Geophysical Research Abstracts
Vol. 16, EGU2014-12553, 2014
EGU General Assembly 2014

Sea Water Intrusion in homogeneous aquifers with random properties

Monica Riva, Aronne Dell'Oca, and Alberto Guadagnini
Politecnico di Milano, Dipartimento di Ingegneria Civile e Ambientale, Milan, Italy (aronne.delloca@polimi.it)

Coastal aquifers are generally affected by sea water intrusion (SWI). Prediction of this process is problematic due to the lack of exhaustive characterization of the subsurface environment.Considering permeability and dispersivity of the porous medium as random variables, we perform a global sensitivity analysis (GSA) of SWI for the dispersive Henry's problem. We investigate five global state variables (GSV) characterizing the salt-water wedge: the average toe penetration and its variance, the width of the mixing zone, the average sinking of the wedge at the seaside boundary and the percentage of contaminated area. Variance-based Sobol indices are adopted to quantify the relative weight of uncertain parameters on the variance of each GSV. These indices are evaluated relying on a polynomial chaos expansion (PCE) surrogate model of the SWI process and on a sparse grid based interpolation technique to reduce the high CPU time generally needed for this analysis. On the basis of Sobol indices, we found that the variability of the permeability greatly influences the variance of the average toe penetration, the average sinking of the wedge at the seaside boundary and the percentage of contaminated area. On the other hand, dispersivity uncertainty affects the variance of the width of the mixing zone and of the toe penetration.
Then, we compute the marginal probability density function (pdf) of each GSV. Relying on Pearson correlation coefficients for each pair of GSV we found that (i) the width of the mixing zone and the average toe penetration are inversely correlated; (ii) the width of the mixing zone and the variance of toe penetration are positively correlated; (iii) the average sinking of the wedge at the seaside boundary and the average toe penetration are positively correlated; and (iv) all the remaining pairs of GSVs are not correlated. We compute their joint pdf of the correlated pairs of GSVs.