



Effect of precipitation on well water levels and drip water intensity in the Buda Castle Cave

Fanni Gazda¹, Dávid Farkas¹, Géza Hajnal¹, and Klaudia Négyesi²

¹National Laboratory for Water Science and Water Security, Budapest University of Technology and Economics, Department of Hydraulic and Water Resources Engineering, Faculty of Civil Engineering, Budapest, Hungary

²Budapest University of Technology and Economics, Department of Hydraulic and Water Resources Engineering, Faculty of Civil Engineering, Budapest, Hungary

The Buda Castle Cave, consisting of natural limestone formations and artificial corridors, lies under the Buda Castle Hill. The landscape of the area above the cave is part of the UNESCO World Heritage Sites. In the area of the Great Labyrinth – part of the Castle Cave – the infiltrating water seems to have reached an amount, that has never been experienced before, and it has also caused more intense weathering and rock falls, especially on the roof of the cave. The main motivation of the research was to preserve the condition of the Castle Cave and the priceless historical and cultural values of the Buda Castle District above by determining the origin of cave waters. In order to achieve this goal, a detailed study of the water conditions in the cave was necessary. Data on the cave system's current water conditions were limited, as the latest measurements were carried out between 2008 and 2010. The monitoring started again in October 2023, and several measurements were carried out to quantify the water conditions and to determine the origin of the cave waters. In addition to measuring the water level in the cave wells and conducting pumping tests, the amount of drip water was measured using self-made tipping bucket gauges and ad hoc field tests. The temporal resolution of the measurements was much more detailed than in previous studies. After processing the data, statistical analyses were performed on the measured data. The precipitation in the area was correlated to well water level and drip water intensity time series. The precipitation data were shifted by different numbers of days, and the maximum correlation coefficients were determined using linear regression. The correlation analyses indicated only a weak relationship, so other – presumably anthropogenic – effects may be present. Although strong linear relation between daily precipitation and daily average water levels and drip water intensities was not revealed, some assumptions could be made. In one of the wells, there was found a weak connection to the precipitation about three months prior and two drip locations in the Castle Cave had very similar correlation coefficient values. However, further measurements are essential to draw more accurate conclusions about the origin of the cave waters.