Application of Isotope Hydrology Techniques in the Oko Transboundary Karst Aquifer

A case study under **IAEA TC Project RER7013** – Evaluating Groundwater Resources and Groundwater – Surface Water Interactions in the Context of Adapting to Climate Change

Bosnia and Herzegovina, Montenegro

Case Study Focus

Impact of climate change on the Oko transboundary karst aquifer

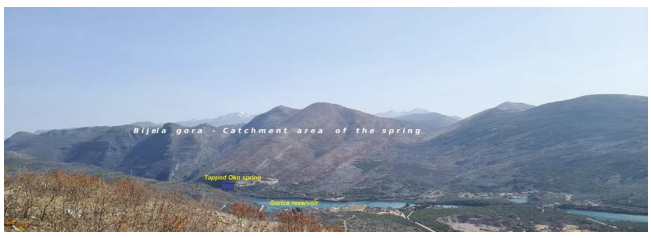
Karst aquifers commonly occur in limestone, and rarely in dolomite. They are highly heterogenous in terms of porosity and hydraulic permeability, generally characterised by fast groundwater flow. Being a main drinking water source in many countries, these aquifers are highly vulnerable to anthropogenic factors and to the impacts of climate change, and require a very specific approach to protection.

The opportunity

Almost 22% of Europe's territory is characterized by carbonate rocks, most of which form karstified landscapes and karst aquifers. Eastern Herzegovina is well-recognized as the world's 'home' of karst. Across an area of approximately 1 800 km^2, Bosnia and Herzegovina and Montenegro share significant transboundary karst aquifers, but there is limited knowledge concerning the water balance and groundwater directions of these aquifers. Elevating the level of understanding about groundwater – surface water interactions, as well as recharge and discharge conditions, in this karst area is essential for increasing the effectiveness of integrated water management in the region and beyond. It thus becomes an overarching goal of this case study. The proposed strategy furthermore includes investigating potential impacts of hydroclimatic variations and their influence on drinking water supply and hydropower generation.

The proposal

This case study will deploy precipitation, groundwater and surface water sampling, as well as environmental isotope analysis, to determine the hydrological conditions of the Oko-Bijela Gora Karst Aquifer. This transboundary aquifer, which is shared by Bosnia and Herzegovina and Montenegro, is predominantly drained by the Oko spring, with an estimated catchment area of approximately 100 km^2. The spring is used to supply water to Trebinje, a town in Bosnia and Herzegovina with more than 15 000 consumers.



Catchment Area. (Photo: B. Jolović)

IAEA International Atomic Energy Agency

Partners: Geological Survey of the Republika Srpska, Geological Survey of Montenegro, Geological Survey of the Federation of Bosnia and Herzegovina; Zagreb University, Croatia; Institute Ruđer Bošković, Croatia

This study is the first attempt to establish the use of isotope techniques as a tool for transboundary groundwater – surface management between Bosnia and Herzegovina and Montenegro, and in the region in general. The regional distribution of stable isotopes in the water molecule ($\delta^{18}O$ and $\delta^{2}H$) will be used to identify aquifer recharge conditions. Based on this, isotope-enabled models and mapping will help to determine the groundwater recharge areas and the influence of surface water on the hydrogeological cycle.

The IAEA will provide field and analytical equipment and consumables, and facilitate training and expertise in isotope analysis.

