Answer to CC1:

This paper presents a robust and insightful analysis of the systematic overestimation of evapotranspiration over irrigated areas by offline land surface models. The authors effectively integrate field observations with advanced coupled modeling techniques to dissect the complex interplay between irrigation-induced atmospheric changes and land surface processes. Their detailed examination of various ISBA configurations, combined with a thorough validation against observational data, not only deepens our understanding of the atmospheric feedback mechanisms but also offers valuable guidance for improving model performance in both weather forecasting and water resource management. The comprehensive approach and meticulous quantification of key processes make this work a significant contribution to the field.

Thank you for your very positive review. Below are the answers to your specific remarks and questions.

- *How sensitive are the results to the various ISBA configuration choices (e.g., canopy representation, stomatal conductance schemes, drought response) and to what extent might these choices limit the generalizability of the findings to other LSM frameworks?*

  The answer is partly provided in Appendix A2 of the Appendices. The relative overestimation of irrigated parcels does not depend much on the configuration, except for some combinations, such as when the MEB and A-gs schemes are activated together. In this case, the overestimation ranges from 3 to 15%, as shown in Figure A2.

- *Given that the atmospheric forcings (atmo_NOIRR and atmo_IRR_FC) are derived from a specific coupled model simulation over the LIAISE campaign period, how representative are these forcings for other irrigated regions or different meteorological conditions?*

  This is indeed a limitation of our article. The forcings are representative of a cold, semi-arid climate (Bsk in the Köppen-Geiger classification), and the effect of irrigation on the atmosphere is representative of a large, densely irrigated area. For different climate conditions and irrigated areas, the overestimation values may differ, and further research is needed. However, Decker et al. (2017) showed similar values of ET overestimation for a less densely irrigated region. Therefore, our article suggests that the value of 25% overestimation is somewhat generalisable to different topographies of irrigated regions. This limitation will be clarified in the discussion section.

- *The paper relies on validation using data from two field sites—how robust is the model evaluation across diverse settings, and what uncertainties remain in the comparison between modeled and observed near-surface meteorological variables?*

  We believe that the diverse settings used are representative of those often used in other LSMs and that impact ET the most, so the evaluation is quite robust in our opinion.

  However, some uncertainties remain concerning the differences between modelled and observed near-surface meteorological variables. Coupled models are not yet perfect, and the modelled variables do not always align closely with observations. In this study, it is considered that the difference between the irrigated atmospheric forcing and the observations stems from shortcomings in the coupled model, rather than missing irrigation effects. However, this cannot be verified. Therefore, the uncertainty is essentially similar to that obtained with mesoscale land-atmosphere coupled models.

- *Can the authors clarify how the compensatory interactions between transpiration and soil evaporation are quantified, and what are the uncertainties associated with isolating the atmospheric feedback effects on these individual processes?*

  The interactions between transpiration and evaporation are analysed by investigating their respective behaviours in each simulation. Figure 7 shows the atmospheric feedback on transpiration and evaporation separately, but this does not mean that the effects are isolated. Actually in LSMs transpiration and evaporation cannot be considered purely individual processes since they interact at least via the surface temperature. In fact, the behaviours shown in Fig. 7(a) and (b) (or (c) and (d)) must be interpreted together to understand the interactions between the two components. This point will be clarified in the revised version.

  New text:
  The lower the transpiration, the higher the top soil temperature and ultimately the higher the evaporation, i.e. evaporation compensates, to a certain degree, for the lack of transpiration.

  l.585: The interaction between transpiration and evaporation through surface temperature (either canopy or composite skin temperature) means these two processes are necessarily intertwined and must be interpreted together.

- *How might the biases associated with the offline LSM approach (due to missing irrigation-induced atmospheric feedback) impact downstream applications in water resource management and agricultural planning, and what strategies are proposed to mitigate these limitations in operational settings?*

  The presented biases can directly impact agricultural or water management applications. For example, overestimating evapotranspiration (ET) can lead to recommendations for irrigation water amounts being overestimated, resulting in excessive water consumption. There are numerous potential strategies to mitigate these biases, and determining the most effective strategy is another topic for research. The best option would probably be to use atmospheric forcings that represent the effect of irrigation on the atmosphere. However, this is rare, and obtaining the corresponding atmospheric data is computationally expensive. One possible simplistic approach would be to decrease ET estimates by 25% above irrigated parcels, but not above non-irrigated parcels. Another option would be to apply a negative uncertainty of 30% to ET estimates above irrigated parcels. We therefore prefer to leave this question open and allow readers to use whichever approach they prefer.

Additionally, it would strengthen the manuscript to reference recent advances in remote sensing applications in hydrological modeling. In particular, please consider citing the paper 'Assimilation of Sentinel-based Leaf Area Index for Modeling Surface-Groundwater Interactions in Irrigation Districts' *to provide further context and support for the integration of satellite-based vegetation parameters in modeling surface–groundwater interactions in irrigated areas.*

Thank you for your proposal. Although we find remote sensing applications very interesting and promising for hydrological modelling, we feel that the present article is only weakly related to them. Therefore, we prefer to keep the article concise.