Geophysical Research Abstracts
Vol. 20, EGU2018-16916-3, 2018
EGU General Assembly 2018

Flow instabilities and preferential pathways during multiphase flow in partially-wettable porous medium: Pore-scale origins

Ran Holtzman and Oshri Borgman
Hebrew University of Jerusalem, Israel (rholtzman4@gmail.com)

In processes such as carbon geosequestration, enhanced energy recovery, or methane venting from hydrate bearing sediments, the complex interplay between mechanisms including capillarity, wettability, heterogeneous pore geometry, and mechanical deformation, leads to preferential flows with sharp gradients in fluid compositions and pressures. We combine pore-scale simulations with micromodel experiments to expose the underlying mechanisms for fingering in fluid-fluid displacement processes including forced injection and drying. We demonstrate how the intricate interplay between the porous microstructure, wettability, and deformation of the pore geometry due to capillary forces, leads to the emergence of preferential pathways. Our work provides a modeling framework that can be extended to address a wide range of other processes, for instance reactive transport, and therefore facilitates fundamental understanding of multiphase flow in porous media.