

CIVIL AND ENVIRONMENTAL ENGINEERING

PNRR - Effects of seasonal freezing-thawing on slope stability in permafrost regions

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
Supervisor	PIRULLI MARINA - marina.pirulli@polito.it
Contact	PIRULLI MARINA - marina.pirulli@polito.it LA PORTA GIULIA - giulia.laporta@polito.it
Context of the research activity	<p>In alpine environments, the effects of seasonal freezing-thawing on active layers represent an open and hot issue, since the related soil weakening can lead to slope instability and debris flows triggering, with serious consequences for structures and human lives. During the seasonal temperature fluctuation, the active layer melting leads to loss of cohesion of previously frozen debris, and thaw consolidation, which influences the hydraulic conductivity of the layer. Thus, the overall mechanical slope stability is affected. The increasing global warming makes the issue even more urgent, for the consequent melting process of snow and ground ice, and increased rainfall intensity and frequency. Additionally, the impermeable permafrost layer can represent a potential shear plane. All these factors can contribute to slope failure.</p> <p>PNRR M4C2, Investimento 1.3 - Avviso n. 341 del 15/03/2022 - PE0000005 Multi risk science for resilient communities under a changing climate (RETURN) - CUP E13C22001860001</p>
Objectives	<p>The study aims to analyze freeze-thaw cycle effects on soil properties and strength.</p> <p>The first step will include the development of a 1D frost heave and thaw settlement device in a climate chamber, to reproduce the condition of seasonal freezing-thawing of active layers in alpine environments. The purpose is the influence evaluation of grain size distribution and initial hydraulic conditions on the thermal, hydraulic and mechanical behavior of materials subjected to freezing-thawing.</p> <p>In the second step, the experimental observations will be used to calibrate a coupled thermo-hydro-mechanical model to reproduce the phenomenon in real scale.</p>

Skills and competencies for the development of the activity

Knowledge of geotechnical and hydraulic fundamentals and soil mechanics are requested. The candidate should be interested in laboratory work.