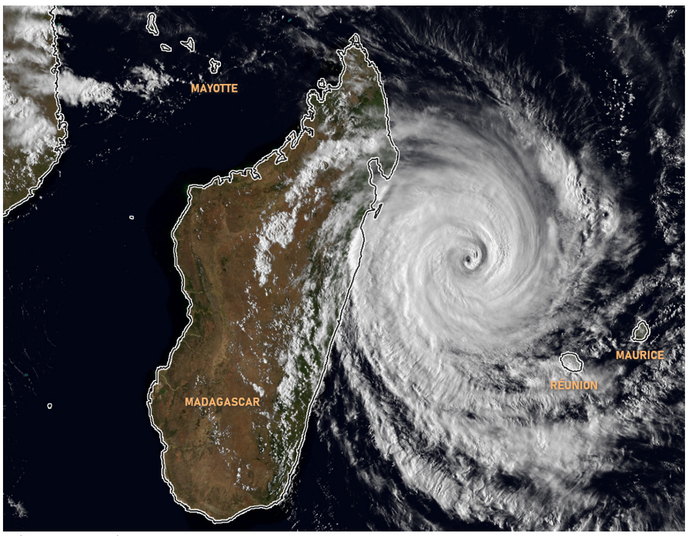
Policy Brief

Resilience of Traditional Houses in Madagascar :
Urgent measures to be implemented to reduce the vulnerability of coastal communities to cyclones

The RC3 project studied the vulnerability of local communities to cyclones in relation to their traditional houses in the context of climate change. The sensitivity of traditional houses, exposure to cyclones and the adaptive capacity of local communities in the study sites were investigated. The results indicate that the communities and their traditional houses are vulnerable to cyclones and this is likely to increase in the future as the intensity of cyclones may increase due to climate change. Everyone needs to be involved in the urgent need to reduce this vulnerability.

Madagascar is located in a region that makes it particularly vulnerable to the impact of tropical cyclones. These catastrophic events can wreak havoc, causing immense damage to both human life and the economy. Climate change may affect the severity and frequency of cyclones in the future. Madagascar's vulnerability to tropical cyclones is therefore of utmost concern and requires urgent action to strengthen the country's resilience.



photography : Meteo France

The "Resilience of Traditional Houses to Cyclones in a Changing Climate in Madagascar" (RC3) project was launched to study and address the challenge of the vulnerability of traditional houses to cyclones. The main objective of the project was to reduce the risk and impact of cyclones on vulnerable communities by providing adaptation options that can improve the resilience of traditional houses. The RC3 project focused on three coastal localities in Madagascar, namely Fénérive Est, Mananjary and Antalaha. The targeted localities are particularly cyclone-prone, and wind-sensitive traditional wooden huts and wind-sensitive are predominant.

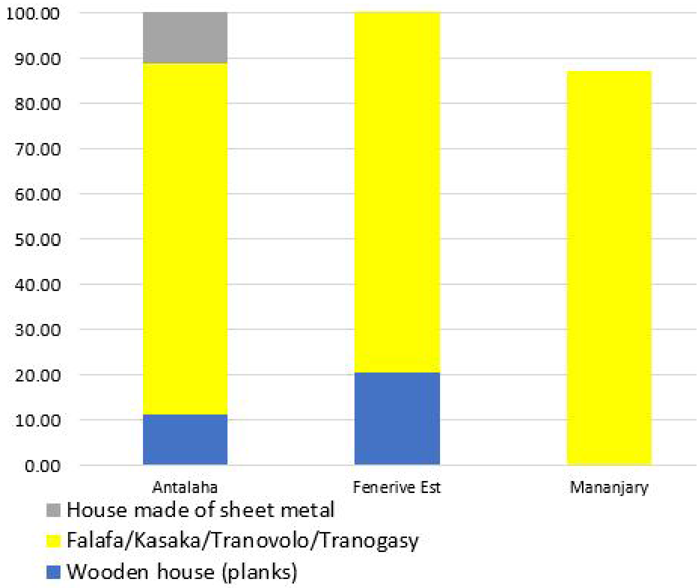


Figure 1. Types of Housing for regions of interest

BOX 1. Climate Study group

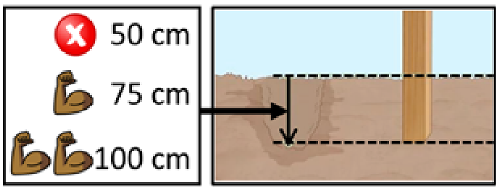
- Previous studies based on observations suggest that tropical cyclones (TCs) in the South Indian Ocean have become less frequent, but that the stronger cyclones have higher wind speeds.
- We have used recent state-of-the-art climate models to analyse TCs characteristics around Madagascar. In particular, we analysed changes in extreme wind speeds between a recent (1980-2010) and future (2020-2050) period, using six climate models for the most active months, such as January. We found a general (slight) decrease in extreme windspeed east of Madagascar, with some regional variation, and a general increase in extreme windspeeds over Madagascar itself and into the Mozambique Channel.
- In summary, the model outputs indicate a change in the geography of cyclone tracks in the coming decades, with fewer cyclones to the East of Madagascar but an overall increase in the Mozambique Channel.
- Nonetheless, extreme wind speeds are projected to increase over parts of Madagascar during some months, as well as decrease in others, with the greatest increase in extreme wind speeds projected for January, during the peak of the cyclone season, in the Northeast and to the West of the country.

