

Anisotropic structure of the upper mantle beneath the northeastern China from surface wave analysis

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In 2009-2011, large-scale high-density seismic array (NECESSArray) in northeast China consisted 120 broadband seismographs has been deployed. We use seismograms observed by these and other temporary observations (NECESSArray, Stagnant Slab Project and BBOBS observation) and permanent network observations in and around China (CB, CD, F-net, IC, II, IU, MY, OHP, RM, TM, TW) to investigate the anisotropic and isotropic three-dimensional shear wave velocity structures in the upper mantle by surface wave tomography technique.

We measured phase speeds of the fundamental and first three higher modes of Love and Rayleigh waves for the source-station pairs using a fully non-linear waveform inversion method by Yoshizawa and Kennett (2002). The measured multi-mode phase speeds are inverted to a 2-D shear wave phase speed structures using an inversion technique by Yoshizawa and Kennett (2004), which allows us to incorporate the effects of finite frequency as well as ray path deviation from the great-circle.

We inverted the multi-mode dispersion curves of Love and Rayleigh obtained by phase speed maps to the anisotropic shear wave velocity model. The reference 1-D model is based on PREM except for the crust for which we adopted the CRUST2.0 model.

We obtained a shear wave velocity structures beneath the northeastern China region. The inverted model has a good resolution in the upper 260 km for isotropic structures and in the upper 460 km for anisotropic structures. Obtained isotropic structure model shows that fast anomalies exist in the Songliao basin and slow anomalies exist in the volcanic region at depths shallower than 120km. Obtained radial anisotropic structure shows that V_{sh} is faster than V_{sv} in most of studied region at depths shallower than 150 km and that V_{sv} is faster than V_{sh} in two region where southeastern and southwestern part of the Songliao basin at depths deeper than 200km. When we assume that the fast axis of olivine is aligned with the flow direction and this is the cause of the seismic anisotropy, obtained anisotropic structure suggests that horizontal flow is existed at depths shallower than 150km and two vertical flows are existed in the deeper part.

Keywords: surface wave, tomography, anisotropy, upper mantle, northeastern China