Geophysical Research Abstracts, Vol. 9, 05368, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05368

Algorithm for site-effect evaluation from non-stationary seismic noise using a priory knowledge

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Usual approach to estimate site-effect from microtremor measurements is to compute spectral ratio of horizontal-to-vertical components H/V (Nakamura's technique). The main problem of this method is a large scatter of H/V ratio maximum amplitudes and a somewhat less scatter of corresponding frequencies. This instability of the estimates is related apparently to non-stationarity of the microtremor sources randomly distributed in time and space. We interpret the H/V ratio in terms of the transfer function of a linear dynamic system (LDS) with input V and output H observed with non-stationary and correlated noise. Consequently the problem of accurate site effect estimation is determined by selection of the sequence of time windows with relatively large input and output Signal-to-Noise ratio. However, we have no means to compute SNR from observations but it is possible to judge about it indirectly. For this purpose we estimate maximal amplitudes and corresponding frequencies of H/V ratio in a sequence of time windows and then collect time windows were the data is clustering around certain frequencies and amplitudes. Then we continue sorting the data fitting best to the assumption of the 1D LDS model described by a vector of parameters. The outliers in the new parameter space are automatically removed by a sort of clusterization procedure based on the statistical robust Maximum-likelihood approach (M-estimtes), thus providing relatively more stable maximum amplitude and frequency estimations. Such approaches make it possible to assist the routine analyst processing but doesn't exclude intelligent interpretation using apriory knowledge about geological and velocity undersurface structure. The interactive and automatic procedures, using this principal have been designed and verified on a number of simulated and real data, showing good performance.