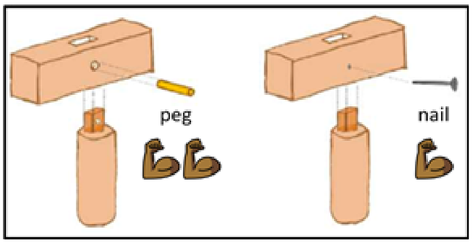
The first component of the RC3 project analyzed extreme wind speeds recent and future tracks of cyclones and tropical storms to understand how the risk to communities in coastal Madagascar will change. They found that extreme wind speeds are expected to increase in some parts of Madagascar during certain months, with the greatest increase expected to take place during January (Cf. BOX 1). Changes in tropical storm and cyclone tracks appear to agree with this. This has important implications for the adaptive capacity of Madagascar's coastal communities and the need to take steps to improve resilience to extreme weather events.

In parallel, the engineering component of the RC3 project recommended increasing the embedding of columns in the ground and using mortise and tenon connectors to improve the wind resistance of a building, especially for the weak points identified in the study (cf. BOX 2). Since the buildings we surveyed generally did not have bracing systems, we did not do extensive testing on bracing, although our limited tests highlighted that bracing is only effective if combined with appropriate connections and foundations. Our tests suggested that the building types we tested would have some roof and wall cladding loss at low wind speeds (around 70 km/h). This could be improved by adding a mid-purlin (see figure 2) and cladding at more points. In some cases, a more complete failure of the system occurred at similar wind speeds of around 70 km/h, and the key to increasing the resistance was to increase the column embedment depth, to 75cm or 100cm, which could enable the building to withstand winds of up to 140 km/h without column failure. The recommendations provided by the CPGU guides are more comprehensive and should be followed to ensure maximum effectiveness, but the points we describe above may help prioritise the key improvements where resources are limited. In light of these challenges, there is a need to improve the resilience of coastal communities in Madagascar to tropical cyclones. This requires not only improving the physical

BOX 2. Engineering Study group

- The primary aim for the project was to understand the current vulnerability of communities, not to tell people how to improve their houses.
- This is useful because it helps NGOs and government to focus their efforts on the most vulnerable.
- We agree with the advice given by GPCU Guides such as “Guide Pour Amelioration De La Resistance Des Cases Habitation Traditionnelle Face Aux Cyclones” BY CPGU. Their guidance is much more complete than the sugges3ons we will give.
- Our work, however, quantifies the benefit gained from each change, so if someone only has the resources to make one or two changes, this can help them prioritise.
- Because of the testing we have done on building system we can suggest some changes which make a big difference to the wind resistance of the building:
  - Increasing the embedment of the columns into the ground to 75cm or 100cm,
  - Using connectors in mortise and tenon connections. The wooden pegs we’ve tested have generally been stronger than the nailed connections.
  - Using a mid-purlin (see Figure 2) and strengthening purlin-to-rafter connections.





infrastructure of buildings but also addressing social, economic, and cultural factors that affect the ability of communities to prepare for and respond to these events.

The project identified six factors that determine adaptive capacity (cf. Table 1), with only one factor, information and communication related to the early warning system, having a high value.

Figure 2. Members and connections in the roof structure

The other five factors, including economic resources, human resources, governance, technical skills, and socio-cultural factors, are constraining adaptive capacity, and the level of adaptive capacity is typically low in all three sites.

Table 1. Determinants and indicators of Adaptive capacity

DETERMINANT	INDICATORS
Economic resources	Energy source for light
	Materials in possession
	Materials for transport
	Diversified livelihoods
	Ability to save money
Information and communication (IC)	IC on construction technique
	Early warning system (EWS)
Human resources	Man head of household
	Education level
Governance	Building permission
	Guide to building resilient houses
Technology and technics	Origins of construction techniques
	Application of the guides
Socio-cultural	Help for the (re)construction of the houses

One of the key challenges is the lack of economic resources among many households in these communities. This makes it difficult for them to invest in building resilient houses or to take measures to protect themselves during a storm. To address this, financial support from NGOs and the government could be provided in the form of grants, low-interest loans, or other forms of financial assistance. This would enable households to make the necessary investments in their homes and communities to improve their resilience.

The human resources determinant highlights the importance of considering vulnerable groups, such as women and those with low levels of education, in efforts to improve resilience.

Support programs should be tailored to address the unique needs and challenges faced by women and other vulnerable groups. This could include training programs, community-based education initiatives, and gender-sensitive policies.

The governance determinant reveals that the CPGU guide to resilient house construction techniques is not widely disseminated. Efforts are needed to promote the guide and ensure its widespread adoption. This could involve working with local leaders and community organizations to raise awareness of the guide and provide training and support to help communities implement these techniques. This would enable communities to build homes that are better able to withstand the impact of tropical cyclones and other extreme weather events.

The socio-cultural determinant highlights the importance of restoring the system of mutual aid, which used to be characteristic of Malagasy culture.This system involves community members coming together to support each other during times of need, such as after a storm. Restoring this system could help those who are weak or lack the means to pay masons to build resilient homes. Creating community-based programs that encourage mutual aid and cooperation among community members would enable them to support each other during times of crisis.

Finally, the technical determinant emphasizes the need for training and sensitization among local communities to apply existing resilient house construction standards. Traditional house constructions often do not follow these standards, which puts communities at risk during a storm. Training programs and awareness campaigns could help to improve understanding and adoption of these standards, leading to stronger and more resilient houses.

AKNOWLEDGEMENT
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