Highlights

- The tropical cyclone Eloise made landfall near the city of Beira (central Mozambique) on 23 January 2021. At least six people died, 12 injured, at least 176,475 affected including 8,363 displaced and more than 7,000 houses destroyed by rains and significant floods.

- A total of 1,950,705 people was modelled as living in the areas affected, and economic losses caused by cyclone Eloise in Mozambique are 225,597,633 USD as estimated by the ARC Tropical Cyclone Explorer (TCE).

- Losses due to tropical cyclone Eloise would have exceeded the attachment point if Mozambique had taken the TC policy insurance for the 2020-2021 TC season. As a result, a payout of 5,459,389.5 USD would have been due to the Government of Mozambique for this current cyclone event.

Event Overview

After exiting Madagascar, tropical cyclone Eloise strengthened in the Mozambique channel, and made landfall near the coastal city of Beira (Province of Sofala, Mozambique), in the early hours of 23 January 2021[1]. It reached the stage of tropical cyclone at winds of 140 km/h and gusts up to 160 km/h, according to the National Institute of Meteorology (INAM)[2]. The cyclone lost strength as it moved inland across Mozambique, downgraded into a moderate tropical storm when moving to Zimbabwe, South Africa and Botswana. The cyclone brought heavy rains and strong winds that caused significant damages, widespread flooding and left roads impassable in Sofala, Zambezia, Inhambane, and Manica provinces. According to the preliminary assessment of the National Institute for Disaster Risk Management and Reduction (INGD), at least six people died, 12 injured, at least 176,475 affected including 8,363 displaced and more than 7,000 houses destroyed by rains and significant floods[3]. The Sofala province has been hardest hit, especially in Buzi, Dondo and Nhamatanda districts and the city of Beira.

Monitoring TC Eloise using ARC's TCE

The ARC's *Tropical Cyclone Explorer (TCE)* software was used to monitor the characteristics of the tropical storm Eloise in Mozambique. The wind and storm surge footprints are parts of TCE's outputs, which shows the regions affected by certain extents of the tropical storm. Based on TCE's footprint for the storm Eloise, wind speeds between 35 km/h and 155

km/h were estimated across Mozambique. The storm surge footprint modelled by TCE indicated that Eloise caused storm surges that could reach a maximum height of 4 meters along the Mozambican coast.

TCE Loss Calculations

The post-event run of the ARC's TC model showed that a total of 1,950,705 people was living in the areas affected by the tropical storm Eloise. The economic losses associated to TC Eloise in Mozambique were estimated at 225,597,633 USD. These losses are direct losses solely due to wind hazard and storm surges, and do not consider damages due to flooding, nor indirect economic losses.

Country	Event name	Losses (USD)	Population potentially affected per wind speed category				
			Category 1 (63 km/h)	Category 2 (89 km/h)	Category 3 (119 km/h)	Category 4 (159 km/h)	Category 5 (211 km/h)
Mozambique	Eloise	225,597,633	648,221	338,098	964,386	0	0

TC Insurance Policy

The payout under the parametric cyclone insurance policy held by a country depends on the conditions of coverage chosen. A key parameter is the Attachment point, the minimum severity of the event loss that results in a payout.

For Mozambique, the calculation of the losses caused by the cyclone Eloise was made using the following insurance model parameters: Premium of 1,700,000 USD, Coverage limit of 14,720,025 USD, Ceding percentage of 2.50%, Attachment point of 7,221,694 USD and Exhaustion point of 596,579,708 USD. The results showed that the losses due to TC Eloise would have exceeded the Attachment point if Mozambique had taken the TC policy insurance for 2020. **As a result, a payout of 5,459,389.5 USD would have been due to the Government of Mozambique under the policy of the parametric insurance against the risks of tropical cyclones with the above parameters.**

ARC expresses its sympathy to the government and people of Mozambique for the impacts on communities and infrastructure caused by the tropical storm Eloise.

