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Title:

Rethinking field-scale geophysics: Quantifying hydraulic conductivity with electrical conductivity

Abstract

Climate change significantly impacts landslide development as well as groundwater availability, necessitating improved mitigation strategies and field-scale methods to characterize subsurface hydraulic parameters. This dissertation explores the potential of geophysical methods, particularly induced polarization (IP) and electromagnetic induction (EMI), for enhancing landslide characterization and understanding subsurface hydrological processes. The research addresses the limitations of traditional applied methods and investigates the application of spectral IP (SIP) and EMI in field-scale studies. It also examines the challenges of upscaling laboratory-derived relationships to field conditions and proposes the use of pedotransfer functions (PTFs) within geophysical imaging frameworks as a potential alternative. Moreover, the use of deep learning networks as an alternative to deterministic inversion of geophysical data, with a particular focus on EMI, is investigated. Overall, this dissertation aims to advance geophysical techniques for quantifying subsurface properties, in particular hydraulic conductivity, ultimately contributing to more effective landslide management and hydrogeological catchment characterization, as required for groundwater modeling.