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GROUND MOTIONS IN THE NEAR FIELD

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Unexpected large ground motions have been recorded in the near field in the case of several recent earthquakes and this aspect has frequently caused criticism to the estimates obtained by probabilistic seismic hazard analyses represented by the national seismic hazard maps considered by the building code of various countries.

Several ground motion prediction equations (GMPEs) are suitable for probabilistic seismic hazard assessment (PSHA) in north-eastern Italy: those of global applicability (e.g., Cauzzi and Faccioli, 2008), those calibrated on European data (e.g., Akkar and Bommer, 2010, Ambraseys and Simpson, 1996), and those specifically computed for the Italian territory (e.g., Sabetta and Pugliese, 1996; Bindi et al., 2011). The most important limit in the definition of almost all GMPEs is represented by the scarcity of instrumental recordings in the near field. This fact determines that almost all GMPEs are not calibrated for distances less than 20 km. The usual approach followed in PSHA consists either in extrapolating the functional form also outside their distance range of definition or in introducing an asymptotic upper bound for the near field. Given this intrinsic limit in modelling the shaking in the near field, larger and larger ground motions have been recently recorded, unexpected according to the standard seismic hazard maps. Conversely, the recent Ferrara earthquake, together with its aftershocks, has provided a huge amount of data in the near field, showing a large excess of recorded data with respect to code provision, that some authors explain as mainly due to the simplified model of site amplification as soil classes. Moreover, the spectral shape that the cited GMPEs forecast is quite different in the high frequency range.

Summing up all the aspects cited above, it is reasonable to state that the uncertainty associated to any result of a PSHA is almost unknown but surely quite large when the study site is located in the proximity of seismogenic sources.

In this work, recent GMPEs suitable for north-eastern Italy have been applied for the computation of the uniform hazard response spectrum (UHRS) of a site close to the major seismogenic source in north-eastern Italy by applying different hypotheses about the application of the GMPEs themselves in the near field and the variety of obtained UHRSs are analysed.

More precisely, seismic hazard has been computed for the Friuli - Venezia Giulia region, in north-eastern Italy, considering a logic tree simplified with respect to that already applied for the regional PSHA (Slejko et al., 2011). In fact, the only node refers to the attenuation model where 3 (Ambraseys and Simpson, 1996, Bindi et al., 2011, Cauzzi and Faccioli, 2008) GMPEs have been taken into account. GMPEs have been either 1) extrapolated in the near field, where they are not calibrated, or 2) asymptotically limited in the near field. Introducing a sort of empirical correction,

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derived from the near field evidence during the Ferrara earthquakes, the possible variability in the expected ground motion is ulteriorly evaluated and GMPEs are 3) modified according to the Ferrara evidence.

The influence of each of these operations on all GMPEs considered has been evaluated and quantified on the basis of the computed UHRs and a total aggregate epistemic uncertainty has been quantified in addition to the aleatory one already considered in the standard PSHA.

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