some cases, this was due to wind-damaged communications channels; warnings eventually arrived but too late to be useful. In other cases, the failure was linked to loss of river gauges and inability to evaluate the growing risk. Flood impacts were further exacerbated by rainfall location; much of the Mozambique flooding was caused by heavy rains in Zimbabwe. Because rain wasn't falling locally, downstream communities in Mozambique were unaware of the risk until floodwaters were rising, leaving little to no time to protect belongings or conduct immediate live-saving activities.

4 "Stay inside" might not always be the appropriate action if houses are not resistant.

## The opportunity

These successes and challenges highlight several opportunities for improving Mozambique’s early warning systems, particularly around how increased attention at community and district levels can complement successes at higher levels.

- **Make early warning messages more understandable and actionable.** Warnings about the cyclones and actions people should take were disseminated by INAM via cars with megaphones, via radio, TV and other channels. However, interviewees highlighted the need for the warnings to be accompanied by clearer information about both potential impacts and more specific actions people can or should take to avoid those impacts. Information should be tailored to the timing of the warning so that action can be taken within the timeframe available. Designing this type of messaging is a challenge and cannot simply be done in the one to three-day lead-up to an event. Messages that help people to understand things such as the difference between 60 km/h winds and 180 km/h winds or a never before experienced event require time to develop and disseminate,

**FIGURE 2**

Principal risks from wind

Durante o ciclone a casa pode ser danificada

Os principais riscos vêm do vento



Source: Cruz Vermelha de Moçambique. Reforçar casas em caso de ciclone.

for example through public messaging or school education campaigns (see Box 1 and Image 1). Communities should be engaged early in the development of these messages to ensure that they are appropriate for and fit the local context.

### BOX 1. BLANKET MESSAGING VS. DIFFERENTIATED MESSAGING

*“A storm with 160 km/h winds is coming – seek shelter at home”*

Blanket messaging

*“A storm with far stronger winds than any previous storm is heading toward your location. Once the storm hits, you will be unable to move from your location until it passes. Un-reinforced or lightweight roofs will blow off. Activate your emergency plan and consider evacuation to pre-identified safe places.”*

Differentiated messaging



Damages from Cyclone Idai in Beira, Mozambique © IFRC

- **Educate and capacitate individuals and communities to act early.** For early warning messaging to be effective, individuals and communities need to understand their risk and the actions they can take to protect themselves, and they need to have the resources to act. There are several tools already available that could be scaled to address this need. For example, Save the Children’s and the International Federation of Red Cross and Red Crescent Societies’(IFRC) Public Awareness and Public Education for Disaster Risk Reduction (PAPE)<sup>5</sup> is a tool that guides community capacity building and can be contextualized to specific locations and hazards. Additionally, the IFRC and German Red Cross Forecast-based Financing (FbF) and Early Action Protocols (EAPs)<sup>6</sup> use cyclone forecasts to activate Mozambican Red Cross volunteers to support the reinforcement of homes and schools, and the distribution of chlorine and buckets to support post-event water sanitation if needed.
- **Expand and strengthen existing early warning and early action systems and structures at the district and community level.** INGC has local community-based committees that support early warning and early action. However, as was particularly highlighted by Cyclone Idai, there is opportunity to expand and strengthen these structures. Further support and capacity building on how to interpret early warnings should be coupled with community development of what emergency actions community members can take for each of

5 See here for more information: <https://media.ifrc.org/ifrc/messages-disaster-prevention/>

6 See here for more information: <https://www.forecast-based-financing.org/projects/mozambique/>



A distribution of non-food items in Buzi, Mozambique, in the aftermath of Cyclone Idai © IFRC

the local hazards and hazard levels, including identification of evacuation routes and safe places or shelters (hotels, schools, churches, etc.) where people can go based on early warning messaging. The identification of safe places should be based on hazard mapping for all local hazards; hazard mapping can also help identify where to encourage or discourage new construction.

- **Strengthen forecasting for floods and increase transnational forecasting and information sharing.** One of the few places where we see a clear need for greater capacity at the sub-national, national, and regional levels is in flood forecasting. Interviewees for this study noted that forecasting cyclone-related flooding is improving, but continues to be a challenge. It is difficult to determine where rains from cyclones will fall, how much rain will fall, how intense the rainfall will be, and what the localized impacts of that rainfall will be. However, recognizing that the water content of tropical storms is increasing as sea surface temperatures

rise, which is contributing to the intensity of cyclones, flood forecasting is an area critically in need of improvement. Immediate action should include replacing and improving the many river gauges that were damaged or destroyed by flooding from Idai with local materials, coupled with improved maintenance and local monitoring of these gauges. Coupling top-down river gauge data with bottom-up community river level observations during high risk conditions can provide additional, actionable information for communities. Higher resolution satellite imagery will also help to inform weather forecasts and close the flood forecasting gap. Establishing back-up power for the communications network, coupled with establishing emergency communication channels via VHF radios or other suitable means, would ensure minimum communication can be facilitated in the case of a power failure, preserving the ability to continue to disseminate warnings in emergency weather conditions.



*Unless stakeholders act now to reduce the risk to natural hazard events, these events will continue to turn into humanitarian disasters that compromise key development gains and divert much needed funds away from other priorities.*

## Conclusion

Tropical Cyclones Idai and Kenneth are, unfortunately, unlikely to be isolated, once-in-a-lifetime events. Even the combination of two such powerful storms in one year should be assumed to be the new reality. Because of the size and shock of the storm impacts in 2019, there is enormous interest on the ground and from donors in identifying and adopting better practices to manage risks arising from these storms. Critical among

these better practices must be strengthening early warning and early action systems in Mozambique, not just technologically, but from the community to the global level. While strengthening early warning systems is not necessarily a novel call to action, interviewees highlighted the ongoing need to continue to improve these systems and the gaps that continue to be overlooked event after event. This includes improving forecasting, but of even greater importance is building the capacity of communities to understand and use that forecasting. Until everyone, including the most rural and most vulnerable, receive warnings, know what to do in response to those warnings, and have the resources, skills, and experience to act, communities around the world will continue to suffer major humanitarian disasters. And unless stakeholders act now to reduce the risk to natural hazard events, these events will continue to turn into humanitarian disasters that compromise key development gains and divert much needed funds away from other priorities.

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The Zurich Flood Resilience Alliance PERC provides research and independent review of large flood events. It seeks to answer questions related to aspects of flood resilience, flood risk management, and catastrophe intervention. It looks at what has worked well (identifying best practice) and opportunities for further improvements. Prepared by the Institute for Social and Environmental Transition - International (ISET), together with other members of the Zurich Flood Resilience Alliance - the International Federation of Red Cross and Red Crescent Societies (IFRC) and Zurich Insurance Company Ltd. - and in collaboration with the Mozambique Red Cross (CVM) and the Swiss Agency for Development and Cooperation (SDC), this publication is intended solely for informational purposes. All information has been compiled from reliable and credible sources; however, the opinions expressed are those of the authors. — March 2020