



REGIONAL GROUNDWATER FLOW COMMISSION

ANNUAL PROGRESS REPORT

(January – December 2020)

1. Sessions at Conferences

Breaking with tradition, this year the annual [EGU General Assembly](#) was held online, in an unusual way at the originally scheduled week between 4–8 May 2020. The event was named EGU2020: Sharing Geoscience Online, which brought part of the activities of the EGU General Assembly 2020 online, as a response to the COVID-19 pandemic situation.

On this online event, RGFC–IAH co-organized a session, 'Groundwater flow and geofluids system understanding with regard to environmental problems and resource management (HS8.2.9)' with the ENeRAG H2020 project. The session's convenors were Manuela Lasagna, Daniela Ducci, Jim LaMoreaux, John Molson, Judit Mádl-Szőnyi, Ádám Tóth, Corrado Camera and Hanneke Verweij. The session aimed to bring together scientists studying different aspects related to groundwater circulation, interaction among fluids of different nature and management of groundwater, geothermal energy and hydrothermal mineral resources.

36 abstracts were submitted to the session, which was held in the form of a live text chat on 5 May 2020 between 2–6 pm. During this timespan, 25 presentations were discussed together with a fantastic number of about 100 individual users, who joined the chat. With this number of participants, this session was one of the most popular in the Groundwater session group.

The EGU General Assembly 2020 in the online format Sharing Geoscience Online was an exciting and new experience for all the attendees. The event gave an excellent chance to meet online and share research and ideas among other researchers. We were happy to try this new platform, thereby also fostering the acquisition of new experiences in geofluid and regional groundwater flow research and we could build new liaison with scientists from all over the world.

2. Training workshops, short courses

Short Course by JJ Carrillo-Rivera: Groundwater Flow Systems, an Introduction. (in Castillian). Unidad Académica de Sustentabilidad y Tecnología, ITESO, Universidad Jesuita de Guadalajara, Mexico, 15–29 April 2020

Short Course by JJ Carrillo-Rivera: Are we really running out of water? (in Castillian) Postgraduate in Water Technology and Management. Autonomous University of San Luis Potosí, Mexico, 28 May 2020

Short course lecture by Á Tóth: Understanding the shallow geothermal potential in light of basin-scale groundwater flow and heat transport processes. Online Workshop Shallow geothermal energy: from the ground to buildings, from the field to modelling, 30 November – 3 December 2020

3. Dissemination of Knowledge

A reform of [Mexico's National Waters Act](#) based on the Groundwater Flow Systems has been recently approved in Mexico. José Joel Carrillo Rivera (RGFC-IAH) initiated the inclusion of regional groundwater flow systems as a scientific background in the reform proposed to the Act. An interactive Colloquium was organized between scientists and senators by him in the Mexican Senate in November 2015 with the contribution of RGFC-IAH members, Alfonso Rivera (Chairman Transboundary Aquifer Commission of IAH, Canada), Andrew Stone (executive director of American Ground Water Trust, USA), Judit Mádl-Szőnyi (Chair RGFC-IAH, ELTE, Hungary), Xiao-Wei Jiang (RGFC-IAH, University of Geosciences, China), Udo Weyer (WDA, Canada), and Juan Maria Fornes (IGME, Spain). The suggestions derived from the Colloquium were presented to the Mexican House of Representatives and the proposals were implemented into the reform to the National Waters Act. It is important to continue educating decision-makers on the role of GWFS in relation to the water cycle. The RGFC-IAH continues to promote awareness in this topic by developing an ongoing strategy to inform politicians and agencies.

Seven two-hour webinars (29 October – 10 December 2020) were organized in collaboration with the Mexican Council of Science and Technology (CONACyT) under the Strategic National Programme (Pronaces) to bring Knowledge and Management of Watersheds for the Wellbeing and Environmental Justice. The topic was the setting of standards and scientific criteria on the functioning of gravitational groundwater flow systems to be applied in Mexico.

The ENeRAG H2020 project with the cooperation of the József and Erzsébet Tóth Endowed Hydrogeology Chair and the RGFC-IAH launched a geofluids blog named "[Groundwater, Geoenergy, Hydrothermal minerals](#)". This scientific blog intends to inform those who are interested in underground fluids including groundwater, thermal water, hydrothermal mineral resources, geothermal energy, hydrocarbons and their

interrelationships. Stay tuned by being a follower of the blog. Our target audiences are colleagues and hydrogeological professionals, but the blog also provides useful information for high school students and their teachers. University students, as well as representatives of related disciplines, such as geography, meteorology, hydrology, water management, ecology, soil science, geothermal energy, hydrocarbon geology and agriculture, are also welcome among our readers!

