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Field-quantification of the preferential and matrix flow domain in structured soils using a hood infiltrometer

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In structured soils field saturated hydraulic conductivity (Ks) is often characterized by a great spatial variability. Flow through a soil's matrix, however, can be considered comparably less heterogeneous in space. Due to preferential flow (PF) in the presence of macropores Ks may be orders of magnitude larger than the conductivity only associated with the soil matrix. Due to that, separate hydraulic conductivities for both the matrix and the PF domain can be defined. To quantify both domains a hood infiltrometer was used in combination with a fine sand layer to fill and shield macropores in order to prevent PF during infiltration experiments. Paired infiltration measurements without sand yielding total Ks followed by a measurement with a sand layer yielding matrix Ks were done to obtain Ks related to PF. The study was conducted on a tillage experiment in Germany (crop: sugar beet). Quantification of PF showed a greater spatial variability than flow in the soil matrix. Using sand for covering macropores reduced and adjusted conductivities to similar levels of matrix Ks in most cases. Further a shift towards greater bubble points (BP) was observed. The BP describes the pressure head at which air is forced through the water saturated soil to the surface. With increasing BP the measurement range of the hood infiltrometer can be extended to higher pressure heads. Further experiments need to be dedicated to quantify the effects of repeated infiltration measurements at the same spot on Ks. Also dye tracer experiments in combination with the hood infiltrometer should be done to evaluate the amount of PF still occurring under the layer of fine sand.