

From: IAH Karst Commission <bwtobin80@212577110.mailchimpapp.com>
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September 2024 KC News

Chairs: Peter Malík (Europe/Africa, 9/21 -12/22); Avi Burg (Asia/Oceania, 1/23 - 4/24); Benjamin Tobin (Americas. 5/24 -8/25)

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Activity of KC members at the IAH conference in Davos

The annual meeting of the IAH was held in Davos, Switzerland, between 8-13.9.2024. Many members of the IAH KC actively participated in the conference. Three sessions on karst hydrogeology were organized and chaired by KC members (Pierre-Yves Jeannin, Hervé Jourde, Laurence Gill, PeterMalik, Zoran Stevanović, Nico Goldscheider and Avi Burg). Moreover, two of the KC members - Nico Goldscheider and Pierre-Yves Jeannin, were the organizers and leaders of two field trips that took place on Wednesday, September 11.

The field trip led and guided by Nico aimed to expose the participants to the unique geology, karst landscape and the characteristic karst phenomena on the Plateau of Mt. Sulzfluh (2817 m asl), one of the highest and most spectacular karst landscapes in the Alps, and one of the best places to see nappe tectonics. The high plateau has a variety of karren, several large cave systems and other karst landforms, strongly influenced by the action of snow and glaciers. Nico led a group of 22 in good-shape participants up and down the ridge, and during this full-day hike briefly presented the ridge's complex geology, its development and karstic nature.

The title of the field trip led by Pierre-Yves Jeannin was: "Huge rockfall, glaciers, tunnels: a long history of impacts on groundwater in the Flims region". During this field trip, almost 100 participants could discover how the rockfall dammed the karst systems ~9500 years ago. Then, a tunnel construction in 2002 crossed a conduit feeding a spring, which dried out and modified the behavior of two other springs. One feeds a hydropower plant, for which the amount of missing water had to be assessed using models of the karst system. The other feeds a stream swallowing into the aquifer located on top of the rockfall and controlling the level of Lake Cauma. The decrease of the spring discharge induced a lowering of the lake. Models and hydraulic tests made it possible to setup a plant for artificially feeding the aquifer and making the lake recovering its original level.

We take this opportunity to send our praises on behalf of all KC participants to our Swiss colleagues - Daniel Hunkeler and his team from the CHYN (Centre of Hydrogeology at the University of Neuchatel) for organizing a successful and fascinating conference.

Some photos from the field trips: (Top: The entire group on summit of Mt. Sulzfluh, bottom: The entire group on summit of Mt. Sulzfluh)



Request for Volunteers

As a volunteer organization, we are currently looking for assistance in updating and maintaining our website. If any members are interested in assisting with this effort and are proficient in WordPress, please reach out to the co-chairs for information.

IAH Applied Hydrogeology Award for Zoran Stevanovic

Congratulations to our friend Zoran Stevanovic for being awarded this prestigious honor during the IAH conference in Davos.

Zoran received this award due to his continual activity in hydrogeology. He has conducted work in two parallel directions: (1) scientific activity mainly on the topic of karst hydrogeology, brought about by hundreds of published articles, monographs, and books, and (2) practical projects aimed at bringing quality water to populations in many countries. Zoran has worked on groundwater management in Serbia, Algeria, Iraq, Georgia, Bhutan, Seychelles, Somalia, Ethiopia, and the Balkans.

His activity in the IAH KC is prolonged, active, and influential; he has been a member since 1988; elected Chairman of the Commission in 2017-2019, and Co-Chair for Europe and Africa between 2019-2021.

As a UNESCO Consultant, he was employed in the DIKTAS project (Dinaric Karst Transboundary Aquifer System), In the KIT/BGR/UNESCO project WOKAM (World's Karst Aquifer Map), and the KARMA/MEDKAM project (Mediterranean Karst Aquifer Mapping).

Recently, Zoran initiated a broad project which he manages with great skill – MIKAS (Most Important Karst Aquifer Springs), which aims at gathering and presenting the most important karst springs at the global level, as well as at a national level (NIKAS) (www.mikasproject.org).

All of these efforts make this a well-deserved award. If you see Zoran, please congratulate him on this honor!

A few images of Zoran receiving this wonderful award:



Upcoming KC Events

Annual Meeting of the Geological Society of America

This conference is taking place in Anaheim, California, USA between September 21 - 26, 2024. There are multiple karst sessions and events held by the Karst Division of GSA.

