DEVELOPMENT OF A SUSTAINABLE WATER MANAGEMENT FOR THE SU GOLOGONE KARST SPRING (SARDINIA, ITALY)

Francesco SANNA [1], Laura SANNA [2], Jo DE WAELE [3], Bartolomeo VIGNA [4]

[1] Department of Hydraulic Projects of Sardinia Region, Via Dalmazia 1-0810 Nuoro, Italy, francescosanna@alice.it
[2] Institute for Biometeorology, National Research Council of Italy, Trav. La Crucca 3-07100 Sassari, Italy, sanna@ibimet.cnr.it
[3] Department of Biological, Geological and Environmental Sciences, University of Bologna, Via Zamboni 67-40126 Bologna, Italy, jo.dewaele@unibo.it
[4] Department of Environment, Land and Infrastructure Engineering, Politecnical University of Turin, Corso Duca degli Abruzzi 24-10129 Turin, Italy, bartolomeo.vigna@polito.it

During recent decades the Mediterranean region has been facing with an increased drought frequency among land areas across the globe. In the last IPCC report, this region is projected to experience the greatest droughts in the last decades of the twenty-first century and has been incorporated in the list of major "climate change hot spots" concerning the threats posed to the good-quality water security.
Also Sardinia (Italy) is included as one of the zones with the highest sensitivity to water deficiency. In this island, the karst water supply is of strategic importance especially during dry periods and considering the growing demand of good-quality water, it is of primary importance to ensure the long-term adequate quantity of potable water.
One of the main karst aquifers in Sardinia is the Supramonte massif in the catchment area of Su Gologone (Central-East Sardinia), an important source of drinking water to the local population. This spring drains a well-developed karst system through two outlets with discharges of about 120 L/s during low flow conditions and up to 5,000 L/s during ordinary floods. However, its recharge is closely related to the unpredictable seasonal climate regime typical of the Mediterranean areas.
Since temporal hydrological variations are of great significance and have a major impact on the groundwater availability, the main objective of this research is to understand how the karst system would react in possible different meteorological conditions and to develop a flexible and appropriate approach for its karst water exploitation both taking into account the special features of the Supramonte karst landscape and without affecting the quality and quantity of the resource.
For this purpose, Su Gologone spring has been equipped with a multi-parametric probe for continuous monitoring of water level, electrical conductivity and temperature. During the monitoring period flow rates were performed monthly at the spring. The recharge was calculated from the meteorological data supplied by the Department of Meteorology and Climatology of the Environmental Protection Agency of Sardinia (ARPAS).
The analysis of historical and present-day discharge rates yielded a rating curve based on the range between the minimum values of the main spring and 3,000 L/s. Based on this scale, the discharge duration curve (which reports the number of days of the year for which the flow rate is greater than a certain threshold value) has been traced. Thanks to the high permeability of

this aquifer, this value allows the calculation of the amount of water resources directly exploitable from a sampling point placed at a sufficient distance from the spring without perceptibly altering its hydrodynamic regime and following its natural recession curve. This means the water withdrawal has to guarantee that the maximum width of its zone of influence has a piezometric level approximately equal to the static level of the spring.
This flexible management of water pumping makes possible to vary the quantity of exploited groundwater from year to year in relation to the actual weather conditions. This means more water can be extracted during the wettest years and vice-versa. This approach requires the continuous monitoring of spring discharges associated with the detection of the main groundwater physical-chemical characteristics and it is able to use alternative water sources in dry periods thanks to the existing artificial reservoirs of Preda Othoni and Olai dams.