



Observed and estimated economic losses in Guadeloupe (French Antilles) after Les Saintes Earthquake (2004). Application to risk comparison

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The main objective of this work is to compare the potential direct economic losses between two different hazards in Guadeloupe (French Antilles), earthquakes and storm surges, for different return periods. In order to validate some hypotheses which are done concerning building typologies and their insured values a comparison between real economic loss data and estimated ones is done using a real event.

In 2004 there was an earthquake in Guadeloupe, Mw 6.3, in a little archipelago in the south of Guadeloupe called Les Saintes. The heaviest intensities were VIII in the municipalities of Les Saintes and decreases from VII to IV in the other municipalities of Guadeloupe. The CCR, French Reinsurance Organism, has provided data about the total insured economic losses estimated per municipality (in a situation in 2011) and the insurance penetration ratio, it means, the ratio of insured exposed elements per municipality. Some other information about observed damaged structures is quite irregular all over the archipelago, being the only reliable one the observed macroseismic intensity per municipality (field survey done by BCSF). These data at Guadeloupe's scale has been compared with results coming from a retro damage scenario for this earthquake done with the vulnerability data from current buildings and their mean economic value of each building type and taking into account the local amplification effects on the earthquake propagation.

In general the results are quite similar but with some significant differences. The results coming from scenario are quite correlated with the spatial attenuation from the earthquake intensity; the heaviest economic losses are concentrated within the municipalities exposed to a considerable and damageable intensity (VII to VIII). On the other side, CCR data show that heavy economic damages are not only located in the most impacted cities but also in the most important municipalities of the archipelago in terms of economic activity (industry, commerce and tourism), even if in these municipalities intensities were quite smaller (V to VI in EMS98 scale). It seems that damage scenario cannot consider completely this situation and the greater complexity of industrial and commercial areas.

The next work is to compare seismic risk and storm surge risk in a little scale (for 3 municipalities in Pointe à Pitre area, the capital of Guadeloupe), in terms of potential direct economic losses for different return periods. The methodology therefore relies on (i) a probabilistic hazard assessment, (ii) a loss ratio estimation for the exposed elements and (iii) an economic estimation of these assets.

Seismic hazard assessment was done for return periods of 100, 475, 1000 and 5000 years. Storm surge hazard assessment is based on the selection of relevant historical cyclones and on the simulation of the associated wave and cyclonic surge. The combined local sea elevations, called "set-up", are then fitted with a statistical distribution in order to obtain its time return characteristics. Several run-ups are then extracted, the inundation areas are calculated and the relative losses of the affected assets are deduced.

Current building vulnerability was adapted for each single risk, vulnerability indices (RISK-UE method) for seismic risk and vulnerability functions for storm surge. State of art of available vulnerability functions in storm surge and floods in tropical context has been done (CAPRA software, HAZUS software) even if these functions do not consider explicitly the local context in Guadeloupe. Damages caused by wind are not considered. The past storm surge events in French Antilles data are not enough to build new vulnerability functions.

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