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# Can vertical gravity gradients monitor seasonal soil moisture dynamics?

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Time-lapse ground-based gravity measurements can provide accurate constraints on subsurface water storage dynamics. In contrast to gravity, vertical gravity gradients are more sensitive to local effects and spatial heterogeneities in mass distribution. Hence vertical gravity gradient monitoring offers the potential of tracking mass changes caused by near surface water content differences. Here we investigate how time-lapse vertical gravity gradient monitoring could be influenced by soil moisture heterogeneities and how gravity and gradient data can be combined with hydrological models to identify seasonal dynamics.
One year of monthly vertical gravity gradient surveys has been completed in the geodetic observatory in karstic environment on the Larzac plateau in southern France. Repeated relative gravity measurements using a Scintrex CG5 on three concrete pillars within the observatory on three heights were used to estimate vertical gravity gradients.
In a parallel, a hydro-gravimetrical model based on Pflotran for the Karst surrounding the observatory building was set-up and calibrated with geophysical and hydro-meteorological time series available for the site. Possible explanations for small-scale spatial and temporal gradient changes derived from the forward model are evaluated. The potential as well as the limits and pitfalls of the method are discussed and perspectives for the use of portable absolute gravimeters for gradient monitoring are given.