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Comparison between the seismic amplification values obtained from the Italian second-level microzonation (SM2) abacuses and numerical simulation

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The Italian second level seismic Microzonation (SM2) aims to solve the uncertainties of the first level with new studies and gives a numeric estimate of seismic amplification through simplified methods. Seismic amplification occurs when the seismic waves reach a site composed at the top by a low velocity and loosened layer and, at the bottom, by a high velocity (Vs > 800 m/s) and rigid layer. SM2 is a simplified approach that can be applied only to 1D subsoil model (i.e., homogenous parallel layers). It consists of several tables of correspondences, called seismic abacuses, that allow to obtain two different seismic amplification factors (AF) values expected at the site: AFa and AFv. AFa corresponds to the low period amplification factor and is determined around the proper period for which there is the maximum acceleration response, whereas AFv corresponds to the amplification factor over long periods for which the maximum pseudo-speed response is obtained. These abacuses were obtained for specific lithologies of sediment cover (i.e., silt, that consists of all cohesive lithologies, sand and gravel), for established shear waves trend (i.e., constant, maximum or intermediate slope), for established peak ground acceleration at site (i.e., ag = 0.06 g, 0.18 g, 0.26 g) and for established range of seismic bedrock depth (5 m – 150 m) and for velocity of Vs30 or Vs equivalent (150 m/s – 700 m/s). Since the abacuses are thought to be applied for the whole national territory and are not site dependent, this study aims to understand if the seismic amplification factors obtained from these abacuses are representative of the actual values obtained from numerical simulation concerning the Friuli Venezia Giulia plain and if they under/overestimate the seismic hazard. Data has been collected from the Italian National Civil Protection repository and analyzed to obtain the necessary parameters to enter the abacuses. With the same data, several numerical simulations were carried out to obtain the site seismic amplification factors. The results were analysed from different perspectives: soil category obtained from Italian regulation, lithology cover soil, slope of the shear wave velocity - depth curve, and depth of the seismic bedrock. The AF obtained from seismic numerical simulations are higher with respect to the those from abacuses; the AF obtained from silt soils have the highest values; the AF from abacuses are greater than the AF obtained from simulations except for the sites where the slope of shear wave velocity - depth curve is considered maximum, i.e., where the seismic bedrock is shallow. Lastly, apart from some isolated values, the AFa ranges for sites characterized by a

seismic bedrock depth lower than 30 m and higher than 30 m, are 1 to 3 and 2 to 5, respectively, while the AFv ranges are 1 to 2 and 1.25 to 4.5, respectively. In general, it is noted that abacuses underestimate the local seismic site effects except for the sites that have a shallow seismic bedrock. Moreover, there were identified no trends between abacuses AF and the ones from numerical simulations.