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Probabilistic seismic hazard study based on active fault and finite element geodynamic models

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We present a probabilistic seismic hazard analysis (PSHA) that is exclusively based on active faults and geodynamic finite element input models whereas seismic catalogues were used only in a posterior comparison. We applied the developed model in the External Dinarides, a slow deforming thrust-and-fold belt at the contact between Adria and Eurasia.. is the Our method consists of establishing s two earthquake rupture forecast models: (i) a geological active fault input (GEO) model and, (ii) a finite element (FEM) model. The GEO model is based on active fault database that provides information on fault location and its geometric and kinematic parameters together with estimations on its slip rate. By default in this model all deformation is set to be released along the active faults. The FEM model is based on a numerical geodynamic model developed for the region of study. In this model the deformation is, besides along the active faults, released also in the volumetric continuum elements. From both models we calculated their corresponding activity rates, its earthquake rates and their final expected peak ground accelerations. We investigated both the source model and the earthquake model uncertainties by varying the main active fault and earthquake rate calculation parameters through constructing corresponding branches of the seismic hazard logic tree. Hazard maps and UHS curves have been produced for horizontal ground motion on bedrock conditions VS 30 $\geq$ 800 m/s), thereby not considering local site amplification effects. The hazard was computed over a 0.2° spaced grid considering 648 branches of the logic tree and the mean value of 10% probability of exceedance in 50 years hazard level, while the 5th and 95th percentiles were also computed to investigate the model limits. We conducted a sensitivity analysis to control which of the input parameters influence the final hazard results in which measure. The results of such comparison evidence the deformation model and with their internal variability together with the choice of the ground motion prediction equations (GMPEs) are the most influencing parameter. Both of these parameters have significan affect on the hazard results. Thus having good knowledge of the existence of active faults and their geometric and activity characteristics is of key importance. We also show that PSHA models based exclusively on active faults and geodynamic inputs, which are thus not dependent on past earthquake occurrences, provide a valid method for seismic hazard calculation.