For more details see: www.community.geosociety.org/gsa2024/home

The 4th European Regional Conference of IAEG (EUROENGEО 2024)

The conference will be held in Dubrovnik, Croatia, between October 8 - 12, 2024, and will include lecture sessions and excursions.

For more details see: <https://www.euroengeo2024.com/>

Visual Karsys Courses

The next dates for Visual karsys & GeoModelling courses are:

- September 25th, 2024 -Visual karsys "Advanced" - Online course,
- October 16-17th, 2024 -Visual karsys- Online course,

The courses are aimed at geologists and hydrogeologists working on "complex" geological environments or "heterogeneous" aquifers. They provide access to the online tool visualkarsys.com for their academic or applied projects. visualkarsys.com has over 1,400 users and a large network of specialists worldwide.

For more details on the courses see: <https://www.visualkarsys.com/courses>

Contact for registration /questions: info@visualkarsys.com

In addition, you are invited to have a look at the visual karsys webinar, which was recorded during the EuroGeoSurveys GMMEG Group Webinar, on October 12th, 2023:

<https://www.youtube.com/watch?v=5892kiqPA5g>

Mammoth Cave National Park 12th Research Symposium

The 12th Mammoth Cave Research Symposium, celebrating more than 100 years of scientific research and resource management in the Mammoth Cave Region will be held May 13 – 14, 2025. Sponsored by Western Kentucky University and the Cave Research Foundation, the symposium is open to talks and posters on research on any aspect of the Mammoth Cave area (cave, surface, science, history, humanities, etc.) Abstract deadline is February 1, 2025. More information can be found at: <https://dyetracing.com/mammoth-cave-symposium>

National Cave & Karst Management Symposium

The 26th National Cave & Karst Management Symposium will be held 6 – 10 October, 2025 in Ely, NV, USA. This conference will include a day of short courses, three days of talks, and a field trip. In addition, there will be an Orientation to Cave Rescue course hosted by the National Cave Rescue Commission the weekend before the conference. For more information:

<https://ely2025.nckms.org/>

Recent Publications

- Ashjari J., Tobin, B., Fryar, A.E., Ashjari, Z. 2024. Numerical modeling of the development of Leandras and Double Bopper Caves, Grand Canyon, USA. Hydrogeology Journal. <https://doi.org/10.1007/s10040-024-02812-z>

Abstract

The Grand Canyon is famous for its awe-inspiring natural wonders, including its caves. Double Bopper and Leandras caves have some of the longest passage lengths in the world and are nestled within the limestone of the Redwall Formation, featuring an intricate maze-like pattern. This study explored previous hypotheses about the formation of these caves. To simulate their development, multiple scenarios were tested utilizing the numerical model CAVE. Model simulation accuracy was evaluated through multivariate statistical analysis. The findings indicated that the intersection of faults surrounding the caves created a highly permeable zone, allowing meteoric and

hypogene water to move freely, with or without a single point source of percolation. Given the uncertainty about past hydrogeologic conditions, the caves are estimated to have taken from 4 to 10 million years to develop, consistent with previous studies.

- Baer, G., Gavrieli, I., Swaed, I., Nof, R.N. 2024. Remote Sensing of Floodwater-Induced Subsurface Halite Dissolution in a Salt Karst System, with Implications for Landscape Evolution: The Western Shores of the Dead Sea. *Remote Sensing* 16(17): 3294. <https://doi.org/10.3390/rs16173294>

