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How useful are Green-Ampt parameters derived from small rainfall simulation plots for modelling runoff at different plot lengths?

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Rainfall simulation on small field plots is an invaluable method to derive effective field parameters for infiltration models such as Green-Ampt. Plot scales of ca. $1m^2$ integrate much of the micro-scale variability and processes, which ring-infiltrometers or soil core measurements cannot capture. However, these parameters have to be used with caution on larger scales, because processes such as run-on infiltration can be considerable.
The Green-Ampt parameters suction across the wetting front (psi) and effective hydraulic conductivity (Ke) were estimated from rainfall simulations on two ridged fields in Togo, West Africa. Additionally, rainfall events were recorded, and on plots of 1m width and lengths of 1, 4 and 16m, total runoff volume and sediment concentration were measured. The storm runoff hydrographs of the plots were modelled with Chu's Green-Ampt variable rainfall intensity infiltration model, using the field-average parameters derived from the simulations. Potential effects of runoff lag time were assumed negligible. Calculated total runoff volumes were compared to measured runoff volumes.
For the 1m plots, runoff was underestimated, as patches of seal in the furrows produced runoff already at rainfall intensities much lower than the average infiltration capacity. For the longer plots, no run-on infiltration or other scale dependent processes were assumed, so the relative error due to scale effects was proportional to the average difference or runoff depth. In contrast to the 1m plots, runoff was overestimated by a factor of 1.2 and 2 for the 4m and 16m plots, respectively.
It appears that the application of the Green-Ampt effective hydraulic conductivity derived from rainfall simulations faces two main problems, which are their dependence on one single rainfall intensity and scale-effects by run-on infiltration. Errors necessarily propagate into the scale dependency of erosion and sediment transport, as these processes are directly dependent on runoff characteristics such as stream power and shear stress.