In the case of Southeastern Hungary, the region is characterized by a flat and fertile plain, largely cultivated, and growing industrial activities. These activities rely on groundwater as the primary water supply source, threatening this resource in terms of its quantity and quality. Hence, this study aimed to assess the groundwater vulnerability to pollution of the shallow aquifer located in Southeastern Hungary, using three index-overlay methods (i.e. DRASTIC, GOD and SI). The accuracy of the models was validated by analyzing the correlation between the vulnerability indices and NO3-N concentrations, and finally the most suitable index-overlay method is identified to assess the vulnerability and pollution risk of groundwater in the study area. For this purpose, the data layers of the three models have been prepared, classified, weighted, and incorporated into a GIS framework, to identify vulnerable areas to contamination in the shallow aquifer. The resultant vulnerability maps reveal that the DRASTIC and SI methods are comparable for vulnerability assessment, as both methods delineate approximately 44% of the groundwater basin area under a high and very high vulnerability zone. However, all three approaches estimated that at least 50% of the groundwater basin is under a moderate risk of NO3-N pollution. The main reasons for these results are the high recharge rates, sandy soils, and shallow water tables. Finally, according to the strength and significance of the correlation coefficient between the vulnerability index and the measured NO3-N concentrations, it was found that the SI method is a better suitable model for assessing the groundwater vulnerability to pollution within the study area. The findings of this study suggest that local authorities need to identify the main contributors to pollution and take appropriate measures to reduce the current rate of risk.

Investigation of structure and composition of artificial levees along the Lower Tisza River (Hungary)

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Levees are earth structures constructed along alluvial rivers, and are considered to be one of the essential components of flood risk and natural hazard reduction. The preservation of their condition would require orderly monitoring. In Hungary, an over 4200 km long levee system was constructed beginning from the 19th century. Since then, many natural and anthropogenic processes, such as compaction, erosion, subsidence may have contributed to the slow but steady deformation of these

structures. However, due to the lack of documentation, their structure and internal composition are still unclear in many sections. The present study uses different geophysical techniques to validate their efficiency in detecting the structure, composition and potential defects along a 3.6 km levee section of the Lower Tisza River, affected significantly by seepage and piping phenomena during floods. Measurements were made using GPR, ERT and drillings. Information obtained by the different techniques was cross-checked and combined. This way, the potential of the applied survey strategy could be demonstrated and showed that The upper 3-4 m of the levee could be investigated by GPR. The higher frequency 200 MHz GPR is capable of detecting not only structural interfaces but various defects as well in the upper layers. It was possible to capture structural changes and resolving the thin layers by 1 m electrode spacing ERT profile. In turn, at a larger spacing it was possible to get information on the sedimentary base below the levee body. The selected levee section could be assessed in terms of its structure and composition and three major units within the levee body and their composition could be resolved by the applied methods. Consequently, the major reasons for frequently occurring adverse flood phenomena at the site could be revealed. The survey approach outlined in the present paper can be applied extensively along lowland levee systems in the region and elsewhere.

Do microplastics and suspended sediment have similar transport patterns in lowland rivers? Insights from high spatiotemporal resolution measurements

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The spatiotemporal distribution of suspended sediment (SS) and microplastic (MP) transport in rivers is quite a complex process influenced by several factors (e.g., human impacts, hydrology, and geomorphology). These factors were usually investigated individually by limited spatiotemporal measurements. Therefore, this study aims to compare them based on high temporal (72 measurements; May 2021 – May 2022) and spatial (26 sites; August 2021 and July 2022) measurements, considering the lowland Tisza River, as a case study. The suspended sediment concentration (SSC) was measured and estimated by in-situ measurements and Sentinel-2 images, meanwhile, the MP was by pumping 1000 liters of water. The main results revealed that the SSC and MP transport in the Tisza varied from 12.6 g/m3 and 0 item/m3 during low stages to 322.5 g/m3 and 129 item/m3 during floods. Given that fibers dominated the composition of the MPs (81-98%), it is probable that the MP transport in the Tisza originated from wastewater. Considering the whole year temporal measurements, a