Response to Reviewers

Note:

(1) In this response, the text in *italic type* is the original comments from the reviewers, and the text in blue, headed with "Reply"**, is the response from the authors.**

(2) In the manuscript, the words in blue **indicate the sentence is improved or revised. Some of them are mentioned in this response via the page and line number.**

***Summary*:**

The Liu et al. improved the Penman equation by considering water depth to calculate evaporation rate and volume for the Loess Plateau. They also performed an attribution analysis using climate, radiation, and area factors. They found that while evaporation rates decreased, the evaporation volume showed an increasing trend. Their analysis suggested that the increase in water body area offset the decrease in evaporation rates, leading to an overall increase in regional evaporation. This work provides an interesting and novel perspective on the causes of changes in regional evaporation.

Reply Summary:

We sincerely thank the reviewer for their insightful and constructive comments. We have carefully addressed each point below and will incorporate the corresponding revisions into the manuscript.

***comments and suggestions*:**

1) In arid and semi-arid regions, such as the Loess Plateau, a large number of small water bodies change relatively quickly. Can the lag time in equations 4 and 5 adequately account for the impact of the variation of small water bodies?

Reply: We appreciate the reviewer's insightful comment regarding the temporal dynamics of small water bodies in arid/semi-arid regions. Below we provide key perspectives: (1) The lag time of one month used in our study is grounded in prior research by Finch and Hall (2001), which demonstrates that this duration is acceptable to describe heat storage changes; (2) While large reservoirs (Tian et al., 2021) exhibit longer lag times in China (~2.9 months), smaller water bodies—with limited storage capacity—adjust thermally much faster, justifying our shorter lag time; And (3) the monthly time step aligns with our meteorological inputs and observational data, balancing accuracy and computational efficiency for seasonal dynamics. Thus, the one-month lag is both physically appropriate and practical for small water bodies on the Loess Plateau.

2) The resolution used for the attribution analysis is coarser than the previous spatiotemporal results. How was the resolution conversion handled?

Reply: Thanks. In the presentation of spatial patterns and temporal variations of the meteorological factors, we used the original resolution of 0.1°. When inputting meteorological data as driving factors, we extracted it based on the latitude and longitude coordinates of each water body. To present the attribution results consistently, we interpolated all outputs on a 0.05° grid.

3) How much improvement in accuracy does the modified method provide compared to the Penman equation that does not consider water depth?

Reply: Thank you for your valuable suggestion. We will conduct a sensitivity analysis by comparing our modified method with a simplified approach that excludes water depth variations. This comparative analysis will quantitatively evaluate the impact of water depth estimation on evaporation calculations, providing key insights into how this algorithmic modification affects our final results.

4) It would be beneficial to include comparisons with results from other regions in the discussion.

For instance, the introduction mentions examples from the U.S. and the Tibetan Plateau, where changes in water body area due to climate change differ from the human-induced expansion of water bodies on the Loess Plateau.

Reply: Thank you. Water body dynamics vary widely across regions, yet large-scale evaporation studies are rarely addressed. Most studies focus on specific large reservoirs or lakes, making cross-regional comparisons of water bodies of different scales challenging. Regional and size-dependent differences can be substantial, which we will elaborate on in the discussion section.

5) *The writing could be more concise. There are unnecessary explanations in the results, such as on pages 19 (lines 4-12, which should be moved to the discussion or removed), 25 (lines 3-7, which should be moved to the discussion), 22 (lines 9-11, recommended for removal), 23 (lines 2-4, recommended for removal), and 26 (lines 2-5, which can be shortened).*

Reply: Thank you for your feedback. We will revise the specified sections to ensure the writing is concise and flows smoothly.

6) *In the second paragraph of the introduction, the examples from the U.S. and the Tibetan Plateau focus on climate-driven changes in water area, which ultimately cause changes in ET. It would be more appropriate to use examples of human-induced changes in water area.*

Reply: We appreciate this recommendation. We will include additional examples of human-induced water changes, such as the severe shrinkage of the Aral Sea due to irrigation expansion, to enhance the professionalism and relevance of the introduction.

7) *The section describing the study area should include an overview of ET in this area.*

Reply: Thanks. The terrestrial evaporation rate on the Loess Plateau is approximately 1.07 mm/day, with an increasing trend of 0.015 mm/day/yr (Jiang et al., 2022; Peng et al., 2024). We will add this information to the study area description.

Minor comments:

1) In Fig. 1a, the legend for "River" should be a line; in Fig. 1b, the text is too small. Also, there are capitalization errors in the figure title.

Reply: Thank you for your careful observation. We will revise as suggested.

2) Validation metrics such as R^2, RMSE, and Bias should be briefly explained in the methods section, after the evaporation pan data description, without listing the formulas.

Reply: We will add brief explanations of R^2 (coefficient of determination), RMSE (root mean square error), and Bias in the section 2 following the evaporation pan data description, to help readers better understand these validation metrics without including formulas.

3) Page 19, line 2. The full forms of R^2 and RMSE have already been provided in lines 6 of page 18, so there is no need to repeat them.

Reply: Thank you. We will remove the full forms to avoid repetition.

4) In Figs. 3 and 4, it is recommended to label R^2, RMSE, and Bias on the figures to provide readers with overall validation information.

Reply: We will add text boxes to Figs. 3 and 4, labeling the values of R^2, RMSE, and Bias directly on the figures.

5) In Fig. 5, using the same color for "Pan" and "Big pan" would improve readability. They can be distinguished by different symbols, and it may be better to use darker colors to represent better results.

Reply: Thanks. We will update Fig. 5 to use the same color for "Pan" and "Big pan" distinguished by different symbols, to enhance readability.

6) In Fig. 6 and 8, it is recommended to use pie charts to show the proportion of area increases and decreases, or frequency distribution charts for each classification.

Reply: Thanks. We will replace Figs. 6 and 8 with pie charts to illustrate the proportions of area increases and decreases.

7) *How are large, medium, and small water bodies defined?*

Reply: We appreciate the reviewer's question regarding water body classification. It is important to note that there is no universally standardized classification system. But we can roughly adopt the following practical classification scheme for analytical purposes: Small: <0.01 km², Medium: 0.01-5 km², Large: ≥ 5 km².

However, this approach effectively serves our research purpose of examining how water body size influences evaporation patterns on the Loess Plateau. The key conclusions remain valid despite the inherent flexibility in size classification.

Reference

Finch, J.W., Hall, R.L., 2001. Estimation of Open Water Evaporation. Report 155.

Jiang, F., Xie, X., Wang, Y., Liang, S., Zhu, B., Meng, S., Zhang, X., Chen, Y., Liu, Y., 2022. Vegetation greening intensified transpiration but constrained soil evaporation on the Loess Plateau. J. Hydrol. 614, 128514. https://doi.org/10.1016/j.jhydrol.2022.128514

Peng, D., Xie, X., Liang, S., Wang, Y., Tursun, A., Liu, Y., Jia, K., Ma, H., Chen, Y., 2024. Improving evapotranspiration partitioning by integrating satellite vegetation parameters into a land surface model. J. Hydrol. 643, 131928. https://doi.org/10.1016/j.jhydrol.2024.131928

Tian, W., Liu, X., Wang, K., Bai, P., Liu, C., Liang, X., 2021. Estimation of reservoir evaporation losses for China. J. Hydrol. 607. https://doi.org/10.1016/j.jhydrol.2021.126142