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应用微动*H*/*V*谱比法和台阵技术探测场地响应和浅层速度结构

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Applications of microtremor *H*/*V* spectral ratio and array techniques in assessing the site effect and near surface velocity structure

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摘要 为了快速而且廉价地获取北京市详细的场地响应和浅层速度结构，应用于地震动模拟和地震灾害预防，我们开展了微动观测技术和处理方法研究.本文利用2007年夏季北京五棵松地区进行的几个微动观测实验数据，使用单台*H*/*V*谱比法分析场地的卓越频率及其对应的放大系数，并对比了不同地震仪和观测时间对*H*/*V*曲线的影响；应用高分辨率*F*-*K*频谱分析方法从微动台阵数据中得到Rayleigh波的频散曲线并使用邻域算法反演出浅层速度结构.*H*/*V*结果表明该地区卓越频率在2.1～2.2 Hz之间，对应的放大系数下限约为3；利用微动*H*/*V*方法得到的场地卓越频率具有较高的稳定性.微动台阵反演结果给出了比较合理的波阻抗界面深度和层平均速度结构，认为地下80多米处的波阻抗界面是决定场地卓越频率和其场地放大系数的主要界面.本研究表明微动技术应用于评估城市地震场地响应和浅层速度结构是可行且易于实施的.

关键词 微动， 浅层速度结构， 场地响应， *H*/*V*谱比法， *F*-*K*频谱分析方法

Abstract: To rapidly and economically assess the detailed seismic site effects and near surface velocity structures which are crucial for accurate strong motion simulation and efficient seismic hazard prevention, we conducted microtremor array observations and subsequent data processing for the urban areas of the Beijing city. In this paper, using the data collected from several microtremor observation experiments at Wukesong area in the summer of 2007, we estimated the predominant frequencies and their amplification factors of this site with the *H*/*V* spectral ratio method. We also investigated the effects of different seismometers and observation times on the *H*/*V* spectra curve. Furthermore we retrieved the Rayleigh wave dispersion curve by applying the high-resolution *F*-*K* spectral analysis method to the microtremor array observation data and inverted for the subsurface velocity structure using the neighborhood algorithm. The *H*/*V* results show that the predominant frequencies in the Wukesong area are about 2.1~2.2 Hz with the lower limit of the amplification factor about 3. The predominant frequencies obtained from the microtremor *H*/*V* analysis are stable in this study. The inversion results from the microtremor array data reveal a reasonable subsurface velocity structure in terms of both impedance interface depths and average layer velocities, and suggest that an interface at about 80 meter depth makes the primary contribution to the predominant frequency and the corresponding amplification factor of this site. This study demonstrates that the microtremor technology is a practical and feasible way to assess the seismic site effect and near surface velocity structure at an urban site.

Microtremor, Near surface velocity structure, Site effect, spectral ratio method, spectral

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