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Afrough, Armin; Mokhtari, Rasoul; Li, Ming; Feilberg, Karen L.

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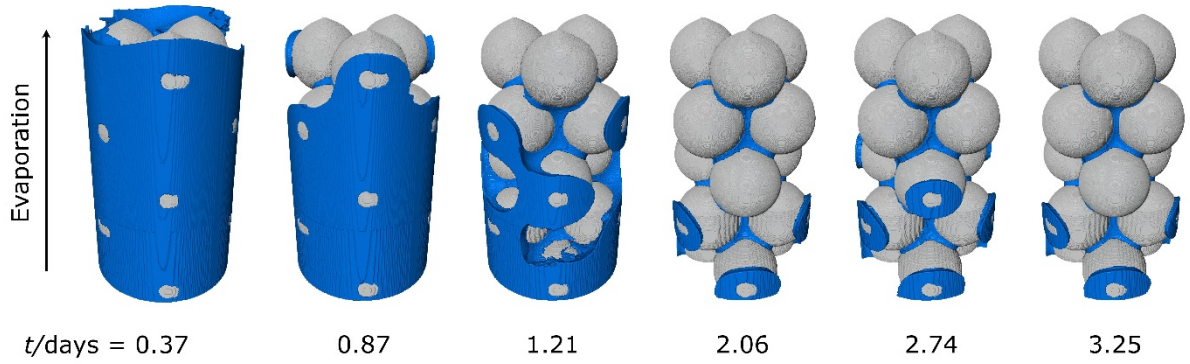
X-ray Computed Tomography (CT) methods can be used to study the internal structure of geomaterials non-destructively and with minor sample preparation. Previously, such methods have been utilized in the characterization of petroleum reservoirs, underground water resources, soil, ores, and carbon storage in aquifers. X-ray CT has the potential to characterize geomaterials at multiple length scales and as a function of time – in the dynamic imaging mode. Multiscale and dynamic imaging of geomaterials in X-ray CT scanners however require open hardware and software architectures that permit programming, scripting, and modifications. We describe the development of a flexible scripting system, *FLEX*T, to control the components of a non-commercial multiscale X-ray CT scanner for geological applications. The modified custom-built X-ray CT scanner is capable of imaging objects as large as 20 cm to smaller than 1 mm with three stages. Flow equipment that may be integrated in the software system permit realistic dynamic imaging experiments. Imaging of three rock samples at the 120-mm, 40-mm, and 2-mm length scales are presented as well as two dynamic evaporation experiments in a model glass-bead pack and a natural chalk core plug. The developed imaging system accelerates hardware and software modifications and permits new applications and discoveries in geosciences. The results of MRI of rocks to estimate saturation of core samples before and after modified salinity core flooding experiments will be discussed.



Deionized water evaporation in a glass-bead pack. Six segmented images demonstrate water (blue) evaporation from a glass-bead (gray) pack at different time steps. Watershed segmentation separated water, air, glass beads, and vial. The container and air are transparent. The deionized water evaporated and left pendular rings behind. It is possible to observe the movement of the geometry of the water phase and its reconfiguration at each time step.