European Seismological Commission

Genova (Italy), September 2002

Frank Scherbaum and all.

DETERMINATION OF SHALLOW SHEAR WAVE VELOCITY MODELS IN THE LOWER RHINE EMBAYMENT OBTAINED FROM INVERSION OF AMBIENT VIBRATIONS

F. Scherbaum (1), K.-G. Hinzen (2) and M. Ohrnberger (1)

(1) Institut für Geowissenschaften der Universität Potsdam, POB 601553, D-14415 Potsdam, Germany. (2) Abt. für Erdbebengeologie der Universität zu Köln, Vinzenz-Palotti-Str. 26, D-51429 Bergisch Gladbach

We have used both single station and array methods to determine shallow shear velocity site profiles in the vicinity of the city of Cologne/Germany from ambient vibration records. Based on fk-analysis we assume that fundamental mode Rayleigh waves dominate the analysed wavefield in the frequency range of 0.7 - 2.2 Hz. Based on tests with synthetic data believed to represent a typical situation in the Lower Rhine Embayment, in this frequency range dispersion curves were found to provide stronger constraints towards the absolute values of the velocity-depth model than the H/V spectral ratios (HVSR) interpreted as Rayleigh wave ellipticities. The shape of the HVSR was found to be subject to a strong tradeoff between layer thickness and average layer velocity. We have made use of this observation by combining the inversion schemes for dispersion curves and ellipticities such that the velocity-depth dependence is essentially constrained by the dispersion curves while the layer thickness is constrained by the HVSR. To test this method in practice, we have used array recordings of ambient vibrations from three sites where the subsurface geology is fairly well known and geotechnical information is at least partially available. In order to keep the parameter space as simple as possible we attempted to fit only a single layer over halfspace model. However, owing to earlier studies from the region (Budny, 1984), we assume a power law depth dependence for sediment velocities. For all three sites investigated, the inversion resulted in models for which the shear wave velocity within the sediment layer both in absolute value at the surface and in depth dependence are found to be remarkably similar to the results obtained by Budny (1984) from downhole measurements.