Evidence of shallow lithosphere and crust in the western continental margin of India through modeling of gravity data

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The seismically active western continental margin of India (WCMI) comprises of the three pericratonic rifts (Kachchh, Cambay, and Narmada) and the Saurashtra uplift that has been formed during the northward trek of the Indian plate. In the present study, forward and inverse modeling of the Bouguer anomaly have been done to calculate the topographical variation of the Moho and Lithosphere-Asthenosphere boundary (LAB). Inversion is implemented over the band-pass (cut-off wavelength 100 and 200 km) and low-pass (cut-off wavelength 200 km) filtered Bouguer anomaly with the assumption of constant density contrast between the Moho and LAB interfaces. Results of the inversion reveal significant variation of the Moho and LAB depths over the WCMI that vary between (1) 33-42 km and 82-124 km in the Kachchh rift, (2) 34-42 km and 68-110 km in the Cambay rift and north Gujarat, (3) 36-44 km and 80-95 in the Narmada rift and south Gujarat and (4) 34-41 km and 85-135 km in the Saurashtra peninsula, respectively. Using the present results of the Moho and LAB depths as constraint, forward modeling has been performed over the band-pass filtered (cut-off wavelength of 100 and 500 km) Bouguer anomaly. The result of forward modeling reveals that the magmatic underplating layer is enveloping the entire crust of the WCMI which indicates that the whole region has been affected by the Reunion hotspot volcanic activity. A thin lithosphere beneath the Cambay and Kachchh rift has been observed which expedited the eruption of volcanic material through the pre-existing rift zones. The Cambay rift is the zone of high geothermal gradient where LAB is upwarped and both the signatures indicate the existence of partial melting condition at a shallow depth that is also confirmed by recent seismological studies.