COMMENTS AND LETTERS TO THE EDITOR

Comments on "Unit Gradient in Internal Drainage Experiments for the Determination of Soil Hydraulic Conductivity", by K. Reichardt, Sci. agric., Piracicaba, 50(1):151-153, 1993.

I think that the point you raise is very well taken. Perhaps a series of drainage experiments in relatively sandy soils would provide a good test case.

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What was observed is correct mathematically, it does not however occur in reality. In the statement "... soil profiles present **fairly** parallel water contents..." the word "fairly" is chosen rightly since the profiles are not exactly parallel as the depth L becomes large. In calculations average water contents $\bar{\Theta}$ are used, and $\partial\bar{\Theta}/\partial t$ becomes smaller as one goes down in the profile (i.e., larger L) and, I guess, this should compensate the wrong expectation, that $K(\Theta)$ would increase with depth. However, what was observed and the question asked were both legitimate and correct.

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It is a good note which shows the consequences of "manipulation" done by many authors with Richard's equation, i.e., they deal with partial differential equations as if they are equations with total diferentials:

$$\frac{\partial[K(\theta)]}{\partial z} \neq \frac{dK(\theta)}{dz}$$

since $\Theta(z, t, h)$!

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The unit gradient approach should be questioned in notes or articles like yours. Similar to the scenarios you were pointing out, I can only imagine theoretically a situation of a unit gradient in a "homogeneous soil", i.e., only under stationary downward water infiltration and efflux in a soil column or profile, where water transport is mainly caused by gravity. If the flux is instationary like under internal drainage conditions, the gradient deviates more or less from unity depending on the slope of $K(\Theta)$ or $\Theta(h)$. Unit gradient should be considered as a simplifying assumption. A simple numerical experiment with upper and lower boundary conditions observed during a field experiment would probably help to answer i) whether unit gradient was violated or not, ii) what is the impact on $K(\Theta)$, and iii) what the $\Theta(t,z)$ prediction failure due to the assumption would be.

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