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High-frequency ground motion scaling in the Gulf of Corinth (Greece)

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The evaluation of the expected peak ground motion caused by an earthquake is of great importance in seismicity and earthquake engineering studies. In the present study, weak-motion data related to small earthquakes are used, in order to extrapolate peak ground motion parameters beyond the magnitude range of the weak-motion dataset, on which they are calculated. A complete description of the seismic ground-motion characteristics in the Gulf of Corinth region in Greece is provided, with parameterization of the attenuation of seismic ground motions with distance and their variability in excitation with earthquake magnitude.
We use over 1000 earthquakes recorded at the Hellenic Unified Seismic Network (HUSN) with magnitudes larger than 2.5 M_L. Following a regression analysis of this large number of weak-motion data, we determine a frequency-dependent crustal quality factor, a geometrical spreading function and the absolute source scaling. In order to calibrate sufficiently the source scaling, it is necessary to use the available moment magnitude values of events from the selected dataset. The National Observatory of Athens Moment Tensor Database (NOA-MTs) is used, which includes 52 events in the range 3.3 to 5.4 M_W for the time period in analysis. Complementary, we calculate moment tensor solutions with high-quality for small events not included in the NOA-MTs catalogue, using the "Cut And Paste" technique.
Results on region-specific crustal attenuation and source scaling, together with the effective duration of seismic ground motion in the region, are used to estimate the peak ground motion parameters, such as PGA, PGV, and SA at different frequencies. Using stochastic ground motion simulations, we predict the absolute level of ground shaking and compare them with strong motion data in the region. The attenuation of simulated ground motion is compared with recent global and regional ground motion prediction equations (GMPEs). The performance of the stochastic model is also tested against moderate sized earthquakes ($\sim$5-6 M_W) recorded by HUSN in the area under study.