Superconducting Gravimeter (SG) GWR 025 at Conrad Observatory – A Contribution to the Global Geodynamics Project (GGP)

Superconducting gravimetry today is the most effective tool for investigating temporal gravity variations caused by various geophysical processes such as earth tides, earth rotation, translational modes of the inner core, seismic normal modes, atmospheric and ocean loading. Identification and modelling of environmental effects on gravity is essential for extracting meaningful geodynamic signals from gravity time series. Within the framework of GGP the SG GWR C025 is operating since November 2007 at CO. The influence of atmospheric and hydrological signals is one major research goal.

Currently, the investigation of environmental effects on gravity at CO is focused on two phenomena related to meteorological and hydrological processes:

1. Long-term gravity residuals dominated by local hydrological processes whereby surface water is moving rapidly from topography (predominantly above the SG) down into the ground and is stored below the SG sensor. Several events could be identified so far associated with periods of heavy rain or intensive snow melt (Figs. 1, 2). As similarly done for the Vienna station (Meurers et al. 2007), rain admittance factors have been derived based on a high resolution DTM, which enables calculating the gravitational effect of precipitation (rain admittance model).

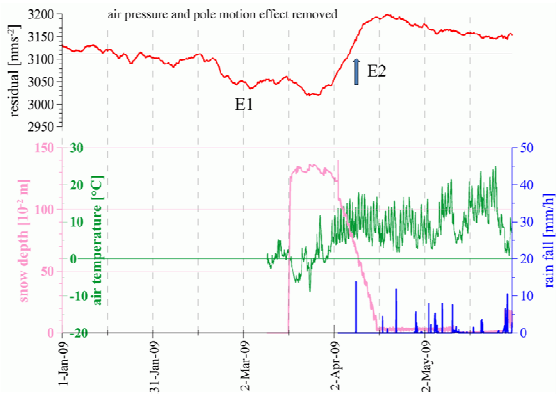

Figure 1: Final residuals (red) after removing the pole motion effect. Snow depth [10^{-2} m] (pink), rain (dark blue), air temperature (green). E1: snow accumulation, E2: rapid snow melt.

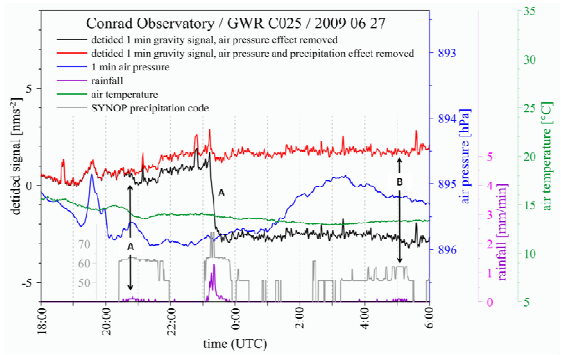

Figure 2: Rain event at CO: gravity residuals with (red) and without (black) rain effect correction, air pressure (blue), air temperature (green), SYNOP precipitation code (grey). The rain admittance model perfectly removes the gravitational effect not only of moderate rain (A) but also of light drizzle and rain (≤1 mm/h) (B). Distrometer data (grey) helps to identify precipitation periods when rain gauge observations do not indicate precipitation due to limited resolution.

.

2. Short-term (period < 5 min) air pressure variations are frequently observed at CO under specific weather conditions. This permits studying the sign-reversal of the pressure admittance to gravity and the gravity response on high frequency air pressure variations (Zürn&Meurers 2009).

References:

Meurers, B., Van Camp, M., Petermans, T., 2007. Correcting superconducting gravity time-series using rainfall modelling at the Vienna and Membach stations and application to Earth tide analysis, *Journal of Geodesy*, *81*, 11, 703–712.

Zürn, W., Meurers, B., 2009: Clear evidence for the sign-reversal of the pressure admittance to gravity near 3mHz, Journal of Geodynamics, 48, 371–377.

Authors:
B. Meurers, M. Dorninger
Institute for Meteorology and Geophysics, University Vienna, Austria

Corresponding author:
Bruno Meurers
Institute for Meteorology and Geophysics, University Vienna, Austria, Althanstrasse 14, UZA II
1090 Vienna,
Austria
Tel.: +43 (1) 4277 53724
e-mail: bruno.meurers@univie.ac.at