Geophysical Research Abstracts
Vol. 12, EGU2010-3348, 2010
EGU General Assembly 2010

Seismic tomography of the upper mantle beneath Baltic Shield – evaluation of anisotropic effects in isotropic images

Tuna Eken (1), Jaroslava Plomerova (1), Ludek Vecsey (1), Vladislav Babuska (1), Roland Roberts (2), Hossein Shomali (2), and Reynir Bodvarsson (2)

(1) Geophysical Institute, Czech Acad. Sci., 141 31 Prague, Czech Republic (tuna.eken@gmail.com), (2) Uppsala University, Department of Earth Sciences, Geophysics, 75236, Uppsala, Sweden

Traditional regional/teleseismic tomography considers only isotropic wave propagation and ignores seismic anisotropy. In this study we examine possible effects of neglecting seismic anisotropy on tomography images of Baltic Shield using data recorded at approximately north-south oriented Swedish National Seismological Network (SNSN). High-velocity perturbations dominate in previous isotropic traveltime inversions from teleseismic P- and S-waves down to depths of about 250 km (Eken et al., 2007; 2008) and indicate a slab-like structure between 65° and 68°N, continuing to a depth of around 350-450 km and dipping gently towards the north. A recent anisotropy study based on joint inversion/interpretation of body-wave anisotropic parameters (shear- wave splitting and P-residual spheres; Eken et al., 2009) proved the upper mantle and particularly the lithospheric mantle is anisotropic. We present isotropic inversions calculated (a) from original data (without considering anisotropy) and (b) from data "corrected for anisotropy". Constituents corresponding to anisotropic propagation were evaluated (1) from directional terms of relative P residuals (e.g. Plomerova et al., 2001) and (2) from the 3D self-consistent anisotropic models retrieved by joint inversion of body-wave anisotropic parameters. The 3D tomographic inversions are conducted with the use of 4200 P travel-time residuals obtained from 136 teleseismic earthquakes. General features of the images for both of the original and "anisotropy corrected" data are similar, but there are discrepancies in details. Data variance reduction increases from about 50% in case of tomography from original data to about 90% if data corrected for anisotropy is used. Regardless of robustness of corrections for anisotropy, magnitude of retrieved velocity perturbations is in accord with findings of mineral physics. The differences between inverted models indicate that anisotropy can contaminate the tomographic image in some parts of models and we therefore should not ignore it in general. As an auxiliary tool in this study we deal with long period P-wave polarization and measure its horizontal deviations beneath stations as an independent indicator of lithospheric mantle anisotropy. We correlate models derived from the P-wave polarization with 3D self- consistent models retrieved by joint inversion of body-wave anisotropic parameters (from shear-wave splitting and P-wave residuals).