Geophysical Research Abstracts
Vol. 20, EGU2018-7544, 2018
EGU General Assembly 2018

Temporal Estimation of Hydrodynamic Parameter Variability in Constructed Wetlands

Mohammad Moezzibadi, Isabelle Charpentier, Adrien Wanko, and Robert Mosé
University of Strasbourg, ICUBE, Mecaflu, France (moezzibadi@etu.unistra.fr)

Constructed wetland (CW) systems are increasingly considered as a natural and rustic treatment process by local authorities in developing and developed countries. Their significant efficiency at reducing the ecological impact of urban runoff has been recently proven in domestic wastewater as well as for combined sewer overflow.
The numerical flow modeling in a vertical variably saturated CW is here carried out (1) by implementing the Richards model by means of a mixed hybrid finite element method (MHFEM) particularly well adapted to the simulation of heterogeneous media, and (2) by using the software HYDRUS-1d based on a finite element discretization for validation purposes.
As van Genuchten-Mualem (vGM) soil hydrodynamic parameters depend on water content and are notoriously difficult to be measured, their estimation is subject to considerable experimental and numerical studies. Meticulous attention is brought to the sensitivity analysis performed with respect to the vGM parameters that reveals a predominant influence of the shape parameters and the saturated conductivity of the filter on the piezometric heads, during saturation and desaturation. Modeling issues arise when the soil reaches oven-dry conditions and particular attention is brought to boundary condition modeling (surface ponding or evaporation) to be able to tackle different sequences of rainfall–runoff events.
For proper parameter identification, large field data-sets would be needed. As these are usually not available, notably due to the randomness of the storm events, we thus propose a simple, robust and low-cost numerical method for the inverse modeling of the soil hydrodynamic properties. The calibration of hydrodynamic parameters for subsurface CWs is a sensitive process and remains to be a challenging task since unsaturated flow modeling involves highly non-linear equations. To that end, a data assimilation technique is implemented by applying automatic differentiation (AD) to augment computer codes with derivative computations. Identification experiments are conducted by comparing measured and computed piezometric head by means of the least square objective function. The temporal variability of hydrodynamic parameter is then assessed and analyzed.