

HYDRO-MECHANICAL ANALYSIS OF A SURFICIAL LANDSLIDE TRIGGERED BY ARTIFICIAL RAINFALL: TWO FIELD EXPERIMENTS

Speaker

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Abstract

This seminar presents a detailed investigation into the hydro-mechanical behavior of a steep, forested slope subjected to artificial rainfall, which triggered a shallow landslide 15 hours after rainfall initiation. The site consists of a low-plasticity silty sand colluvium overlying fractured bedrock and was instrumented to monitor hydro-mechanical responses in real time. A coupled hydro-mechanical finite element model was developed using a critical state constitutive framework extended to unsaturated conditions. Model parameters were calibrated through an extensive laboratory testing program, including water retention curve measurements and triaxial stress path tests under both saturated and unsaturated states. Rainfall was applied as a surface flux, and boundary conditions accounted for soil-bedrock interactions. Simulation results showed excellent agreement with field observations, revealing that water exfiltration from bedrock fissures was the key triggering mechanism. The seminar highlights how combining field experimentation and advanced modeling improves the understanding and prediction of rainfall-induced shallow landslides. Finally, the setup of a second experiment to be held on an area within the Lattari Mountains (Campania Region, Italy), historically prone to flow-like landslides, is presented.

Biography

Francesca Casini is Full Professor of Geotechnics at Università di Roma Tor Vergata. Her research focuses on soil mechanics in saturated and unsaturated conditions, with emphasis on thermo-hydro-mechanical behavior of soils. She has held Marie Curie Fellowships as both Early Stage and Experienced Researcher and was a postdoctoral fellow at ETH Zurich, studying rainfall-induced landslides. She received the Rita Levi Montalcini grant and has led nationally and internationally funded projects, including the FROZEN project, which produced a patented triaxial apparatus for frozen soils. She is a member of ISSMGE's TC308 on Energy Geotechnics, a former member of the Géotechnique Advisory Panel, and Associate Editor for ASCE's Journal of Geotechnical and Geoenvironmental Engineering. In 2022, she received the George Stephenson Medal from the ICE and delivered the Thomas Telford Prestige Lecture in 2023 on the hydro-mechanical analysis of the Ruedlingen field experiment.



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