

Residual Analysis and Ground Motion Prediction Equation Ranking Metrics for Western Balkan Strong Motion Database

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Abstract : The geological structure of Western Balkans is strongly affected by the collision between Adria microplate and the southwestern Euroasia margin, resulting in a considerably active seismic region. The Harmonization of Seismic Hazard Maps in the Western Balkan Countries Project (BSHAP) (2007-2011, 2012-2015) by NATO supported the preparation of new seismic hazard maps of the Western Balkan, but when inspecting the seismic hazard models produced later by these countries on a national scale, significant differences in design PGA values are observed in the border, for instance, North Albania-Montenegro, South Albania- Greece, etc. Considering the fact that the catalogues were unified and seismic sources were defined within BSHAP framework, obviously, the differences arise from the Ground Motion Prediction Equations selection, which are generally the component with highest impact on the seismic hazard assessment. At the time of the project, a modest database was present, namely 672 three-component records, whereas nowadays, this strong motion database has increased considerably up to 20,939 records with Mw ranging in the interval 3.7-7 and epicentral distance distribution from 0.47km to 490km. Statistical analysis of the strong motion database showed the lack of recordings in the moderate-to-large magnitude and short distance ranges; therefore, there is need to re-evaluate the Ground Motion Prediction Equation in light of the recently updated database and the new generations of GMMs. In some cases, it was observed that some events were more extensively documented in one database than the other, like the 1979 Montenegro earthquake, with a considerably larger number of records in the BSHAP Analogue SM database when compared to ESM23. Therefore, the strong motion flat-file provided from the Harmonization of Seismic Hazard Maps in the Western Balkan Countries Project was merged with the ESM23 database for the polygon studied in this project. After performing the preliminary residual analysis, the candidate GMPE-s were identified. This process was done using the GMPE performance metrics available within the SMT in the OpenQuake Platform. The Likelihood Model and Euclidean Distance Based Ranking (EDR) were used. Finally, for this study, a GMPE logic tree was selected and following the selection of candidate GMPEs, model weights were assigned using the average sample log-likelihood approach of Scherbaum.

Keywords : residual analysis, GMPE, western balkan, strong motion, openquake

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