Reviewer #1

We thank you for the valuable feedback received. The comment on the model output validation using independent data has motivated us to look into additional data, such as weather and crop variables, to further validate our results. We will add figure C4 below, comparing the trend in our estimated evaporation with independent crop yield data, and edit lines 425-432 as follows:

"Finally, we note the interplay between all variables: water balance (*P*, *E*, *C,* and *Q*), weather, and crop variables. Despite relying on external water supplies, the basin has been experiencing a decreasing trend in the river discharge (Dwivedi and Yadav, 2025), coupled with increased evaporation from 2010 to 2022 (see the annual time series of the posterior mean in Fig. C2). The increase in posterior mean evaporation mirrors the increasing trend in the sugarcane yield and leaf area index from 2011 (Fig. C4). This aligns with a period of increasing temperatures (see Fig. C4) and with the period when farmers started adopting new high-yielding sugarcane varieties in the basin, as reported by the Indian Council of Agricultural Research. The accelerating rate of evaporation in our estimates follows a similar trend in the Landsat-based SSEBop evaporation data set (Fig. C2). This shows, on the one hand, the usefulness of the water balance constraints in evaluating the data products, and on the other hand, that simplified ET models like SSEBop can sufficiently reproduce the evaporation dynamics.
The interplay between variables is also pronounced in dry years such as 2009 and 2016, showing a decline in the posterior mean precipitation, together with the canal water imports. The limited availability of rainfall and surface water for irrigation during droughts, along with rising temperatures in recent years (Fig. C4), does not, however, depress the evaporation rates because crop water demand is met by increased groundwater pumping. The effect of unsustainable groundwater pumping is particularly notable in the dynamics and trend of basin water storage, which we discuss next."

And the first lines of section 6.4 become:

"The presented methodology is motivated by the availability of diverse water balance remote sensing data, with very few in situ data available for the Hindon basin, making independent validation of our estimates challenging. For this reason, we evaluated our results using soft validation techniques. For example, for evaporation, in the absence of in situ data, we compared the trend in our estimated evaporation with independent crop yield data, and the seasonal dynamics with known cropping and irrigation patterns (see Sect. 5.1)."

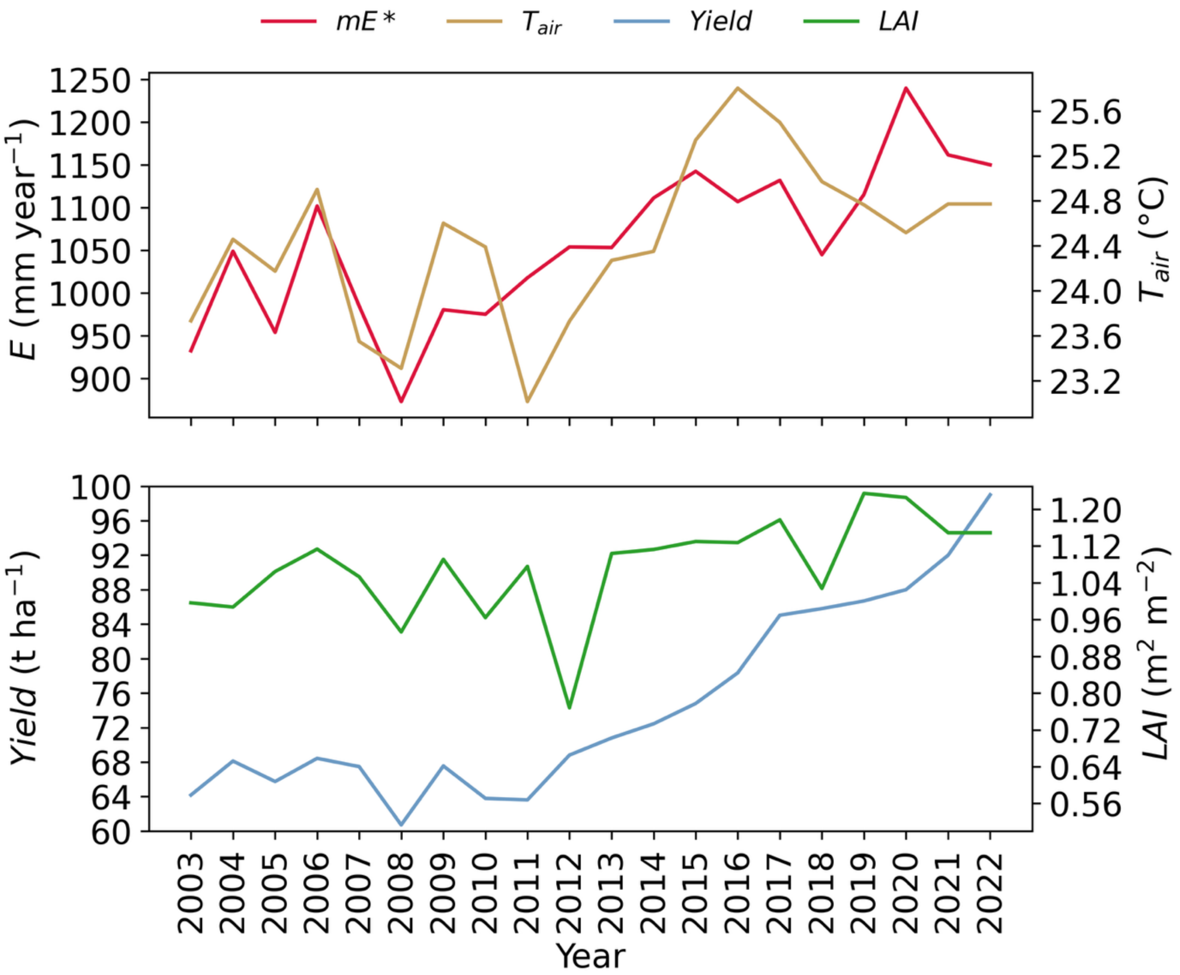

Figure C4. Interplay between the annual: evaporation posterior mean (mE^{*}), air temperature (T_{air}) variable from GLDAS Noah Land Surface Model v2.1 (Rodell et al., 2004), MODIS 15 Leaf Area Index (LAI) (Myneni et al., 2021), and district-wise sugarcane crop yield from International Crops Research Institute for the Semi-Arid Tropics database.

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Indian Council of Agricultural Research: Indian Council of Agricultural Research, Co 0238 – The Wonder Variety of Sugarcane: https://icar.org.in/en/node/4869.

International Crops Research Institute for the Semi-Arid Tropics: District Level Database (DLD): Crops dataset,http://data.icrisat.org/dld/src/crops.html.

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Rodell, M., Houser, P., Jambor, U., Gottschalck, J., Mitchell, K., Meng, C.-J., Arsenault, K., Cosgrove, B., Radakovich, J., and Bosilovich, M.: The global land data assimilation system, Bulletin of the American Meteorological society, 85, 381-394, 2004.