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COUPLED THMC PROCESSES IN GEOLOGICAL MEDIA INDUCED BY LOW-CARBON GEO-ENERGY APPLICATIONS

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ABSTRACT

Geological media are a strategic resource to mitigate climate change through the energy transition by means of low-carbon geo-energy applications. Subsurface engineering applications such as nuclear-waste disposal, deep geothermal energy harnessing, geologic carbon storage, and energy storage involve multi-physical processes in porous and fractured rock. These processes include fluid flow, solute and heat transport, rock deformation and geochemical reactions, which occur simultaneously and impact each other. In general, these low-carbon energy-related applications involve injection into and, sometimes, extractions of fluids from the subsurface, which cause pore pressure and temperature changes that deform the rock and in some occasions may lead to fracture and fault reactivation, inducing seismicity. Additionally, the injected fluids alter the geochemical equilibrium, leading to dissolution and/or precipitation of minerals that, in turn, may modify rock properties. These intricate interactions should be accounted for in numerical models to reproduce experimental and field applications and, ultimately, to achieve reliable predictive capability. Therefore, the safe and efficient deployment of such geo-energy applications is bounded to the adequate understanding of these coupled thermo-hydro-mechanical-chemical (THMC) processes, and predictive capabilities heavily rely on numerical models describing the evolution of the multi-physical systems.

This Invited Session is dedicated to studies investigating some of these THMC interactions in low-carbon geo-energy applications by means of computational methods. The Invited Session aims at presenting state-of-the-art numerical developments to solve coupled THMC processes as well as applications that advance understanding of coupled processes in porous and fractured media. Welcomed topics include radioactive waste disposal, enhanced geothermal systems, superhot geothermal systems, conventional and alternative concepts for geologic carbon storage, hydrogen storage, energy storage, reservoir stimulation, including hydro-shearing and hydraulic fracturing, reservoir management, fluid injection-induced seismicity.