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Delineation of Different Geological Interfaces Beneath the Bengal Basin: Spectrum Analysis and 2D Density Modeling of Gravity Data

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Abstract : The Bengal basin is a spectacular example of a peripheral foreland basin formed by the convergence of the Indian plate beneath the Eurasian and Burmese plates. The basin is embraced on three sides; north, west and east by different fault-controlled tectonic features whereas released in the south where the rivers are drained into the Bay of Bengal. The Bengal basin in the eastern part of the Indian subcontinent constitutes the largest fluvio-deltaic to shallow marine sedimentary basin in the world today. This continental basin coupled with the offshore Bengal Fan under the Bay of Bengal forms the biggest sediment dispersal system. The continental basin is continuously receiving the sediments by the two major rivers Ganga and Brahmaputra (known as Jamuna in Bengal), and Meghna (emerging from the point of conflux of the Ganga and Brahmaputra) and large number of rain-fed, small tributaries originating from the eastern Indian Shield. The drained sediments are ultimately delivered into the Bengal fan. The significance of the present study is to delineate the variations in thicknesses of the sediments, different crustal structures, and the mantle lithosphere throughout the onshore-offshore Bengal basin. In the present study, the different crustal/geological units and the shallower mantle lithosphere were delineated by analyzing the Bouguer Gravity Anomaly (BGA) data along two long traverses South-North (running from Bengal fan cutting across the transition offshore-onshore of the Bengal basin and intersecting the Main Frontal Thrust of India-Himalaya collision zone in Sikkim-Bhutan Himalaya) and West-East (running from the Peninsular Indian Shield across the Bengal basin to the Chittagong–Tripura Fold Belt). The BGA map was derived from the analysis of topex data after incorporating Bouguer correction and all terrain corrections. The anomaly map was compared with the available ground gravity data in the western Bengal basin and the sub-continents of India for consistency of the data used. Initially, the anisotropy associated with the thicknesses of the different crustal units, crustal interfaces and moho boundary was estimated through spectral analysis of the gravity data with varying window size over the study area. The 2D density sections along the traverses were finalized after a number of iterations with the acceptable root mean square (RMS) errors. The estimated thicknesses of the different crustal units and dips of the Moho boundary along both the profiles are consistent with the earlier results. Further the results were encouraged by examining the earthquake database and focal mechanism solutions for better understanding the geodynamics. The earthquake data were taken from the catalogue of US Geological Survey, and the focal mechanism solutions were compiled from the Harvard Centroid Moment Tensor Catalogue. The concentrations of seismic events at different depth levels are not uncommon. The occurrences of earthquakes may be due to stress accumulation as a result of resistance from three sides.

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