Geophysical Research Abstracts
Vol. 15, EGU2013-11930, 2013
EGU General Assembly 2013

Highly parameterized inversion using hydraulic tomography and pilot points

Santos Jimenez, Ralf Brauchler, and Peter Bayer
ETH Zurich, Department of Earth Sciences, Zurich, Switzerland (bayer@erdw.ethz.ch)

This work presents a new methodology to characterize subsurface hydraulic parameter distribution using the information provided by hydraulic tomography (HT) as prior information, in combination with pilot point based inversion. HT is a methodology that facilitates characterizing the spatial variation of hydraulic conductivity and storage at a higher level of detail than traditional field methods. It utilizes sequential pumping or injection at a well, which is divided in different vertical sections by, for instance, a packer. During the perturbation of the hydraulic regime from each section, the response of the aquifer is monitored at depth-dependent observation points in surrounding wells, obtaining the pressure response. This data set is treated with an eikonal solver, which yields a fast reconstruction of the heterogeneity present in the aquifer. However, by this, only the possible spatial variability of diffusivity is interpreted, and the heterogeneity of the components storage and hydraulic conductivity are not derived. We suggest exploiting the diffusivity tomograms in a pilot points framework. Additionally, spatial reliability of the tomograms is determined using singular value decomposition. This information and clustering allows for determining an initial guess of the hydraulic facies distribution by HT, which is the basis for assigning and positioning pilot points in a numerical flow model. In order to inform the inverse problem about the hydrofacies distribution, the relationships between pilot points are modelled by a graph and by implementing the adjacency matrix using Tikhonov regularization. This methodology was successfully tested at the highly heterogeneous aquifer Herten analog.