

The authors have done a good job responding to the reviewer comments, including adding substantial additional analyses, appropriate limitations statements, and stronger links to the existing literature. The additional analyses reinforce the previous findings and provide new insights to the data. I have only a few minor remaining comments (in italics), which I have added to my initial comments (in bold) and the authors' response below (in plain text). After these have been addressed, I believe the manuscript is suitable for publication and will make an excellent contribution to the literature.

Lines 77-79: Assumptions 2 and 3 should be further justified and referenced. Assumption 2 is particularly concerning in grid cells with highly manipulated hydrologic systems, such as where irrigation results in substantial drawdown of groundwater and reservoir levels throughout the growing season.

We will update this in the text in the same line with justifications.

Perhaps I am missing it, but I do not see any text changes in response to this comment. Could you please 1) add a citation to support the assumption that canopy water storage is much smaller than soil water storage (across all biomes), and 2) add further justification, a citation, and/or a caveat pertaining to the assumption that water storage in lakes (including reservoirs) and groundwater is negligible? Short-term fluctuations in reservoir and volumes can be very large in some areas due to human management of water, as was recently comprehensively quantified by Cooley et al. Similarly, seasonal and sub-seasonal changes in groundwater storage can be very large in areas with intensive groundwater irrigation; for example, the papers by Strassberg et al. and Breña-Naranjo et al. listed below report short-term changes in groundwater storage in the High Plains Aquifer. I understand if this assumption is not avoidable, but it should be acknowledged as a limitation and appropriately referenced.

*Cooley, S. W., Ryan, J. C., & Smith, L. C. (2021). Human alteration of global surface water storage variability. *Nature*, 591(7848), 78-81.*

*Breña-Naranjo, J. A., Kendall, A. D., & Hyndman, D. W. (2014). Improved methods for satellite-based groundwater storage estimates: A decade of monitoring the high plains aquifer from space and ground observations. *Geophysical Research Letters*, 41(17), 6167-6173.*

*Strassberg, G., Scanlon, B. R., & Rodell, M. (2007). Comparison of seasonal terrestrial water storage variations from GRACE with groundwater-level measurements from the High Plains Aquifer (USA). *Geophysical Research Letters*, 34(14).*

Figure 1c legend: Please specify what the white areas represent. Also, the color scale is variously described as blue and purple for positive correlations and red and orange for negative correlations in this legend and the legend for Figure S2; this should be standardized.

We will specify in the caption that the white areas represent regions with no or insufficient number of data. Apart from this, the references to the figure's colors will be standardized.

The caption is clearer, but the description of the legend colors is still inconsistent between Figs 1 and S2.

Line 238 and Figure S7: This figure is referenced in text after Figure S2; the SI figures should be reordered to be sequential.

We will take it into consideration and update our manuscript accordingly.

Figures S7 and S8 still appear to be out of order.

Finally, a number of typos remain (mostly related to spacing and punctuation). I did not record them all, but examples are present in lines 119, 127, 199, 325, 369, 393, 404 and 405, etc.