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Rivulet flow puts preferential flow between Darcy's law and Richards'equation.

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Darcy's law implies a linear relationship between the hydraulic gradient and the volume flux density in water saturated soils (i.e., $\theta_{sat} = \varepsilon$, where θ is volumetric soil moisture and ε is porosity). Richards' equation is assumed to apply to flow in soils whenever $\theta < \theta_{sat}$. We position preferential flow between the realms of Darcy's law and Richards' equation by proposing that preferential flow carries features of Darcy-type flow in the moisture range of θ*$\leq \theta \leq \theta_{sat}$. We also consider that *D*(θ*) = η ($\approx 10^{-6}$ m^2.s^{-1}), where D is diffusivity and η is kinematic viscosity of soil water i.e., *D*/η = 1 when $\theta = \theta$*.

Soil moisture waves, θ*(Z,t)*, were recorded with TDR-probes at rates of up to 0.1 Hz during sprinkler-infiltration experiments *in situ* and in columns of undisturbed soils. Interpretation of moisture waves supports the proposition and the consideration in that (i) the decreasing limb of a wave was modeled from its increasing limb when Newton's law of shear was applied to the range of θ*(Z,t)*$>$ θ*, (ii) water flow occurred under atmospheric conditions (i.e., matric potential collapsed to close to atmospheric pressure after the wave's wetting front had hit a tensiometer), and (iii) soil moisture returned repeatedly to θ* when preferential flow had ceased.

A moisture wave is composed of rivulet ensembles. A rivulet ensemble is characterized by the common time frame of rivulet arrivals at some depth. Rivulets are streaks of water that are superimposed to rivulet ensembles. Newton's law of shear uses superposition that applies to stable laminar flows when Reynolds numbers are less than 3 i.e., for rivulets thinner than 60 μm. Wetting fronts of such rivulets move faster than 10 mm.s^{-1} which was never observed. Superposition thus allows for up-scaling preferential flow from horizons to profiles and to hill slopes.