Geophysical Research Abstracts
Vol. 17, EGU2015-4049, 2015
EGU General Assembly 2015

Estimation of water table level and nitrate pollution based on geostatistical and multiple mass transport models

Ioannis Matiatos (1), Emmanouil A. Varouhakis (2), and Maria P. Papadopoulou (3)

(1) Faculty of Geology and Geoenvironment – National and Kapodistrian University of Athens, 15784 Panepistimiopolis, Athens, Greece (imatiatos@geol.uoa.gr), (2) School of Environmental Engineering – Technical University of Crete, Chania, Greece (varuhaki@mred.tuc.gr), (3) School of Rural and Surveying Engineering – National Technical University of Athens, 9 Iroon Polytechniou, University Campus, 15780 Zografou, Greece (mpapadop@mail.ntua.gr)

As the sustainable use of groundwater resources is a great challenge for many countries in the world, groundwater modeling has become a very useful and well established tool for studying groundwater management problems. Based on various methods used to numerically solve algebraic equations representing groundwater flow and contaminant mass transport, numerical models are mainly divided into Finite Difference-based and Finite Element-based models. The present study aims at evaluating the performance of a finite difference-based (MODFLOW-MT3DMS), a finite element-based (FEFLOW) and a hybrid finite element and finite difference (Princeton Transport Code-PTC) groundwater numerical models simulating groundwater flow and nitrate mass transport in the alluvial aquifer of Trizina region in NE Peloponnese, Greece. The calibration of groundwater flow in all models was performed using groundwater hydraulic head data from seven stress periods and the validation was based on a series of hydraulic head data for two stress periods in sufficient numbers of observation locations. The same periods were used for the calibration of nitrate mass transport. The calibration and validation of the three models revealed that the simulated values of hydraulic heads and nitrate mass concentrations coincide well with the observed ones. The models' performance was assessed by performing a statistical analysis of these different types of numerical algorithms. A number of metrics, such as Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Bias, Nash Sutcliffe Model Efficiency (NSE) and Reliability Index (RI) were used allowing the direct comparison of models' performance. Spatiotemporal Kriging (STRK) was also applied using separable and non-separable spatiotemporal variograms to predict water table level and nitrate concentration at each sampling station for two selected hydrological stress periods. The predictions were validated using the respective measured values. Maps of water table level and nitrate concentrations were produced and compared with those obtained from groundwater and mass transport numerical models. Preliminary results showed similar efficiency of the spatiotemporal geostatistical method with the numerical models. However data requirements of the former model were significantly less. Advantages and disadvantages of the methods performance were analysed and discussed indicating the characteristics of the different approaches.