Special Collection to be published in Water Resources Research

Impacts on Water Resources of Coupled Hydrological, Chemical, and Mechanical Processes in the Fractured Subsurface

Aims and Scope

Fractures play a crucial role in processes in shallow groundwater systems, where they can influence drinking water quality through their control on permeability, and the Critical Zone, where they affect greenhouse gas cycling, soil development, CO2 mitigation, and plant processes. In deeper subsurface environments, fractures play a role in sequestration, energy storage, and geothermal systems, and these systems may affect water resources through their interaction with shallower environments. The understanding and prediction of the role of fractures, however, is complicated by the interplay between hydrology, chemistry, and mechanics—coupled hydro-mechanical-chemical (or HMC) processes—in both near-surface and subsurface Earth systems. Understanding the response of hydrological flow in fractures to both chemical and mechanical stresses is essential. However, these often time-dependent stresses make the interpretation of coupled hydrological, chemical, and mechanical processes in fractures quite challenging. Even though the near-surface systems and subsurface systems appear to have distinct HMC features, the similarities, bridges and interplays between these two types of systems have not been fully explored. Thus, there is a crucial need to report the latest advances in modeling, experiments, and field observations of HMC processes in fractured near-surface and subsurface environments where they may exert a critical control on hydrology and water resources.

In this special collection, we will focus on hydrological processes in fractures affected by these coupled processes. This special collection invites original and review papers that advance our understanding of the role of coupled processes in regulating flow in fractured earth systems in all parts of the shallow Earth's crust, with a particular interest in those important in the Critical Zone and groundwater reservoirs. Of particular interest are those that bring new insights into the role of coupled hydrology, geochemistry, and mechanics in determining fracture behavior, with implication for water quality and resources, greenhouse gas cycling, plant function, and evapotranspiration. Experimental, characterization, and modeling studies at all scales ranging from molecular to reservoir are encouraged.

This special collection will focus on contributions in hydrology and water resources from the **3rd International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application** (coufrac2022.org), which will be held in Berkeley, USA on November 14-16, 2022. The planned topics of the special collection will include:

- Critical Zone coupled processes
- Hydro-chemical trapping of CO_2 in fractured subsurface systems
- Enhanced weathering
- Hydrogen storage
- Chemistry-assisted fracturing
- Contaminant transport
- Geochemical fluxes in fractured materials
- Pore-scale/microscale hydro-mechanical-chemical measurements and modeling
- Machine learning applied to coupled THMC processes in fractured systems

Instructions for Authors

Authors should follow *Water Resources Research* manuscript requirements: https://www.agu.org/Publish-with-AGU/Publish/#1

Acceptance Criteria

Submitted manuscripts will be reviewed by 2-3 reviewers, with stringent quality control by the WRR Editors.

Special Collection Organizers

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Suggested Special Collection Timeline

Deadline for manuscript submission: August 1, 2023
Online publication of the last accepted article: February 1, 2024
Publication of the Special Collection: April 1, 2024