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Assessment of seasonal gravity variations at local and regional scale with high precision absolute and relative gravity observations

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High precision gravity variations are known to be influenced by local and regional water storage changes, ranging from a few up to several tens of microgals. The major part of the local signal is generated by mass changes within a zone of some hundred meters around the gravity sensor. When interpreting these variations as water storage changes, a major question is whether the observed gravity variations are representative for a larger region or if local effects are dominating. This is essential if terrestrial time series from superconducting gravimeters should be compared with gravity variations from GRACE or global models for continental water storage changes.
At the Geodetic Observatory Wettzell (Germany), superconducting gravimeters are operated at two locations since many years which provide in combination with repeated absolute gravity observations high resolution temporal gravity variations with long term stability. These variations have been compared with GRACE and global hydrology models in the past. An extensive hydrological instrumentation allows the characterization of local water storage changes. During a two years period starting in February 2015, an iGrav superconducting gravimeter (SG) was deployed in a field installation with minimized footprint. Based on these observations, gravity changes within a local zone of a few hundred meters have been compared.
In order to assess the coherence of local and regional gravity changes, a footprint network was established around the observatory in 2014. The stations are separated into two groups, one in the close vicinity of the observatory and another within a radius of 10 km. Absolute gravity observations were performed twice per year with an A10 field absolute gravimeter since October 2014, which are supported by surveys with relative gravimeters and local soil moisture measurements.
We present a first consistent analysis of seasonal gravity variations derived from this set of observations and concluding on the coherence of local and regional signals, which gains importance again with the success of the GRACE-FO mission.