Terrain correction in extremely disturbed terrain

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Abstract: It has been for several decades that computers have enabled us to perform the terrain correction computation much faster and accurate then before. In the meantime several programs for terrain correction computation have grown up among geophysicists and geodesists. All these programs have something in common – they all use a digital elevation model (DEM) as an input. On the other hand there are some differences, either in form of the integration kernel (planar, spherical), or in the integration scheme and integration method. While browsing over the flat region, all of the programs give almost identical results, assuming all use the same DEM. However, when terrain grows higher and gets more broken, the differences in results become significant. Now, it is not an easy task to decide which program produces better results. One way how to do it would be to produce an etalon computed analytically from idealized terrain. Such an approach, in fact, has several disadvantages: it is rather complicated and it cannot be done in real, or at least real-like, terrain. A different way how to compare the quality of terrain corrections in the mountains is presented in this contribution. The main idea is very simple: terrain corrections that produce smoother refined Bouguer gravity anomalies

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are better. This approach, of course, can only be used when the computation points are sufficiently close each other and when the real gravity at these points is known from direct measurement.

During summer 2004 the unique joint measurements of gravity and 3D position had been collected in High Tatra Mountains. The amount of 153 points had been measured using Scintrex CG-3 gravity meter and Trimble 5700 GPS receivers (3D position). At some points the additional measurements of 3D position in close surrounding area had been performed. These measurements are very convenient for our investigation.

In this contribution we compare three different programs for terrain correction computation. At first we briefly explain the basic differences between the programs. As a next step we compute the terrain corrections by each program using the same DEM obtaining the 3 sets of terrain corrections. The integration radius is 166.7 km $\approx$ 5390 arcsec. and density is standard 2670 kg$\cdot$m^{-3}. Consequently we compute the 3 sets of refined Bouguer gravity anomalies corresponding to 3 sets of terrain corrections. Finally we compare 3 different sets of refined Bouguer anomalies and evaluate the smoothness of each set using statistical testing. At the end we give conclusions and recommendations based on obtained results.

Key words: terrain correction, refined Bouguer gravity anomaly, smoothness, statistical testing