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Seismological evidence of the Hales discontinuity in northeast India

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Abstract

The crust and upper mantle shear wave velocity structure beneath the northeast India is estimated by joint inversion of Rayleigh wave group velocity and receiver function, calculated from teleseismic earthquakes data recorded at nine broadband seismic stations. The Assam valley and the Shillong-Mikir plateau are the two important tectonic blocks in the northeast India, which are surrounded by the Himalayan collision zone in the north, Indo-Burma subduction zone in the east and by the Bengal basin in the south. The joint inversion followed by forward modeling reveal crustal thicknesses of 30-34 km beneath the Shillong plateau, 36 km beneath the Mikir hills and 38-40 km beneath the Assam valley with an average shear wave velocity (V_s) of 3.4-3.5 km/s. The estimated low upper mantle shear wave velocity (V_{sn}) 4.2-4.3 km/s may be due to the rock composition or grain size or increased temperature and partial melt (<1%) in the upper mantle, or an effect of all. Also, we report for the first time, the existence of the Hales discontinuity at depths 56-74 km with $V_s \sim 4.4-4.6$ km/s. Variable depth of the Hales discontinuity may be explained by the geotherm and /or addition of Cr^{3+} and Fe^{2+} in the spinel-garnet system.

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