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Pore scale simulations of how mucilage alters connectivity of liquid and gas phase in the rhizosphere

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Compared to bulk soil, rhizosphere has different properties because of the existence of root mucilage which affects the physical, chemical and also microbial processes. Hydraulic phenomena like limiting water flow at certain dry soil conditions, modulating extreme water contents by slow response to water potential changes; and also influencing solute transport and gas diffusion by varying the connectivity of liquid and gas phases are all classified under the set of the physical processes which are affected by mucilage in the rhizosphere.

Overview of the literature and previous models shows the lack of a three-dimensional pore-scale dynamic model for a better understanding of the connectivity between different phases during imbibition and drainage processes. A major challenge is that mucilage shows a complex behavior which at low concentrations is more like a liquid while at higher concentration when it is almost dry, it becomes a solid.

In particular, this study will use the Lattice Boltzmann method as a powerful tool for fluid dynamics study and the discrete element method for describing solids to present a pore-scale model for more accurate simulation and study of physical processes in the rhizosphere.