

Numerical simulation of groundwater flow in Dar es Salaam Coastal Plain (Tanzania)

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They are presented the results of a groundwater modeling study on the Coastal Aquifer of Dar es Salaam (Tanzania). Dar es Salaam is one of the fastest-growing coastal cities in Sub-Saharan Africa, with more than 4 million of inhabitants and a population growth rate of about 8 per cent per year. The city faces periodic water shortages, due to the lack of an adequate water supply network. These two factors have determined, in the last ten years, an increasing demand of groundwater exploitation, carried on by quite a number of private wells, which have been drilled to satisfy human demand.

A steady-state three dimensional groundwater model has been set up by the MODFLOW code, and calibrated with the UCODE code for inverse modeling. The aim of the model was to carry out a characterization of groundwater flow system in the Dar es Salaam Coastal Plain.

The inputs applied to the model included net recharge rate, calculated from time series of precipitation data (1961-2012), estimations of average groundwater extraction, and estimations of groundwater recharge, coming from zones, outside the area under study. Parametrization of the hydraulic conductivities was realized referring to the main geological features of the study area, based on available literature data and information. Boundary conditions were assigned based on hydrogeological boundaries. The conceptual model was defined in subsequent steps, which added some hydrogeological features and excluded other ones. Calibration was performed with UCODE 2014, using 76 measures of hydraulic head, taken in 2012 referred to the same season. Data were weighted on the basis of the expected errors. Sensitivity analysis of data was performed during calibration, and permitted to identify which parameters were possible to be estimated, and which data could support parameters estimation. Calibration was evaluated based on statistical index, maps of error distribution and test of independence of residuals. Further model analysis was performed after calibration, to test model performance under a range of variations of input variables.