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Receiver function crustal imaging in Western Nepal

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The Himalayas are the result of the Indian and Eurasian plates' convergence at a velocity of 4 cm/yr. Half of this is accommodated by shortening on the Main Himalayan Thrust fault (MHT), the megathrust and plate boundary fault present under/along the 2500 km-long Himalayan range. The upper segment of the fault is locked, from the surface to a down-dip end situated under the high Himalayan range, at a depth between 10 and 20 km. This segment ruptures partially or entirely during large earthquakes (M7-8, like 1833 AD or 2015 Gorkha) or great earthquakes (M 8+, 1505 or 1934 AD), which propagates toward the surface the slip accumulated at depth. The structure of the crust, which is still poorly known in Western Nepal, is the focus of this study.
To investigate the crustal structure using the P-to-S receiver function (P-RF) technique, we analyze the tele-seismic data recorded by the first temporary seismic experiment in Western Nepal, composed of 15 stations, the "Himalaya-Karnali-Network" (Hi-KNet, 2014-2016)[Hoste-Colomer, et al. 2017], complemented by one station of the Regional Seismological Network (RSC). Receiver function is a powerful technique introduced about four decades ago for imaging crustal and upper mantle interfaces beneath a seismic station. The P-RF method utilizes the P-to-S (Ps) converted waves originating from interfaces to investigate the depth of discontinuities and shear-wave velocities in the crust and upper mantle. Here we compute iterative time-domain deconvolved RFs in the 0.2 – 1.0 Hz frequency band. These processed RFs are then migrated with the Common Conversion Point technique using a velocity model adapted for our study area.
The deepening of the Moho is observed from south to the north, from about 40 km depth beneath the Siwalik, to about 58 km depth beneath the Higher Himalaya. The shape of the Moho is smooth, but there are hints towards lateral variations in its depth on the order of several kilometers.
Furthermore, a strong signal in the upper crust is observed and corresponds to a velocity decrease at $\sim$ 10 km depth followed by a velocity increase at $\sim$ 20 km depth. This indicates the presence of a low-velocity zone (LVZ) which is 55 km long along profile, expanding approximately between the surface position of Main Central Thrust (MCT) and the front of the Higher Himalaya. This LVZ seen in the upper crust coincides locally with the northernmost flat segment of the MHT. Our new image constrains the position of the MHT in Western Nepal, and connects well to previous geological and geophysical studies in the region. It also highlights that lateral variations exist within the crust over relatively short distances.