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From Tsunami Hazard Modelling to Vulnerability Assessment in Mayotte's east coast: an Interdisciplinary Risk Analysis

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Mayotte island is divided in two main islands, Grande Terre (363 km²) and Petite Terre (11 km²), and is located in the Comoros archipelago in the Indian Ocean between Madagascar and Mozambique. From a social point of view, this French department is characterised by a young and highly vulnerable population (over 70% live below the poverty line). Furthermore, many households are exposed to hazards such as floods and landslides, cyclones, earthquakes and tsunamis. Concerning these last two, the 2018 seismo-volcanic crisis linked to Fani Maoré (the submarine volcano located 50 km east of Mayotte) has generated a demand from the local and national authorities for decision support elements to implement a risk prevention strategy and anticipate crisis situations.

The objective of this study is to question the interdisciplinary contributions of landslide-generated tsunami numerical modelling and geographical analysis in order to characterise Mayotte's vulnerability regarding tsunami hazard. By combining the results of numerical simulations performed with the HySea model (Poulain et al, 2022) with available data on the assets (location, level of vulnerability to tsunami risk, etc. (Sahal, 2011)), we carried out a spatial analysis to identify the critical areas in the event of a tsunami, and the consequences of their potential damage.

Our results provide a characterisation of land use in hazard prone areas for four levels of hazard, from low to very high, resulting from the correlation of water depths and velocity. They also support an analysis of the vulnerability of part of the built environment of Petite Terre (which is most at-risk) by mapping these hazard data with vulnerability data at building level. Although the proportion of buildings and roads potentially affected remains relatively low (around 3%), the modelled scenario highlights major organisational vulnerability. Indeed, early warning strategies and systems are challenged on the one hand by the arrival times of the first simulated wave (between 4 min at the airport in the south of Petite Terre, and 13,5 min in Mamoudzou, the capital located to the east of Grande Terre (Poulain et al., 2022)), and on the other by the complexity of detecting a submarine landslide in advance if it is not generated by an earthquake.

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