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Spatial and temporal trends in groundwater quantity and quality in urban area

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Nowadays one of the most important environmental problems in urban areas is groundwater contamination, since it takes effect on all parts of the urban environment. Therefore in this research the groundwater-system of Szeged (SE Hungary) was monitored and the temporal and spatial changes of heavy metals and other inorganic contaminants were examined. Water quantity and quality investigations twenty-eight sampling wells from the groundwater monitoring network of Szeged were carried out. In the course of well selection, we were about to cover complete area of the city.
The water samples were collected every month from October of 2010 to September of 2011 and every second month from November 2011. Temperature, pH, total salt content, electrical conductivity, water levels and the concentrations of 12 components (copper, cadmium, cobalt, chrome, lead, nickel, zinc, arsenic, nitrate, nitrite, ammonium, orthophosphate) were measured.
The water levels were strongly influenced by the extreme precipitation of the investigated period, so the maximum and minimum of groundwater levels have differed from the average. Changes of water levels followed the changes of precipitation in autumn and winter, but in spring and summer other factors, like evaporation and effects of the vegetation influenced the water regime.
The relationship of different pollutants and their distribution were determined in the city. As the results show, the amount of toxic materials in the groundwater in Szeged has exceeded the limit values (according to the joint decree) in many cases. The groundwater is contaminated with lead, nickel, copper, zinc, arsenic, nitrate, ammonium and orthophosphate mainly in the downtown, close to the river Tisza, which can cause ecological and human-health risk as well. In outskirts lowest concentrations were detected. Significant statistical relationship, used Spearman's rank correlation, was determined among the siderophile (namely chrome and nickel), chalcophile elements (lead, zinc, cadmium, copper) and forms of nitrogen (nitrate and ammonium) with electrical conductivity. Five groups were separated by the factor analysis, which were consisted of parameters with strong correlation relationships, so the results of factor analysis confirmed the statements of correlation calculations.