Abstract

We study the interrelations between salt karst and landscape evolution at the Ze'elim and Hever alluvial fans, Dead Sea (DS), Israel, in an attempt to characterize the ongoing surface and subsurface processes and identify future trends. Using light detection and ranging, interferometric synthetic aperture radar, drone photography, time-lapse cameras, and direct measurements of floodwater levels, we document floodwater recharge through riverbed sinkholes, subsurface salt dissolution, groundwater flow, and brine discharge at shoreline sinkholes during the years 2011–2023. At the Ze'elim fan, most of the surface floodwater drains into streambed sinkholes and discharges at shoreline sinkholes, whereas at the Hever fan, only a small fraction of the floodwater drains into sinkholes, while the majority flows downstream to the DS. This difference is attributed to the low-gradient stream profiles in Ze'elim, which enable water accumulation and recharge in sinkholes and their surrounding depressions, in contrast with the higher-gradient Hever profiles, which yield high-energy floods capable of carrying coarse gravel that eventually fill the sinkholes. The rapid drainage of floodwater into sinkholes also involves slope failure due to pore-pressure drop and cohesion loss within hours after each drainage event. Surface subsidence lineaments detected by InSAR indicate the presence of subsurface dissolution channels between recharge and discharge sites in the two fans and in the nearby Lynch straits. Subsidence and streambed sinkholes occur in most other fans and streams that flow to the DS; however, with the exception of Ze'elim, all other streams show only minor or no recharge along their course. This is due to either the high-gradient profiles, the gravelly sediments, the limited floods, or the lack of conditions for sinkhole development in the other streambeds. Thus, understanding the factors that govern the flood-related karst formation is of great importance for

predicting landscape evolution in the DS region and elsewhere and for sinkhole hazard assessment.

- Cheng, S., Yu, X., Li, Z., Xu, X., Wang, K. 2024. Quantitatively Distinguishing the Factors Driving Runoff and Sediment Yield Variations in Karst Watersheds. *Water Resources Research*, 60 (8), e2024WR037089. <https://doi.org/10.1029/2024WR037089>

Abstract

Due to the coupled or interconnected relationships among frequent climate extremes, unique geological conditions, discontinuous soil distribution, rugged geomorphology, and highly heterogeneous landscapes in different karst watersheds, few studies were conducted to decouple the relative magnitudes of the climate, lithology, soil, topography, and landscape on soil erosion in karst regions. The objective of this study was to quantify the relative importance of these influencing factors on runoff and sediment yield (SY) in 40 typical karst watersheds in southwest China. To address this issue, the Pearson correlation and random forest were first to select the dominant factors influencing runoff and SY. Subsequently, the partial least squares-structural equation model (PLS-SEM) was used to decouple the complex relationships among runoff, SY and their potential influencing factors. Results showed that climate, lithology, soil, topography and landscape could explain 79% of the runoff variation, and only climate factors have significant impact on runoff for heterogeneous karst watersheds ($P < 0.01$, path coefficient (β) = 0.589). The explanation of five factors to SY variability is 59%, and the landscape has the greatest impact on SY ($P < 0.01$, $\beta = -0.458$). Different from runoff, climatic factors have no significant influence on SY. By elucidating a complex coupled relationship framework, this study can provide a scientific basis for the formulation of soil and water loss program, and the optimization of land resources and ecological environment sustainable development in karst watersheds.

- Medici G, Munn JD, Parker B.L. 2024. Delineating aquitard characteristics within a Silurian dolostone aquifer using high-density hydraulic head and fracture datasets. *Hydrogeology Journal*, doi:10.1007/s10040-024-02824-9.

Abstract

Dolostone aquifers are heterogeneous due to the variable frequency, orientation, and intersections of rock discontinuities. A ~100-m-thick Silurian dolostone sequence provides a bedrock aquifer supplying the city of Guelph, Canada. Here, fracture network characteristics and influences on hydraulic head were examined using several data types obtained from cored holes in a study that is novel for the quantity and quality of data. High angle joint orientations, heights, and terminations relative to bedding features were determined from acoustic televiewer logs and outcrop scanlines. These data were compared to high-resolution hydraulic head profiles showing head loss over depth-discrete intervals identifying zones with lower vertical hydraulic conductivity. Hydraulic head profiles are straight and vertical in highly permeable zones characterized by karstified rock discontinuities. The vertical position of head loss varies across the study area and occurs in any of the lithostratigraphic units of the Lockport Group. Within this sedimentary sequence, aquitards are laterally discontinuous or “patchy” at variable depths and relate to: (1) the frequency of the high-angle joints; (2) shorter joint height; and (3) the type of joint terminations. The head loss occurs in thin (2–2.5 m) intervals where the frequency of the high-angle joints is low. Where a large proportion of small joints cross-cut marl bedding planes, head loss is negligible, suggesting that the vertical hydraulic conductivity is not reduced. Overall, these findings are potentially applicable to assessing aquitard and cap rock integrity in carbonate sedimentary sequences worldwide.

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IAH Karst Commission · 333 Bassett Ave · Lexington, KY 40502-1541 · USA

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