Geophysical Research Abstracts, Vol. 9, 03353, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03353

Field evidence of a dynamic leakage coefficient. Studies with a 3D transient groundwater flow model of the upper Limmat valley (Switzerland).

H.J. Hendricks Franssen (1), T. Doppler (1), H.-P. Kaiser (3), U. Kuhlmann (2) and F. Stauffer (1)

(1) Institute of Environmental Engineering, ETH Zurich, Switzerland, (2) TK Consult, Zurich, Switzerland, (3) Water Supply Zurich, Zurich, Switzerland

The aquifer of the upper Limmat valley (Zurich, Switzerland) is used for groundwater exploitation, which covers about 15% of the water demand of the city of Zurich. Water is pumped by a series of bank filtration wells along Limmat river and recharged by basins and wells. Drinking water is produced by several production wells. To ensure drinking water quality, the inflow of potentially contaminated groundwater from the industrial part of Zurich should be avoided. In addition, the pumped groundwater should not have a temperature above 16°C. Due to infiltration from river Limmat, in late summer and autumn the pumped groundwater is sometimes too warm. In order to prevent pumping of groundwater of inferior quality in the future, a real time numerical model is in development. Finite elements models for 3D saturated- unsaturated groundwater flow, 3D mass transport and 3D heat transport have already been developed, together with a 1D hydraulic model for river flow and a scheme that calculates groundwater recharge and lateral inflow to the aquifer from meteorological data and a simple soil water balance model. The interaction river-aquifer represents an important part of the groundwater system and is modelled with the help of a conventional leakage concept.

In this presentation we would like to concentrate on some results from 3D groundwater flow modelling. The Pilot Points method was used to calibrate the groundwater flow model using piezometric head data from Mai und June 2004 and July and August 2005. The calibrated model was verified for the period December 1992- August 2005, using more than 40,000 transient piezometric head data of 90 piezometers. The

residuals obtained from calibration are in general satisfyingly small, and in addition interpretation by statistical analysis of the residuals shows that the leakage coefficient is time dependent due to (1) flood events which are associated with enhanced sediment transport, (2) the large fluctuations of the water temperature of the river (the leakage coefficient is temperature dependent because the water viscosity is a function of temperature) and (3) the water level of the river, which increases the amount of bank infiltration by increasing the area of the river bed.