Azimuthal anisotropy of Rayleigh-wave phase velocity from ambient noise tomography in south-central Mongolia

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Although far from any subduction zone, it is interesting that the Mongolian Plateau has high and young (<30 Ma) topography culminating at ~4000 m as well as extensive volcanic activity. The seismic anisotropy could offer constraints on the past and present deformation in the crust and upper mantle. This study for the first time presents the azimuthal anisotropy of Rayleigh-wave phase velocity at periods ranging from 8s to 30s using ambient noise tomography in south-central Mongolia (SCM). Continuous time-series of vertical component between August 2011 and July 2013, recorded by 69 broadband stations temporarily deployed in SCM, have been cross-correlated to obtain estimated Rayleigh wave Green’ s functions. Applying the frequency and time analysis technique based on the continuous wavelet transformation, a total number of 1478 inter-station phase velocity dispersion curves have been measured. Moreover, Rayleigh wave phase velocity and azimuthal anisotropy maps at periods from 8 s to 30 s have been reconstructed with a grid knots spacing of 50 km. The inversion results reflect the structure from the shallow crust to upper mantle up to approximately 50 km depth. The S-wave velocity structure as well as the azimuthal anisotropy has weekly lateral heterogeneity beneath SCM, with perturbation about ±2% to the phase velocity and ±1% to the azimuthal anisotropy, respectively. At short periods (<10s), the phase velocity variations are well correlated with the principal geological units in SCM, with low-speed anomalies corresponding to the major sedimentary basins or Gobi area and high-speed anomalies coinciding with the main mountain ranges. At long periods (e.g. 30 s), the phase velocity distribution is mainly associated with the crustal thickness. The Middle Gobi area always characterized with low-speed anomalies from 8 s to 30 s is possibly related to Cenozoic volcanism. Overall, the fast direction as well as the phase velocity distribution in the northern domains of Mongo-Okhotsk Suture (MOS) is very different from that in the southern domains, indicating the significant differences of distribution of the phase velocity and the azimuthal anisotropy between two sides of MOS may related to the closure of Paleo-Mongo-Okhotsk Ocean. In another words, this study may give geophysical evidence for the location of the front edge of the closure of Paleo-Mongo-Okhotsk Ocean.This work was supported by NSFC (41574054) and the international cooperation project of the Ministry of Science and Technology of China (2011DFB20210).

Keywords: Rayleigh wave, phase velocity, azimuthal anisotropy, ambient noise tomography, south-central Mongolia

