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Validation of GOCE time-wise gravity field models using GPS-levelling, gravity, vertical deflections and gravity gradient measurements in Hungary

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With the advantage of satellite gravity gradiometry (SGG) high standard global gravity determination could attain in the static part of the gravitational field. This study presents the validation of the first, second and third generation GOCE-only models using terrestrial data sets in Hungary. GOCE global geopotential models (GGM) are consistent models with global coverage (without the unobserved polar caps of 6.5° spherical radius) in sense that GGMs have been compiled utilizing measurements refer to short time period. Besides GOCE-based GGMs satellite only GRACE models were evaluated to assess the improvements by GOCE observations with respect to GRACE in gravity field determination. EGM2008 as the state-of-the-art model and SRTM3 elevation model were applied to provide that measurements involving Hungarian data sets and model derived gravity field functionals have almost the same spectral content. Results with GPS-levelling and gravity data support that there is an improvement in the determination of medium wavelength constituents of the gravitational field with GOCE models. Although vertical deflections characterize the short wave part of the gravity field, they are also capable to sense the advancement of SGG observations. Our experiences show that torsion balance measurements depict the fine structure of the gravity field, and hence they are not adequate in low-degree GGM validation.