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# Long-term pumping test to study the impact of an open-loop geothermal system on seawater intrusion in a coastal aquifer: the case study of Bari (Southern Italy)

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The high cost and scarcity of fossil fuels have promoted the increased use of natural heat for a number of direct applications. Just as for fossil fuels, the exploitation of geothermal energy should consider its environmental impact and sustainability.

Particular attention deserves the so-called open loop geothermal groundwater heat pump (GWHP) system, which uses groundwater as geothermal fluid. From an economic point of view, the implementation of this kind of geothermal system is particularly attractive in coastal areas, which have generally shallow aquifers. Anyway the potential problem of seawater intrusion has led to laws that restrict the use of groundwater. The scarcity of freshwater could be a major impediment for the utilization of geothermal resources. In this study a new methodology has been proposed. It was based on an experimental approach to characterize a coastal area in order to exploit the low-enthalpy geothermal resource. The coastal karst and fractured aquifer near Bari, in Southern Italy, was selected for this purpose.

For the purpose of investigating the influence of an open-loop GWHP system on the seawater intrusion, a long-term pumping test was performed. The test simulated the effects of a prolonged withdrawal on the chemical-physical groundwater characteristics of the studied aquifer portion.

The duration of the test was programmed in 16 days, and it was performed with a constant pumping flowrate of 50 m3/h. The extracted water was outflowed into an adjacent artificial channel, by means of a piping system. Water depth, temperature and electrical conductivity of the pumped water were monitored for 37 days, including also some days before and after the pumping duration. The monitored parameters, collected in the pumping and in five observation wells placed 160 m down-gradient with respect to the groundwater flow direction, have been used to estimate different scenarios of the impact of the GWHP system on the seawater intrusion by mean of a numerical model. Model flow simulations were carried out under transient flow conditions, in order to determine perturbations of the saline front into the Bari fractured aquifer, caused by the long-term pumping at 50 m3/h.