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Crust-mantle density contrast derived globally using gravity and seismic models

R. Tenzer (1), M. Bagherbandi (2), and P. Novak (3)

(1) National School of Surveying, University of Otago, Dunedin, New Zealand (robert.tenzer@otago.ac.nz), (2) Division of Geodesy and Geoinformatics, Royal Institute of Technology (KTH), 10044 Stockholm, Sweden (mohbag@kth.se), (3) Department of Mathematics, University of West Bohemia, Univerzitní 22, Plzeň, Czech Republic (panovak@kma.zcu.cz)

We utilize the combined least-squares approach to determine jointly the crustal thickness and the crust-mantle density contrast using gravity data and constraining information from seismic model. The principle of this combined approach is based on solving Moritz's generalization of the Vening-Meinesz inverse problem of isostasy. The EGM2008 global gravity model coefficients, the DTM2006.0 global topographic/bathymetric model coefficients, global ice thickness data, and the sediment and consolidated crust thickness and density data from the global crustal model CRUST2.0 are used to generate the isostatic gravity anomalies. All computations are realized and presented globally on a 1×1 arc-deg geographical grid. The estimated values of the crust-mantle density contrast (defined relative to the adopted value of the reference crust density of 2670 kg/m3) are between 81 and 965 kg/m3. The minima correspond with locations of the divergent oceanic tectonic plate boundaries. The maxima are found along the convergent tectonic plate boundaries in Andes and in Himalayas (extending under the Tibetan plateau). We demonstrate that the spatial distribution of the crust-mantle density underneath the oceanic crust is attributed to the age of oceanic lithosphere. The corresponding distribution beneath the continental crust is significantly correlated with the crustal thickness.