Upper mantle S-wave structure beneath Mongolia, Central Eurasia

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We present a radially anisotropic 3–D shear wave model of the continental lithosphere and asthenosphere beneath central Eurasia around Mongolia using multimode surface wave tomography. We have employed seismic waveform data recorded at the permanent and temporary stations in Mongolia and neighboring GSN (Global Seismograph Network) stations. Our dataset includes three–component seismograms from 2151 teleseismic events (M>5.8) from 2009 to 2021. The model is constructed using the three-stage inversion scheme developed by Yoshizawa and Kennett (2004, JGR). In the first stage, we performed fully nonlinear waveform fitting for individual seismograms to extract the multimode phase speeds of Love and Rayleigh waves (Yoshizawa & Kennett, 2002a, GJI; Yoshizawa & Ekström, 2010, GJI). In the second stage, we retrieved multimode phase speed maps using the linearized inversions based on the method of surface-wave tomography incorporating approximate effects of finite frequency (Yoshizawa and Kennett, 2002, GJI). In the third stage, localized multimode dispersion curves derived from the multimode phase speed maps were used to construct local 1–D S–wave profiles, including radial anisotropy, which formed a 3–D shear wave speed model beneath central Eurasia around Mongolia. In stable eastern Mongolia, high–velocity anomalies are seen above 120 km depth, particularly in the V_{SH} model. However, the tectonically active western Mongolia is characterized by a low–velocity anomaly, especially in the Hangay and Huvsgul regions, where the low–velocity feature extends down to a depth of 150 km. The radial anisotropy model shows a faster SH wave speed than SV in almost the entire Mongolian lithosphere above 100 km depth, except for the northern edge of the Altay Mountains region. However, the faster SV anomaly below 180 km depth is seen in central and eastern Mongolia, including the Hangay and Huvsgul regions. A slow wave-speed area with the anisotropic parameter $\xi < 1$ beneath the Hangay dome above 150 km depth may reflect the mantle upwelling resulting in the uplifting process in this region. In addition, we can see remarkably distinct lateral heterogeneities near the expected boundary between the Eurasian and Amur plates, especially near the northern and western edges of the Amur plate. This may indicate the seismological evidence of the enigmatic plate boundary of the Amur plate in the Mongolian region.

