

Meteorological quantities and temporal changes in gravity

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Gravity changes provide considerable indications of geodynamic and tectonic processes. However, gravimetric records are constantly influenced by hydrological and atmospheric signals. A detailed investigation of the effect of such meteorological quantities was carried out in three projects (EMGISCO I – III) from 2010 till 2013.

Atmospheric pressure and precipitation are two of the main factors causing temporal changes of gravity. Therefore, sufficient and accurate modelling of their effects is indispensable for the interpretation of the gravity measurements. At the Conrad Observatory, gravity is registered by the high precision superconducting gravimeter GWR SG CT025, as well as air pressure in the lab. Additionally, meteorological sensors are installed in the outdoor area to measure parameters including precipitation, air pressure, temperature, humidity and wind.



Figure 1: Conrad Observatory building fundament construction (credit: Wilhelm)

Project aims of EMGISCO I – III:

The project aimed to provide quality control of new meteorological sensors (installed two years before the project started), development of a local meteorological network around the observatory, as well as implementation of a micro rain radar and using the data of the weather radar station Rauchenwarth in a distance of 52 km for profiling the liquid water content of the

atmosphere. This supports models which can be used to calculate the gravity effect of meteorological processes. Main targets were air pressure variations and precipitation in form of snow. Potential underground water reservoirs in front of the observatory building were investigated by seismic and geoelectrical measurements.

Snow profile measurements (snow depth and layer thickness, snow water equivalent) and snow depth observations by a Laser sensor right above the gravimeter GWR CT025, by an ultrasonic sensor on the roof of the observatory building as well as monitoring the snow water equivalent at a representative place in front of the observatory were undertaken for characterizing the water content and its temporal change.

A special focus was set to the hydrological setting underneath the building. For this case the building construction was studied carefully.

The results of these measurements could further reduce site noise effects at the Conrad Observatory. This project is another step to efficiently increase utilization of the Conrad Observatory and its excellent technical infrastructure as a distinguished research centre. The project resources were made available by the Ministry of Science (BMWFW).

References:

Meurers, B., Dorninger, M., Blaumoser, N., 2011: Atmospheric signals in the SG gravity record at Conrad Observatory, Austria. Geophysical Research Abstracts Vol. 13, EGU2011-12474, 2011.

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