For additional information, contact the ARC at: info@arc.int

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[1] Météo France/La Reunion: http://www.meteofrance.re/cyclone/cmrs/bulletin-cmrs
[2] Southern Africa - Tropical Cyclone Eloise Flash Update No.6: https://reliefweb.int/report/mozambique/southern-africa-tropical-cyclone-eloise-flash-update-no6-23-january-2021

[3] ECHO Daily Flash: https://erccportal.jrc.ec.europa.eu/ECHO-Flash/ECHO-Flash-List/yy/2021/mm/1

Tropical Cyclone Explorer (TCE)

About ARC

The African Risk Capacity (ARC) was established by treaty as a Specialised Agency of the African Union (AU) to help Member States improve their capacities to better plan, prepare and respond to extreme weather events and natural disasters, therefore protecting the food security of their vulnerable populations. By linking early warning systems with contingency planning and supported by modern financial mechanisms, ARC enables governments to provide targeted responses to disasters in a more timely, cost-effective, objective and transparent manner, thereby reducing response costs and loss of livelihoods.

About TCE

The ARC Tropical Cyclone (TC) risk model is a parametric insurance product developed for the South West Indian Ocean (SWIO) region to provide rapid financing and early response to countries affected by tropical cyclone events. It covers winds and storm surge hazards while excess rainfall associated with cyclones will be covered under another ARC insurance product.

The Tropical Cyclone Explorer (TCE) software package is a dedicated interface, developed by the ARC to allow users to easily access all the model data and view the characteristics of the cyclone (trajectory, wind speed, storm surge heights, etc.), calculate the affected population as well as the economic losses caused by the cyclone event. The losses calculated by TCE are limited to six SWIO countries: Mozambique, Comoros, Madagascar, Mauritius, Seychelles and Tanzania. The TCE will be available to ARC Member States and partners via the ARC's *Africa RiskView* (ARV) platform.

Methodological Note on TCE

TC Risk Model

The ARC's TC risk model is implemented through four modules, logically sequenced to offer a reliable estimate of people affected and economic losses caused by cyclones, namely hazard, exposure, vulnerability/damage and insurance modules.
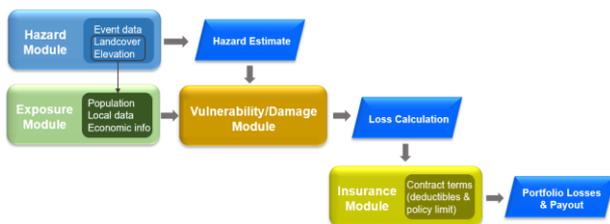
- *Hazard module*: It calculates in near-real time the maximum wind speed and the height of storm surges caused by a tropical cyclone.

- *Exposure module*: It describes the economic assets based on the land use categories in each country as well as the replacement cost of each exposed asset.

- *Vulnerability/Damage module*: It defines the probability distribution of economic losses for different levels of wind speed and storm surge height induced by a tropical cyclone.

- *Insurance module*: It calculates loss estimates for an asset portfolio based on contractual conditions. The payout is based on the following set of parameters selected by each country: Attachment Point, Exhaustion Point, Coverage Limit and Ceding Percentage.
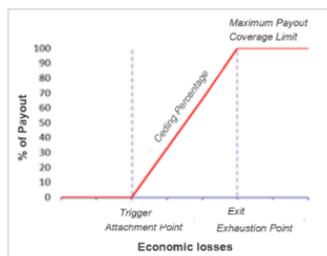
As per Section 6.2 of the TC Policy, the calculation of the MCLD (*Modelled Cyclone Losses and Damage*s) payout amount is shown below using the following formula:

$P = \min(L, y * x)$, where $x = \min(EP - AP, \max(MCLD - AP, 0))$

where:

P	MCLD Payout Amount
L	Coverage limit
AP	Attachment Point
EP	Exhaustion Point
x	The amount by which the MCLD exceeds the Attachment Point (AP) (which amount shall not be greater than the Exhaustion Point (EP) minus the Attachment Point)
y	Ceding Percentage

TCE Components

The TCE is a client Windows application which is composed of three main modules:

- *Loss Calculator*: It is the main element for calculating the economic losses and the population affected and for each country.

- *Event Overview*: It is a dedicated module which combines mapping and loss calculation. It helps viewing different elements of one event during calculation.

- *Map*: It provides to users a general GIS mapping functionality including vector and raster-based project parameters.

After downloading the dataset, the *Loss Calculator* engine calculates the modeled losses for the selected country (ies) and selected cyclone event(s). The losses (in USD) is calculated only for A-deck and B-deck data, not for in-event data and forecasts. In addition, the TCE's *Loss Calculator* calculates the number of populations affected for five categories of cyclone wind speeds.

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