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Impact of geological information on scenario based hybrid ground motion simulations in Izmir, Turkey

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Peak ground motion levels and frequency content from an expected future scenario earthquake can be estimated from deterministic ground motion simulations. This information is valuable for engineering applications and risk mitigation. In this study we investigate the variability in simulated ground motions due to uncertainty in input parameters adopted in the simulations, such as fault dimensions, rupture geometry and rupture parameters (slip, rupture velocity, rise time etc.). We have calculated broad-band frequency ground motions on various sites within Izmir, the third largest city of Turkey, and discuss the differences in peak ground motion as well as the dominating frequencies for bedrock conditions at different locations. While a magnitude 6.9 earthquake along Izmir fault, underlying the city of Izmir, will result in strong ground shaking exceeding 700 cm/s2 and 60 cm/s for acceleration and velocity, respectively, it is in this study verified that the resulting peak ground motions and frequency content are highly dependent on the input parameters. These parameters are to a large extent controlled by regional stresses and structural style, cumulative deformation, fault kinematics and fault rupture complexities. It is therefore very important to take available geological/ paleoseismological information into account in several possible earthquake scenarioss when assessing the deterministic seismic hazard for an area.

Furthermore, we have conducted a field study from which we have obtained H/V curves from selected sites in order to quantify local site amplification. The observed dominant frequencies for site conditions are compared with the dominant frequencies for bedrock conditions obtained from the simulations. In the northern part of the city, high simulated ground motion levels are found at frequencies where local site amplifications are expected to occur, presenting a significant challenge for the future.