Geophysical Research Abstracts, Vol. 9, 08275, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08275

New techniques for site characterization from ambient ground noise

E. Safak (KOERI)

Bogazici University, KOERI, Istanbul, Turkey (erdal.safak@boun.edu.tr)

Analysis of ambient ground noise is becoming an increasingly popular method to determine site amplification. Ambient noise represents the vibrations of the ground due to small excitations from various sources, such as the energy transmitted from the foundations of buildings vibrating under wind loads, energy transmitted by heavy machinery operating on the surface, vibrations generated by traffic loads, and microtremors.

In general, records of ambient ground noise have very low amplitudes and signal-to-noise ratios. Fourier-based standard methods that are commonly used to analyze seismic data are not appropriate to analyze ambient data because low signal-to-noise ratios can cause large errors in spectral analysis, particularly when analysis involves spectral ratios. However, ambient vibrations are always available and data can be collected continuously. In most cases, ambient records are stationary (i.e., their frequency and temporal characteristics do not change with time), and the record length can be made infinitely long. Also, since there are a large number of sources for noise and excitation, it can reasonable be assumed that both the noise and the excitation are wide-band random processes. These properties of ambient data make it possible to utilize advance stochastic techniques for data analysis, such as statistical signal processing, optimal filtering, and adaptive noise cancelling.

This paper first presents some examples of the types and magnitudes of errors of standard techniques that are currently used to determine site amplification from ambient ground noise. The paper then shows that the analysis of ambient ground noise is equivalent to extracting low amplitude sinusoids buried in noise. By using elementary concepts from the statistical signal processing and optimal filtering theories, the paper introduces several new techniques to analyze ambient noise. The superiority of the

new methods over the Fourier-based methods is demonstrated by using real records of ground noise from urban areas.