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Effect of seismic anisotropy on P tomography images of the Baltic Shield.

T. Eken (1), J. Plomerova (2), R. Roberts (1), L. Vecsey (2), H. Shomali (1), V. Babuska (2), and R. Bodvarsson (1)

(1) Department of Earth Sciences, Uppsala, Geophysics Department, Uppsala, Sweden (Tuna.Eken@geo.uu.se, +46 018-50 1110), (2) Geophysical Institute, Czech Acad. Sci., 141 31 Praha 4, Czech Republic

It has been previously suggested that ignoring seismic anisotropy can distort tomographic images. We investigate possible effects of neglecting seismic anisotropy on P-velocity tomographic images of the Baltic Shield. Isotropic inversions of teleseismic P- and S-wave data (Eken et al, 2007; 2008) indicated 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 joint inversion/interpretation of body-wave anisotropic parameters (shear-wave splitting and P-residual spheres (Eken et al., Tectonophysics, submitted) showed that the upper mantle and particularly the mantle lithosphere is anisotropic. A synthetic test performed with real ray geometry of observed data and based on 3D self-consistent anisotropic models retrieved by the joint inversion of body-wave parameters, show effects in tomography images caused by neglecting anisotropy. We also calculated an isotropic inversion from data "corrected for anisotropy". Constituents corresponding to anisotropic propagation were evaluated (1) from directional terms of relative P residuals and (2) from the 3D self-consistent models. The inversion is calculated from 4200 observed P travel-time residuals from 136 teleseismic earthquakes. The general pattern of the velocity-perturbation images does not change. The slab-like structure identified in the pure isotropic inversion appears in the new inversion with lower amplitude. Velocity-perturbations below about 250 km decrease in whole the model, which is about the lithosphere thickness of the Baltic Shield, with which we associate the laterally variable seismic anisotropy. The maximum difference in estimated velocity perturbations between the two inversions is about 1%, with a total range of about $\pm 3\%$ in the models. The analysis implies that anisotropic structure modeled in 3D with generally oriented symmetry exes (plunging) can, and does, have a significant effect on tomographic images. Effects of anisotropy should not be ignored to prevent simplified interpretations of potential artifacts and to get realistic models of the upper mantle structures on regional scales.