Geophysical Research Abstracts
Vol. 20, EGU2018-2800, 2018
EGU General Assembly 2018

Use of fluorescein dye to visualize evaporation within porous media

Tomáš Weiss, Martin Slavík, and Jiří Bruthans
Charles University, Faculty of Science, Praha, Czech Republic (bruthans@natur.cuni.cz)

Evaporation from coarse porous media can be conceptually divided into three stages. During the latest stage, when a critical suction is reached in the sub-surface, a so-called evaporation front is formed dividing the region of capillary flow from the dry surface layer where water flows in gas phase only. The knowledge of the dry surface layer thickness and geometry of evaporation front is critical for estimating water flux through the surface and for understanding evaporating processes in general. However, visualization of the evaporation front remains a challenge. Here we show the use of fluorescein dye, a popular hydrological tracer, to visualize the evaporation front in porous media. The fluorescein solution changes its color according to its concentration and this can be used to i) visualize the evaporation front by forming a distinctive red line where the pore water evaporates, and ii) to distinguish the zone of vapor flow and the zone where capillary flow is present. The method has been used both in the laboratory and the field on sand and sandstone material for better understanding of water flow and evaporation in near sub-surface (Slavík et al., 2017; Bruthans et al., 2018). It has also been used to visualize the evaporation processes relevant to the origin of sandstone honeycombs and the complex pattern of hydrophobicity in the biologically-initiated rock crust on sandstones. The advantage of using fluorescein to visualize the evaporation front over other dyes lies in its property to change color at places of evaporation. In comparison with other techniques such as sensible heat balance or heat pulse methods, using fluorescein is accurate, cost-effective, and straight forward. Nevertheless, further improvements are needed such as reducing destructiveness in sub-surface investigations.

References:
Bruthans J., Filippi M., Slavík M., Svobodová E. (2018): Origin of honeycombs: Testing the hydraulic and case hardening hypotheses. Geomorphology 303: 68–83.

Slavík M., Bruthans J., Filippi M., Schweigstillová J., Falteisek L., Řihošek J. (2017): Biologically-initiated rock crust on sandstone: mechanical and hydraulic properties and resistance to erosion. Geomorphology 278: 298–313.

This research was funded by the Czech Science Foundation (GA16-19459S) and Charles University Grant Agency (GAUK #1046217).