Comparative measurements of 3 relative spring gravimeters and the GWR SG025 for calibration purposes

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In tidal analysis as well as in geodynamical research the knowledge of accurate scale factors of relative spring gravimeters has crucial importance. In order to determine the instrumental response (calibration factor) of Scintrex CG-5, LCR-G949 and LCR-G220 gravimeters comparative measurements were carried out at Conrad Observatory (ZAMG) between 12/12/2012 and 04/05/2013 co-located with the SG GWR-C025.

A special problem was that - contrarily to the SG25 and CG5 - the two LCR-G meters were not equipped with feedback systems. The LCR-G949 was registering by using a CCD ocular while LCR-G220 uses the CPI output voltage. The transfer functions of LCR-G gravimeters are expected to be non-linear and dependent on the beam position. After data pre-processing (e.g. spike and step elimination) a standard tidal analysis was computed by using the ETERNA software package (Wenzel 1996) to determine the instrumental response in the frequency domain. Then a comparison and adjustment with the SG data was carried out to achieve the proper scale factors in the time domain.

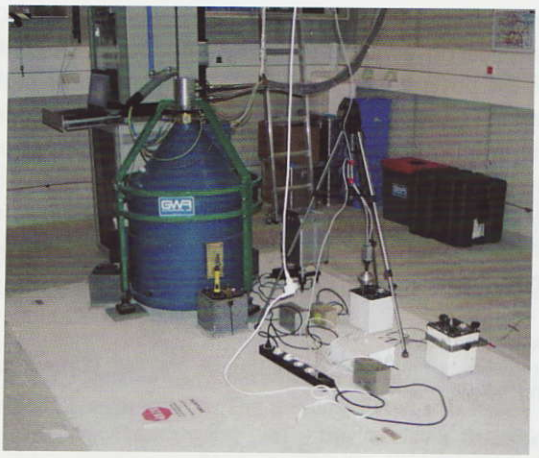

Figure 1: GWR-025, Scintrex CG-5, LCR-G 949 and LCR-G 220 at the Conrad Observatory.

Due to the slightly non-linear instrumental drift of LCR-G the four months data sets were analysed also in daily sequences. After applying convolution filters to every SG and LCR segment both the daily phase between the two time series and the daily scale factors were computed. The latter can be assigned to the daily mean beam position and in this way the discrete scale function is determined for the 1500 µGal wide measuring range.

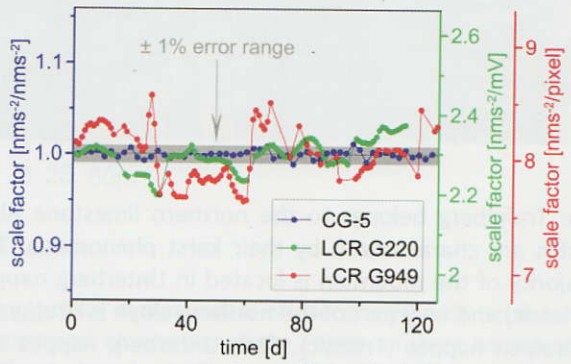

Figure 2: Temporal scale factor variation derived by analyzing data of non-overlapping 2 days' intervals.

The temporal variation of scale factors is displayed in Fig. 2. Table 1 lists the average scale factors obtained in the time domain. The relatively high standard deviations for the LCR gravity meters is due to the dependency of the scale factor from the tilt and beam position.

Table 1: Time domain calibration.

	CG5	LCR220	LCR949
Scale factor	1.00004	2.29596	8.03474
Std-dev	0.00432	0.03898	0.25223
unit	nms^{-2}/nms^{-2}	nms^{-2}/mV	$nms^{-2}/pixel$

Average scale factors.

Acknowledgement
The experiment was carried out in the framework of Hung. Res. Fund Nr. 101603.

References:

Wenzel H.G. (1996) The nanogal software: earth tide data processing package eterna3.30. Bulletin d'Informations Marées Terrestres, vol. 124, 9425-9439.

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