Geophysical Research Abstracts
Vol. 13, EGU2011-6653, 2011
EGU General Assembly 2011

Incorporating aquifer heterogeneity into groundwater flow model, Ljubljana polje aquifer case study

Mitja Janža
Geological Survey of Slovenia, Hydrogeology, Ljubljana, Slovenia (mitja.janza@geo-zs.si, +386 12809753)

Heterogeneity of the aquifers is one of the key factors that control transport processes in groundwater. It is often described by the spatial distribution of hydofacies - sediments formed in characteristic depositional environments and having typical hydraulic properties. Due to the (in time and space) changing sedimentation conditions, the distribution of hydrofacies in nature is often complex and difficult to define. The contribution presents case study of implementation of aquifer heterogeneity in groundwater flow modelling. The study was made in the frame of the INCOME project (LIFE07 ENV/SLO/000725) for the purposes of improvement on reliability of groundwater flow modelling in alluvial deposits of Ljubljana polje area. The aquifer in the area was characterized by geostatistical model. It is based on transition probabilities combined with Markov chains and use of the borehole logs, supplemented with geological conceptual information. The model consists of four units - hydrofacies with different volumetric portions (gravel 45 %, silt and clay with gravel 36 %, silt and clay 5 % and conglomerate 14 %). Spatial distributions of hydrofacies in the model are conditioned to the borehole data and represent geologically plausible image of the heterogeneity of the aquifer. Four realisations of the model were implemented in a transient numerical model that simulates river flow and three-dimensional groundwater flow. Values of hydraulic parameters of hydrofasies and leakage coefficient of the river bed were defined by automatic calibration procedure based on shuffled complex evolution optimisation algorithm (global search method). The models were calibrated against observed groundwater levels in monitoring wells. Due to the computational constrains, the number of grids of geostatistical simulations was reduced by upscaling hydraulic parameters in vertical grid columns. Horizontal discretization (200 m x 200 m) was preserved. The horizontal and vertical hydraulic conductivities of grid columns were calculated from the arithmetic and harmonic means of the hydrofacies conductivities within the column. The results of the modelling show improvement of reliability and more realistic simulation of groundwater flow compared with the existing model, based on deterministic geological model.