



Numerical modeling of groundwater flow in the coastal aquifer system of Taranto (southern Italy)

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The Mediterranean region is characterized by a strong development of coastal areas with a high concentration of water-demanding human activities, resulting in weakly controlled withdrawals of groundwater which accentuate the saltwater intrusion phenomenon. The worsening of groundwater quality is a huge problem especially for those regions, like Salento (southern Italy), where a karst aquifer system represents the most important water resource because of the deficiency of a well developed superficial water supply. In this frame, the first 2D numerical model describing the groundwater flow in the karst aquifer of Salento peninsula was developed by Giudici et al. [1] at the regional scale and then improved by De Filippis et al. [2]. In particular, the estimate of the saturated thickness of the deep aquifer highlighted that the Taranto area is particularly sensitive to the phenomenon of seawater intrusion, both for the specific hydrostratigraphic configuration and for the presence of highly water-demanding industrial activities.

These remarks motivate a research project which 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. In this context, the CINFAI operative unit aims at providing a contribution to the characterization of groundwater in the study area. The specific objectives are:

- a. the reconstruction of the groundwater dynamic (i.e. the preliminary identification of a conceptual model for the aquifer system and the subsequent modeling of groundwater flow in a multilayered system which is very complex from the hydrostratigraphical point of view);
- b. the characterization of groundwater outflows through submarine and subaerial springs and the water exchanges with the shallow coastal water bodies (e.g. Mar Piccolo) and the off-shore sea;
- c. the modeling of seawater intrusion in the coastal aquifer system.

The first objective is achieved through the analysis of hydrostratigraphic reconstructions obtained from different data sets: well logs, published geological field maps, studies for the characterization of contaminated sites. The hydrostratigraphic setup is merged with maps of land use, hydraulic head maps, data on water extraction and source discharge, in order to identify the conceptual model.

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 (i.e. high well pumping rates), is extended to the case of a variable density flow. The results will be compared with those obtained with other modeling software (e.g., Tough2).

[1] Giudici M., Margiotta S., Mazzone F., Negri S., Vassena C., 2012. Modelling Hydrostratigraphy and groundwater flow of a fractured and karst aquifer in a Mediterranean basin (Salento peninsula, southeastern Italy), *Environmental Earth Sciences*. doi: 10.1007/s12665-012-1631-1

[2] De Filippis G., Giudici M., Margiotta S., Mazzone F., Negri S., Vassena C., 2013. Numerical modeling of the groundwater flow in the fractured and karst aquifer of the Salento peninsula (Southern Italy), *Acque Sotterranee*, 2:17-28. doi: 10.7343/AS-016-013-0040