The authors have investigated an interesting aspect of hyporheic exchange that has yet to receive much attention. Although the results are compelling, I found that there is a large discrepancy between what was simulated and its conceptual interpretation. The issue with the conceptual interpretation of the model results is that the prescribed flux boundary along the bottom of the model domain does not directly represent groundwater table drawdown at some distance away from the river. My comments below should clarify this discrepancy.

Detailed comments:

1. The modelling does not actually simulate the effects of daily groundwater table drawdown.

The boundary condition that conceptually represents a daily fluctuation in groundwater table is a prescribed flux on the bottom boundary of a 2D model. The title should instead read: "How does dynamic losing and gaining river conditions affect the diel rhythm of hyporheic exchange?"

There is a disconnect between the way the authors describe the groundwater table and the conditions at the river. Only in lines 428 to 433 do the authors explain this conceptually. It is possible that pumping can lower groundwater tables, thus effecting the hydrogeologic gradients and fluxes to a river. However, this depends on the hydraulic properties between the pumping well and the stream (transmissivity, storativity), as well as the distance between the pumping well and the stream (Barlow and Leake, 2012). Unless the well is directly connected and next to the river, there will be a delay between the start of pumping and its influence on hydrogeologic conditions at the river (i.e., magnitude of river gaining/losing).

How realistic is the prescribed flux boundary that represents daily groundwater withdrawals? I believe that this boundary condition is not realistic in cases where the pumping well is far away from or is not well connected to the river. Hence, I would remove from the manuscript any mention of groundwater table dynamics and simply discuss changing in river losing/gaining conditions, which is what was simulated. Alternatively, more should be stated at the beginning of the manuscript about the assumptions the authors have made about hydraulic connection between the dewatering well and river, as well as the distance between said well and river (i.e., they need to be relatively close to one another). I have referenced specific lines below with where I think these changes should be made. There are many more places in the manuscript where this wording should be changed, I have only listed a few.

Line 68 – The aim to quantify the impact of "groundwater table drawdown" on hyporheic exchange processes. Replace "groundwater table drawdown" with "the degree of gaining/losing conditions".

Fig 3 – "Effect of diel river temperature fluctuations and daily groundwater table drawdowns on hyporheic fluxes…". Again daily groundwater table drawdown was not simulated, but daily fluctuations in gaining/losing conditions of the river.

Line 300 – "The timing of groundwater table drawdown also affects hyporheic exchange rates." Upward and downward fluxes representing gaining/losing conditions affects hyporheic exchange rates. There is a conceptual disconnect here.

Line 310 – "Therefore, the timing of the aquifer pumping can potentially amplify or reduce the dispersal of pollutants in the aquifer". It would be better to state that the 'timing of river gaining/losing magnitude can potentially amplify or reduce…"

Lines 313 to 317 - Sure, but it also depends on the level of hydraulic connection between the river and the well (Barlow and Leake, 2012).

Line 380 – Scheduling pumping activities to protect thermal heterogeneity across multiple spatial scales again depends on the well-stream connection, if any.

Line 392 – "hyporheic denitrification potential can be regulated by adjusting the timing of daily groundwater table drawdown." It would be better to state the "timing of hydraulic gradients towards the river or groundwater in/out flow to the river" and not "timing of daily groundwater table drawdown". The influence of groundwater table drawdown on the state of the river depends on its hydraulic connection and distance between the well and the river. It's possible to have a delayed response in the rivers condition or no response at all if there is little to no connection or if the well is very far from the river.

Line 456 – "Groundwater table dynamics" replace with "Groundwater discharge/recharge to/from rivers substantially…"

Line 471 – "…hyporheic denitrification potential is also changing following groundwater table drawdown." Replace "groundwater table drawdown" with "groundwater discharge/recharge". For the statement made be the authors about groundwater tables, one would require a 3D model that contains areas beyond the river banks. Instead, what has been simulated is a 2D section along the river with a prescribed flux boundary representing fluctuating gaining/losing conditions. There is a conceptual gap between the prescribed boundary condition simulated in this study and groundwater table drawdowns that the authors describe. Groundwater table drawdowns could be happening at some distance away from the river with varying hydraulic properties between, which would dramatically influence the degree to which aquifer pumping would effect gaining/losing conditions at the river.

2. Model parameters

I am trying to gauge the realism of the model parameters but am having a hard time finding certain values. I have listed the specific line numbers for parameter values that were not stated or difficult to find. Clearly stating the parameter values would help future researchers to extend or repeat these numerical experiments.

Line 91 – What were the values selected for permeability and porosity?

Line 100 – Do you have references to support this aspect ratio?

Line 108 – What is the hydrodynamic thermal dispersion tensor value chosen?

Line 288 – "mainly due to the change of hydraulic conductivity which is a function of diel temperature fluctuations." Again what was the permeability value chosen? How much does hydraulic conductivity vary in your simulations due to temperature? Line 341 states that there is a 220% change in K due to a 30 degree change in temperature, but I'm not sure if this is a realistic magnitude of daily temperature change or K change. Thomas (2014) shows temperature fluctuations over a year in Sauk River, Washington. There is a 18 degree C range over the year, but at the daily scale there is rarely more than a 10 degree fluctuation throughout the day. Perhaps the daily temperature range should be decreased by 3x, unless the authors have references that support a daily 30 degree temperature change in river water.

3. Other comments

Line 28 – Chow et al. (2019) conducted a sensitivity analysis on the effects of river bathymetry (i.e., geomorphological settings) on meander-scale hyporheic exchange.

Line 30 – Chow et al. (2020) evaluated sediment heterogeneity and its effects on meander-scale hyporheic exchange.

Line 40 – "Large groundwater upwelling and downwelling may compress 'or extend' hyporheic…"

Fig 1b and c – The hyporheic exchange should be compressed in Fig 1b and extended in Fig 1c. Instead it looks the same between Fig. 1b and c.

Lines 324 to 330 – I find this sentence confusing. So what plays a dominant role in the winter? Pumping? Please clarify.

Line 380 – Remove s from 'cares'

Line 387-389 – Wouldn't losing conditions have longer residence times since the flow paths would be extended and stretched?

Line 467 to 468 "The timing of aquifer pumping should be adjusted to avoid…". Can you be more specific here. I.e., "The pumping should decrease or stop during flood events in order to ensure minimal contaminant uptake".

Lastly, a general comment about the two scenarios of in-phase and out-of-phase compared throughout the manuscript. It would be nice to get from the authors their ideas on how likely these two scenarios are and what kinds of assumptions must be met in order for them to be realistic. I can imagine that in-phase is a more likely scenario because ET tends to increase as temperatures increase during the day. Also, in cases where there is hydraulic connection and a short distance between the well and river, I would expect that groundwater usage would increase following daytime activity. Out-of-phase may be less likely, but this could depend on the well-stream connection.

References

Barlow, P.M. and Leake, S.A., 2012. Streamflow depletion by wells: understanding and managing the effects of groundwater pumping on streamflow (p. 84). Reston, VA: US Geological Survey.

Chow, R., Bennett, J., Dugge, J., Wöhling, T. and Nowak, W., 2020. Evaluating subsurface parameterization to simulate hyporheic exchange: The Steinlach River Test Site. Groundwater, 58(1), pp.93-109.

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Thomas, L., 2014. Stream Temperature Variability: Why It Matters to Salmon. Science Findings, United States Department of Agriculture Forest Service. https://www.fs.fed.us/pnw/sciencef/scifi163.pdf