

Highlights

- Following EMNATI's landfall on the east coast of Madagascar on 23 February 2022, more than 169,000 people have suffered damage to their homes, more than 17,000 people evacuated, and at least 15 persons have died according to the BNGRC.
- The post-event run of the ARC's Tropical Cyclone model has identified 8,8 million people as living in the areas affected by EMNATI.
- The modelled economic losses due to EMNATI in Madagascar are estimated at USD54,4 million by ARC's Tropical Cyclone model. This amount is less than the attachment point of USD155,4 million set in Madagascar's insurance policy. As a result, no payout is due to the Government of Madagascar under the 2021/22 parametric insurance policy against the risks of tropical cyclones.

Overview of the Cyclonic Event

The tropical cyclone EMNATI formed in the Indian Ocean on February 14, 2022 and gradually intensified over the next several days. After moving about 300 km north of Mauritius Island and La Reunion, EMNATI continued its route towards the east coast of Madagascar. It made landfall after midnight on 23 February, in the village of Mangatsiatra (Fitovinany region) at the of tropical cyclone with windspeeds of 140 km/h, with wind gust of between 150 km/h and 200 km/h¹. EMNATI impacted multiple areas that were hit by the tropical cyclone BATSIRAI just 18 days before. It then weakened as it crossed inland and gradually moved away from the southwest coast of Madagascar through the Mozambique Channel. EMNATI brought heavy rains and strong winds to the southeast, including the Grand Sud region which has been suffering from an extremely severe drought². EMNATI is the fourth cyclone to make landfall in Madagascar in one month.



Ahead of the tropical cyclone EMNATI, about 45,000 people were preventatively evacuated to 130 shelters sites in 7 regions according to the Malagasy National Disaster Management Agency (BNGRC). The assessment carried out on March 2nd, 2022, by the BNGRC reports more than 169,000 people have suffered damage to their homes in 12 regions of Madagascar, more than 17,000 people have been evacuated, and at least 15 persons have died³. EMNATI's winds and rains have heavily damaged houses and schools. More than 23,000 homes and 7,000 school buildings have been damaged or destroyed by the cyclone. The health sector was also impacted by EMNATI, with 34 health centres damaged across 9 districts. According to the BNGRC, EMNATI caused considerable damage to transport infrastructures, leaving some of the hardest-hit areas inaccessible by road.

Monitoring of EMNATI with TCE

As part of the ARC Parametric Tropical Cyclone Insurance Policy, a post-event report is required for any cyclone event affecting a Member State for windspeeds higher than 63 km/h. The ARC's Tropical Cyclone Explorer (TCE) software enabled real-time monitoring of the characteristics of the tropical cyclone EMNATI in Madagascar. Wind and storm surge footprints are among the products generated by TCE, and these indicate the areas affected by EMNATI. From the landing of EMNATI on the east coast to its

departure from Madagascar by the southwest coast, TCE estimated maximum windspeeds decreasing from 140 km/h to 65 km/h. The maximum storm surge caused by EMANT was estimated at 1,9 m by TCE.

Calculation of Economic Losses and Population at Risk

The post-event run of TCE showed that a total of 8,8 million people were living in the areas affected by the cyclone EMNATI (Table below). The economic losses caused by EMNATI were estimated at USD54,4 million in Madagascar by TCE. These losses are direct losses solely due to winds hazard and storm surges, and do not consider damages due to flooding, nor indirect economic losses.

