

Response to comments made by a member of the scientific community 1 on a manuscript entitled 'Changes in mean evapotranspiration dominate groundwater recharge in semi-arid regions'

Tuvia Turkeltaub¹ and Golan Bel^{2,3}

¹Zuckerberg Institute for Water Research, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus 8499000, Israel

²Department of Environmental Physics, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus 8499000, Israel

³Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Kamýcká 129, Praha – Suchbátka, 165 00, Czechia

Correspondence: Tuvia Turkeltaub (tuvia@bgu.ac.il)

Community comment 1

General comment: Good research in the field of groundwater hydrology that has been approached with a worldwide angle. However, important detail is missing. Please, take into account my minor points to fix the issues.

Reply to general comment: *Thank you for acknowledging the contribution of our work to the field of groundwater hydrology. In what follows we address your helpful specific comments.*

Specific comments

Specific comment 1: Line 18. “In recent years, much effort has been devoted to the analysis of the sensitivity of groundwater systems to climate change”. Add recent literature on the effects of climate change in mountain ranges, the aquifer recharge from the snow is very sensitive to the climate:

- Lorenzi, V., Banzato, F., Barberio, M. D., Goepfert, N., Goldscheider, N., Gori, F., Lacchini A., Manetta M, Medici G, Rusi S, Petitta, M. (2024). Tracking flowpaths in a complex karst system through tracer test and hydrogeochemical monitoring: Implications for groundwater protection (Gran Sasso, Italy). *Heliyon*, 10(2).

- Langman, J. B., Martin, J., Gaddy, E., Boll, J., & Behrens, D. (2022). Snowpack aging, water isotope evolution, and runoff isotope signals, Palouse Range, Idaho, USA. *Hydrology*, 9(6), 94.

Reply to specific comment 1: *Thank you for bringing those works to our attention.*

We added the suggested references to the revised manuscript (line 26).

Specific comment 2: Line 48. Clearly mention the 3 to 4 specific objectives of your research by using numbers (e.g., i, ii and iii).

Reply to specific comment 2: *We accept the comment and have numbered the objectives of our research (line 52).*

Specific comment 3: Line 78. “1 is the pore connectivity”. Your research appears to focus on porous aquifers of siliciclastic nature (plio-quadernary age?). This point is not clear by reading the manuscript.

Reply to specific comment 3: *We accept the comment and revised the text to indicate that in our study, the unsaturated zone is considered to consist of siliciclastic materials (line 92).*

Specific comment 4: Lines 80-81. “Sand, silt, and clay contents”. The geological nature of your aquifers have not been disclosed, see also my comment above.

Reply to specific comment 4: *See our reply to specific comment 3.*

Specific comment 5: Line 184. “Under some future climate predictions, the frequency of extreme events is expected to double”. Please, be more specific. Are you talking about semi-arid / arid regions?

Reply to specific comment 5: *Myhre et al. (2019) do not specify changes in particular regions but rather illustrate projected changes in extreme rainfall statistics in Europe and the United States. We investigated the potential impact of these changes in extreme statistics on groundwater recharge in semi-arid and arid areas. The goal of our study is not to quantify the effects of specific predicted future climate but rather to quantify the effects of various changes in the climate statistics on groundwater recharge.*

Specific comment 6: Line 184. “Under some future climate predictions, the frequency of extreme events is expected to double”. This sentence should be expanded and moved to the discussion section.

Reply to specific comment 6: *The changes in extreme rainfall statistics was reported by Myhre et al. (2019) and not in the current study. Note that we only examined the impact of this possible change in extreme climate statistics on groundwater recharge.*

Specific comment 7: Lines 231-240. The conclusion is too short, it needs more detail.

Reply to specific comment 7: *We accept the comment and have expanded the text in Section 5 (Conclusions) to briefly explain our main goal and describe the conclusions drawn in our study. (lines 250-280).*

Specific comment 8: Lines 232-234. “Our results suggest...rainfall statistics”. The sentence is unclear and too long. Please, split it in two parts.

Reply to specific comment 8: *We accept the comment and revised the text accordingly (lines 263-267).*

Specific comment 9: Line 237. “Focused processes”. Which processes? Please, be more specific.

Reply to specific comment 9: *We mainly refer to preferential flow and recharge of runoff at specific locations on the landscape. We added the above definition to the text (lines 276-277).*

Specific comment 10: Figure 1a. You also have study sites and aquifers in highly arid settings, this is not clear in the text. You don't have only semi-aridity.

Reply to specific comment 10: *We revised the text to indicate that arid regions are also considered.*

Specific comment 11: Figure 1c. You can also report Mean Error, Mean Absolute Error and RMS in the graph.

Reply to specific comment 11: *We provided the suggested statistical indices for model performance evaluation in the caption of Figure 1.*

References

Myhre, G., Alterskjær, K., Stjern, C. W., Hodnebrog, Ø., Marelle, L., Samset, B. H., Sillmann, J., Schaller, N., Fischer, E., Schulz, M., et al.: Frequency of extreme precipitation increases extensively with event rareness under global warming, *Scientific reports*, 9, 16 063, <https://doi.org/10.1038/s41598-019-52277-4>, 2019.