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Intelligent Earth system sensing, scientific enquiry and discovery

Mapping of tidal effects in the Pannonian basin – an effort to check location dependencies at microGal level

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Abstract:

Accuracy demands of geodynamics require a consistent analysis of tidal models from place to place on the Globe to fully exploit the resolution capabilities of both absolute and relative gravimetry. In the hope of the dramatically decreasing observation time promised by the technological developments in absolute gravimetry one has to consider carefully all those local and global, mainly periodical influences the inaccurate knowledge of which is usually compensated by full day measurements.

Analysing visually the characteristics of absolute gravimetric measurements available in the Pannonian basin the time variation of the tide-free residuals of drop set averages resembles the tidal signal with a few microGal peak-to-peak amplitude at some observation places. It may indicate the deficiencies of the applied solid earth tidal and/or the corresponding loading models which can be a significant source of biased g determination if short term (~ 1 h) absolute measurements make the dream of +/- 1 microGal accuracy true in the near future.

Although Hungary has no leading edge instrumentation to investigate this problem, feasible configurations of earth tide observing systems based on LCR G type gravity meters have been developed recently. These are equipped by either conventional CPI (G220) or a novel electro-optical readout system (G949) but none of them by feed-back. The sensor characteristics of these instruments were investigated by moving mass calibration, comparison to available high resolution local tidal models and parallel recording with GWR SG025 operated by ZAMG (Austria) at the Conrad Observatory. In spite of the difficulties (e.g. the accurate determination of the scale factor function) the systems have been used successfully for tidal mapping at microGal

level of accuracy as the analyses of 4 – 9 months long observations indicate at 3 locations (Conrad Observatory, Piszkéstető, Tarpa) spaced almost equidistantly along the latitude of 48 degrees. Although the research project is still running the preliminary results show that spring gravity meters provide self-consistent diurnal and semidiurnal amplitude factors at COBS (G220, O1: 1.16386, M2: 1.17646; G949; O1: 1.16430, M2: 1.17515) but those are significantly different from the parameters derived from parallel SG025 observations (O1: 1.15007, M2: 1.18418). The same „rule of thumb" barometric correction was applied on all data sets but loading effects were not counted for. The observations at Piszkéstető show about 1 % less amplitude factor for O1 constituent (O1: 1.1567, M2: 1.1742). The presentation involves also an interesting comparison of CPI and electro-optical readout systems demonstrating an electric coupling between CPI and sensor heating cycles for G220.