

## **Hydrological risks in anthropized watersheds: modeling of hazard, vulnerability and impacts on population from south-west of Madagascar**

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Hydrological risks, especially for floods, are recurrent on the Fiherenana watershed - southwest of Madagascar. The city of Toliara, which is located at the outlet of the river basin, is subjected each year to hurricane hazards and floods. The stakes are of major importance in this part of the island. This study begins with the analysis of hazard by collecting all existing hydro-climatic data on the catchment. It then seeks to determine trends, despite the significant lack of data, using simple statistical models (decomposition of time series). Then, two approaches are conducted to assess the vulnerability of the city of Toliara and the surrounding villages. First, a static approach, from surveys of land and the use of GIS are used. Then, the second method is the use of a multi-agent-based simulation model.

The first step is the mapping of a vulnerability index which is the arrangement of several static criteria. This is a microscale indicator (the scale used is the housing). For each House, there are several criteria of vulnerability, which are the potential water depth, the flow rate, or the architectural typology of the buildings.

For the second part, simulations involving scenes of agents are used in order to evaluate the degree of vulnerability of homes from flooding. Agents are individual entities to which we can assign behaviours on purpose to simulate a given phenomenon. The aim is not to give a criterion to the house as physical building, such as its architectural typology or its strength. The model wants to know the chances of the occupants of the house to escape from a catastrophic flood. For this purpose, we compare various settings and scenarios. Some scenarios are conducted to take into account the effect of certain decision made by the responsible entities (Information and awareness of the villagers for example). The simulation consists of two essential parts taking place simultaneously in time: simulation of the rise of water and the flow using classical hydrological functions and multi agent system (transfer function and production function) and the simulation of the behaviour of the people facing the arrival of hazard.