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Nature of the seismic noise wavefield: implications for H/V and array processing methods

S. Bonnefoy-Claudet (1,7), C. Cornou (2,1), M. Ohrnberger (3), M. Wathelet (4,5), P.-Y. Bard (1,6), F. Cotton (1), P. Moczo (7,8), J. Kristek (7,8), D. Faeh (2)

(1) LGIT, University Joseph Fourier, Grenoble, France, (2) Swiss Seismological Service, ETH Zurich, Switzerland, (3) Institute of Geosciences, University of Potsdam, Germany, (4) GEOMAC, University of Liege, Belgium, (5) LIRIGM, University Joseph Fourier, Grenoble, France, (6) Laboratoire Central des Ponts et Chaussees, France, (7) FMPI, Comenius University, Bratislava, Slovak Republic, (8) Slovak Academy of Sciences, Bratislava, Slovak Republic

Ambient vibration techniques such as the H/V method and the more advanced array technique have the potential to significantly contribute to site effects evaluation, in particular in urban areas. Within the SESAME European project (Site EffectS assessment using AMbient Excitations) we investigated the nature of ambient seismic noise in order to assess the reliability of these ambient-vibration-based techniques. Through 1D seismic noise modeling, the ambient noise is simulated for a set of various horizontally stratified structures: (1) varying impedance contrasts and Poisson's ratio of one sedimentary layer overlaying bedrock; (2) varying thicknesses and impedance contrasts of two sedimentary layers overlaying bedrock; (3) varying S-wave velocity gradient of one sedimentary layer overlaying bedrock. The array analysis (conventional f-k and high resolution f-k array techniques) performed for both vertical and horizontal synthetics allowed to estimate the contribution of different seismic waves (body/surface waves, Rayleigh/Love waves) to the characteristics of the H/V peak. The physical composition of the ambient noise wavefield, and thus the H/V peak origin, depends not only on the soil characteristics, especially by the impedance contrast between sediment and bedrock, but also on the noise source characteristics (distance, depth). However, the H/V peak frequency observed on H/V curves always provide a good estimate of the fundamental resonance frequency whatever the H/V peak origin (Rayleigh waves ellipticity, Love waves Airy phase, or the S-wave resonance). On the contrary, for the models considered here, the H/V peak amplitude always overesti-

mates the site amplification factor.