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Mantle deformation patterns beneath southern Tibet using splitting of direct-S waves

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This study presents a total of 12008 shear wave splitting measurements obtained using the reference station technique applied to direct S-waves from 106 earthquakes recorded at 143 seismic stations of the Hi-CLIMB seismic network. The results reveal significant anisotropy in regions of southern Tibet where null or negligible anisotropy has been hitherto reported from SK(K)S measurements. While the individual fast polarization direction (FPD) at each station are found to be consistent, the splitting time delays (TDs) exhibit deviations particularly at stations located south of the Indus–Tsangpo Suture Zone. The fast polarization directions (FPDs) are oriented (a) NE–SW to E–W to the south of the Indus–Tsangpo Suture Zone (b) NE–SW to ENE–SSW between Bangong–Nujiang Suture Zone and the Indus–Tsangpo Suture Zone (ITSZ) and (c) E–W to the extreme north of the profile. The splitting time delays (dt) vary between 0.45 and 1.3 s south of the ITSZ (<30N latitude), while they range from 0.9 to 1.4 s north of it. The overall trends are similar to SKS/SKKS results. However, the differences may be due to the not so near vertical paths of direct S waves which may sample the anisotropy in a different way in comparison to SKS waves, or insufficient number of SKS observations. The significant anisotropy (0.8 s) observed beneath Himalaya reveals a complex deformation pattern in the region and can be best explained by the combined effects of deformation related to shear at the base of the lithosphere and subduction related flows with possible contributions from the crust. Additional measurements obtained using direct S-waves provide new constraints in regions with complex anisotropy.