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Temporal hydrological and hydrochemical behaviour of the regional discharge area of a carbonate system – why we can not see fast responses?

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The subsurface part of the hydrologic cycle, the saturated groundwater flow can be mostly studied in regional discharge areas. In these regions the water has already spent geologically long time under the surface, therefore the upwelling water reflect the effect of the geometry and boundary conditions of the whole flow field, its geology and chemical processes. According to these conditions, the discharging waters can be characterized with different values and variability of physicochemical parameters (temperature, total dissolved solids, cations, anions, gas content etc.). This question has special interest in carbonate systems where the concept of regional groundwater flow was only introduced in the last few years. Hydrographs and chemographs are frequently used in karst studies to demonstrate the effect of variability of the system and to derive information for the nature of flow inside the karst (channel, fracture or matrix). Usually these graphs show abrupt changes after precipitation events, but this is typical for epigenic karsts. However, discharge areas, where hypogenic karsts developed, can behave differently due to their feeding flow systems. These systems and their effects are not so well studied yet.
In this study we examined hydrographs and chemographs of the regional discharge area of a deep and thick carbonate range of Buda Thermal Karst and tried to understand those mechanisms which determine the hydrological and hydrochemical behaviour of the region. Here cold, lukewarm and also thermal waters discharge along the River Danube. The variability of physicochemical parameters (temperature, electric conductivity, pH, volume discharge, water level, dissolved CO_2 and 222Rn, δ18O, δD) of the discharging water was studied to understand influencing mechanisms. We tried to understand the effect of precipitation (short and long term) and the effect of River Danube with geomathematical methods for the lukewarm components of the discharging water.
Based on the results, it was found that the hydrological and hydrochemical parameters of the regional discharge zone are only slightly variable compared to the other parts of the system. The local effect of precipitation is not detectable at the area, and it has only buffered influence in the recharge zone based on comparison with integrated precipitation. However, this buffered effect is eliminated at the discharge zone. It means that these regional discharge zones of carbonates are less sensitive to the change in short and long term climatic conditions. This can be explained easily by their position in the gravity-driven flow systems. However, the transient effect of the river influences the discharge conditions, therefore the hydrological and hydrochemical conditions. These findings display the quasi permanent flow conditions regarding the regional discharge areas of carbonates with the superimposed transient effect of the river.
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