



Seismic Scenarios for Mexico City

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The high seismic potential of south-central Mexico and its destructive effects on Mexico City (MC) has been shown over the last several centuries. For example, the 7th of April 1845 a large ($M_s 7^+$) shallow thrust subduction (ST) earthquake with an epicentral distance of about 250 km from MC occurred in the coasts of the state of Guerrero, a Maximum Mercalli Modified Intensity (MMI) of X was reported in MC. Also, in 1854 a large ($M_s > 7^+$) intermediate depth normal mechanism (ID) earthquake occurred in southeastern Mexico, at an epicentral distance of about 200 km from MC, a maximum MMI of IX was reported in the latter. Furthermore, in 1912 a $M_s 6.9$ shallow intraplate normal (SN) event occurred in the Transmexican Volcanic Belt at an epicentral distance of 100 km from MC, the Maximum MMI reported for this event was of IX in MC. Finally, the 19th of September 1985 an $M_s 8.1$ ST earthquake with an epicentral distance of about 240 km from MC occurred in the coasts of the state of Michoacan, a maximum MMI of X was reported in MC. Also, for this event maximum ground accelerations (A_{max}) up to 40 and 170 cm/s² were recorded on its stiff (S) and compressive (C) soils, respectively, and their associated maximum response spectra accelerations (Sa_{max}) were of about 120 and 965 cm/s², respectively.

The frequency of occurrence of large ST, ID and SN earthquakes in Mexico is poorly known but it might vary from decades to centuries [1]. On the other hand, the beginning of the recordings of strong ground motions in MC dates from the early 1960's and most of them were recorded after the 19/09/1985 earthquake. Therefore, the bulk of strong ground motions observations in MC, particularly for large events of the

three types mentioned above, is reduced to about ten recordings for the ST 19/09/1985 event.

In order to fulfill the lack of strong ground motions records for large damaging events, which are of extreme importance for MC seismic hazard purposes [2], in this work we have generated broadband synthetics, expected in MC stiff and compressive soils, associated to seismic scenarios for ST, ID and SN earthquakes. The proposed scenarios are based on the seismic history and update seismotectonic, seismological, geophysical, and geotechnical information for south-central Mexico and for MC. The synthetics were generated by a hybrid model combining long period and high frequency simulations. The low frequency ($< 1\text{Hz}$) synthetics were simulated by using a fourth order finite difference method including a finite-fault description of the sources of the ST, IT and SN earthquakes [3]. The high frequencies ($> 1\text{Hz}$) were modeled by the empirical Green function technique [4]. The results obtained with this hybrid model had already been satisfactorily compared with the near, the intermediate and the far field (including the local soil effects) observations of the 9th of October 1995 Colima-Jalisco Mw 8 earthquake [5].

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