



Modeling coastal aquifers in a Mediterranean area: the example of Taranto gulf (southern Italy)

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Water resources stored in coastal aquifers are of strategic relevance for several regions throughout the world and in particular in the Mediterranean basin. They are extremely important in areas characterized by heavy urbanization, active industrial or touristic systems, where the need for fresh water is very acute and, sometimes, they are the only water resources available. This in turn can lead to the phenomenon of seawater intrusion because of aquifer overexploitation to satisfy the demand of an increasing population in coastal plains. Furthermore, karstic aquifers are well known for their specific vulnerability to natural and human-induced contamination, due to their particular characteristics such as thin soils, point recharge in dolines and swallow holes and increased hydraulic conductivity. Within this framework, the Taranto gulf is an example of paramount importance. In fact the presence of a wide industrial area close to the city of Taranto and the numerous maritime and military activities in the harbor area favored the increase of population density in the XX century. Moreover, they constitute factors of great concern for the protection of groundwater quality and quantity, in particular for the presence of the highly-vulnerable basins of Mar Piccolo and Mar Grande. In this area, groundwater resources are stored in a karst multilayered aquifer, which is very complex from the hydrostratigraphic point of view. Furthermore, the presence of highly water-demanding activities makes the seawater intrusion phenomenon very serious, especially along the coastline.

In order to characterize the groundwater dynamic in the study area, we discuss the hydraulic relationships between the different hydrostratigraphic units and between the sea and the aquifer system by developing a numerical groundwater model to test and refine the preliminary conceptual model and estimate the most uncertain hydraulic parameters. To achieve these objectives, we used different data-sets to characterize the study area from the hydrostratigraphic point of view and to identify the source terms and the groundwater outflows (i.e. submarine and subaerial freshwater springs). For the numerical simulations, the computer code YAGMod, which was originally developed to perform 3D groundwater flow simulation with a simplified treatment of unsaturated/saturated conditions and the effects of strong aquifer exploitation, has been upgraded to the case of a variable density flow. This research activity is part of the research program RITMARE (The Italian Research for the Sea), within which a subprogram is specifically dedicated to the problem of the protection and preservation of groundwater quality in Italian coastal aquifers and in particular, among the others, in the Taranto area.