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Balancing spatial and temporal variability of infiltration processes as basis for urban soil and groundwater management

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Infiltration processes in urban areas are affecting soils and groundwater quality. Different kinds of infiltration sources can be distinguished by their origin, their hydraulic characteristics and their contaminant loads. Natural infiltration sources are precipitation and flood water from flood plains taking up pollutants from the atmosphere, the ground surface and the uppermost subsurface area. Anthropogenic sources are related to uncontrolled leakage from urban water infrastructure and managed waste water or storm water disposal to the surface or subsurface areas respectively. Latter is of increasing importance because it is able to reduce infrastructure investment and operation costs and simultaneously returns water to the natural water balance.

The proper quantification of these infiltration processes requires the consideration of the large spatial variability of the hydraulic parameters determining the infiltration and their contamination load. Additionally, there exists a large temporal variability in the source conditions. Therefore, an approach has been developed that represents all infiltration sources by individual simple balance models based on analytical solutions. First applications could quantify mass fluxes to the groundwater from areal infiltration sources using GIS for the regionalization of the spatial parameter variability.

Furthermore, this simple approach enables the application of Monte Carlo techniques in order to investigate the influence of uncertainties and to derive statistic quantities for impact assessment purposes. The results of such impact analyses can be used for the evaluation of alternative urban water management strategies. Particularly, the requirements for the management of soils and groundwater in urban areas can derived

from these impact analyses.