

## Response to Referee #2

**Comment (1):** The present study investigated the ratio of latent heat flux to available surface energy (EF) using an ANN method and FLUXNET and meteorological station data, and reported that EF decreased on a fractional land surface, especially, it was accompanied by increased runoff (precip–et). The topic of the study falls into the scope of the HESS journal, and the conclusion is interesting. A minor revision is recommended before its publication.

**Reply:** We thank the reviewer's valuable suggestions and constructive comments, which help us improving our study and the quality of the manuscript. The comments and suggestions are addressed below.

**Comment (2):** Major concerns: a) The validation of the ANN method needs further clarifications. From lines 161-162,  $r$  ranged from 0.782 to 0.768, corresponding to a  $R^2$  of 0.59-0.61. More clarifications are need to prove that such accuracy is acceptable. Probably, the authors could compare the accuracy obtained in the study with those in previous similar studies.

**Reply:** Thanks for the valuable suggestion. We have expanded the cross-validation in terms of not only values but also trends and found that the trends predicted by the ANN model were highly correlated with the observed trend, and even in most cases, the estimation of the trends were more reliable than the estimation of the values (see the Attached Figure at the end). In some land cover types such as ENF, DBF, GRA, and WET, the statistical correlations in the trends validation exceed 0.90 ( $p < 0.001$ ), and those statistics are the ones being reported. Meanwhile, we will provide more discussion here through comparing the accuracy with previous similar studies according to the comment.

**Comment (3):** b) The writing of introduction and conclusion sections need to be improved. The introduction section: this section mainly stated that the traditional method did not consider the dynamic change of leaf stomatal resistance/conductance, while info about the similar studied based on observed

data is a little bit limited. The conclusion section: this section is too simple, only the sentence starting with 'however' is a conclusion. Please add more info to this section.

**Reply:** Following the comment, we will extend the introduction and conclusion, including on the studies of using observation-driven latent heat and sensible heat fluxes in the introduction section, and we will improve and refine the conclusions of this study.

**Comment (4):** Minor concerns: Line 18: 'namely that. . .' should be changed to 'namely, . . .'

**Reply:** After considering the suggestion, we have modified 'namely that...' to 'that is,' in the revised manuscript.

**Comment (5):** Lines 35-38: the description about the ET output from models is incorrect, cause most simulated ET output actually has already considered insufficient soil moisture's influences.

**Reply:** We agree with this comment, and we have modified the expression of this sentence. We want to emphasize that some traditional drought assessments use the output of climate models (e.g., predicted temperature) to estimate potential ET. This is an offline method that can ignore insufficient soil moisture's influences.

**Comment (6):** Line 64: 'EF' seems to appear for the first time here, so full name is needed for EF.

**Reply:** Done.

**Comment (7):** Line 72: radiation is missing after "shortwave"?

**Reply:** We have added the term "shortwave" in the revised manuscript.

**Comment (8):** Line 82: Station meteorological data might be a better caption.

**Reply:** According to the comment, we have modified the caption to "Observed weather station data", which is consistent with the expression in the full text.

**Comment (9):** Line 135: ‘rs’ appears for the first time here? If so, the full name is needed.

**Reply:** We have added the full name and avoid such omissions in the revised manuscript.

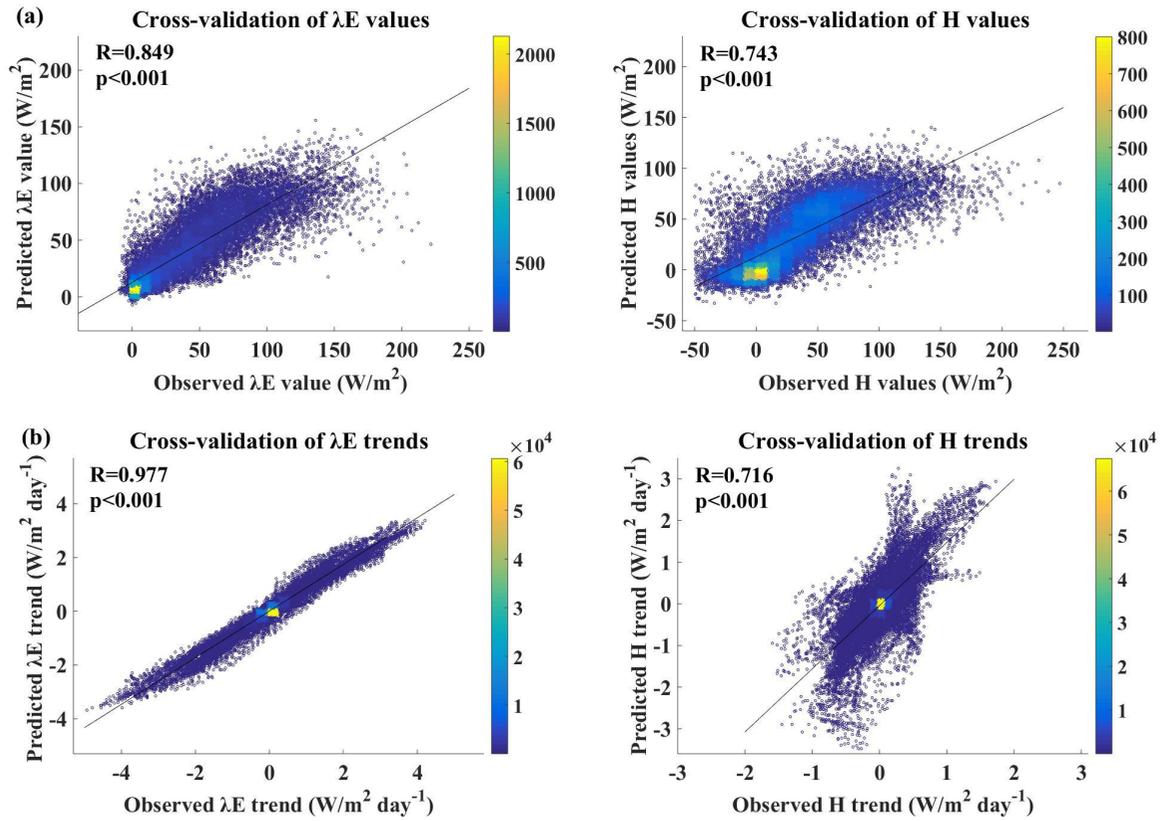
**Comment (10):** Line 242: References of Fu et al. (2012WRR, 2015JGR-A) are recommended here to illustrate ENSO’s influences.

**Reply:** Thank you very much for your recommendations. After studying the papers, we find that Fu et al (2012) is very suitable to illustrate the influences of ENSO, and we will add this paper as one of the references in the revised manuscript.

**References:**

Fu, C., James, A. L., and Wachowiak, M. P. Analyzing the combined influence of solar activity and El Niño on streamflow across southern Canada. *Water Resour. Res.*, 48, W05507. <https://doi.org/10.1029/2011WR011507>, 2012.

## Attached Figures



**Figure 2.** Density scatter plot for (a) the cross-validation in terms of values and (b) the cross-validation in terms of trends. Samples of the validation set in the values cross-validation are randomly composed of 10 flux towers from different plant function types, and the validation set in the trends cross-validation are composed of trends calculated from all time periods.