Geophysical Research Abstracts
Vol. 19, EGU2017-16717, 2017
EGU General Assembly 2017

Identifying dominant controls on the water balance of partly sealed surfaces

Tobias Schuetz, Marleen Schübl, Caroline Siebert, and Markus Weiler
University of Freiburg, Hydrology, Faculty of Environment and Natural Resources, Freiburg, Germany
(tobias.schuetz@hydrology.uni-freiburg.de)

It is the challenge of modern urban development to obtain a near natural state for the urban water balance. For this purpose permeable alternatives to conventional surface sealing have been established during the last decades. A wealth of studies – under laboratory as well as field conditions – has emerged around the globe to examine the hydrological characteristics of different types of pavements. The main results of these studies - measured infiltration and evaporation rates, vary to a great extent between single studies and pavement types due to methodological approaches and local conditions.
Within this study we analyze the controls of water balance components of partly sealed urban surfaces derived from an extensive literature review and a series of infiltration experiments conducted on historical and modern pavements within the city of Freiburg, Germany. Measured values published in 48 studies as well as the results of 30 double-ring infiltration experiments were compiled and sorted according to the measured parameter, the pavement type, pavement condition, age of the pavement, porosity of the pavement material and joint filling material as well as joint proportion of joint pavements. The main influencing factors on infiltration / hydraulic conductivity, evaporation rates and groundwater recharge of permeable pavements were identified and quantified using multiple linear regression methods. The analysis showed for both the literature study and our own infiltration experiments that condition and age of the pavement have the major influence on the pavement's infiltration capacity and that maintenance plays an important role for the long-term effectiveness of permeable pavements. For pavements with joints, the porosity of the pavement material seemed to have a stronger influence on infiltration capacity than the proportion of joint surface for which a clear influence could not be observed. Evaporation rates were compared for different surface categories as not enough measured values for different pavement types have been published. The highest evaporation can be expected for joint filling aggregates such as gravel and sand followed by bare soil (as reference), porous pavements and lastly non-porous pavements. The proportion of precipitation lost due to evaporation/evapotranspiration processes was expectedly highest on turf grid pavements, while maximum groundwater recharge rates were identified under non-porous pavements. Our results improve the tools available for urban water management controlling the state of urban water balances from a dominant surface runoff component to either dominant evaporation or groundwater components.