RGFC launched its [LinkedIn](#) page, which is a forum for scientific discussion, in autumn of 2014 and since then the number of members reached 335 (~15 new members during this report period).

Now, the news and activities of RGFC can be followed on another social media platform. We will share conference pictures and updates @rgfc_iah [Instagram](#) profile, as well. You can use hashtag #rgfc_iah if you would like to share a photo of regional groundwater related topics or even a memory of your daily hydrogeology practice. We already have 75 followers!

The Commission launched a [ResearchGate](#) project entitled *Selection of papers related to Regional Groundwater Flow*. This project was created and is managed by the Regional Groundwater Flow Commission of the International Association of Hydrogeologists (RGFC-IAH) in cooperation with the József & Erzsébet Tóth Endowed Hydrogeology Chair. This project is a selection of international papers related to the research and practical application of regional groundwater flow theory. The project has 73 followers (~10 new ones) and 894 reads (~250 new ones) at the end of this reporting period.

Teams of university students competed on 14 February in the first, online test, round of the [Problem Solver Competition](#). Undergraduate, graduate and PhD students from China, Egypt, India, Iran, the Netherlands, Nepal, Nigeria, South Korea, Uganda and the USA answered the multiple-choice and essay-type questions focusing mostly on the groundwater side of the processes. The following teams qualified for the second round:

- By two: Ying Tan and Jiaxin Shi (China University of Geosciences, Beijing)
- Cugb_gw: Zhang Yipeng and Wang Qi (China University of Geosciences, Beijing)
- GroundwatCH: Ricardo Leonel Marroquín Paíz and Aditya Vikram Jain (IHE-DELFT, Institute for Water Education, UNESCO, the Netherlands)
- Pro-gro: Ajayi Abiodun Olugbenga and Arinloye Samuel Adebisi (Federal University Oye Ekiti, Nigeria)
- The origin: Ji TaoTao and Tang Xulin (China University of Geosciences, Beijing)

The qualified teams submitted a short video presenting a practical problem related to groundwater. A panel of experts is working on the decision at this moment, the winners will be announced by February 2021.

4. Future plans

- EGU General Assembly, 19–30 April 2021, online

Groundwater flow and geofluids system understanding with regard to environmental problems and resource management

The session aims to bring together scientists studying different aspects related to groundwater circulation, interaction among fluids of different nature and management of groundwater, geothermal energy and hydrothermal mineral resources. Strategic management of resources and understanding of gravitational groundwater flow, which requires knowledge of the prevailing flow system from the local to a regional and basin-scales, are the key of sustainable future development of the environment and economies. In this context of groundwater flow understanding, the session intends to analyze issues connected to geofluids systems and their economic resources, groundwater management and its protection from degradation with respect to quantity and quality (e.g. due to overexploitation, climate change, resource development or contamination). Papers related to methods (hydrological, geochemical, environmental tracers, microbial, numerical and statistical modelling) of defining groundwater flow, and preventing, controlling and mitigating negative environmental impacts related to groundwater, including those in developing countries, are also welcome. The session is sponsored by the RGFC–IAH and the ENeRAG project of EC.

- International Symposium on Geofluids, 7–9 July 2021

The declared objective of the Symposium is to bring together scientists, professionals, stakeholders to share and discuss all kinds of aspects of geofluids, i.e., groundwater, geothermal energy, hydrocarbon, geogenic contaminations and hydrothermal mineral resources, with special emphasis on harmonized exploration and utilization. We, therefore, welcome researchers in all aspects of geofluids' research. The greater the diversity of interests the more significant will be the result.

The symposium is organized by the József and Erzsébet Tóth Endowed Hydrogeology Chair and Foundation and by the Regional Groundwater Flow Commission of the International Association of Hydrogeologists, in scientific collaboration with the ENeRAG H2020 project of Eötvös Loránd University.



- Tunisian Groundwater Congress Autumn 2021: Special Session on the importance of induced and natural vertical groundwater flow
- The Commission is planning to meet in-person next year in Brussels at the 48th IAH Congress, Belgium, and we are also organising special sessions during the week.

