

Publication

A city scale study on the effects of intensive groundwater heat pump systems on heavy metal contents in groundwater

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As a result of the increasing use of shallow geothermal resources, hydraulic, thermal and chemical impacts affecting groundwater quality can be observed with ever increasing frequency (Possemiers et al., 2014). To overcome the uncertainty associated with chemical impacts, a city scale study on the effects of intensive geothermal resource use by groundwater heat pump systems on groundwater quality, with special emphasis on heavy metal contents was performed. Statistical analysis of geochemical data obtained from several field campaigns has allowed studying the spatiotemporal relationship between temperature anomalies in the aquifer and trace element composition of groundwater. The relationship between temperature and the concentrations of trace elements resulted in weak correlations, indicating that temperature changes are not the driving factor in enhancing heavy metal contaminations. Regression models established for these correlations showed a very low reactivity or response of heavy metal contents to temperature changes. The change rates of heavy metal contents with respect to temperature changes obtained indicate a low risk of exceeding quality threshold values by means of the exploitation regimes used, neither producing nor enhancing contamination significantly. However, modification of pH, redox potential, electrical conductivity, dissolved oxygen and alkalinity correlated with the concentrations of heavy metals. In this case, the change rates of heavy metal contents are higher, with a greater risk of exceeding threshold values.

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