

## **Drying of heterogeneous porous media with sharp wettability contrasts**

N. Shokri (1), and D. Or (2)

(1) Department of Earth Sciences, Boston University, Boston, MA, USA

(2) Soil and Terrestrial Environmental Physics, Department of Environmental Sciences, ETH Zurich, Zurich, Switzerland

Porous media containing sharp wettability discontinuities may occur in natural systems due to depositional processes, accumulation of organic layers or modification of soil wettability following intense forest fires all of which are known to significantly modify water flow and transport processes. Wettability contrasts may have other engineering applications such as outdoors clothing and building materials. We study the drying of sandy columns containing sharp vertical wettability contrasts formed by chemically rendering the sand hydrophobic. Evaporation from initially water saturated sand columns containing interacting domains with identical particle size but sharp wettability contrasts was quantified using neutron transmission technique to map dynamics of interfacial processes induced by the presence of vertical wettability interfaces. Additionally, we conducted laboratory experiments to evaluate evaporative water losses affected by this type of heterogeneity. A physically-based model for describing effects of wettability interfaces on drying rates was proposed. We confirmed experimentally predictions regarding the spatial extent of the capillary flow affecting the position of the vaporization plane, and preferential liquid phase distribution and drying front displacement. Insights on the disruption of capillary pathways due to hydrophobic interfaces (vertical and horizontal) offers opportunities for suppressing evaporation in natural and engineered systems and may be used to manipulate selective drying of porous media.