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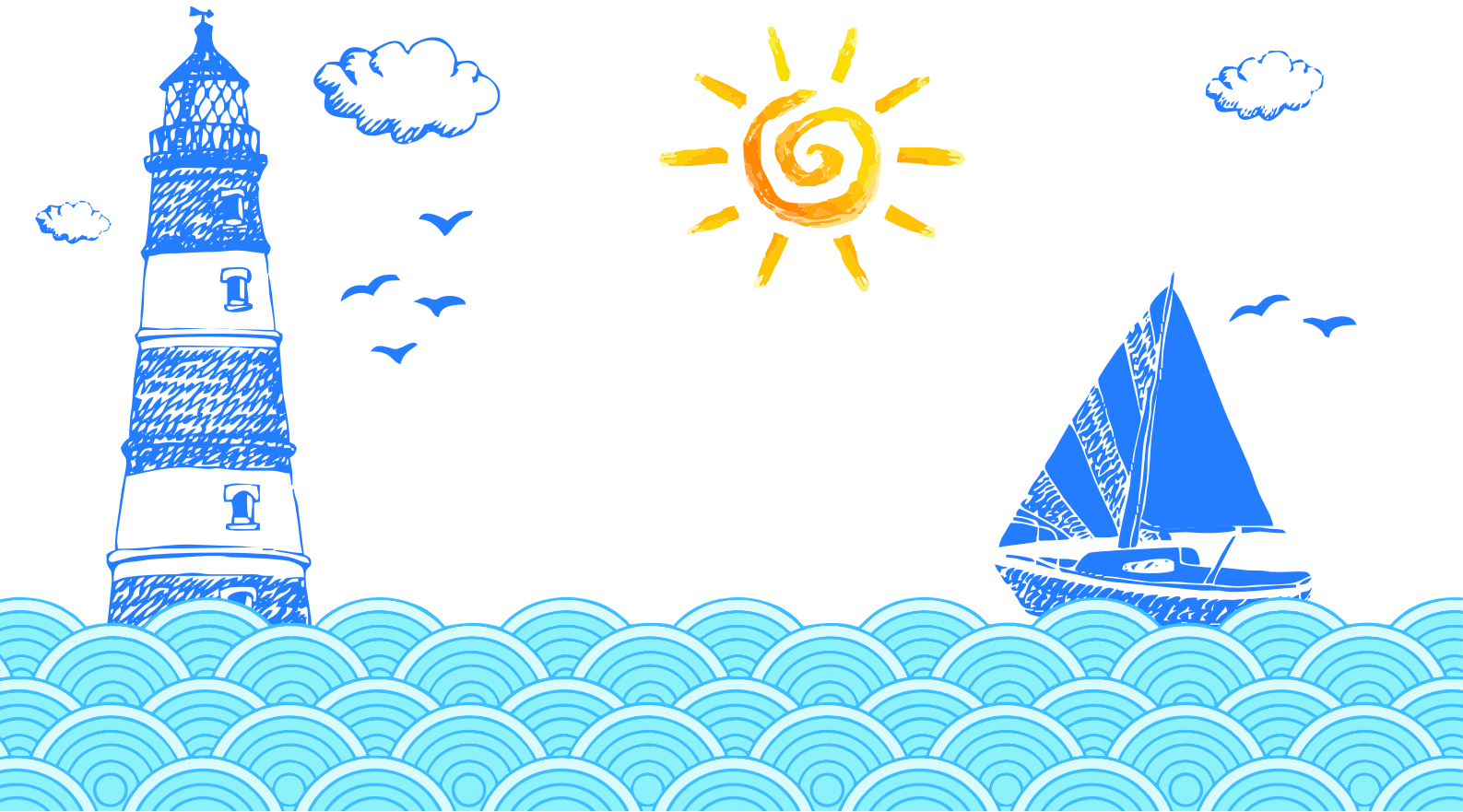
Groundwater Management and Governance

Coping with Uncertainty

Proceedings of IAH2019, the 46th Annual Congress of the International Association of Hydrogeologists, Málaga (Spain), September 22-27, 2019

Spanish Chapter of the International Association of Hydrogeologists (AIH-GE)

J. Jaime Gómez Hernández & Bartolomé Andreo Navarro



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IAEA International Atomic Energy Agency

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SCIENTIFIC PROGRAMME

Topic 1 - Groundwater assessment and management

Groundwater management should be based on adequate resource assessment and aquifer functioning. Nevertheless, groundwater is in the origin of many conflicts. In many cases, these conflicts arise not due to groundwater availability but to poor management and governance.

Topic 2 - Groundwater and climate change

Countries from temperate zones of the Earth, such as Western Mediterranean countries of both Southern Europe and North Africa, are expected to experience impacts on the sustainability, quantity, quality, and management of water resources. Future scenarios forecast the decline in streamflow reducing reservoir storage for population supply. In this context, groundwater becomes an increasingly strategic resource to meet water demand from urban areas and agriculture.