Country	Event name	Losses (USD)	Number of population potentially at risk per windspeed categories				
			Category 1 (63 km/h)	Category 2 (89 km/h)	Category 3 (118 km/h)	Category 4 (167 km/h)	Category 5 (212 km/h)
Madagascar	EMNATI	54,397,904	5,073,442	3,742,944	19,464	0	0

TC Parametric Insurance Policy

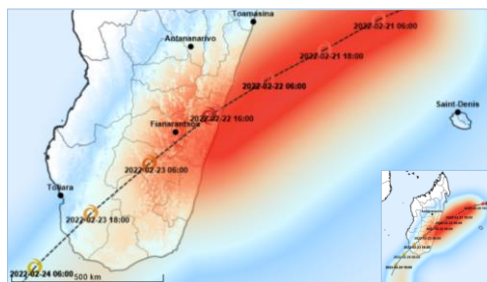
The payout under the TC parametric insurance policy held by a country depends on the conditions of coverage chosen. A key parameter is the Attachment Point, the minimum severity of the event loss that results in a payout.

For Madagascar, the calculation of the payout per the insurance model, in relation to the wind and storm surge risks associated with EMNATI, was carried out using the following parameters of Madagascar's TC insurance contract: a Coverage Limit of USD11,690,000, an Attachment Point of USD155,440,233 and an Exhaustion Point of USD2,359,518,806. The results showed that the economic losses caused by EMNATI are less than the attachment point set in Madagascar's insurance policy.

As a result, no payout is due to the Government of Madagascar under the policy of the 2021/22 parametric insurance against the risks of tropical cyclones.

The ARC Group expresses its sympathy to the Government and people of Madagascar for the impacts on communities and infrastructure caused by the tropical cyclone EMNATI.

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



¹ Meteo France

² Southern Africa: Cyclone Season Flash Update No. 9 (24 February 2022) - Madagascar | Relief Web

³ Southern Africa: Cyclone Season Flash Update No. 10 (2 March 2022) - Madagascar | Relief Web

Tropical Cyclone Explorer (TCE)

About ARC

The African Risk Capacity (ARC) was established by treaty as a Specialized 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.

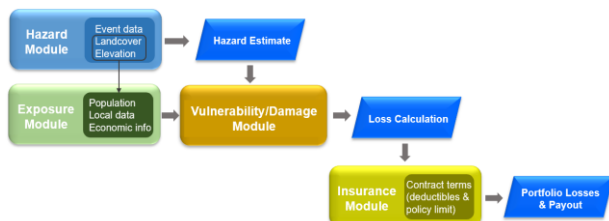
About TCE

The ARC Tropical Cyclone (TC) risk model is a parametric insurance product developed for the Southwest 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.

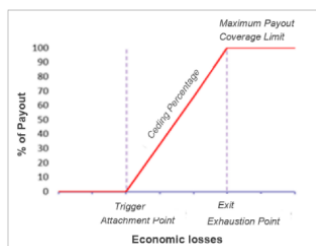
The Tropical Cyclone Explorer (TCE) software package is a dedicated interface, developed by the ARC to allow users to easily access all the model data and view the characteristics of the cyclone (trajectory, wind speed, storm surge heights, etc.), calculate the affected population as well as the economic 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.

Overview of the Tropical Cyclone 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 Damages*) payout amount is shown below using the following formula:

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

where:

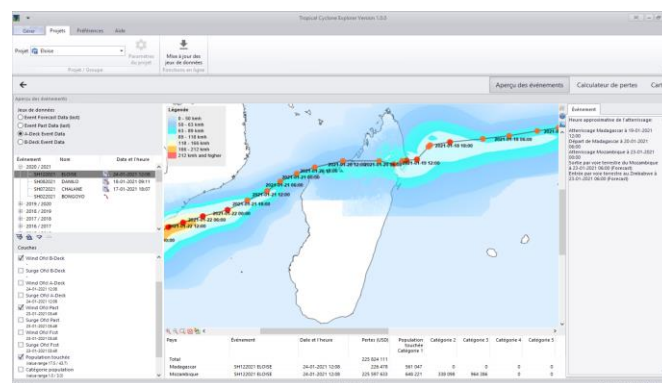
- P MCLD Payout Amount
- L Coverage limit
- AP Attachment Point
- EP Exhaustion Point

- 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

Components of the TCE

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) are 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.