Base studies on seawater intrusion in coastal aquifers in the Volturno Plain (Campania region, Southern Italy)

Stevenazzi S.*, Corniello A., Del Gaudio E. & Ducci D.

Dipartimento di Ingegneria Civile, Edile e Ambientale, Università di Napoli "Federico II".

Corresponding author e-mail: stefania.stevenazzi@unina.it

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Scarcity of rainfall and droughts have a direct impact on groundwater resources, increasing the issue of seawater intrusion in coastal areas, where, once the phenomenon of saline contamination has been activated, it is very difficult to reverse the trend. Moreover, the saline contamination in coastal aquifers is often high over very large sectors of the coast and it is gradually increasing due to the increase in groundwater withdrawals for drinking purposes, agriculture, industry and tourism. This is aggravated by the decrease in aquifer recharge and increased evapotranspiration due to global warming and the ongoing climate changes (MedECC, 2020). Thus, a comprehensive knowledge of the seawater intrusion phenomenon and its evolution in the future should be achieved for a proper and sustainable management of groundwater resources in coastal areas.

In this study, we focus on the analysis and implementation of the methodologies to study and prevent the saline contamination in coastal areas. We intend to reconstruct the dynamics of the seawater intrusion phenomenon with the aid of 3D litho-stratigraphic models and flow models and attempt to evaluate the evolution of the freshwater / saltwater interface over a medium-to-long time span. The areas of interest are the most affected sectors of the coastal plains in the northern part of Campania (Southern Italy): the Volturno Plain, a coastal plain of about 1340 km² constituted of fluvial, pyroclastic and marine sediments (Allocca et al., 2005; Corniello & Ducci, 2014).

An interactive 3D / 4D hydrogeological geo-database for the optimization of the handling and storage of spatio-temporal data is implemented. The database includes the available geographical, geological and hydrogeological information. Geographical data include elevation, hydrography, land cover and land use. Geological data include stratigraphies from more than 700 boreholes. Hydrogeological data include piezometric levels and more than 600 hydrochemical analyses (i.e., physico-chemical parameters, major and minor cations and anions, metals, organic compounds, H_2O stable isotopes) from about 300 wells and piezometers, spanning from 2002 to 2020. After a quality check, data are organised in a geographic information system (GIS) environment. Hydrogeological field surveys and monitoring activities are planned to integrate new data into the database: a selected number of wells will be instrumented with probes for a continuous monitoring of groundwater characteristics (i.e., piezometric level, electric conductivity, salinity).

The 3D / 4D hydrogeological geo-database allows the development of reliable conceptual and numerical models describing the seawater intrusion phenomenon, as well as for the implementation of medium-to-long term future scenarios. The outcomes of this study would be a useful support to groundwater managers and decision-makers for a sustainable management of the resource.

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