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Regional groundwater flow mapping in NE Hungary – a tool to understand drinking water quality and quantity problems for sustainable resource management

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In Hungary, the drinking water supply almost exclusively uses groundwater resources. Recent investigations revealed that waterworks have difficulties in maintaining the proper quantity and quality (e.g. because of elevated gross alpha activity concentration) of drinking water in certain settlements in NE Hungary. To understand and to solve these groundwater-related issues, there is a need for a thorough understanding of groundwater flow dynamics and the associated geochemical characteristics in the broader area. The aims of the present study in the research area are 1) to evaluate the groundwater flow systems based on measured hydraulic data on regional and local scale, 2) to characterize the geochemical composition of the waters based on archive geochemical data to support the hydraulic studies 3) to use natural radioanuclides (234U/238U ratio, 226Ra and 222Rn) as natural tracers to evaluate local water quality issues. Firstly, regional groundwater flow mapping was carried out in the study area. Based on data collected from archive well documentation, a database was built containing the main properties (e.g. coordinates, water level, well depth, screening) of 722 wells. Pore pressure and hydraulic head values were calculated. To examine the horizontal groundwater flow directions, six potential maps were constructed between -200 m asl and 600 m asl elevation intervals. On the other hand, 34 pressure-elevation profiles were compiled to understand the vertical flow dynamics and identify the different flow regime areas (i.e. recharge, midline, discharge). The results showed that in the examined depth, topography-driven groundwater flow systems exist. Recharge areas are characteristic of the hilly and mountainous areas along the Hungarian-Austrian border, while discharge regime is dominant in the surroundings of Lake Fertő/Neusiedl and along water courses. The dominant horizontal flow direction is from W- SW to E-NE. The geochemical results were evaluated in the groundwater flow system context. Uranium was identified as the main cause of elevated gross alpha activity. The results contribute to the sustainable production of healthy drinking water and planning of new drinking water abstraction sites.

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