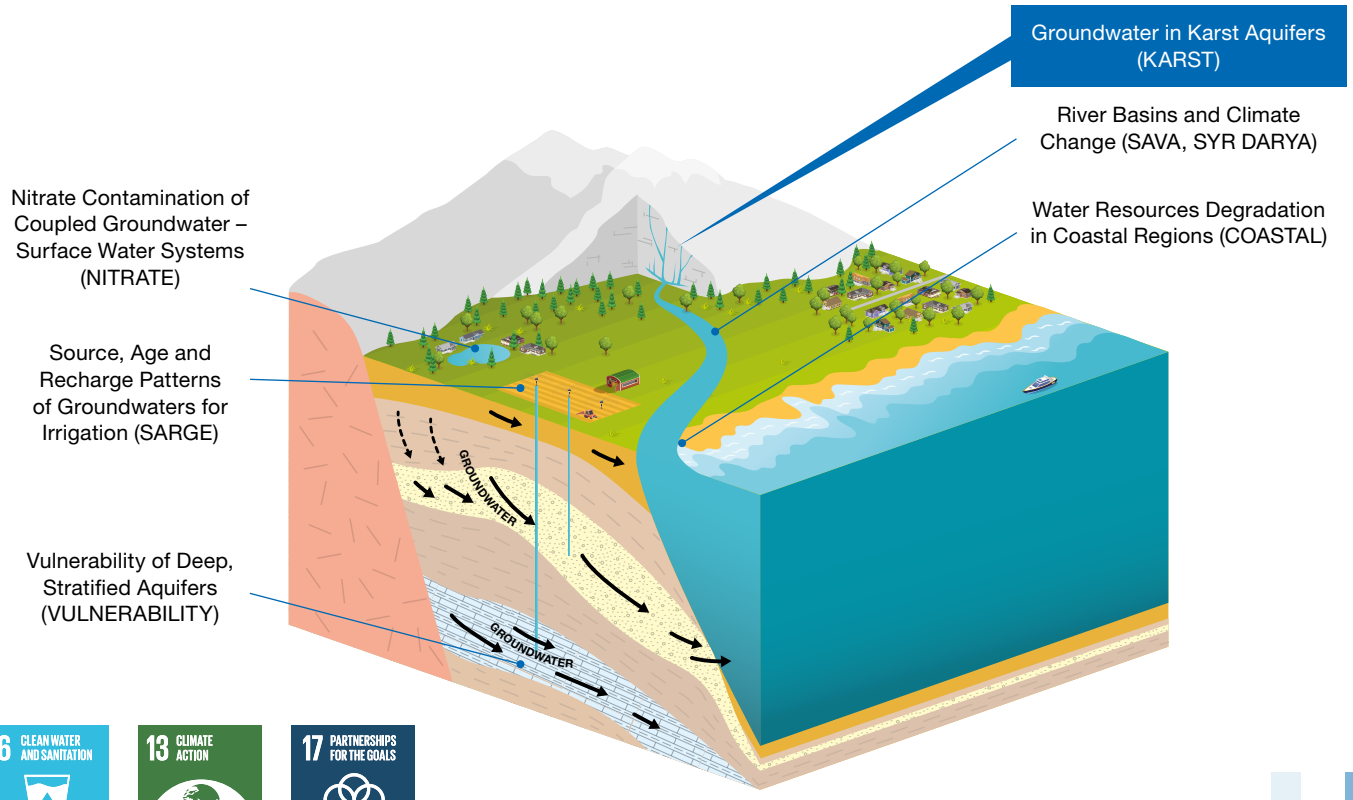
The benefits

Together with historical hydrological and meteorological data, the evaluation of novel isotopic results will make it possible to analyse the influence of climate change on groundwater resources. Partners also aim to estimate the proportion of recharge contributions to the Oko-Bijela Gora karst aquifer, located between the two countries, based on recharge elevation distinctions in the catchment area. The impact of surface water from the Gorica reservoir to the Oko spring will also be analysed. Additionally, this project shall demonstrate the applicability of isotope methods in the karst, and is expected to be an important tool in future explorations.

These results can lead to important conclusions on water management measures, to be implemented by both countries, and to protect the aquifer in the future. The project will demonstrate that isotope hydrology techniques are an important complementary tool to answer complex hydrological questions. Experiences obtained within the pilot area could be widely applied in the future to other parts of the transboundary karst aquifers area between the two countries, or on a regional level.

Oko spring, before tapping, ca 1976. (Photo: Institute for the Karst of the company “Hydro Power Plants at the Trebišnjica river”)

Tapped Oko spring in year 2020. (Photo: B. Jolović)



6 CLEAN WATER AND SANITATION

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

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