



## Methods to characterize long-term reservoir behavior for thermal energy storage – preliminary results

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Aquifer thermal energy storage (ATES) has gained interest as a possibility to store thermal energy using groundwater. The aquifer acts as a storage facility to bridge the time between energy production and demand. As with all well systems, the productivity and lifespan of ATES systems are threatened by chemical and biological processes. At the ATES research drilling site Gt BCh 1/2015 on the campus of Technische Universität Berlin in Berlin, Germany the Exter formation was chosen as reservoir and screened at a depth between 222 und 226 m below ground surface.

So-called “push-pull” tests were performed to characterize the reservoir. In a push-pull test a known amount of several solutes including a conservative tracer is injected into the aquifer (“push”) and afterwards extracted (“pull”). The measured break-through curve during the pumping back phase can then be analysed. This method was already used a various time with various aims (e.g. Hebig et al. 2015, 2016).

The objective of this study was to investigate the factors that temperature changes have on an aquifer and on water chemistry. In ATES applications the injected waters can either lower the aquifer temperature (typically down to 2°C) or increase it (typically to between 60 and 70°C, but sometimes even up to 90°C).

Two push-pull tests were performed under controlled boundary conditions in the same well: one with an ambient groundwater temperature of about 17°C with an immediate pull phase a second test with a temperature at the well head of up to 90°C and a drift phase of 13 days. Results show that the reservoir exhibits a reduction potential. Nitrate was added as a reactive tracer and was denitrified after injection. Temperature also decreased rather fast and only little thermal energy could be recovered after the drift period of 13 days. There was no significant change in fluid chemistry during the experiment other than influenced by the test itself. These first results show that the reservoir is suitable for aquifer thermal energy albeit its high salinity and the limited thickness.

### References:

HEBIG, K.H., ITO, N., TECKLENBURG J., MACHIDA, I., MARUI, A., SCHEYTT, T. (2016): Use of single-well push-pull tracer tests to simulate a dynamic saltwater-freshwater interface. *Environmental Earth Sciences* 75: 281.

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