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A proposal for combination of GPS/Leveling data in the gravimetric geoid computation Case study: Test area Southwest of Finland

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It has become a common practice in geoid computations that a geoid model based on a gravimetric boundary value problem (BVP) be fitted to the geoid model that comes from GPS/leveling (i.e. geoidal height = ellipsoidal height − orthometric height) using a 7-parameter conformal transformation. This procedure is suffering from following flaws: (1) Determination of the orthometric height requires the computation of mean gravity within the Earth, and as such its accurate computations is as hard as geoid computation and requires some technique for estimation of gravity field within the Earth, which is the same as the main problem involved in the geoid computations itself. (2) The final surface fitted to the geoid at the GPS/Leveling points is not anymore an equipotential surface (because it is transformed to fit into the geoid at the GPS/Leveling point and even if the GPS/Leveling geoid be errorless the fitted geoid is just a least square approximation to the geoid at the GPS/Leveling points). Considering the aforementioned shortcomings we propose that the GPS/Leveling geoid be also involved in the BVP of geoid computations as a weighted constraint, so that the result of the gravimetric geoid computation is also affected by those information with their due weight. In this way there will be no need to fit to GPS/Leveling point at the end of computations. The observation equations and technical details for implementation of GPS/Leveling geoid into the BVP of gravimetric geoid computations are presented in this paper. As geoid computation we have considered the methodology introduced by Ardalan and Grafarend in 2004 (Journal of Geodesy, 78: 138-156), and further developed by Safari, Ardalan, and Grafarend in 2005 (Journal of Geodynamics, 39: 545-568). As the case study the geoid of a test area in Finland is presented.