Geodynamic implications from satellite GOCE in Tibet-Kohistan-Ladakh-Himalayas

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The gravity field produced from the observations of the satellite GOCE have a homogeneous resolution of 80 km and precision of 3 mGal, representing the best field today available in terms of resolution and precision. The satellite guarantees homogenous coverage, which by terrestrial methods cannot be achieved in difficult terrain as the one under study. Compilations of terrestrial observations suffer from inhomogeneities in sampling, different timing of the campaigns, cross-border problems in the reference systems, possible differences in instrumentation and tying errors of relative measurements to the reference stations. This is demonstrated by using the GOCE field to check the reliability of terrestrial data following the schemes described in [1,2]. For the first time the gravity field can be reconstructed over large areas as the Himalayan mountain range from the eastern to western syntaxis and the Tibetan plateau, with a resolution which is sufficient to detect geologic macrostructures.

The gravity anomaly and the Bouguer field of GOCE is reduced in terms of regression between topography and gravity to obtain a residual field highlighting the geologic macrostructures and lineations. The amplitude range of the residual Bouguer field is greatly reduced, demonstrating that the regression efficiently eliminates the isostatic field. As expected, for the gravity anomaly the reduction is less, but nonetheless effective in extracting the field generated by crustal density variations.

The residual fields highlight geological units, as the complete Kohistan-Ladakh arc, crustal transitions, cratonic units and deep sedimentary basins. The observation of these anomalies is new and shows the strength of GOCE in mapping the field homogeneously crossing geologic, topographic and national boundaries.

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