5. Publications

Papers and books

Anda D, Szabó A, Kovács-Bodor P, Makk J, Felföldi T, Ács É, Mádl-Szőnyi J, Borsodi AK 2020: In situ modelling of biofilm formation in a hydrothermal spring cave. *Scientific Reports* 10:1, Paper: 21733

Aouiti S, Hamzaoui-Azaza F, El Melki F, Hamdi M, Celico F, Zammouri M 2020: Groundwater quality assessment for different uses using various water quality indices in semi-arid region of central Tunisia. *Environmental Science and Pollution Research*

Cochand M, Molson J, Barth J A-C, van Geldern R, Lemieux J-M, Fortier R, Therrien R 2020: Rapid groundwater recharge dynamics determined from hydrogeochemical and isotope data in a small permafrost watershed near Umiujaq (Nunavik, Canada), *Hydrogeology Journal* 28, pp. 853–868

Csondor K, Czauner B, Csobaji L, Győri O, Erőss A 2020: Characterization of the regional groundwater flow systems in south Transdanubia (Hungary) to understand karst evolution and development of hydrocarbon and geothermal resources. *Hydrogeology Journal* 28:8, pp. 2803–2820

Csondor K, Baják P, Surbeck H, Izsák B, Horváth Á, Vargha M, Erőss A 2020: Transient nature of riverbank filtered drinking water supply systems - A new challenge of natural radioactivity assessment. *Journal of Environmental Radioactivity* 211, Paper: 106072

Erőss A, Csondor K, Czuppon Gy, Dezső J, Müller I 2020: Groundwater flow system understanding of the lukewarm springs in Kistapolca (South Hungary) and its relevance to hypogene cave formation. *Environmental Earth Sciences* 79:6, Paper: 132

Ghouili N, Jarray Horriche F, Hamzaoui-Azaza F, Zaghrani MF, Ribeiro L, Zammouri M 2020: Groundwater vulnerability mapping using the Susceptibility Index (SI) method: Case study of Takelsa aquifer, Northeastern Tunisia. *African Journal of Earth Science*

Hamzaoui-Azaza F, Ameur M, Chaouch R, Ben-Cheikha L, Gueddari M, Carrillo-Rivera JJ 2020: Assessment of groundwater quality based on GIS and geochemical methods: coastal aquifer of Bouficha (North-Eastern Tunisia). *Journal of Coastal Conservation* 24:45

Hamzaoui-Azaza F, Zammouri M, Ameur M, Baba Sy L, Gueddari M, Bouhlila R 2020: Hydrogeochemical Modeling for groundwater management in arid and semi-arid

regions using MODFLOW and MT3DMS: A case study of the Jeffara of Medenine coastal aquifer, South-Eastern Tunisia. *Natural Resource Modeling*

Jamin P, Cochand M, Dagenais S, Fortier R, Molson J, Brouyère S, Lemieux J-M 2020: Direct measurement of groundwater flux in aquifers within the discontinuous permafrost zone: an application of the finite volume point dilution method near Umiujaq (Nunavik, Canada). *Hydrogeology Journal* 28, pp. 869–885

Jiang X-W, Cherry J, Wan L 2020: Flowing wells: terminology, history and role in the evolution of groundwater science. *Hydrology and Earth System Sciences* 24, pp. 6001–6019

Garamhegyi T, Székely F, Carrillo-Rivera JJ, Mádl-Szőnyi J 2020: Revision of archive recovery tests using analytical and numerical methods on thermal water wells in sandstone and fractured carbonate aquifers in the vicinity of Budapest, Hungary. *Environmental Earth Sciences* 79:6, Paper: 129

Iván V, Stevenazzi S, Pollicino L, Masetti M, Mádl-Szőnyi J 2020: An Enhanced Approach to the Spatial and Statistical Analysis of Factors Influencing Spring Distribution on a Transboundary Karst Aquifer. *Water* 12:8, Paper: 2133

Kachadourian-Marras A, Alconada-Magliano MM, Carrillo-Rivera JJ, Mendoza E, Herrerías-Azcue F, Silva R 2020: Characterization of Surface Evidence of Regional Groundwater Flow Systems in Continental Mexico. *Hydrology-Hydrogeology Sections. Characterizing Groundwater-Surface Water Interaction Using GIS. Water* 12(9), 2459

Kreamer DK, Ball DM, Re V, Worthington SRH, Simmons CT, Bothwell Th, Verweij JM, Mukherjee A 2020: The Future of Groundwater Science and Research. Chapter 37, In: Mukherjee A, Scanlon B, Aureli A, Langan S, Guo H, McKenzie A (Eds): *Global Groundwater. Source, Scarcity, Sustainability, Security, and Solutions*. Elsevier, 503–517

