

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/hess-2022-379-RC2>, 2023
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Comment on hess-2022-379

Anonymous Referee #2

Referee comment on "Improving regional climate simulations based on a hybrid data assimilation and machine learning method" by Xinlei He et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-379-RC2>, 2023

This study investigates the performance of the advanced WRF model in the HRB based on the coupled data assimilation and machine learning framework. Also, the authors assessed the impact of the hybrid framework on near-surface air conditions and land-atmosphere interactions in this region. The paper is readable and easy to follow. However, the manuscript still needs moderate revisions. Please find my comments below:

(1) Although the description of the manuscript is clear, I am still confused about why the authors did not directly assimilate the Soil Moisture Active Passive (SMAP) soil moisture observations. The advantages of the machine learning-based soil moisture surrogate model need to be enhanced.

(2) It is not clear which soil moisture data are used for training and which data are used for validation. Independent soil moisture validation data are required.

(3) Line 114: The observation elements of the automatic weather stations need to be briefly described.

(4) Line 132: ETMap is also uncertain and affected by assumptions. Explain why it can be used as a reference.

(5) Line 195: The structure diagram can provide a clear description of the coupled land-atmosphere framework.

(6) Line 202: The details of the statistical metrics need to be listed.

(7) In Figure 2, the WRF (DA-ML) LAI value is still higher than GLASS products in cropland. Please explain the specific reasons.

(8) Line 235: "The maps of estimated LAI and SM from the DA-ML method consistently resembled the rainfall, vegetation cover, irrigation event, and shallow groundwater table features". Please explain why.

(9) In Figure 5, the spatial distribution of ET estimates from the WRF (OL) and WRF (DA-ML) is more consistent in the upstream of the HRB. The authors need to explain whether the improvement of the WRF (DA-ML) is related to the original performance of the WRF (OL). Compared to ETMap, ET estimated from the WRF (OL) is underestimated in the downstream oasis, please explain more.