Introduction:
In the era of modern technologies and GNSS developments the precise quasi-geoid (QGeoid) model is necessary as geodetic infrastructure for GNSS services in different engineering needs, as it allows the determination of normal height much faster in comparison to levelling and directly from GNSS. This poster represents the DFHRS (Digital Finite-element Height Reference Surface) software for QGeoid determination based on parametric modelling, as well as further version based on Adjusted Spherical Cap Harmonics (ASCH) modelling. The example of the QGeoid model for Western region of Latvia (Kurzeme) and preliminary computation results are introduced. The theory of Deflections of Vertical measurements by digital zenith camera is also included.

Computations of Kurzeme aigeod:
In order to compute the DFHRS_DB for Kurzeme 71 identical points (ellipsoidal h and normal heights H in EVRS system) together with the EGM2008 geopotential model data were used. Additionally terrestrial 63 DoV observations were included. EGM2008 is a spherical harmonic model of the earth’s external gravitational potential in degree and order of 2160, with additional spherical harmonic coefficients extending up to degree of 2190 and order of 2160 that offers a spatial resolution of 9 km [1]. For meshing the area, mesh size of 5x5 km was chosen. Total amount of meshes – 969. The total number of patches is 6.

Zenith camera and determination of DoV:
Digital Zenith Camera [7]

The difference between the solution with only GNSS/levelling (blue triangles) data and GNSS/levelling + DoV (red squares)

The present DFHRS was calculated on the basis of the EGM2008 [2] model and 59 identical reference points. 12 first order levelling/GNSS points were excluded from the computations because of Gross errors in the DFHRS, which could reach up to 9.6 cm. Some of these points were located along the shore of Gulf of Riga and were replaced by DoV observations (see fig.2). The results of 2 solutions are depicted in table 1.

Table 1. STDEV of 2 solutions

<table>
<thead>
<tr>
<th>Used data</th>
<th>Stdev of residuals</th>
<th>Stdev of repro</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS/levelling</td>
<td>0.007m</td>
<td>0.015m</td>
</tr>
<tr>
<td>GNSS/levelling +DoV</td>
<td>0.008m</td>
<td>0.024m</td>
</tr>
</tbody>
</table>

Conclusions:
The quasi-geoid model for Kurzeme region has been computed with evaluated accuracy of 1-3 cm. ASCH modelling in terms of integrated geodesy allow the combination of both geometrical and physical data, moreover this method is much faster in comparison to SH. Implementation of vertical deflections observations in terms of ASCH gives additional improvement of quasi-geoid and gravity field determination.

References:

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