Geophysical Research Abstracts, Vol. 9, 03786, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03786

Gravity data inversion without modelling for 3D topography of a contact surface

I. Prutkin (1), U. Casten (2)

(1) Delft University of Technology, Netherlands (I.Prutkin@tudelft.nl), (2) Ruhr University of Bochum, Germany (casten@geophysik.ruhr-uni-bochum.de)

Developed are new algorithms to find geometry of 3D contact surface of arbitrary shape using square gravity data. It should be emphasized, that we have managed to get rid of any modelling: an integral equation is being solved to find a function, determining geometry of the object sought. Instead of solving the equation by means of linearization or nonlinear minimization, we apply the new method of local corrections, which makes it possible to solve a full (nonlinear) problem and to curtail the time required to solve an inverse problem approximately by an order of magnitude. To extract the gravity signal of the contact surface we look for, the new algorithm is suggested, based on upward and downward continuation. The algorithm allows to separate the effects of subsurface and deeper objects and to eliminate the sources from the Earth's surface till a prescribed depth. Both algorithms are applied to extract the field of the Moho boundary and to find its 3D topography for the Hellenic subduction zone.

First, a model of the layer till the depth of 20 km is constructed, which includes two contact surfaces: depressions of the light sediment layer and an uplift of the crystalline basement. The model of the layer demonstrates the opportunities of the local corrections approach: several contact surfaces with different density contrast have been found simultaneously. Besides, our results have been obtained automatically without any forward modelling. Then, the gravitational signal from the half-space below 100 km is found by means of the algorithm of upward and downward continuation. After subtracting signals of the subsurface layer and from deeper sources we obtain ultimately the field, which is regarded as the gravitational signal from the Moho boundary. The method of local corrections is applied to find its 3D topography. The main features of the obtained topography are quite in agreement with seismic information and results of previous gravity modelling.