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How sensitive is earthquake ground motion to source parameters? Insights from a numerical study in the Mygdonian basin

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Understanding the origin of the variability of earthquake ground motion is critical for seismic hazard assessment. Here we present the results of a numerical analysis of the sensitivity of earthquake ground motion to seismic source parameters, focusing on the Mygdonian basin near Thessaloniki (Greece).
We use an extended model of the basin (65 km [EW] x 50 km [NS]) which has been elaborated during the Euroseistest Verification and Validation Project.
The numerical simulations are performed with two independent codes, both implementing the Spectral Element Method. They rely on a robust, semi-automated, mesh design strategy together with a simple homogenization procedure to define a smooth velocity model of the basin.
Our simulations are accurate up to 4 Hz, and include the effects of surface topography and of intrinsic attenuation.

Two kinds of simulations are performed: (1) direct simulations of the surface ground motion for real regional events having various back azimuth with respect to the center of the basin; (2) reciprocity-based calculations where the ground motion due to 980 different seismic sources is computed at a few stations in the basin.
In the reciprocity-based calculations, we consider epicentral distances varying from 2.5 km to 40 km, source depths from 1 km to 15 km and we span the range of possible back-azimuths with a 10 degree bin.

We will present some results showing (1) the sensitivity of ground motion parameters to the location and focal mechanism of the seismic sources; and (2) the variability of the amplification caused by site effects, as measured by standard spectral ratios, to the source characteristics