
Forearc crustal faulting and associated tsunami hazard in the upper plate of subduction zones. Case study of the Morne Piton fault system (Lesser Antilles, Guadeloupe Archipelago).

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Résumé

In this study, alternatively to the megathrust we identify upper plate normal faults orthogonal to the trench as a possible tsunami source along the Lesser Antilles Trough. We determine the seismic and tsunami hazard of the Morne Piton fault system, a trench-perpendicular upper crustal fault affecting the Lesser Antilles forearc at the latitude of Guadeloupe. By the means of seismic reflection, high resolution bathymetry, Remotely Operated Vehicle images and dating: we reassess the slip rate of the Morne Piton fault at 0.2 mm.yrs⁻¹ since fault inception (i.e. 7 Ma), dividing by five previous estimations and thus lowering the earthquake time recurrence and associated hazard. we evidence a metric scarp with striae at the toe of the Morne Piton fault system suggest a recent fault rupture. Along this fault system, we estimate a rupture area of ~ 675 km² and then a magnitude range for the seismic event between 6.5 ± 0.5 . We present results from a multi-segment tsunami model representative for the worst-case scenario which give an overview of what could happen in terms of tsunami generation if the whole identified Morne Piton fault segments ruptured together. Our model illustrates the impact of local tsunamis sources on the surrounding coastal area as well as local bathymetric controls on tsunami propagation as (i) shallow water plateaus trigger secondary sources and are responsible for a wrapping effect around the island of Marie-Galante, (ii) canyons are focusing and enhancing the wave height in front of the most touristic and populated town of the island, (iii) a resonance phenomenon is observed in Les Saintes archipelago showing that the waves' frequency content is able to perturbate the sea-level during many hours after the seismic rupture and (iv) evidence the importance of submarine morphological features located at the coast vicinity.

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Mots-Clés: Petites Antilles forearc faulting tsunami hazard