



Water dynamics in the rhizosphere - a new model of coupled water uptake and mucilage exudation

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The flow of water from soil to plant roots is affected by the narrow region of soil close to the roots, the so-called rhizosphere. The rhizosphere is influenced by mucilage, a polymeric gel exuded by roots that alters the hydraulic properties of the rhizosphere.

Here we present a model that accounts for: (a) an increase in equilibrium water retention curve caused by the water holding capacity of mucilage, (b) a reduction of hydraulic conductivity at a given water content due to the higher viscosity of mucilage and (c) the swelling and shrinking dynamics by decoupling water content and water potential and introducing a non-equilibrium water retention curve.

The model has been tested for mixtures of soil and mucilage and we applied it to simulate observations of previous experiments with real plants growing in soil that show evidences of altered hydraulic dynamics in the rhizosphere. Furthermore we present results about how the parameters of the model depend on soil texture and root age.

Finally we couple our hydraulic model to a diffusion model of mucilage into the soil. Opposed to classical solute transport models here the water flow in the rhizosphere is affected by the concentration distribution of mucilage.