Seismic shaking scenarios for city of Zagreb, Croatia

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In order to assess the seismic shaking levels, following the strong Zagreb March 22nd 2020 earthquake, we compute broadband seismograms using a hybrid technique. In a hybrid technique, low frequency (LF, f < 1 Hz) and high frequency (HF, f = 1–10 Hz) seismograms are obtained separately and then merged into a single time series. The LF part of seismogram is computed using a deterministic approach while for the HF part, we adopt the semi-stochastic method following the work of Graves and Pitarka (2010). For the purposes of the simulation, we also assemble the 3D velocity and density model of the crust for the city of Zagreb and its surrounding region. The model consists of a detailed description of the main geologic structures that are observed in the upper crust and is embedded within a greater regional EPCrust crustal model (Molinari and Morelli, 2011). To test and evaluate its performance, we apply the hybrid technique to the Zagreb March 22nd 2020 Mw = 5.3 event and four smaller (3.0 < Mw < 5.0) events. We compare the measured seismograms with the synthetic data and validate our results by assessing the goodness of fit for the peak ground velocity values and the shaking duration. Furthermore, since the 1880 Mw = 6.2 historic earthquake significantly contributes to the hazard assessment for the wider Zagreb area, we compute synthetic seismograms for this event at two different hypocenter locations. We calculate broadband waveforms on a dense grid of points and from these we plot the shakemaps to determine if the main expected ground-motion features are well-represented by our approach. Lastly, due to the events that occurred in the Petrinja epicentral area at the end of 2020, we decided to extend our 3D model to cover the area of interest. We will present the preliminary results of the simulation for the December 29th 2020 Mw = 6.4 strong earthquake, as well as our plans for further research.