Studying interactions of five adjacent Aquifer Thermal Energy Storage (ATES) systems in Cenozoic and Palaeozoic aquifers in Brussels (Belgium)

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Three adjacent shallow open-loop systems (ATES) were studied and installed in two overlaying aquifers in the center of Brussels. For two of them, operations started in 2014 and 2017 respectively with pumping and reinjection wells in Cenozoic mixed sandy and silty shallow formations. The third one, a larger ATES system was started in 2020 with 5 doublets of wells in the Palaeozoic fractured phyllites and quartzites to provide heating and cooling power to a large multi-service building. Now two additional adjacent ATES systems are projected in these Palaeozoic formations, one for a residential complex, and the other one for an office building. The properties of the two aquifer systems are different and respective potentiometric heads are independent showing their relative disconnection. The cumulative effect and heat interactions of the three first geothermal installations were previously investigated using Feflow© showing how the thermal imbalance of the first ATES system was affecting the upper aquifer (Bulté et al. 2021) and thus also the second ATES system. Then, adding the third system in the deep Palaeozoic aquifer, relatively small interactions were simulated through the aquitard formed by low permeability Cretaceous base deposits and the weathered top of the bedrock (De Paoli et al. 2023). Now, the research work is extended including the two new ATES systems and their impact and interactions are simulated. Also, recent measured data (i.e., potentiometric heads, groundwater temperatures, detailed pumping, injection flow rate) have allowed us to improve the Feflow 3D model. First results are shown illustrating the sensitivity of the ATES interactions to an adequate hydrogeological characterization. The model results are also very useful to guide the optimized future management of the five adjacent ATES systems to prevent losses in efficiency for some (or all) of them. We acknowledge the partial support of the GEOCAMB project (Brain BE 2.0, BELSPO).

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