Topic 3 - Groundwater sustainability and governance

Major changes are ongoing in population growth, human migration, and land use, increasing the stress on the available quantity and quality of water resources. Water demand is increasing particularly in regions where it is already scarce, both for human and agricultural uses. It is important to analyze the sustainability of groundwater use around the world, and especially of some of the largest aquifers in the world. At the current pace, aquifers on which millions of people depend could be depleted in the near future. Can we move from groundwater mining into groundwater usage of renewable resources?
Within this topic will be organized a session on **Groundwater and water security in developing countries (Topic 3.1)**.

Topic 4 - Groundwater footprint and virtual water

Water resources management is an important issue in arid and semi-arid regions. In many cases water conflicts arise not because of the scarcity in water resources but because of improper management. Concepts such as virtual water and water footprint can help in improving current management practices and provide new insights, a new awareness about the importance of the resource. The groundwater footprint has served to bring awareness about the current usage of groundwater and to point out the aquifers whose management is unsustainable. The low number of abstracts submitted to this Topic has been included in related topics.

Topic 5 - Tools, methods and models to study groundwater

This topic deals on the broad spectrum of methodologies and models conventionally applied in Hydrogeology (hydrogeological mapping, hydrodynamic, hydrochemistry, isotopes, tracers, etc.), but particularly to the most innovative ones and to new trends in modelling.

Within this topic several sessions will be organized:

- Topic 5.1 - Dynamic Analogues (TOTAL)
- Topic 5.2 - High island hydrogeology
- Topic 5.3 - Advanced modelling tools for subsurface hydrology: from the vadose zone to deep environments.
- Topic 5.4 - Innovative approaches for understanding groundwater flow systems

Topic 6 - Groundwater, wetlands and natural heritage

Most wetlands, particularly the permanent ones, are groundwater dependent. They are fragile ecosystems that can be located in the recharge or in the discharge areas of aquifers (some can be located in an intermediate position). To recognize the relationship between wetlands and groundwater is crucial for their adequate management and the preservation of the natural heritage to which they belong.

Topic 7 - Karst Hydrogeology

This section deals with the recent advances and novel application of research methods in hydrogeological studies in karst systems. Special emphasis will be focused on issues related to quantity and quality of karst waters, hydrodynamic, hydrochemistry and isotopes. A deeper understanding of tracing techniques by means of fluorescent and natural tracers are key aspects for a more precise conceptualization of carbonate karst aquifers. Additionally, new trends on groundwater recharge and water management as well as modeling methods for simulating flow distribution, solute transport and reactive (coupled) processes will also be highlighted in this topic.

Topic 8 - Groundwater quality and pollution processes

Groundwater usage, once available, very often depends on its quality. Groundwater quality is greatly modified by the geologic substratum, but also it is threatened by human-induced pressures and the appearance of emerging chemicals. Therefore, appropiate groundwater protection and remediation strategies (in case of polluted waters) must be applied for preserving present and future human health and its well-being.

Topic 9 - Groundwater and socio-economic development in Latin-America

Under this heading it is proposed to organize an Ibero-American mini-symposium, specifically targeted to Iberian and Latin-American participants, concerning on topics like mining activities, groundwater monitoring and assessment, socio-economic impact of groundwater.

Topic 10 - Urban groundwater

Groundwater forms a pivotal resource for future cities worldwide, for water, energy, flood mitigation, integrated surface-ground water management, and low carbon, equitable and sustainable cities. All abstracts on presentation of new scientific understanding of key processes of urban groundwater resources, contamination impacts and opportunities, are welcomed, as well as interdisciplinary presentations on urban planning, groundwater management and use.

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Examination of the hydrologic cycle with long-term precipitation and groundwater level data

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The impact of the ever-changing climate on Earth is already evident in the emergence of weather extremes and increased water demand from the agriculture. These changes and the human responses to it can greatly change many elements of the hydrological cycle. Weather extremes all appear in the amount and intensity of the fallen precipitation, while increased water demand in many areas has led to a permanent water level decrease in mainly shallow groundwater aquifers.

Examining the changes requires large amounts of measured data, both for rainfall and water levels. In our study, these two elements of the hydrological cycle were analyzed in the Carpathian Basin involving several sample areas.

Changes in the amount and time distribution of the fallen precipitation were investigated across the entire Carpathian Basin by analyzing more than 100-year-long data sets, while the impact of the increased water demand was analyzed for the largest continuous agricultural area at the Hungarian Great Plain.

The different hydrological time series were analyzed by various mathematical methods. Spectral analysis based on the Discrete Fourier transformation was used to study long-term precipitation and shallow groundwater time series, and several deterministic cycles were calculated. In both rainfall and groundwater data, we have identified 13 cycles that were found in each time series, just like the 5-year, 12-year, and 4.5-year long cycles. With the help of Wavelet analysis, we also examined the extent to which these cycles changed during the 20th century, and whether there was an increase in the stochastic effects.

On long-term shallow groundwater time series, a complex method of factor and cluster analysis were performed based on the linear modeling of each monitoring point's seasonality, so data sets were generated from the often incomplete time series registered in different measurement intervals, which will later meet the conditions of the spectral analysis.

The research was carried out within the GINOP-2.3.2-15-2016-00031 "Innovative solutions for sustainable groundwater resource management" project of the Faculty of Earth Science and Engineering of the University of Miskolc in the framework of the Széchenyi 2020 Plan, funded by the European Union, co-financed by the European Structural and Investment Funds.