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Ground motion prediction equation tailored for specific hazard assessment: the case of updating PSHA in Germany

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In the framework of probabilistic hazard assessment (PSHA), it is common practice to account for the epistemic uncertainties following a logic tree approach. Among the levels where different branches of alternative models are allowed, the implementation of the ground motion prediction equation (GMPE) logic tree is critical for PSHA due to its strong impact on the propagation of uncertainties. The selection and weighting of the GMPEs for the logic tree from a set of suitable candidates is generally based on both goodness-of-fit scores with respect to the ground motion recorded at the target area, and on expert judgment. In areas of low to moderate seismicity, such as continental Europe, the reduced availability of strong motion recordings above magnitude Mw=5 hamper both the development of regional GMPE based on regression analysis and the ranking of host models. Therefore, the logic trees for such areas generally include either recent models derived from global data sets (e.g., NGA2west PEER project) or ground motion models based on simulations (e.g., NGAeast PEER project). Recent global models are, however, often based on complex functional forms combining explanatory variables that cannot be constrained with the level of information available in low seismic areas like continental Europe. The application of the global model, where some variables are a-priori fixed using default values, is prone to introduce bias in the median model and in under-estimating the overall variability. In this study, we present the approach followed to develop a GMPE calibrated on the NGA2 flat-file data, but tailored for updating the German hazard map. Both, the filter applied to data and the functional form are selected considering the application at hand and exploiting the high quality of the flat-file entries to derive a customized GMPE. The comparison of the tailored model with NGA2 and RESORCE GMPEs is presented in terms of scaling plot and Sammon's map. The comparison with recordings available for the area is presented as well. Finally, we exemplify the impact on hazard by comparing the hazard curves and the disaggregation results for the Cologne site in Germany, considering both the new and existing GMPE as term of comparison.