EGU21-7967
https://doi.org/10.5194/egusphere-egu21-7967
EGU General Assembly 2021

Identifying the main factors that control Probabilistic Seismic Hazard Assessment (PSHA) in the Aegean area: Results from OFAT (One Factor at A Time) analysis

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The broader Aegean area is one of the highest seismicity regions in Europe, with almost half of the European seismicity released in this region, often with damaging mainshocks, such as the recent **M**7.0 Samos event. While several Probabilistic Seismic Hazard Assessment (PSHA) studies have been performed for this area, an attempt to quantify the main factors controlling PSHA has not been performed. To study the effect that each input factor (seismic source model, GMPE, seismicity parameters, etc.) has on the seismic hazard calculations, an **OFAT** (One Factor at A Time) analysis has been conducted. For this analysis we considered two standard peak ground motion parameters, PGA and PGV, for a typical PSHA scenario, namely 10% probability of exceedance for a mean return period of 50 years (equivalent to a 476 yr return period). For the analysis the following factors were considered: a) Four (4) seismicity area-type source models for the broader Aegean area (Papazachos, 1990; Papaioannou and Papazachos, 2000; Woessner et al., 2015; Vamvakaris et al., 2016), as well as various uncertainties for the associated G-R seismicity parameters and active fault geometries of each seismic source, b) ten (10) Ground Motion Prediction Equations (GMPEs), which contain four NGA-West2 (Abrahamson et al., 2014; Boore et al., 2014; Campbell and Bozorgnia, 2014; Chiou and Youngs, 2014), two European (Bindi et al., 2011; Cauzzi and Faccioli, 2008) and four "Greek" (Theodulidis and Papazachos, 1992; Skarlatoudis et al., 2003; Danciu and Tselentis, 2007; Chousianitis et al., 2018) equations, as well as a variable number of sigma for each equation and, c) the minimum (Mmin) and maximum (Mmax) source magnitude of each seismic source. Tornado diagrams (Howard, 1988) were generated for 42 selected sites of seismological interest that span the study area, allowing to explore the extent of each factor's effect on the PSHA results. The sensitivity analysis results suggest that the GMPE selection, as well as uncertainties in the G-R parameters **a** and **b** are the most critical factors, significantly affecting the PGA/PGV levels for all sites. They also reveal a strong correlation of PSHA sensitivity with other seismicity parameters. For example, the employed source model and Mmax play a more critical role for regions of low seismicity, while the least important factor is the selected Mmin. The spatial distribution of the PSHA sensitivity on the various factors considered was also examined through the generation of several maps, exposing regions of high and of low

PSHA uncertainty. The results can be efficiently employed by scientists and engineers in order to focus research and application efforts for a targeted uncertainty minimization of the most critical factors (which may not be the same for all sub-regions of the examined Aegean area), as well as to evaluate the reliability and uncertainty of the current PSHA estimates that are employed in seismic design.