

SEMINAR

Carbon Dioxide injection into Deep Aquifers: a Geomechanical Perspective

Speaker | Prof. Lyesse Laloui

April 24th – 2:30 PM

POLITECNICO DI TORINO – DISEG | Aula Albenga (Entry 1, 2nd Floor)



Abstract

Carbon capture and storage (CCS) in deep geological formations is a key strategy for reducing atmospheric CO₂ emissions and mitigating climate change. However, the successful and safe implementation of CO₂ injection into deep aquifers requires a comprehensive understanding of the geomechanical and multiphase flow responses of the subsurface. This lecture will explore the pore-scale to reservoir-scale challenges and opportunities associated with CO₂ sequestration, focusing on reservoir integrity, caprock stability, and reactive transport processes. By integrating experimental studies, numerical modeling, and field data, we will examine the complex interactions between fluid injection, pore pressure evolution, two-phase flow, and rock deformation within heterogeneous porous media. The discussion will highlight recent advances in understanding and predicting thermo-hydro-mechanical (THM) processes triggered by CO₂ injection. Additionally, we will explore the role of permeability evolution and wettability effects in storage security. The development and evaluation of analytical and computational modeling approaches will be presented as essential tools for reliable risk assessment and process optimization. By providing a multiscale perspective, from microstructural effects to large-scale reservoir behavior, this presentation aims to foster cross-disciplinary discussions and contribute to the development of robust and sustainable CCS solutions, aligning with key challenges in porous media research, geomechanics, and subsurface engineering.



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Biosketch

Dr. Lyesse Laloui

Professor Laloui, Full Professor at the Swiss Federal Institute of Technology in Lausanne (EPFL), is a member of the Swiss Academy of Engineering Sciences and Academia Europaea, and a recipient of two honorary doctorates. His profile embodies multifaceted excellence: a leading scientist, distinguished engineer, innovative inventor, serial entrepreneur, and influential intellectual figure on the global stage. As founder and Honorary Editor-in-Chief of Geomechanics for Energy and the Environment, he steers the international discourse on sustainable geomechanics and subsurface energy.

His work has produced seminal theories, models, and experimental frameworks, contributing decisively to the foundations of modern geomechanics. These contributions provide essential tools to confront climate change, advance environmental stewardship, and drive the transition toward clean energy through the responsible use and storage of subsurface resources.

A masterful teacher and mentor, he has trained generations of scholars and professionals, including dozens of PhD graduates, numerous postdoctoral researchers, and hundreds of students who now hold influential positions across academia and industry worldwide.



24.04.2026

14:30

Aula Albenga

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