TOWARD A HIGH-RESOLUTION GLOBAL CRUSTAL MODEL BASED ON NEW PRINCIPLES OF DATA ANALYSIS.

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Crust is the most heterogeneous layer within the Earth. Therefore, crustal effects often dominate over other effects in the observed fields, e.g. in gravity, seismic, geothermal, geomagnetic and some other studies. For example, in seismic tomography it is almost impossible to separate the effects of Moho variations and upper mantle heterogeneity. On the other hand, the crust is well studied by various (primarily seismic) methods. Based on these data, it is possible to construct a-priori model of the crust and to use it then for corrections of the observed fields. Unfortunately, the existing seismic data are so heterogeneous that their integration into a 3D model is still a big problem. Existing global crustal models are unclear about the methodology and data that are used. Moreover, differences in e.g. depth to the Moho between the models and direct seismic determinations are often larger than 10km, which is far above any acceptable limit. We have developed a new formalized approach to construct crustal models based on all available data. The new method involves both interpolating main crustal discontinuities down to Moho and estimating velocity-density-depth curves for the crust at each interpolation location. The interpolation is not straightforward but takes into account distribution of all available parameters and tectonic position of each area. It is also possible to assess the uncertainty of the constructed model.

The developed method has been applied successfully to Asia (Stolk et al., 2013). For calculations we used the most complete data-base compiled in the US Geological Survey. The resulting new Moho map leads to a much better fit to the data, especially in Russia and Eastern China. The reliability of our estimation in these regions is confirmed by relatively low estimation uncertainties. Previous models have been unable to cater for locally varying velocity depth relations in Asia. Our model easily adapts to the data and brings out more crustal heterogeneities than before. Now we expand this study to the whole Earth. One of the first results is a new high-resolution global map of the Moho.

Stolk W., Kaban M.K., Beekman F., Tesauro M., Mooney W.D., Cloetingh S. (2013). High resolution regional crustal models from irregularly distributed data: Application to Asia and adjacent areas. Tectonophysics. Accepted paper in press. Available online since 31 January 2013.