SECOND EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING
AND SEISMOLOGY, ISTANBUL AUG. 25-29, 2014

STATISTICAL PROPERTIES OF THE SEISMIC NOISE WAVE FIELD: INFLUENCE OF SOIL HETEROGENEITIES

Marco PILZ[1] and Stefano PAROLAI[1]

Seismic noise is generally considered as a reproducible and temporarily stationary natural source of energy. Based on the recording of seismic noise by a dense temporary network installed at various sites in the city of Dushanbe we have investigated the variations of the 3D average squared soil displacement on different time scales. This allows studying the statistical features of the soil motion due to the seismic noise wave field properties and its dependency on the near-surface geology. A self-affine random medium is the most appropriate description of the heterogeneous material properties of the geological structures. In particular, the intrinsic properties show a clear dependency on the local shallow subsoil conditions with consolidated soils being characterized by a nearly ballistic behavior for short time scales. A distinct multi-fractal behavior, being characterized by a crossover to a diffusive character for longer time scales, indicates a long-range anti-correlated motion which can be seen as a mixture between uncorrelated noise and white noise. Although in a strict sense the seismic wave field is not completely isotropic, an ultimate pre-condition for a diffusive wave field, the deviations compared to a uniform distribution are rather small, meaning that the emergence of the Green's function is effective for all network sites after a sufficient self-averaging process that is provided by the scattering and the random spatial-temporal noise source distribution. By analyzing the transition in the dynamical character of the energy propagation process allows studying seismic noise from a different perspective. Complementary to a 1D description of the wave propagation for a diffusive field (e.g. Kawase et al. 2011) this enables quantifying also the 2D variability and the multiple scattering required to produce diffusive wave field.

REFERENCES

Kawase, H., F. J. Sánchez-Sesma, S. Matsushima (2011), The optimal use of horizontal-to-vertical spectral ratios of earthquake motions for velocity inversions based on diffuse-field theory for plane waves, *Bull. Seismol. Soc. Am.* **101**, 2001-2014

[1] Helmholtz Center Potsdam, German Research Center for Geosciences, Helmholtzstr. 7, 14467 Potsdam, Germany, email: pilz@gfz-potsdam.de