GROUNDWATER TEMPERATURE AS NATURAL TRACERS TO CHARACTERIZE HYDRAULIC BEHAVIOUR AND GEOMETRICAL PROPERTIES IN CARBONATE AQUIFERS: M. NERONE KARST AQUIFER, CENTRAL ITALY

Andrea TAMBURINI [1], Marco MENICHETTI [1]

[1] Department of Pure and Applied Sciences (DiSPeA), University of Urbino, Italy, andrea.tamburini@uniurb.it

Groundwater temperature is a physical parameter which is widely used in hydrogeological investigation. Analysis of natural responses of karst springs were used as additional information to characterize the different flow types and the structural organization of drainage patterns in karst aquifers (Roy and Benderitter 1986; Birk et al. 2004). A deterministic approach was adopted to model the spatial variability of discharge (Q) and water temperature (T) at main karst outlets, in order to observe the different responses to rainfall events, as suggested by Martin and Dean (1999) and Birk et al. (2004).

The Giordano karst system is located at SW limb of the Monte Nerone anticline in northern Apennines (central Italy), with a recharge area of about 3.8 km2 (Tamburini 2016). The karst system discharge about 32.2 l/s on average during over the hydrological year and it's characterized by two outlets: a basal-continuous spring (BCS) with a mean discharge of 8.9 l/s and an upper-intermittent spring (UIS) with a mean discharge of 23.3 l/s, located about 60 m above the previous one.

In the present study, flow patterns and geometrical properties (conduits and fractures) have been distinguished by combining discharge and groundwater temperature data, monitored continuously for six months from January to July 2016.

Results show significant difference in the two spring outlets between the time lags as well as non-simultaneous and not analogue responses of temperature (T) to the same recharge events: temperature of UIS range from 9.5 to 10.1°C whereas temperature of BCS remain rather stable, ranging from 9.8 to 9.9°C. This data suggests a stratification of the water along the aquifer probably associated by different residence times and linked to the structural organisation of karst aquifer (conduit and fracture networks): deeper and oldest water in the basal-continuous springs and youngest water in the upper-intermittent spring.

References

Birk S, Liedl R, Sauter M (2004) Identification of localised recharge and conduit flow by combined analysis of hydraulic and physico–chemical spring responses (Urenbrunnen, SW-Germany). J Hydrol 286:179–193.

Martin JB, Dean RW (1999) Temperature as a natural tracer of short residence times for groundwater in karst aquifers. In: Palmer AN, Palmer MV, Sasowsky ID (eds) Karst Modeling. Spec.

Roy B, Benderitter Y (1986) Natural thermal transfer in a superficial fissured carbonate system (in French). Bull Soc Géol France 2 (4):661–666.

Tamburini A. (2016) Structural characterization of a carbonate hydrostructures in the Umbria-Marche Apennines. Rend. Online Soc. Geol. It., Vol. 41, pp. 88-91, 1 fig. (doi: 10.3301/ROL.2016.100).