Geophysical Research Abstracts
Vol. 12, EGU2010-10391, 2010
EGU General Assembly 2010

Modelling of the density inhomogeneities with the geoid data (Gravimetric Tomography)

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The gravimetric tomography technology (1) is based on determination of density anomalies from spherical harmonics of the given geopotential anomalies (geoid). It includes implementation of the following tasks:
1. Determination of a relationship between the harmonic degree and depth of the disturbing mass using the inverse decision of the harmonic function 1/l, known in a physical geodesy.
2. Determination of the harmonic density of anomalous disturbing mass by the Prof. H Moritz's program (2).
3. 3D visualization of tomographic models of dense inhomogeneities.
The lateral resolution or the spatial-scale of tomographic images is depended on the highest degree of the geopotential model. It is 360 for the used EGM96 geoid model and the spatial resolution is 0.5° accordingly. Computing was carried out with an interval of 0.25° for maps and of 30 km for vertical sections. A resolution between disturbing layers is defined by an interval between depths which correspond to harmonic degrees. These intervals are not equal.
A distribution of global dense inhomogeneities is shown on maps of the lateral slices for depths of 5300 km, 2800 km and 1500 km. Similar results between gravimetric and seismic tomographic images are observed on the global scale with works (3, 4).
An agreement is also in the regions of the Antarctic continent which is complex regarding isostasy. It is shown a likeness of the bodies' geometry and signs of density anomalies along the meridional section of 108°W (5) in the layer of the high mantle and lithosphere up to depth of 400 km.
The isostasy reduction of density distribution for the mid-ocean ridges regions is shown on an example of the Angola-Brazil Geotraverse. In accordance with the work (6) observed geoid height anomalies are directly proportional to the dipole moment of density distribution. The dipole in our case is a distribution of harmonic density anomalies beneath the each of point measured along the section. Our gravimetric tomography models after procedure of the isostatic compensation are coordinated with the available seismic tomography models.
Density inhomogeneities in the crust body and the sedimentary layers are discovered on the tomographic images.
At the same time, a low radial resolution at large depths in the gravimetric tomography method does not allow to identify low velocity anomalous heterogeneity on the core-mantle boundary. However, there is a quite high lateral and radial resolution at the smaller depths. The EGM2008 geoid model shows more detail density distribution than the EGM96 geoid for the Ukrainian territory. Therefore, joint modelling of seismic and gravimetric tomography data may be fruitful.

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