Geophysical Research Abstracts
Vol. 15, EGU2013-11274, 2013
EGU General Assembly 2013

A Simulation/Optimization approach to manage groundwater resources in the Gaza aquifer (Palestinian Territories) under climate change conditions

Marta Dentoni (1,2), Khalid Qahman (3), Roberto Deidda (1), Claudio Paniconi (4), and Giuditta Lecca (2)

(1) University of Cagliari, Italy (mdentoni@unica.it, rdeidda@unica.it), (2) Center for Advanced Studies, Research and Development in Sardinia (CRS4), Italy (mdentoni@crs4.it, giuditta@crs4.it), (3) Environment Quality Authority, Palestine (kqahman@gmail.com), (4) INRS-ETE, Université du Québec, Canada (Claudio.Paniconi@ete.inrs.ca)

The Gaza aquifer is the main source of water for agricultural, domestic, and industrial uses in the Gaza Strip. The rapid increase on water demand due to continuous population growth has led to water scarcity and contamination by seawater intrusion (SWI). Furthermore, current projections of future climatic conditions (IPCC, 2007) point to potential decreases in available water, both inflows and outflows.

A numerical assessment of SWI in the Gaza coastal aquifer under climate induced changes has been carried out by means of the CODESA-3D model of density-dependent variably saturated flow and salt transport in groundwaters. After integrating available data on climatology, geology, geomorphology, hydrology, hydrogeology, soil use, and groundwater exploitation relative to the period 1935-2010, the calibrated and validated model was used to simulate the response of the hydrological basin to actual and future scenarios of climate change obtained from different regional circulation models. The results clearly show that, if current pumping rates are maintained, seawater intrusion will worsen.

To manage sustainable aquifer development under effective recharge operations and water quality constraints, a decision support system based on a simulation/optimization (S/O) approach was applied to the Gaza study site. The S/O approach is based on coupling the CODESA-3D model with the Carroll's Genetic Algorithm Driver. The optimization model incorporates two conflicting objectives using a penalty method: maximizing pumping rates from the aquifer wells while limiting the salinity of the water withdrawn. The resulting coastal aquifer management model was applied over a 30-year time period to identify the optimum spatial distribution of pumping rates at the control wells. The optimized solution provides for a general increase in water table levels and a decrease in the total extracted salt mass while keeping total abstraction rates relatively constant, with reference to non-optimized conditions.

Keywords: Climate change, coastal aquifer, seawater intrusion, simulation/optimization model.

Acknowledgements. The study is partially funded by the project "Climate Induced Changes on the Hydrology of Mediterranean Basins (CLIMB)", FP7-ENV-2009-1, GA 244151.