Geophysical Research Abstracts
Vol. 14, EGU2012-633, 2012
EGU General Assembly 2012

Accurate topographic reduction of potential field data

NK Köther, WS Szwillus, HG Goetze, and SS Schmidt
Kiel, Germany, Geosciences, Geophysics, Kiel, Germany (nkoether@geophysik.uni-kiel.de)

Topographic reduction of potential fields (gravity and magnetics) is an important processing step for geophysical applications. The topographic signal can obscure subsurface anomalies, so measurements have to be corrected for its influence. Several algorithms are available for topographic reduction. These are based on cylindrical ring compartments, rectangular prisms, mass lines or mass points. Earth curvature is often taken into account using various different approaches. Calculations are done in the space or frequency (FFT) domain. In general, the mass correction of gravity data is done to a radius of about 167 km around an observation point. Although mass correction is a crucial processing step, these standards are often used without modification. However, the choice of limiting radius is questionable and the approximation error can be higher than the accuracy of the measurements. In particular, planar corrections are erroneous for surveys covering large areas.
In our study, we analyzed the influence of distant topography (>167 km) and approximations on gravity data. We developed two algorithms for this purpose. The first calculates the topographic effect with an exact surface integral of a polyhedron on a sphere. The other calculates the topographic effect with an exact calculation of spherically-shaped prisms using numerical integration. Furthermore, we use an adaptive approach to change the resolution of topographic data depending on its influence on the station. We also used elevation from a digital terrain model (DTM) and the elevations of ground stations are included in the approach to avoid systematic errors.
Data from high mountains (the Andes and the Himalaya) were examined to test the new methods. Finally, we identify a) the influence of distant topography on the measured gravity, b) the effect of different topography resolutions and c) the differences to other approaches.
All approaches differ in speed and accuracy. Our results show that some algorithms have large errors due to approximations. Depending on the investigation area and the objective of the survey, it is advisable to put more effort into obtaining an accurate, exact and reliable method for the reduction of topographic effects.