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Regionally Adaptable Ground Motion Prediction Equation (GMPE) from Empirical Models of Fourier and Duration of Ground Motion

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The current practice of deriving empirical ground motion prediction equations (GMPEs) involves using ground motions recorded at multiple sites. However, in applications like site-specific (e.g., critical facility) hazard ground motions obtained from the GMPEs are need to be adjusted/corrected to a particular site/site-condition under investigation. This study presents a complete framework for developing a response spectral GMPE, within which the issue of adjustment of ground motions is addressed in a manner consistent with the linear system framework. The present approach is a two-step process in which the first step consists of deriving two separate empirical models, one for Fourier amplitude spectra (FAS) and the other for a random vibration theory (RVT) optimized duration (D_{rvto}) of ground motion. In the second step the two models are combined within the RVT framework to obtain full response spectral amplitudes. Additionally, the framework also involves a stochastic model based extrapolation of individual Fourier spectra to extend the useable frequency limit of the empirically derived FAS model. The stochastic model parameters were determined by inverting the Fourier spectral data using an approach similar to the one as described in Edwards and Faeh (2013). Comparison of median predicted response spectra from present approach with those from other regional GMPEs indicates that the present approach can also be used as a stand-alone model. The dataset used for the presented analysis is a subset of the recently compiled database RESORCE-2012 across Europe, the Middle East and the Mediterranean region.