Response to reviewers' comments (Paper # essd-2024-370)

We have fully considered the reviewer's comments during the revision and have improved the manuscript accordingly. We summarize our responses point by point below in blue. The revised places are highlighted in yellow background in the revised manuscript.

Reviewer comments:

In this manuscript, Wang et al compiled and post-processed half-hourly flux data from these 34 EC flux sites in the Heihe River Basin to create a continuous, homogenized time series dataset. This work filled the gaps in carbon flux data and auxiliary meteorological data of the Heihe carbon flux network, and generated a carbon flux dataset. Then the half-hourly NEE measurements were partitioned into GPP and Reco. The diurnal, seasonal, and inter-annual variabilities of carbon flux across diverse ecosystems in the Heihe River Basin were explored based on the gap-filled and partitioned dataset. This post-processed carbon flux dataset with a total of 34 EC sites in the Heihe River Basin is very valuable and important.

Response: We sincerely appreciate the reviewer's positive feedback on our dataset.

Overall, I find the paper compelling and fit for publication after minor revision. I only have a few comments as below:

ERA5-Land dataset is a reanalysis dataset. It would be great if some evaluation for variables from ERA5-land vs observations can be added.

Response: Thank you for your comments. We have evaluated the ERA5-Land variables against observational data and found that ERA5-Land variables exhibit systematic errors (as shown in Fig. 1 of this response letter). These systematic errors are inconsistent; for instance, ERA5-Land Ta and VPD closely match observations in the morning but are significantly lower than observations in the afternoon.

Given these errors and the spatial scale mismatch between ERA5-Land data and observations, we developed an RF model using ERA5 data and local observations. The RF model accurately predicts local observations based on ERA5 data, as demonstrated in Fig. 3 of the manuscript. This model is then utilized to effectively fill gaps in the observed meteorological data.

Considering the length of the article, we did not include the figures related to the evaluation of ERA5 in the manuscript.

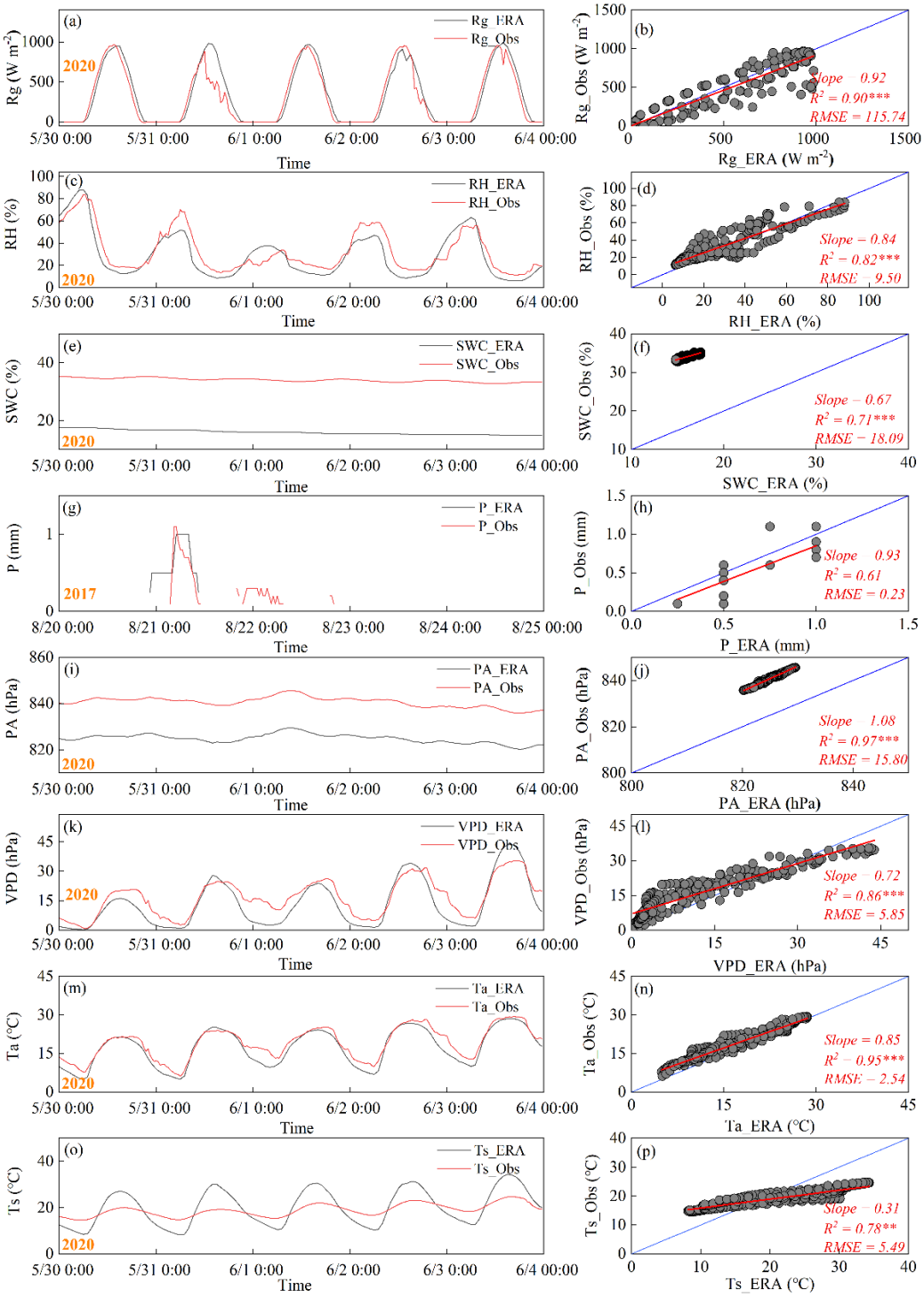

Fig.1 Comparison ERA5-land variables vs observation

If possible, comparing the MDS with RF results will be interesting.

Response: Actually, we compared the performance of the MDS method with the RF method. Specifically, in section 3.2, we introduced artificial gaps into the NEE data, and both MDS and RF effectively filled these gaps, with the RF method slightly outperforming MDS. In some cases, MDS struggled to fill longer gaps, while RF was able to fill these gaps more effectively. This comparison has also been discussed in section 6.2.

The RF model was used for meteorological and carbon-flux data post-processing. The readers will be curious to know the construction and parameter selection of the RF model.

Response: Thank you for the comments. We have added the details for RF model construction for meteorological and carbon-flux gap-filling in section 3.1 and 3.2, respectively.

In section 3.1:

In the RF model, the tree number (n_estimators) was set 800, the random_state was set to 30, test sample size was set to 0.3, other parameters kept at their default values as provided in the sklearn package.

In section 3.2:

The RF model settings are identical to those used for meteorological data gap-filling.

Please give some explanation why only Rg, Ta, and VPD are selected as input of the RF model to predict NEE.

Response: Since the MDS method also uses Rg, Ta, and VPD to fill the gaps, we built the RF gap-filling model using the same three variables. Meanwhile, these three variables are easily accessible. We have added an explanation for selecting Rg, Ta, and VPD in section 3.2, which is highlighted with a yellow background.

Since the MDS method uses Rg, Ta, and VPD to fill the gaps, we built the RF gap-filling model using the same three variables. Additionally, Rg, Ta, and VPD are the main factors that control ecosystem carbon exchange.