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Title: Influence of snow on the integrative signal of a superconducting gravimeter installed on top of Mount Zugspitze, Germany (Northern Calcareous Alps)

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Abstract:

Snow water equivalent (SWE) is an essential climate variable and has vital importance on the water cycle and the wellbeing of billions of people living in and downstream of mountain catchments. However, estimating its amount and the spatiotemporal distribution in complex high-alpine terrain is currently considered as one of the most important challenges in alpine hydrology. Besides, it is extremely difficult to measure or estimate further alpine water storage components, e.g. karst water reservoirs, and to examine the relationship between precipitation, evapotranspiration, storages, internal fluxes and discharge. Hydrogravimetry is the method of observing temporal gravity variations as the integral of all hydrological mass variations on a wide spectrum from 1 s to several years after reduction of all other geophysical signals. So far, the terrestrial hydrogravimetric method has been applied successfully for the direct, integral and non-invasive monitoring of water storage variations at several lower laying sites. The Zugspitze Geodynamic Observatory Germany (ZUGOG) with its worldwide unique installation of a superconducting gravimeter on top of a well-instrumented, snow dominated high-alpine catchment is applied for the first time as a novel snow hydrological sensor system within a footprint of 2 to 4 km. In general, we want to investigate to what extent such a snow-hydro-gravimetric approach contributes to a better understanding and quantification of processes and storages in high-alpine catchments. In this study, we will use this unique instrumental setup in synthesis with in situ measured data, detailed physically-based snowpack and hydrological modelling as well as satellite based data including high resolution snow depth maps derived by stereo photogrammetry. We will give an introduction into the novel sensor setup and will show first results, especially regarding the sensitivity of the integrative gravimetric signal regarding the spatially distributed snowpack and the hydro-gravimetric signal changes over the last three years.