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Lithospheric mantle heterogeneities within the Tibetan Plateau. Results from a geophysical-petrological approach

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We present two 2D crust and upper mantle cross sections down to 400 km depth, along two profiles which cross perpendicularly the Himalaya Mountains and the surrounding areas. The eastern profile goes from the Indian shield to the Beishan Basin, crossing the eastern Himalaya, Tibetan Plateau, Qaidam Basin and Qilian Mountains. The western profile crosses the western Himalaya, Tarim Basin, Tian Shan Mountains and Junggar Basin. We apply a combination of numerical techniques which integrate potential field (gravity and geoid), isostasy (elevation), and thermal (heat flow and temperature distribution) equations, with petrophysical models. The mantle density is a function of temperature-pressure conditions and composition. We prescribe the geometry and properties of the crust according to available geophysical models. We calculate seismic velocities (Vp and Vs) and density in the mantle and then we compare the resulting elevation, Bouguer anomaly, geoid, heat flow and seismic velocities with the observations.

Our results show the crust and LAB geometries and the variations of the lithospheric mantle composition along the profiles. In the Eastern Himalaya the high Tibetan Plateau is characterized by a significant variation in the lithospheric thickness from south to north. A change in the lithospheric-mantle composition in the so-called “crush zone”, the weak and deformable zone which divides the Indian and Asian lithospheres, is needed to fit observables. In the western transect, the Indian lithospheric mantle underthrusts the Tibetan Plateau further to the north and with a shallower angle with respect to the eastern profile, whereas the presence of the rigid block of the Tarim basin is reflected by a change in the lithospheric mantle composition.