Full-wave anisotropy tomography for the upper mantle of Northeast China using SKS splitting intensities

Junliu Suwen\textsuperscript{1,2}, Yi Lin\textsuperscript{3,4}, Li Zhao\textsuperscript{3}, and Qi-Fu Chen\textsuperscript{1,2}

\textsuperscript{1}Institute of Geology and Geophysics, Chinese Academy of Sciences, Key Laboratory of Earth and Planetary Physics, China
\textsuperscript{2}College of Earth and Planetary Sciences, University of Chinese Academy of Sciences, Beijing, China
\textsuperscript{3}School of Earth and Space Sciences, Peking University, Beijing, China
\textsuperscript{4}Key Laboratory of Earth Exploration and Information Techniques of the China Ministry of Education, Chengdu University of Technology, Chengdu, China

Northeast (NE) China is located in the eastern Central Asian Orogenic Belt, and has a complex deformation history. The evolution of NE China has been controlled by the (Paleo-)Pacific Plate since the late Mesozoic and was affected by the closure of the Paleo-Asian and Mongol-Okhotsk oceans. Meanwhile, large strike-slip faults and extensive intraplate volcanisms characterize active tectonics in NE China. Different mechanisms have been proposed to interpret the origin of the intraplate volcanism, such as interactions between the lithosphere and the big mantle wedge, and the subduction-induced upwelling within the gap of the stagnant Pacific slab.

Seismic anisotropy describes the directional dependence of the seismic velocities. In NE China, seismic anisotropy not only reveals the past and present deformations in the lithosphere but also helps us clarify the possible intraplate volcanism. In this study, we apply the full-wave multi-scale anisotropy tomography method to investigate the seismic anisotropy in NE China. We measure the splitting intensities of SKS waves, which can be linearly inverted for the 3D variation of anisotropy. We employ broadband seismograms recorded at ~450 regional seismic stations (including ~250 temporary stations deployed for 2 years) of unprecedented density from teleseismic events of magnitudes greater than 5.5 occurring in 2009-2018. We obtain a total of 4249 splitting intensity measurements, and perform the multi-scale inversion using sensitivity kernels computed by normal-mode summation. The resulting 3D anisotropic model of the upper mantle in NE China shows a dominant NW-SE fast axis, which highlights a strong correlation between the intraplate volcanoes and upper-mantle seismic anisotropy, and indicates that NE China is still mainly controlled by the Pacific Plate.