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The 1843 earthquake: a maximising scenario for tsunami hazard assessment in the Northern Lesser Antilles?

Jean Roger, Narcisse Zahibo, Bernard Dudon, and Yann Krien

Université des Antilles et de la Guyane, Laboratoire de Recherche en Géosciences et Energies, Guadeloupe (jeanrog@hotmail.fr)

The French Caribbean Islands are located over the Lesser Antilles active subduction zone where a handful of earthquakes historically reached magnitude Mw=6.0 and more. According to available catalogs these earthquakes have been sometimes able to trigger devastating local or regional tsunamis, either directly by the shake or indirectly by induced landslides. For example, these islands have severely suffered during the Mw$\sim$7.5 Virgin Islands earthquake (1867) triggering several meters high waves in the whole Lesser Antilles Arc and, more recently, during the Mw=6.3 Les Saintes earthquake (2004) followed by a local 1 m high tsunami. However, in 1839 a Mw$\sim$7.5 subduction earthquake occured offshore Martinica followed a few years after by the more famous 1843 Mw$\sim$8.5 megathrust event, with an epicenter located approximately between Guadeloupe and Antigua, but both without any catastrophic tsunami being reported. In this study we discuss the potential impact of a maximum credible scenario of tsunami generation with such a Mw=8.5 rupture at the subduction interface using available geological information, numerical modeling of tsunami generation and propagation and high resolution bathymetric data within the framework of tsunami hazard assessment for the French West Indies. Despite the fact that the mystery remains unresolved concerning the lack of historical tsunami data especially for the 1843 event, modeling results show that the tsunami impact is not uniformly distributed in the whole archipelago and could show important heterogeneities in terms of maximum wave heights for specific places. This is easily explained by the bathymetry and the presence of several islands around the mainland leading to resonance phenomena, and because of the existence of a fringing coral reef surrounding partially those islands.