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On the applicability of the Virtual Earthquake Approach (VEA) to predict ground motion using the ambient seismic field in the Vienna Basin area

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The Vienna Basin is one of the most seismically active regions in Austria. Because of the population density and sensitive infrastructure, seismic hazard assessment in this area is of critical importance. An important part of seismic hazard analysis is ground motion prediction, which can in principle be done using either empirical studies to derive ground motion prediction equations (GMPEs) or using a physics-based approach to simulate ground motion by modelling surface wave propagation. Recently a new method has been presented that is based on the emergence of the inter-station Green's function from ambient noise cross-correlations (Denolle et al., 2013), which provides the impulse response of the Earth from a point source at the surface (from the site of one of the two receivers to the other). These impulse responses are dominated by surface waves, which would, in the case of a real earthquake, cause the major damages. The Green's function can in principle be modified to simulate a double-couple dislocation at depth, i.e. a virtual earthquake. Using an adapted pre-processing method, the relative amplitudes of the ambient noise records of different inter-station paths are preserved in the correlation functions, and effects like attenuation and amplification of surface waves in sedimentary basins can be studied. This provides more precise information that will help improve seismic hazard evaluations. We present first results on the applicability of the Virtual Earthquake Approach to a new dataset, consisting of about one year of continuous seismic data recorded at 12 broadband stations recently deployed in the Vienna Basin region.

References

Denolle, M. A., E. M. Dunham, G. A. Prieto, and G. C. Beroza (2013), Ground motion prediction of realistic earthquake sources using the ambient seismic field, J. Geophys. Res. Solid Earth, 118, 2102–2118, doi:10.1029/2012JB009603.