# Short term effects of atmospheric processes on gravity

**Atmospheric processes contribute to temporal gravity variations within a broad frequency range. Air pressure and water mass redistribution within the atmosphere play an important role. One of the major research goals of Superconducting Gravimetry (SG) at Conrad Observatory (COBS) is focused on the identification and modelling of environmental effects, which is essential for extracting meaningful geodynamic signals from gravity time series. Short period phenomena like the response on air pressure variations within the frequency band from 1 to 10 mHz or water mass redistribution due to convective atmospheric processes are analyzed. First attempts are made to utilize weather radar observations for modeling purposes.**

Currently, the investigation of atmospheric effects on gravity at COBS is focused on two phenomena related to meteorological processes:

1. Short-term (period < 15 min) air pressure variations are frequently excited at COBS during specific weather conditions. The sign-reversal of the pressure admittance to gravity (e.g. Zürn & Meurers 2009) can be clearly indentified. The notch frequency turns out to vary between 300 and 600 seconds. In many cases, the observed admittance function matches a simplistic atmospheric gravity wave model proposed by Zürn & Wielandt (2006). Fig. 1 shows a typical example.

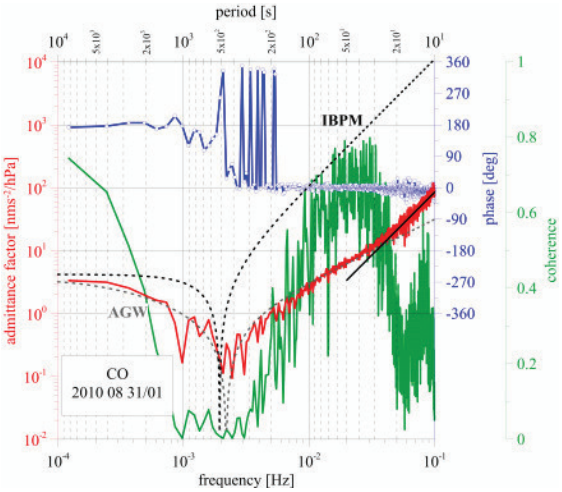


**Figure 1:** Air pressure admittance function (red) observed in the SG gravity record at the Conrad Observatory. The sign reversal close to 500 sec is clearly visible in the phase vs frequency function (blue).

2. First attempts are made in utilizing radar reflectivity data for modeling the liquid water content within the atmosphere above the SG sensor. In some cases, the gravity signatures visible in the residuals after correcting the rain effect can be partially explained by the Newtonian effect of liquid water within the atmosphere.

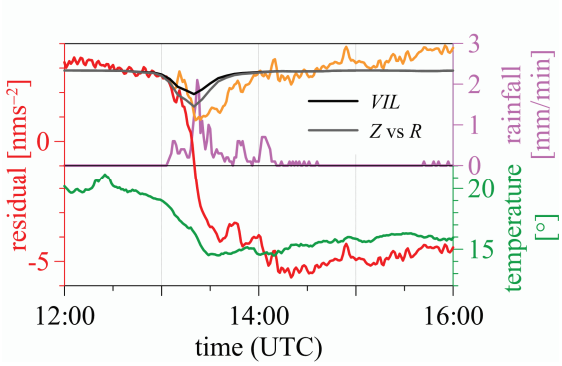


**Figure 2:** Heavy rain event at CO: gravity residuals without (red) and with (orange) rain effect correction, rain fall (magenta), air temperature (green). The residual drop is mainly due to the gravitational effect of rain water distributed on the topographic surface. For explaining the remaining signal (orange) information on the liquid water content of the air has been extracted from weather radar data. The model response on gravity based on different reflectivity – water content relations is displayed in grey.

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**References:**

Zürn, W. & Wielandt, E., 2006. On the minimum of vertical seismic noise near 3 mHz, *Geophys. J. Int.*, 168, 647 - 658.

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.

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