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A Lagrangian Representation of Water Movement in Structured Soils

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Modelling 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.

We propose a Lagrangian representation of infiltration and percolation, where water itself is regarded as particles. The first results show, that the concept is suitable to reproduce dispersive (matrix) and advective (preferential) flow based on a random walk and observed advective velocity distributions from dye tracer experiments. We present the underlying theory of our model, a comparison to results of other models and a comparison to observed travel distance distributions.

The Lagrangian representation opens up an alternative to double domain and Richards-based representations of structured soils. 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.