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Preliminary estimation of the peak discharge at the Su Gologone spring (Central-East Sardinia) during the flood event of November 18th, 2013

Antonello Cossu (1), Jo De Waele (2), Francesco Sanna (3), and Laura Sanna (4)

(1) Gruppo Speleo Ambientale Sassari, Italy, (2) Department of Biological, Geological and Environmental Sciences, University of Bologna, Italy, (3) Gruppo Grotte Nuorese, Italy, (4) National Research Council of Italy, Institute for Biometeorology, Sassari, Italy (l.sanna@ibimet.cnr.it)

Last November 2013, an exceptional rainfall has occurred in Sardinia causing 18 casualties at Olbia and Bitti and severe economic damage to infrastructures and land in many areas (e.g. Torpè and Cedrino plains). From a meteorological point of view, this rainfall event was caused by south-western warm and humid air currents moving from Africa coming in contact with cold air masses located above the higher parts of the island, creating convective phenomena of a certain intensity.
Estimating the peak discharge of the rivers related to these high intensity rainfall events is of fundamental importance to improve flood-risk management and to prevent and/or reduce the damages. In carbonate areas, quantifying the karst aquifer recharge is an even more difficult task due to the fact that the precipitation and resulting surface flow is rapidly transferred to the underground cave systems, and then suddenly released at karst outflows. We report the case of the Su Gologone spring, in Supramonte area (Central-East Sardinia, Italy), a karst resurgence located only twenty metres from the Cedrino river and one of the main water supplies to this river. The freshwater of this karst spring feeds the Preda 'e Othoni dam, located a few kilometres downstream of the resurgence, and originally built to regulate the flooding of Cedrino river but currently used for all sorts of purposes, as electricity supply, irrigation of farmlands, industrial uses and especially for drinking water, an important source that has to be quantified and preserved.
With the purpose of evaluating the contribution of this karst spring to the river discharge, at the beginning of the hydrological year 2013-14, Su Gologone has been equipped with a multi-parametric probe for in-continuous monitoring, at regular intervals, of the values of pressure (and therefore the level of water), electrical conductivity and water temperature. During the entire monitoring period flow rate measurements have been performed three times at the spring, based on the speed of the water taken with a hydraulic reel specially dedicated for this type of survey. These data show that an increase in water level of just 60 cm, produces a flow rate ten times higher than that during low discharge. During the peak discharge at the spring the probe has recorded a rise in the water level of over 11 metres, between 18:00 and 21:00 on November 18th, 2013. Part of this increase, however, was due to the barrier function of the nearby Cedrino river, whose high water level has blocked the drainage of the water from the karst system. The water spring level curve shows a temporary lowering around noon, before the flood peak, probably due to the opening of the dam.
On the basis of the comparison between the measured speed of water flow in the stages immediately preceding and succeeding the flood event and of the values of water level recorded by the multi-parametric probe, it has been possible to estimate the contribution of the karst spring to the peak discharge of the river in around 40 cubic metres per second, a value of two orders of magnitude greater than the average flow of the spring (around 200 L/s).