

Interactive comment on “Observed groundwater temperature response to recent climate change” by K. Menberg et al.

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The study examines groundwater temperature changes in response to air temperature change over the past decades, by analyzing observed time series from 4 wells at 2 locations in Germany, and by simulating changes with an analytical model of 1D heat convection (via water table recharge) and conduction through the unsaturated zone. The study is carried out nicely and the results and interpretations make sense. It is interpreted in local (aquifer properties and water table depth, with or without a forest canopy buffer), zonal (N. latitude) and global climate change context, and the implications to understanding groundwater-dependent ecosystems are brought out.

I only have some minor suggestions:

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I find it interesting that the water table is deeper at Dansweiler and Sinthern (~17m), at a lower elevation of ~61m, than the Hardtward wells (water table ~6m), although at a much higher elevation of ~121m. The two sites are not too far apart, and unless the underlying geology and hydrogeology (sources/sinks) make them entirely separate flow systems, one would expect that the water table is shallower in the lower part of the landscape. Perhaps the authors could discuss the hydrogeologic system in more details and provide insights on this.

Equation-1. The bulk thermal diffusivity is missing.

Equation-2. Perhaps the authors should mention that the Darcy velocity q in the convective term is related to water table recharge rate.

Page-11, line 33. Remove one of the “in”.

Page-12, line 21-24. I tend to think that GWT change should be more as a trend than as steps, because of its delay and dampening of atmospheric signals, which smooth out the sharp rises (and falls) of the surface forcing. So a more fundamental explanation is perhaps not the short regime, but the nature of groundwater response. This bears out in the p values anyway, as the last sentence of the paragraph suggested.

Page-14, line 18 and onward. Maybe replace the word “annual” to “inter-annual” to avoid confusion with “annual cycle” which refers to seasonal cycle within a year, not between years as is the case here? There are more of this word later, e.g., page-16, line-11.

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