Lemieux J-M, Fortier R, Murray R, Dagenais S, Cochand M, Delottier H, Therrien R, Molson J, Pryet A, Parhizkar M 2020: Groundwater dynamics within a watershed in the discontinuous permafrost zone near Umiujaq. *Hydrogeology Journal* 28, pp. 833–851

Lemieux, J-M., Fortier, R., Molson, J., Therrien, R., Ouellet, M., Topical collection: *Hydrogeology of a cold-region watershed near Umiujaq (Nunavik, Canada)*, *Hydrogeology Journal*, 28, p809–812

Tóth Á, Galsa A, Mádl-Szőnyi J 2020: Significance of basin asymmetry and regional groundwater flow conditions in preliminary geothermal potential assessment – Implications on extensional geothermal plays. *Global and Planetary Change* 195, Paper: 103344

Troudi N, Hamzaoui-Azaza F, Tzoraki R, Melki F, Zammouri M 2020: Assessment of groundwater quality for drinking purpose with special emphasis on salinity and nitrate contamination in the shallow aquifer of Guenniche (Northern Tunisia). *Environmental Monitoring and Assessment Journal* 192:641

Conference Presentations

Tóth Á, Szijártó M, Mádl-Szőnyi J: On the importance of hydrodynamic conditions in geothermal potential reconnaissance. 34th Nordic Geological Winter Meeting, 8–10 January 2020, Oslo, Norway

Ben Mahrez H, Szabó Zs, Havril T, Czauner B, Mádl-Szőnyi J: Combination of Basin Scale Data Analysis and Numerical Simulations for the Interpretation of the Coexistence of Thermal Water and Hydrocarbon Accumulations. EGU General Assembly, 4–8 May 2020

Carrillo-Rivera JJ, Hatch-Kuri G, Ouyse S: Some challenges for reaching a groundwater flow understanding to manage water and environmental responses. EGU General Assembly, 4–8 May 2020

Csondor K, Baják P, Izsák B, Vargha M, Surbeck H, Horváth Á, Erőss A: Transient nature of riverbank filtered drinking water supply systems - a new challenge of natural radioactivity assessment. EGU General Assembly, 4–8 May 2020

Hayat S, Ben Mahrez H, Szabó Zs, Tóth Á, Mádl-Szőnyi J: Managed Aquifer Recharge (MAR) in Baluchistan, Pakistan, Present Situation and Future Prospects. EGU General Assembly, 4–8 May 2020

Molson J, Frind EO: Numerically simulated groundwater age distributions within complex flow systems and discrete fracture networks. EGU General Assembly, 4–8 May 2020

Szabó Zs, Szijártó M, Masetti M, Pedretti D, Visnovitz F, Mádl-Szőnyi J: Managed Aquifer Recharge suitability mapping combined with field examination and numerical simulation in the Danube-Tisza Interfluvium, Hungary. EGU General Assembly, 4–8 May 2020

Carrillo-Rivera JJ, Ouyse S, Hatch-Kuri G: Groundwater mismanagement: impacts on society due to a response lacking geoethics in Mexico. Geoethics & Groundwater Management online Congress, 18–22 May 2020

Hatch-Kuri G, Carrillo-Rivera JJ, Schmidt S: Science and Policy: How Ethical Is Groundwater Management in Mexico (1948-2018). Geoethics & Groundwater Management online Congress, 18–22 May 2020

Ouyse S, Carrillo Rivera JJ: Ethical dilemmas behind groundwater sampling, laboratory testing processes and data analysis outcomes. Geoethics & Groundwater Management online Congress, 18–22 May 2020

Molson J, Perreault C, Liu W, Fortier R: Numerical modelling of permafrost-impacted hydrogeological flow systems under climate change. GSA 2020 Connects Online, Session T171: Measuring and Modeling the Water Cycle in Cold Regions, Keynote presentation, 26–30 October 2020

Hayat S, Ben Mahrez H, Szabó Zs, Tóth Á, Mádl-Szőnyi J: Site suitability mapping for 'Managed Aquifer Recharge (MAR)' implementation in Poralai and Hangol, the coastal basins of Baluchistan, Pakistan to alleviate water table and reduce saltwater intrusion.

IWRA Online Conference “Addressing Groundwater Resilience under Climate Change”, 29–30 October 2020

Trásy-Havril T, Tóth Á, Molson JW, Galsa A, Mádl-Szőnyi J: How might groundwater flow systems be modified by climate change? IWRA Online Conference “Addressing Groundwater Resilience under Climate Change”, 29–30 October 2020

Budapest, 17 January 2021

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