



Gravity change in Finland 1962–2010 from the comparison of new measurements using the outdoor absolute gravimeter A10-020 with legacy relative measurements

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Finland belongs to the Fennoscandian Postglacial Rebound (PGR) area, with vertical velocities of up to 1 cm/yr and corresponding surface gravity rates as large as -2 microgal/yr. Knowledge of the secular gravity change in Finland comes so far from three sources:

- (i) repeated absolute gravity measurements at a limited number of indoor laboratory-type sites, made by various teams and instruments (1976–),
- (ii) repeated relative measurements on the Fennoscandian Land Uplift Gravity Lines (1966–2003) which run in East-West direction along the approximate latitudes 61, 63 and 65 degrees N,
- (iii) satellite gravimetry with the GRACE (2002–).

We are adding a new source: In 2009–2010 the Finnish Geodetic Institute (FGI) together with the Institute of Geodesy and Cartography (IGiK) re-measured the Finnish First Order Gravity Network (FOGN), using the A10 No. 020 outdoor absolute gravimeter of the IGiK. The FOGN consists of 50 outdoor stations, typically on the stairs of churches and other monumental buildings. The purpose of the FOGN (or its re-measurement) is not geodynamic research but the provision of easily-accessible reference sites for tasks of practical relative gravimetry, like gravity mapping for geodesy, geology and applied geophysics.

However, as the FOGN was first measured in 1962 (with a Worden gravimeter) and re-surveyed in 1988 (with two LCR gravimeters), the time span 1962–2010 provides the opportunity to extract a signal of gravity change from the comparison of the three campaigns. While the accuracy of the 1962 measurements is limited, at some FOGN stations additional data is provided by North-South traverses measured from 1966 onwards for calibrating LCR gravimeters.

During the 2009–2010 campaign with the A10-020 altogether 50 old and new stations in the FOGN were occupied. Some original stations had been destroyed or were not accessible with the A10, e.g. for lack of mounting space. In 2010–11 relative ties were established to connect original and new stations, and the vertical gradients of gravity were measured. In the end, at nearly 40 stations it is possible to establish a chain, in some cases quite sinuous, between the 1962 campaign station and the A10 station.

We discuss the campaigns, the experience with the A10, and the accuracy achieved. The observed gravity change is compared with results obtained with other methods and with predictions from PGR models.