

This study contributes to the field of irrigation modeling by incorporating an irrigation scheme into the Common Land Model (CoLM) by building upon established methodologies from existing literature. I believe this article has the potential for publication in *Hydrology and Earth System Sciences* (HESS). However, there is still much room for improvement in model validation. My comments are outlined below.

Major Comments

1. Before introducing the "Two-way coupled irrigation water use module," it would be beneficial to provide a brief overview of the Common Land Model (CoLM)'s water and energy processes related to irrigation. This will help readers better understand CoLM's key mechanisms and how the new module integrates with them.
2. The irrigation system employed in this study is based on the soil moisture deficit method. The authors need to explain how this strategy is appropriate for the study region. Specifically, are the parameters f_{irrig} and f_{thresh} set to their default values? If so, using field capacity or saturation water amount as the target and threshold values for the root zone (1m) may be impractical, as it would theoretically demand an excessively large volume of water (as illustrated in Figure 3). While subsequent limitations might arise due to water availability constraints, this process remains inherently passive, as it is predicated on an initially overestimated assumption. If not, I suggest listing the value of the

parameters.

3. Model evaluation. Terrestrial Water Storage (TWS) anomaly is a crucial variable for model evaluation. Comparing this variable with GRACE satellite data would enhance the study's robustness and provide additional validation for the model's performance.

Minor Comments

1. Experimental Design. Consider creating a table that clearly delineates the differences between each experiment. Specifically, the table should highlight the scheme-specific variations in surface water and groundwater supply between the two irrigation experiments. This would help improve clarity and facilitate comparisons.
2. Figure 7. Although the simulations of latent heat flux and sensible heat flux have improved, there is still a discrepancy compared to FLUXCOM data. Additionally, the fact that irrigation leads to an underestimation of temperature from June to September needs further discussion.
3. References. Some citations share the same author surname and publication year, which may cause linking issues. To resolve this, distinct labels (e.g., 2024a, 2024b) should be added, or additional author names can be included to differentiate them.
4. Figure S1. (1) Please confirm that the units in the figure ($\text{km}^3 \rightarrow \text{km}^2$?); (2) The color bar range needs to be adjusted. Due to at mid-latitudes

(around 40°N), a 0.25°×0.25° grid cell covers approximately 770 km².

Alternatively, you could use percentages to present the data for better clarity.

5. Since the validation of simulated irrigation is obtained from the USGS.

I suggest including some supporting text related to USGS and show total irrigation water withdrawals and categorized by surface and groundwater sources in Table format as a supplementary text.