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Comparing site response techniques by means of earthquake data and ambient seismic noise analysis in Karakol (Kyrgyzstan)

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Surface geology plays an important role in the variation of earthquake ground motion and hence in seismic hazard and risk assessment. This makes Kyrgyzstan, being located in one of the seismically most active regions in the world, an important investigation area for studying site effects. To this regard, as part of Earthquake Model Central Asia (EMCA) project, a temporary seismic network of 16 short period sensors was installed in the city of Karakol which operated continuously for more than 3 months from 10th of July 2011 until October 2011. A significant number of around 80 events, local, regional and teleseismic, were recorded during this time. Moreover, single station seismic noise measurements were carried out at 34 sites across the city. Since the shear-wave velocity structure is hardly known in the city, 3 array measurements with 20 stations were also carried out in different parts of the city, respectively.

Here we present the results obtained from a combined analysis of earthquake and noise data. Standard Spectral Ratios (SSR) from earthquake analysis show amplification over a broad frequency range for stations in the city with respect to a reference station in the south located on hard rock. Moreover, also the amplitudes of the spectral ratios are varying over short scales, showing high amplitudes of around 7 to 9 in the northern part of the study area near Lake Issyk-Kul, whereas the amplitudes in the southern part of the city are around 1.5 to 3. H/V from noise analysis shows a flat response in the central and northern part of the city while some stations in the southern part show clear peak with large amplitude. Such strong variations of ground motion over short scales might therefore be indicative of a complex subsurface structure. The array recordings were analyzed for Rayleigh wave phase velocity dispersion curves using extended spatial autocorrelation (ESAC) method. The dispersion curves were inverted for the local shear-wave velocity structure, indicating large velocity variations over short scales with lower velocities for the northern part and higher velocities for the southern part of the study area