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Disentangle Structured Soil Domain and Fluid Properties and Dynamics - a Lagrangian Representation of Water Movement in Structured Soils.

Representing hydrological systems is dominated by an Eulerian representation of storages and their transitions. At certain scales and under preferential structures, this successful simplification proves insufficient for a physical description of the subsurface flow processes. This soon contradicts the PUB notion of observability and transferability of parameters.
We present a model approach where we disentangle soil properties (Eulerian) and fluid properties and dynamics (Lagrangian). Representing water itself as particles opens up ways to reproduce dispersive (matrix) and advective (preferential) flow based on a random walk and observable advective velocity distributions from tracer experiments at the plot scale. We present the underlying theory of our model, a comparison to results of other models and a comparison to observed travel distance distributions.
The Lagragian representation opens up an alternative to double domain and Richards-based representations of structured soils. Its main advantage is the observability of its parameters: Soil matrix properties are adequately taken from soil physical analysis and refer to the dispersive fluxes, while preferential flow through macropores is linked to advective water particle transport based on observed tracer profiles. Moreover, it has low conceptual assumptions, is physically consistent and implicitly mass conservative. It is a generally scaleable approach compatible with residence time assessments. Solutes and heat can be further simply attached to the particles which makes the approach promising for model testing with joint soil moisture, temperature and solute concentration measurements.