Geophysical Research Abstracts
Vol. 21, EGU2019-16552, 2019
EGU General Assembly 2019

Multi-technique groundwater flow system analysis and dating of deep aquifer in Alessandria basin (Piedmont)

Nicola Quaranta (1), Elena Cogo (1), Massimo Marchesi (2), and Mariachiara Caschetto (2)
(1) GEOengineering s.r.l., Torino (TO-IT), (2) Isotope Tracer Technologies Europe (IT2E), Milano (MI-IT)

The aim of the study was to setting up a protection system from pollution of the deep aquifer of the Alessandria basin, by redefining the recharge areas, focused on this portion of Piedmont territory, and therefore by creating some reserve areas of deep groundwater, to be preserved for future drinking purposes.
In addition to the classical hydrodynamic and geochemical monitoring techniques, the groundwaters were analyzed with reference to a monitoring network of selected wells with deep screens (80-300 m below ground surface) using a combined measurement approach for isotope analysis (δ2H and δ18O – H_2O, 14C and δ13C of dissolved inorganic carbon - DIC and δ37Cl and 87Sr/86Sr) and anthropogenic tracers (CFCs) as indicators of recent recharge/mixing.
Stable isotope composition (δ2H and δ18O – H_2O) has been defined during a 1-year sampling of snow-rain precipitations gauges distributed in order to design Local Meteoric Water Lines; isotope composition has been checked seasonally also into main river flows and in selected deep-wells.
By the use of the selected tracer it has been possible to delineate a differentiation of the circuits in the hydrogeological system, detecting fresh-Olocenic water nearby the recharge areas and upper-Pleistocene waters into the depo-central basin zone, but above all to establish the degree of confinement of deep aquifers (whereas stable isotopic seasonal fluctuations are negligible) and the need for protection of the same. Areal distribution of isotopic composition in deep aquifer reflects alpine-type or appenninic basin recharge pattern.
The recharge areas have been outlined by stratigraphic and hydrodynamic evaluations (vertical hydraulic gradient), through the support of a mathematical flow model.
The 3D numerical model was implemented in FEflow platform and calibrated on the basis of the available monitoring data; it was used as a support tool in the delimitation of the recharge areas, starting from the analysis of the distribution of flows.
It has become also fundamental in the delimitation of reserve areas, since it is able to simulate underground flows using both purely advective transport conditions (particle tracking technique) and more realistic conditions of advective and dispersive transport, introducing dispersive parameters and using the Life Time Expectancy reservoir distribution.