Abstract

A refined continental scale 3D isotropic velocity model is produced for India and Tibet by incorporating the effects of azimuthal anisotropy and crustal structure. To achieve the objectives, inversions are performed over 52,050 teleseismic P-wave residuals to account for the anisotropic effects and crustal structure, while 30,423 S-wave residuals are inverted to reduce the bias due to crustal structure. Travel time corrections to P-wave delays are focussed within -1 to +3 s for crust, and -0.25 to +0.5 s for azimuthal anisotropy. These results suggest that the bias introduced due to the crustal structure and anisotropic effects does not affect the gross features, but it does introduce certain artifacts, especially at deeper levels.

In absence of a unified crustal model for India and Tibet, a high resolution crustal velocity model (*Ind-CRUST*) is developed by inverting P-to-s receiver functions (RFs). RFs are computed using the same P-wave dataset which is used to create the P-wave tomographic model for India and Tibet. In this way, it fills the gap in existing crustal models for the study region and provide an improved comprehensive model for India and Tibet representative of each seismic station. The inversions are performed with an a priori correction of contributions from the crust, which effectively reduce the bias introduced in the tomographic images due to near surface effects of a complex and highly heterogeneous crust.

P-wave travel time corrections for azimuthal anisotropy effects are calculated from the compilation of 1648 individual SKS splitting measurements covering a broader region of India and Tibet. Integration of these corrections into the 3D modelling is achieved in two ways a) a priori adjustment to the delay time vector, (*anisotropic-corr-I*) b) inverting only for anisotropic delays by introducing strong damping above 80 km and below

360 km depths and then subtracting the obtained anisotropic artifact image from the isotropic image, to get the corrected image (*anisotropic-corr-II*). Under the assumption of azimuthal anisotropy resulting from lattice preferred orientation (LPO) alignment due to horizontal flow, the bias in isotropic P-wave tomographic images is clear. The anisotropy corrected velocity perturbations are in the range of $\pm 1.2\%$ at depths of around 150 km and reduced further at deeper levels.

The differences between various models (*isotropic*, *anisotropic-corr-I* and *anisotropic-corr-II*) are quite evident and effects of anisotropy and crustal structure should not be ignored to achieve high resolution tomographic models.