Spatiotemporal Variations in the Hydromechanical Property of Aquifers in Choushui River Alluvial Fan, Taiwan

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Abstract

Land subsidence is a severe geohazard that can result in the loss of water and land resources, infrastructure damage, and economic disruption. The Choushui River Alluvial Fan in Taiwan suffers land subsidence problems because of soil consolidation due to natural and anthropogenic factors. It is necessary to have a comprehensive understanding of the hydromechanical properties that govern the relationship between pore water pressure and deformation in aquifer systems. This study aims to analyze the spatiotemporal changes of the skeleton storage parameters associated with multiple layers to investigate the land subsidence behavior due to groundwater level changes. The storage parameters investigated in this study include elastic skeletal specific storage (S_{ske}) and inelastic skeletal specific storage (S_{skv}), which illustrate the rate and potential of land subsidence. The linear regression method was used to estimate the storage parameters from the groundwater level variations and cumulative compression data collected from 38 groundwater wells and 31 multi-layer compaction wells provided by the Water Resources Agency of Taiwan. The results demonstrate temporal variability in skeletal-specific storage, with higher values estimated during dry seasons and lower values during wet seasons. Moreover, spatial variability is evident as the skeletal-specific storage exhibits distinctions across diverse locations and geological layers. This study shows that the hydrogeological storage parameters vary spatiotemporally, which can provide the potential assessment of land subsidence in the Choushui River Alluvial Fan of Taiwan.

Keywords: Land subsidence, Elastic skeletal storage coefficient, Inelastic skeletal storage coefficient, Groundwater level variation, Soil compression, Choushui River Alluvial Fan of Taiwan.