Contribution ID: **438** Type: **Oral Presentation**

Hydro-mechanical coupling to uncover stability and permeability of coated biopore on the pore-scale: the way to improve larger-scale modelling

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Exudates and finer particles often coat the surface of biopores, increasing mechanical stability and altering the physico-chemical properties (e.g. wettability or sorption) of the surrounding. Consequently, the pore region of the biopore surface governs the macropore-matrix mass exchange processes during preferential flow in the soil macropores. However, the relationships between mechanical and hydraulic properties of coated biopore regions are not fully understood nor expressed by numerical models. Correlations between soil hydraulic and mechanical properties could perhaps be established by quantifying the water flow in defined pore structures of the biopore. In this contribution we develop a model-based approach for studying coupled hydro-mechanical properties of biopore walls and the effects of clay-organic coatings. The technical challenge was first to develop a one-way coupling (i.e., structural impact on fluid flow) between discrete element method (DEM) and a Stokes solver to perform hydro-mechanical simulations of a coated biopore structure. The presented one-way coupling method between DEM and Stokes solver provided data for quantitative analysis of coupled hydro-mechanical properties of the biopore structure. A relationship between Young's modulus and permeability depending on the coating cohesion could be established. This model-based approach could be extended to describe hydro-mechanical properties of dynamic and more complex soil structures. All in all, our finding pave the way to a better understanding of preferential flow and matrix domains and we discuss important implications to improve continuum-scale models based on pore-scale simulations –the necessary step to produce reliable models of all soil processes and functions.

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Participation

In person

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