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Stability of preferential flow paths in paved urban soils

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Increasing rainwater infiltration in urban areas is among the main ideas of recent urban planning. Infiltration active partially sealing is promoted and supported e.g. by special tax regulations. Consequences on water flow and solute transport are not examined in detail until now, for example the effect of preferential flow. Therefore, paved urban soils have been investigated for their flowpaths using dye tracer experiments with Brilliant Blue (BB). Digital images of the flowpaths have been taken after preparation of horizontal cross sections. Stained and unstained soil samples have been taken for the quantification of BB concentration. In comparison with most natural soils, heterogeneous soil colours limited the analysis of flowpaths. A method for the quantitative description of the flowpath geometries (flow path cross sectional areas) from heterogeneously coloured urban soils has been developed. Preferential flowpaths have been found, which were induced by the pavement geometry. Under a cobblestone paved street, the effective flowpath cross sectional area has been reduced to only 60 %. One disadvantage of dye tracer studies is the limitation on a single flow event in the irrigation experiment. In a second step, stained and unstained soil regions have been analyzed for increase or decrease of elements as results of consecutive water flow. C, N and S have been chosen as tracers as they are frequently deposited on the pavement and mobile enough to be displaced. The samples have been classified to be flowpath and non-flowpath according to their BB contents. The C, N, and S contents are significantly higher in the stained soil regions, indicating accumulation of the elements in the flowpaths. A correlation between C, N, and S in the samples and BB contents was quantified and considered in the calculations. We could show, that preferential flowpaths in paved urban soils are stable enough in time to consider them for solute transport studies and we provide a tool to estimate effective cross sectional areas from dye tracer experiments also in heterogenously colored soils.