



Modelling cave flow hydraulics in the Notranjski Kras, Slovenia

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The Notranjski Kras region is a karst region in western Slovenia, developed in Cretaceous limestone. The region is characterised by hilly relief, with peaks reaching 1300 m elevation. Several well-developed cave systems drain the karst aquifer, providing preferential flow paths along two sections: The Pivka River, which sinks into Postojnska Jama and reappears in Planinska Jama, and the Stržen and Cerknjščica rivers, which sink into Karlovica Jama, flow through Zelške Jama and Tkalca Jama and also reappear in Planinska Jama. Both sub-surface flow paths merge in Planinska Jama, providing water for the Unica river. The Unica river leaves Planinska Jama via a large karst spring and passes through Planinsko Polje, disappearing again through two groups of ponors, finally emerging in the Ljubljanka Springs at around 300 m asl.

The sub-surface flow path through the Postojnska Jama cave system has been monitored with 7 stations distributed along the flow path, monitoring stage and temperature. We have used the stage data to model flow through the cave system with the program package SWMM, simulating the active parts of Postojnska Jama with simplified geometry.

From the comparison of stage observations and predictions, we identified key sections in the cave, which control the sub-surface flow, such as passage constrictions, sumps and by-passes. Using a formal inverse procedure, we determined the geometry of this key sections by fitting predicted to observed stages, and we achieved a very high degree of correlation.