Contribution ID: **474** Type: **Poster (+) Presentation**

How heterogeneous distributions of wettability affects infiltration into soil

Tuesday, 1 June 2021 10:00 (1 hour)

A central component of the rhizosphere is root mucilage, a hydrogel exuded by plants that dramatically alters chemical and physical properties of the soil. It is characterized by its large water holding capacity and is hydrophilic or hydrophobic depending on its hydration status: when swollen, mucilage is hydrophilic but becomes hydrophobic when dry, forming local hydrophobic spots on the surface of soil particles. The morphology of these hydrophobic regions formed by dried mucilage is affected by the type of mucilage and microorganisms and can vary from isolated local spots, to networks spanning across larger areas of the soil particle surface. However, until now the understanding on how this heterogeneous distribution and its morphology affect infiltration and water repellency in soil is limited.

Therefore, the goal of this study is to investigate the impact of the spatially heterogeneous wettability distributions on the infiltration into soil. For this purpose, we utilize a two-phase flow model based on the Lattice-Boltzmann to numerically simulate the infiltration in porous media with a simplified geometry and for different selected heterogeneous wettability coatings. Additionally, we simulated the rewetting of dry rhizosphere of a sandy soil where dry hydrophobic mucilage depositions on the particle surface are represented via a locally increased contact angle.

Our simulations show that water repellency in porous media can occur not only when the soil particles are hydrophobic but also when their wettability is reduced on small local spots. In particular, we can show that the hydraulic dynamics and effective water repellency are determined by the specific location within the pore space where wettability is reduced or hydrophobic, rather than by the averaged contact angle. This raises questions about the applicability of the Cassie equation that considers only an averaged contact angle to most porous media, since for instance, coatings in the pore throat and pore body often have different effect strengths. Thus, within the rhizosphere, even relatively small areas coated with dry hydrophobic mucilage in the pore throats can cause water repellency in an otherwise well-wettable and water-conducting soil.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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Primary author: Mr BENTZ, Jonas (Universität Koblenz-Landau)

Co-authors: Prof. KRÖNER, Eva (Forschungszentrum Jülich); Dr PATEL, Ravi (Karlsruher Institut für Technologie)

Presenter: Mr BENTZ, Jonas (Universität Koblenz-Landau)

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