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Letter to the Editor

Scale Factor Determinations of a LaCoste and Romberg Gravimeter Model D

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Key words: Gravimetry – LCR model D "microgal" gravimeter – Nonlinearity of scale factor.

LCR gravimeters model D have a resolution in the microgal-range, which exceeds the resolution of usual field gravimeters almost by one order or magnitude. The model D has only a scale range of 200,000 units, with 1,000 unit being equivalent to approximately 1 mgal. The scale ranges of less sensitive gravimeters cover some times many thousands of mgals. In the later case the scale factors are often not linear within these broad scale ranges. For the model D gravimeter the manufacturer claims that the scale factor is constant for the complete scale range, which seems to be reasonable because of its small size. However, this assumption should not be generalized. When, during field work resetting of the D-9 gravimeter was required, systematic deviations from the gravity differences which have been measured previously with other scale ranges occured. Because this seemed to indicate a nonlinearity of the scale factor, systematic tests were performed between two gravity stations situated in the departmental building Hohe Warte, Vienna, and at the top of the Kahlenberg (near Vienna) respectively. A series of measurements at five different range settings was carried out. At each station at least three readings were taken. After eliminating drift and tidal effects the following scale values resulted:

Reading Hohe Warte	Reading Kahlenberg	Difference
57,186	20,188	36,998
90,332	53,323	37,009
120,018	82,989	37,029
150,175	113,135	37,040
174,837	137,785	37,052

(All values are given in scale units)

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Obviously the scale factor of the gravimeter decreases when the reading increases within the scale range. The following equation is obtained by least square fitting:

$$F = 1{,}12356 \frac{1}{1 + 6{,}3595 \cdot 10^{-6} \cdot S}$$

(F = Scale factor [mgal/scale unit], S = Scale value.)

In comparison with the non-linear scale factor the use of a constant one would cause errors up to 72 μgal. Thus, the nonlinearity of the scale factor of the LCR-D 9 is rather large, compared to an equivalent range of LCR gravimeters model G. Therefore LCR gravimeters model D should be checked for nonlinearities when high precision measurements have to be performed.

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