Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07347, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07347
EGU General Assembly 2008

Influence of climatic and human activities on the salinization process in two coastal aquifer systems of Sicily (Italy)

Dimitra Rapti-Caputo and Carmela Vaccaro

Department of Earth Sciences, University of Ferrara, via Saragat, 1, I-44100, Ferrara, Italy, (cpr@unife.it)

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In the present work the Syracuse and the Licata coastal aquifer system (Sicily), has been investigated to evaluate the influence of the human activities and that of the climatic changes in the hydrological cycle in terms of qualitative and quantitative impact on the groundwater. The Syracuse area (eastern Sicily) is famous since ancient times for its natural springs, like Aretusa and Ciane, as well as for the hydraulic management handicraft know from 480 B.C. Unfortunately, the recent hyper-exploitation of the underground water resources and the concomitant decrease of the precipitations caused a general lowering of the piezometric level of the aquifers therefore enhancing the intrusion of marine salty waters. In the present work, numerous hydrochemical parameters have been investigated, among which the pH, the total dissolved solid, the electric conductivity, the temperature and the concentration of Ca, Mg, Na, K, HCO3, Cl and SO4. The data have been collected from five well fields located at different distances from the coast. The analyses have been performed in order to understand the relationships between the intense exploitation and the geochemical characteris-

tics of the underground water resources. Our results obtained by applying classical geochemical methodologies integrated with techniques of multivariate statistics emphasise, firstly, the predominance of the Ca-HCO3 hydrochemical facies. Secondly, we could determine the evolution of mixing phenomena between salty and fresh waters approaching the coast line (San Nicola field). This behaviour is mainly associated with the pumping increase. Obviously, this intrusive process characterised by chlorides concentrations larger than 2000 mg/l affects all the coastal natural environment and generates severe problems to the entire aqueduct network. In the alluvial plain of Licata (southern Sicily) the evolution of the Salso River (in Italian it means 'Salty River') and the coastal dynamics, characterised by consecutive transgressions and retreats of the coast-line, qualitatively and quantitatively influenced the underground water resources. In this complex geological contest, also the anthropogenic activities played a crucial role, especially the farming activity as largely testified by the occurrence of numerous greenhouses that cover most of the plain. The analysis of thermopluviometric data concerning the last 75 years allowed to obtain inferences on the climatic evolution of this region characterised by a mean annual temperature of about 18 °C and mean annual precipitations of only 454 mm. In particular, during the last 24 years a 12% decrease of the precipitation with respect the previous period of observation is observed together with the increase of the temperature of the air about 1 °C. The research was focused on the unconfined, mainly sandy, aquifer developed in the Quaternary deposits of the Licata plain. The water depth of this aquifer is between to 0.3 to locally 5 m from the surface and the principal alimentation occurs via infiltration from precipitations and lateral outflow from the Salso river. The high salinity of the river especially during Summer periods and the intense farming activities played a crucial role for the quality degradation of the aquifer.