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3D transversely isotropic shear-wave velocity structure of India and Tibet from joint modeling of Rayleigh and Love waves group velocity dispersion.

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We use regional Rayleigh and Love wave data, from 4750 earthquakes (M >= 4.0) recorded at 726 stations across India and Tibet, to compute fundamental mode group velocity dispersion between 10 s and 120 s, using the Multiple Filter Technique (MFA). These result in the dense coverage of 14,706 and 14,898 ray-paths for Rayleigh and Love waves, respectively. The dispersion data at discrete periods have been combined through a ray-theory based tomographic formulation to obtain 2D maps of lateral variation in group velocities, where the best resolution is upto 2.5° and 4° for Rayleigh and Love waves tomographic maps, respectively. The Peninsular Shield, the Himalayan foreland basin, the Himalayan collision-zone and the Tibetan Plateau, have been sampled at unprecedented detail. Rayleigh and Love wave dispersion curves, at each node point of the tomography, have been inverted for 1D isotropic shear-wave velocity structure of Vsv and Vsh, respectively, which are combined to obtain 3D Vsv and Vsh structures across India and Tibet. We jointly invert the two datasets at each node to obtain an isotropic 1D velocity structure. The isotropic inversion fits the two datasets reasonably well, however, the misfit in the dispersion dataset both at high and low periods is high. For this, we incorporate radial anisotropy in the velocity structure and parameterize the crust with three layers and upper mantle with two layers. Assuming this radially anisotropic earth structure, we use Genetic Algorithms (GA) to explore the model space extensively. The synthetic dispersion curves are computed using Thomson-Haskell method with reduced delta matrix. The free parameters used in the inversion are VPH and VSH, layer thickness (h) and Vs anisotropy represented by Xi (ξ=VSH/VSV)2. The non-linear inversion technique converges to a best-fitting model by iteratively minimising the misfit between the observed and the data. The 2D group velocity dispersion heterogeneities, the 3D structures of Vsv and Vsh (both isotropic and transversely isotropic) will be presented with a focus to characterize a) the structure of the Indian plate and it's extent of underthrusting beneath Tibet, and b) to quantify the low-velocity zone at the base of the Himalayan wedge, across the basal decollement, which ruptures in megathrust earthquakes.