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Characteristics of band-limited ambient seismic noise in South Korea

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To decide optimum stations and time windows for imaging crustal structures using the passive reflection interferometry, we analyzed ambient seismic noise recorded at 115 accelerograph stations in South Korea. The continuous 20-Hz data of one-year length were reformatted, segmented into 932,512 files of one-hour length, removed their means and trends, corrected for the instrument responses, edited, and band-pass filtered. As the power spectral density of the noise indicated double peak characteristics, we decomposed the data into low-frequency (0.05-0.1-1.0-2.0 Hz) and high-frequency (0.5-1.0-5.0-10.0 Hz) parts.

In the time domain, average root-mean-squared (rms) amplitudes were computed for each one-hour long data. The rms amplitudes of low–frequency components are relatively constant ($8.6\pm2.8 \times 10^{-7}$ m/s^2) for all stations. Their hourly and weekly variations are almost negligible ($\sigma < 0.2 \times 10^{-7}$ m/s^2), but monthly variation is moderate ($\sigma = 1.4 \times 10^{-7}$ m/s^2). However, the amplitudes of high–frequency components show a strong spatial variation ($1.4\pm1.0 \times 10^{-6}$ m/s^2). The rms level is much lower at night ($1.0\pm0.1 \times 10^{-6}$ m/s^2) than in the daytime ($1.4\pm0.1 \times 10^{-6}$ m/s^2) and slightly lower during weekends ($1.1\pm0.1 \times 10^{-6}$ m/s^2) than weekdays ($1.2\pm0.0 \times 10^{-6}$ m/s^2). We interpret the characteristic difference in temporal variations between the low and high frequency components are related to their source origins: the natural and artificial, respectively.

The power spectral density (PSD) of the noise data indicates that the average peak frequency (f_p) is at 0.34 Hz identified as the double-frequency. The PSD curves also indicate that frequency components greater than 2 Hz are greater in the daytime than at night while no distinct hourly variation is observed with the low-frequency components. This observation coincides with the time-domain interpretation on their origin.