Characteristics of lithospheric structure beneath the Eurasian continent as inferred from the analysis of teleseismic P-coda

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We systematically analyze three-component seismograms of teleseismic P-coda waves to characterize the lithospheric heterogeneity beneath the Eurasian continent, since seismic coda waves are sensitive to random heterogeneity in the medium and transverse amplitude is considered to be originated from lateral heterogeneity.

Waveform data of 32 stations are selected from the broadband three-component traces stored in the IRIS FARM archive from January 1998 through December 2002. We concern only shallow earthquakes with focal depth less than 35 km and body wave magnitude between 5 and 6. The distance range is restricted from 15º to 60º. The NS and EW oriented components are converted to the radial and transverse components. After bandpass filtering the three components for 0.5-1, 1-2 and 2-4 Hz, a set of 1091 seismograms with the highest signal to noise ratio are used for the following analysis. For each hypocenter-station combination, the ratio of the seismic energy of the transverse and radial components to the total seismic energy of the three components is calculated for 10 seconds from the P-wave onset. Taking the square root of the ratio averaged for all events recorded at each station, we obtain the averaged amplitude of transverse and radial components, respectively.

The transverse amplitudes increase with increasing frequency: 0.1-0.5, 0.1-0.6 and 0.2-0.6 for 0.5-1, 1-2 and 2-4 Hz, respectively. On the other hand, radial amplitudes indicate weak frequency dependence: 0.3-0.7, 0.2-0.7 and 0.3-0.6 for 0.5-1, 1-2 and 2-4 Hz, respectively. In the low frequency bands of 0.5-1 Hz and 1-2 Hz, the radial amplitude is larger than the transverse amplitude, indicating predominance of direct arrival over scattered waves. However in the high frequency band of 2-4 Hz, the radial amplitude is almost proportional to the transverse amplitude, suggesting a predominance of scattered waves from random heterogeneity.

We find a clear spatial and regional variation of transverse amplitude. The largest transverse amplitude is found at station NIL in Pakistan, which is located on the India-Eurasia collision zone. Most of the stations in southern Eurasia show large amplitudes, while the small amplitudes dominate in the mid-Eurasia. Large amplitude is also observed at a polar station KBS which is located on the north Atlantic ridge-transform system. These results strongly indicate that the regions showing large amplitudes correspond to the tectonically active regions where large strain rates are observed.