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Constraining the vertical coherence of deformation in lithosphere in the eastern Himalayan syntaxis using GPS, Quaternary fault slip rates and shear wave splitting data

Lijun Chang (1), Lucy Flesch (2), Chunyong Wang (1), and Zhifeng Ding (1)

(1) Institute of Geophysics, China Earthquake Administration, Beijing, China (ljchang@cea-igp.ac.cn), (2) Department of Earth, Atmospheric, and Planetary Sciences, Purdue University, West Lafayette, Indiana, USA (lmflesh@purdue.edu)

The extent of vertical coherence and inferred crust mantle coupling in lithosphere beneath the Eastern Himalayan Syntaxis (EHS) and surrounding regions can be determined through the joint analysis of surface and mantle deformation fields. We present 59 new SKS/SKKS and combine them with 69 previously published data to infer the mantle deformation field in SE Tibet. The dense set of anisotropy measurements in the EHS are oriented along a NE-SW azimuth and there is an overall clockwise rotation pattern from west-to-east of the fast directions around the EHS that are oriented NE-SW to the northwest of the EHS, to E-W north of the EHS, to NW-SE northeast of the EHS, and then to N-S east of the EHS. We use a continuous surface deformation field inferred from GPS observations and Quaternary fault slip rates to quantify the surface deformation style based on the kinematic vorticity number W*k that is used predict a shear wave spitting direction at each station assuming the anisotropy is generated within the lithosphere. Comparison of splitting observations with predictions yields an average misfit of 11.7º illustrating that deformation is vertically coherent, consistent with previous studies. Within the central EHS in area directly surrounding the Namche-Barwa metamorphic massif the average misfit of 11 stations increases to 60.8º and vertical coherence in the deformation is no longer present. The complexity of the mantle anisotropy and surface observations argues for local alteration of the strain fields here associated with recent rapid exhumation of the Indian crust.

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