

### Highlights

- Following BATSIRAI's landfall on the east coast of Madagascar, more than 112,100 people were affected, at least 61,500 displaced persons and 99 people dead according to the latest update from the Malagasy National Disaster Management Agency (BNGRC).
- For the windspeed of 119 km/h, ARC's Tropical Cyclone model has identified more than 6 million people as living in the areas affected.
- Modelled economic losses due to BATSIRAI in Madagascar are estimated at USD2,176,988,546 by ARC's Tropical Cyclone model. This amount has exceeded the Attachment Point indicated in Madagascar's TC policy. As a result, a payout of USD10.714.206 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 BATSIRAI formed in the Indian Ocean on January 21, 2022 and gradually intensified over the next several days. After moving about 200 km north of Mauritius and La Reunion, BATSIRAI continued its route towards the east coast of Madagascar. It landed on Saturday evening, near the northern town of Mananjary (Vatovavy region) at intense tropical cyclone stage with windspeeds of 165 km/h and extreme and destructive gusts of up to 230 km/h<sup>1</sup>. It crossed the country from Saturday 05 to Sunday February 06 (evening) and emerged in the Mozambique Channel after a significant weakening following its passage on land. Weather conditions were disturbed over the southern half of the island, with strong winds and heavy rains exceeding 300 mm on the eastern plateaus.



The provisional assessment carried out on February 10, 2022, by the Malagasy National Disaster Management Agency (BNGRC) reports more than 112,100 people affected, at least 61,500 persons displaced and 99 people dead<sup>2</sup>. BATSIRAI's winds and rains have caused considerable damage to houses, schools and health centres. More than 2000 classrooms have been completely or partially destroyed. The most affected districts are Mananjary, Nosy Varika and Manakara, according to preliminary reports. BATSIRAI also caused considerable damage to transport infrastructure, leaving some of the hardest-hit areas inaccessible by road.

### Monitoring of BATSIRAI 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 BATSIRAI in Madagascar. Wind and storm surge footprints are among the products generated by TCE, and these indicate the areas affected by BATSIRAI. TCE thus estimated windspeeds varying from 75 km/h

to 165 km/h between landing and exit points of the cyclone. As for the maximum storm surge, it was estimated at 2.6 m by TCE.

### Calculation of Losses and Population Affected by BATSIRAI

The post-event run of TCE showed that a total of 6,174,337 people were living in areas affected by BATSIRAI where windspeeds of 119 km/h were experienced (Table below). The economic losses associated to the cyclone BATSIRAI were estimated at USD2,176,988,546 in Madagascar. 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 (119 km/h)	Category 4 (159 km/h)	Category 5 (211 km/h)
Madagascar	BATSIRAI	2,176,988,546	5,868,947	5,889,844	6,174,337	1,871,527	0

### TC Parametric Insurance Policy

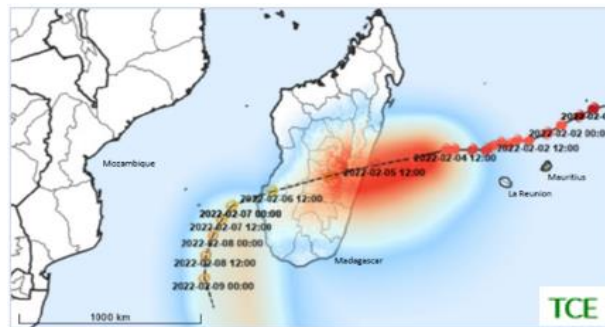
The payout under the TC parametric insurance policy held by a country depends on the conditions of coverage chosen. A key parameter is the Attachment Point, the minimum severity of the event loss that results in a payout.

For Madagascar, the calculation of the payout per the insurance model, in relation to the wind and storm surge risks associated with BATSIRAI, 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 losses due to BATSIRAI have exceeded the Attachment Point indicated in the contract. **As a result, a payout of USD10.714.206 is due to the Government of Madagascar under the 2021/22 parametric insurance policy against the risks of tropical cyclones with the above parameters.**

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 BATSIRAI.

For additional information, contact us at: [info@arc.int](mailto:info@arc.int).



<sup>1</sup> Meteo France

<sup>2</sup> OCHA Southern Africa: Cyclone Season Flash Update No. 5 - 10 February 2022

# 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.

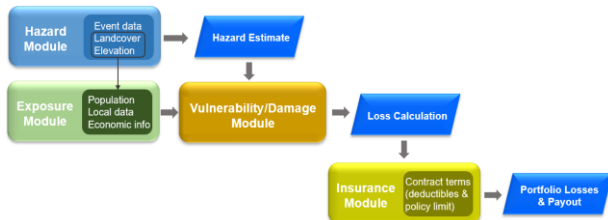
## About TCE

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.

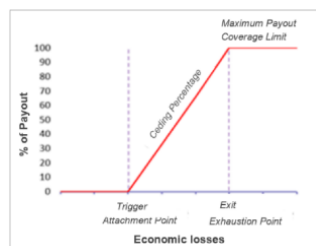
The Tropical Cyclone Explorer (TCE) software package is a dedicated interface, developed by the ARC to allow users to easily access all the model data and view the characteristics of the cyclone (trajectory, wind speed, storm surge heights, etc.), calculate the affected population as well as the economic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

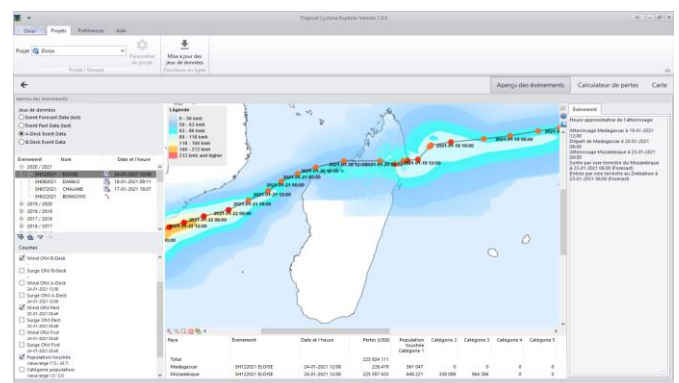
- P MCLD Payout Amount
- L Coverage limit
- AP Attachment Point
- EP Exhaustion Point

- 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.