

Non-Invasive Monitoring of Hillslope Groundwater Using High-Precision Relative Gravimetry

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A high-precision relative gravimetry approach was applied to monitor groundwater variations in hillslope environments in the Sandimen–Wutai region of southern Taiwan. A Scintrex CG-6 relative gravimeter was used to detect small gravity changes associated with groundwater recharge and drainage. Five gravity survey campaigns were conducted between May and September 2026 to capture groundwater-related gravity variations over the wet season. All of the gravity observations were corrected for instrumental drift, solid Earth tides, and atmospheric effects to better isolate gravity changes related to groundwater variation. The groundwater-level records were compared with repeated gravity measurements to investigate the response of gravity to water-table fluctuations. The analysis examines both the temporal relationships among gravity change, groundwater-level variation, and rainfall, and the spatial distribution of groundwater-related gravity signals. These observations are also used to assess whether repeated gravity measurements can provide broader spatial information than conventional point-based observation wells. In addition, the study explores the relationship between gravity variation and groundwater-level change, with the aim of evaluating the potential of relative gravimetry for groundwater monitoring in hillslope environments. Overall, the work examines the applicability of high-precision relative gravimetry as a non-invasive method for groundwater monitoring and for understanding hillslope hydrological processes.

Keywords: Hillslope, Relative gravimetry, Groundwater