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Hybrid zoneless probabilistic seismic hazard analysis: Test and first application to SW Germany

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When a probabilistic seismic hazard assessment (PSHA) methodology is applied, some requirements are expected. For example: a minimum of model assumptions, such as seismic source zones and maximum credible magnitude; applicable to large regions characterized by different seismic regimes and regionally varying catalog completeness; and suitable for non-stationary behavior of seismicity for future automatic applications in cases when the spatial and temporal seismicity pattern is changing. However, none of PSHA approaches fully agrees these requirements. Here we develop the hybrid zoneless approach PSHA. For this approach, the acquirement of the earthquake occurrence probability is the same as the standard zoneless approach, which considers bandwidth function as smoothing kernel in the neighboring region of events. Rather than assuming identical parameters for entire assessed region as the standard procedure of zoneless approach, large-scale zones based solely on the large scale geological architecture are introduced. These zones meet the requirements of introducing different seismic catalogue completeness time and bandwidth functions. Another innovation of our approach is to take into account the actual depth of each earthquake, rather than assuming a certain weighting set of depths. We apply this approach to the SW Germany, which considerable PSHA experience exists from previous studies and covers several tectonic environments and seismic catalogues, which requires the use of the described this methodology. The use of area specific magnitude completeness, bandwidth function, and actual depths of all events clearly results in a more realistic PSHA. Furthermore, we compare the results of the hybrid zoneless approach with the results of a recent study using a zone-based methodology. They show fairly good agreement with respect to the peak values. We confirm the general observation that

the hybrid zoneless approach has larger values between the peaks.