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Determining preferential flow through plot- and point-scale infiltration experiments

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This investigation focused on the identification of preferential flow in a hillslope and the estimation of the saturated hydraulic conductivity for the fast-flow region, $K_{s,f}$, by infiltration experiments carried out at different soil depths and spatial scales (point- and plot-scale). The differences between the considered scales were mainly attributed to macropore flow and the impossibility to adequately embody the macropore network on small sampled soil volumes. Conversely, at the plot-scale, the sampled volume was sufficient to activate the macropore network. This information helped to establish the usability of a given technique to determine the parameters describing the soil hydraulic properties of matrix and fast-flow regions. While K_s data obtained from the beerkan method (point-scale) (Lassabatere et al., 2006) with BEST-steady algorithm (Bagarello et al., 2014), were used to describe the matrix ($K_{s,m}$), the saturated hydraulic conductivity for the fast-flow region was estimated using the soil block method (plot-scale) (Pirastru et al., 2017). $K_{s,f}$ estimates were 1-4 orders of magnitude higher than $K_{s,m}$. The overall decrease of $K_{s,f}$ with soil depth supported the hypothesis that the macropore density decreased in the deeper horizons, yielding higher macropore flow variability. In our study, we clearly proved the advantage of experimental protocols based on multi-scales experiments. Our results, yielded encouraging signs of the applicability of the soil block method along the beerkan infiltration runs for a plausible estimation of the saturated hydraulic conductivity for the fast-flow region by a relatively simple field procedure.

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