Improvement of Latvian geoid model

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The high precision geoid model is essential for precise normal height determination when the GNSS positioning methods are used. In Latvia gravimetric geoid model LV'98 is broadly used by surveyors and scientists. The computation of this model was performed using GRAVSOFT software using gravimetric measurements, digitized gravimetric measurement data available on USSR era maps and satellite altimetry data over Baltic Sea, the estimated accuracy of LV'98 geoid model is 6-8cm [3]. But 15 years have passed since the creation of LV'98 and the precision of Latvian geoid model is no longer compatible with that of GNSS measurements and volumes of use.

In order to improve the accuracy of Latvian geoid model, the evaluation of several methods and test computations have been made.

KTH method was developed at the Royal Institute of Technology (KTH) in Stockholm. This method utilizes the least-squares modification of the Stokes integral for the biased, unbiased, and optimum stochastic solutions. The modified Bruns-Stokes integral combines the regional terrestrial gravity data with a global geopotential model (GGM) (R. Kiamehr, 2006). Experimental gravimetric Latvian geoid model was computed using digitized gravimetric measurement data from USSR era maps but more precise model for Riga region was achieved using recent gravimetric measurement data.

DFHRS (Digital Finite-Element Height Reference Surface) method has been developed at the Karlsruhe University of Applied Sciences, Faculty of Geomatics [2]. In the DFHRS concept the area is divided into smaller finite elements – meshes. The height reference surface N in each mesh is calculated by a polynomial in term of (x,y) coordinates. Each group of meshes forms a patch, which is related to a set of individual parameters, which are introduced by the datum parameterizations. As an input data the European Gravimetric Geoid Model 1997 (EGG97) and 102 GNSS/levelling points were used.

Astrogeodetic method is known since mid-20th century, however with little recognition, since the acquisition and processing of high quality data was a slow and laborious process. During the recent decades and thanks to the emergence of charge-coupled device (CDD) imaging technologies, this method has become increasingly popular. It provides a faster result with a smaller number of measurements than in the case of gravimetric methods using CCD imaging technologies and recently complied massive areosptatial star catalogues. In order to apply and expand the astrogeodetic method in Latvia, the prototype of mobile digital zenith telescope for determination of vertical deflections is developed at University of Latvia, Institute of Geodesy and Geoinformation [1].

References

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