

Site effects estimation in urban areas: past and ongoing activities at the GFZ

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Site effects estimation is a mandatory task for improved seismic hazard assessment. However, estimating site effects over wide urban areas requires the development and the application of ad-hoc methods for such a complicated environment.

During the last years the GFZ has been involved in several projects aiming at estimating site effects in large urban areas and megacities. Within these projects different techniques for site effects estimation have been proposed/tested and applied. In general a procedure combining the installation for a few month period of a seismological network for recording small to moderate local seismicity, as well as regional and teleseismic events, with a large amount of single station and array measurements of seismic noise was found to be optimal for the studied cases. In fact, it allows us to estimate via horizontal-to-vertical spectral ratio (H/V) and standard spectral ratio with respect to a reference station the site response at a number of characteristic sites selected on the basis of geological, geophysical and geomorphological information. Furthermore, the seismic noise measurements, calibrated by comparison with the earthquake data recordings, allow to spatially extend the area of investigation. Finally, the array measurements and the array data analysis carried out with a procedure we developed allow retrieving the S-wave velocity structure down to the depth of the seismological bedrock. The peculiarity of this approach is that it takes into account Love waves and the influence of higher modes.

The case studies of the experiments carried out in Cologne (Germany), Istanbul (Turkey), Santiago de Chile (Chile), Bishkek (Kyrgyzstan) and Italy will illustrate how the procedure can be applied in different environments in order to provide input data that can be useful for preparing improved hazard and risk scenarios. Finally, first results from the analysis of data collected by a vertical array of accelerometers installed in Istanbul will highlight the importance of this kind of experiments for improving our understanding of wave propagation in the shallow-most crustal layers that will influence future seismic hazard assessment procedure.