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SMOOTHED SEISMICITY APPROACH FOR THE SEISMIC HAZARD ASSESSMENT OF THE CARIBBEAN REGION

Seismic hazard assessment for Cuba and the surrounding regions has been performed according to the methodology recently applied in the United States for the national seismic hazard map (Frankel, 1995). In this approach the spatially smoothed seismicity is used to derive the hazard estimates. The major motivation for directly using the smoothed seismicity methodology is to avoid to draw seismic sources in a region where the structures causative of seismicity are not well known.

We have applied the logic tree approach (Kulkarni et al., 1984) to take into account different choices for the seismicity characteristics: the logic tree consists of 24 branches. More precisely, we have defined three different seismicity models according to the threshold magnitude used and the method applied for the rate computation: magnitude 3 and 5 using the corresponding complete parts of the catalogue, and magnitude 3 considering a normalisation scheme of the magnitudes with different completeness periods. In addition, four different models for the seismicity parameter computation have been considered. This is a notable variation with respect to the original approach and is based on the evidence of seismotectonic heterogeneity of the study region and, therefore, that different $b$-values and maximum magnitudes can be proposed for different parts of it. The study region, in fact, has been considered as whole, and subdividing it into two and three parts: two different hypotheses have been taken into account when subdividing Cuba into 3 parts (Fig. 1). These subdivisions are motivated by the presence in the study region of the contact between the North American plate and the Caribbean one and the major seismicity is concentrated along this boundary. The difference among various sectors of Cuba is also supported by the $b$-values we obtained. Furthermore, two different attenuation relations (Dahle et al., 1995; Ambraseys et al., 1996) have been applied to compute the acceleration estimates. Different weights have been assigned to the different branches of the logic tree and the final hazard map represents a nice balance of the present knowledge on the Cuban seismicity.

The results coming from the different branches have been compared as well and the individual maps show some similarities and differences. The regional subdivisions we have introduced to characterise the seismicity pattern play an important role and the results reflect this fact. This aspect could be seen as a sort of inclusion of seismotectonic contents into an approach that is based on the contrary on seismicity only. It is not the case, because the analysis of the seismicity pattern pinpoints some characteristics that are hidden when a single zone is considered for whole Cuba. It is interesting to compare the specific features of each map with the seismicity distribution to investigate the capability of the hazard maps to mimic the seismogenic pattern and to point out where events which occurred in the previous centuries play only a marginal role because of the computational approach used. Entering into details, a high hazard can be seen in all maps along the southern coast of Cuba, around Santiago.
Fig. 1 - Models used to compute the seismicity parameters (b-value and maximum magnitude). The plate boundary between the American and Caribbean plates has been modelled separating the two plates or with a specific area (c) and sector (d). The triangular area in southern Cuba has been introduced to smooth the values between the neighbouring areas.

A comparison between these hazard estimates and those computed according to the standard approach of the seismotectonic probabilism (Cornell, 1968) points out the areas where the space distribution of the seismicity supports the seismogenic zonation and the areas where a disagreement exists. In particular, with the smoothed seismicity approach higher hazard is found along the southern Cuban coast with respect to the results obtained with the standard approach, while the neighbouring Hispaniola island results less dangerous.

REFERENCES