Geophysical Research Abstracts
Vol. 19, EGU2017-13877, 2017
EGU General Assembly 2017

Can we calibrate simultaneously groundwater recharge and aquifer hydrodynamic parameters ?

Fadji Hassane Maina (1), Philippe Ackerer (1), and Olivier Bildstein (2)

(1) CNRS, Laboratory of HYdrology and GEochemistry of Strasbourg, Strasbourg Cedex, France , (2) CEA-Laboratoire de Modélisation des Transferts dans l'Environnement, Cadarache, France

By groundwater model calibration, we consider here fitting the measured piezometric heads by estimating the hydrodynamic parameters (storage term and hydraulic conductivity) and the recharge. It is traditionally recommended to avoid simultaneous calibration of groundwater recharge and flow parameters because of correlation between recharge and the flow parameters. From a physical point of view, little recharge associated with low hydraulic conductivity can provide very similar piezometric changes than higher recharge and higher hydraulic conductivity. If this correlation is true under steady state conditions, we assume that this correlation is much weaker under transient conditions because recharge varies in time and the parameters do not. Moreover, the recharge is negligible during summer time for many climatic conditions due to reduced precipitation, increased evaporation and transpiration by vegetation cover.
We analyze our hypothesis through global sensitivity analysis (GSA) in conjunction with the polynomial chaos expansion (PCE) methodology. We perform GSA by calculating the Sobol indices, which provide a variance-based 'measure' of the effects of uncertain parameters (storage and hydraulic conductivity) and recharge on the piezometric heads computed by the flow model. The choice of PCE has the following two benefits: (i) it provides the global sensitivity indices in a straightforward manner, and (ii) PCE can serve as a surrogate model for the calibration of parameters.
The coefficients of the PCE are computed by probabilistic collocation. We perform the GSA on simplified real conditions coming from an already built groundwater model dedicated to a subdomain of the Upper-Rhine aquifer (geometry, boundary conditions, climatic data). GSA shows that the simultaneous calibration of recharge and flow parameters is possible if the calibration is performed over at least one year. It provides also the valuable information of the sensitivity versus time, depending on the aquifer inertia and climatic conditions. The groundwater levels variations during recharge (increase) are sensitive to the storage coefficient whereas the groundwater levels variations after recharge (decrease) are sensitive to the hydraulic conductivity.
The performed model calibration on synthetic data sets shows that the parameters and recharge are estimated quite accurately.