Geophysical Research Abstracts
Vol. 21, EGU2019-6771-2, 2019
EGU General Assembly 2019

A model choice criterion for the simulation of storm water pipe leakage in suburban residential areas

Aaron Peche (1), Thomas Graf (1), Jacob Kidmose (2), Heidi Christiansen Barlebo (2), and Insa Neuweiler (1)

(1) Leibniz Universität Hannover, Institute of Fluid Mechanics and Environmental Physics in Civil Engineering, Faculty of Civil Engineering and Geodetic Science, Hannover, Germany (peche@hydromech.uni-hannover.de), (2) Department of Hydrology, Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark

Pipe leakage consists of pipe water exfiltration (exchange flux from defect pipes into the variably saturated subsurface) and groundwater infiltration (exchange flux from the saturated subsurface into defect pipes). Pipe water exfiltration may lead to problems such as groundwater contamination. Groundwater infiltration may lead to a reduction of groundwater recharge, land subsidence and increased expenses to water cleaning facilities. Due to inaccessibility of pipe defects, mathematical models are required to quantify leakage and mitigate associated risks. Leakage models in literature can be distinguished into both, inaccurate simplified models with small computational costs which neglect unsaturated-saturated flow (e.g. DeSilva et al., 2007, Vizintin et al., 2009, Karpf & Krebs, 2011), and accurate coupled physically-based models with large computational costs, which include unsaturated-saturated flow (Kidmose et al., 2015; Peche et al., 2017).
In the present study, we compare model results from a simplified and a coupled physically-based model. The conceptional model represents storm water pipe leakage in suburban residential areas. Based on model results, we investigate the validity range in which simplified models are sufficiently accurate and introduce a novel criterion, which can be used for choice of leakage model. We show that the use of this model choice criterion may reduce computational costs significantly while maintaining result accuracy.

References:

DeSilva, D., Burn, S., Moglia, M., Tjandraatmadja, G., Gould, S., and Sadler, P. (2007). Chapter. 2 the models: Network exfiltration and infiltration model neimo. Urban Water Resources Toolbox-Integrating Groundwater into Urban Water Management, pages 34-50.

Karpf, C. and Krebs, P. (2011). A new sewage exfiltration model - parameters and calibration. Water Science and Technology, 63(10):2294-2299.

Kidmose, J., Troldborg, L., Refsgaard, J., and Bischoff, N. (2015). Coupling of a distributed hydrological model with an urban storm water model for impact analysis of forced infiltration. Journal of Hydrology, 525:506-520.

Peche, A., Graf, T., Fuchs, L., & Neuweiler, I. (2017). A coupled approach for the three-dimensional simulation of pipe leakage in variably saturated soil. Journal of Hydrology, 555, 569-585.

Vizintin, G., Souvent, P., Veselič, M., and Curk, B. C. (2009). Determination of urban groundwater pollution in alluvial aquifer using linked process models considering urban water cycle. Journal of Hydrology, 377(3-4):261-273.