GROUNDWATER CHANGES IN THE NERA RIVER VALLEY DUE TO THE AUGUST-OCTOBER 2016 SEISMIC SEQUENCE IN CENTRAL ITALY

Francesca BANZATO [1], Marino D. BARBERIO [1], Livio CAMPAGNOLI [2], Stefania PASSARETTI [1], Andrea POLLASTRELLI [2], Carlo DOGLIONI [1], Marco PETITTA [1]

[1] Department of Earth Sciences, Sapienza University-Rome, Italy, francesca.banzato@uniroma1.it
[2] Nera aqueduct company (S.A.N.)-Macerata, Italy

The earthquake sequence occurred in central Italy in 2016 was the strongest in Italy since 1980, with 5 major shocks of Mw>5.4 and over 9000 shocks with magnitude Mw>2.0. The area interested by a ground deformation up to -70 cm, stretches for about 40 km in length and 15 km in width. However, the effects of seismic sequence affected a wide sector in central Apennines, involving the inner portions of Lazio, Marche, Umbria and Abruzzo regions.
As already observed for previous earthquakes (i.e. Adinolfi Falcone et alii, 2012), changes of the hydrologic regime have been recorded in regional carbonate aquifers. Particularly, this study describes the changes in groundwater discharge and in groundwater levels induced by the earthquakes in the upper Nera river. The study area, belonging to Umbria-Marche geological domain, is located in the epicentral zone of the earthquake sequence, with particular reference to the 26-30 October 2016 events.
The upper Nera River, located in the western area of Sibillini Mts., represents the main discharge of the basal aquifer at regional scale. The San Chiodo spring tapped for drinking purposes by the S.A.N. company, is interested by monitoring of seasonal and annual changes in piezometric levels and in discharge of the regional aquifer since 2011. Correlating hydrometric level and discharge at the gauging station along the Nera river, it has been possible to evaluate short- and mid-term changes in groundwater discharge, as additionally fed from basal aquifer, induced by the earthquakes. In fact, considering a base flow in the depletion phase of about 1.5 m^3/s, after the earthquakes of 30 October the discharge of the upper Nera river was more than doubled, trespassing 4 m3/s. Furthermore, in the San Chiodo spring area a progressive increase of the water table elevation (from +2 m to +12 m) has been recorded. After August events, the response was limited to an average increase of about 1 m of the water table; the October events, which struck directly the spring area, caused a steep rise of both discharge and water table. This quick increase reached a steady state in December 2016. Taking into account the conceptual model previously suggested for the L'Aquila 2009 earthquake, a possible explanation could be related to an increase of hydraulic conductivity due to fracture cleaning in the recharge areas; conversely, a different conceptual model is based on a decrease of hydraulic conductivity due to geodetic elevation decrease, estimated in 25 cm in average in the study area. Additional monitoring, including hydrochemical and isotopic data, is useful to test the different conceptual models and mainly for estimating the future behavior of the basal aquifer interested by the above cited changes in hydrogeology. To ensure a correct management of groundwater resources and of the post-earthquake emergency, representative conceptual model of groundwater flow, previewing future evolution of the water table and spring and river

discharge, have been finally considered.

References

Adinolfi Falcone R., Carucci V., Falgiani A., Manetta M., Parisse B., Petitta M., Rusi S.,Spizzico M. & Tallini M. (2012) Changes on groundwater flow and hydrochemistry of the Gran Sasso carbonate aquifer after 2009 L'Aquila earthquake. Ital. J. Geosci., 131, 459-474.