

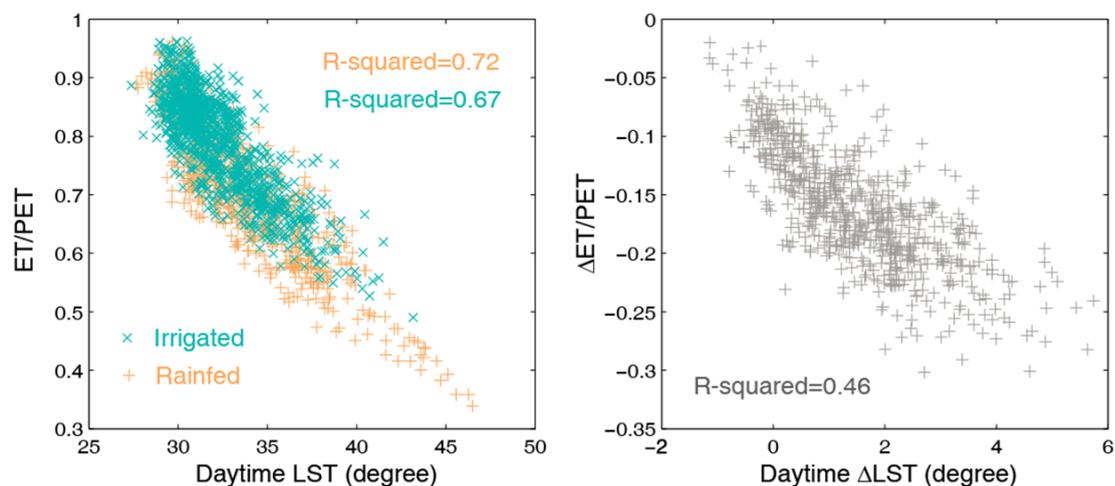
Review2:

Irrigation benefits crop yield mainly through water stress and high temperature stress mitigation. Although water stress alleviation via irrigation has been addressed intensively, a further understanding of high temperature stress alleviation is still required. This paper attempts to separate the irrigation effects on maize heat stress from that on water stress using satellite vegetation, temperature, and evaporation products. The paper is well written and structured overall. The conclusions are drawn based on solid analyses and interpretations of the results. The pathway provided to improve the state-of-the-art crop models is of great interest to the community.

The only major concern for me is the collinearity between LST and ET considering LST is directly impacted by ET through surface energy balance. Thus, it should be careful to disentangle the heat stress and water stress. More illustrations would be required.

We thank the reviewer for the constructive review and suggestions. Please see the point-by-point response below.

The following figure shows ET/PET v.s. LST in each county.



The left panel is the original growing season mean ET/PET and LST, the right panel is the difference of LST ( $\Delta$ LST) and ET/PET ( $\Delta$ ET/PET) between rainfed and irrigated maize.

Although the difference of ET/PET and LST was still correlated, we also calculated the Variance inflation factor (VIF) to diagnose the severity of collinearity and the impact it might be having on the ability to statistically estimate the parameters of interest. The statistical rule-of-thumb is that VIFs over 10 indicate collinear variables that may be causing coefficient instability (with 5 being a more strict standard). Here the VIF in our statistical model is 2.2, suggesting the collinearity is not severe, and there remains enough independent variation to trust our estimates. The results may be surprising, but these two parameters do in fact exhibit some independent variation. This is why the variance inflation factors are quite low (and thus not problematic for the statistical estimation).

In sum, we understand the reviewer's intuition and potential surprise at the amount of independence here; this is the very reason we think this is an exciting and publishable result.

Some minor comments are as follows.

Lines 190-194, I could not find the citations ‘Senay et al., 2013’ and ‘Velpuri et al., 2013’ in the reference.

Thanks for catching the missing citations. We have added the two omitted references.

Lines 195-196, Is the PET also available in the SSEBop ET product? It would be better to use consistent ET and PET to calculate the water stress index.

SSEBop only has estimation for ET. But based on our validation using Flux tower estimations in Supplementary Figure 3-5, MODIS PET has a good performance. So we just blended the two products for our analysis.

Lines 256-257, I would suggest to simply describe the uncertainties of AGE rather than just include the reference for better readability.

We added some details on how we quantify the uncertainties related with AGB: “The uncertainties in AGB estimation results from the parameters in the regression model (Eq. (6)) converting IWDRVI to AGB. Here we quantified the uncertainties rooted in the estimated parameters through running the panel model 1000 times with the samples generated from each parameter's 95% confidence interval (Zhu et al., 2019).”

Lines 286-287, what is the added value by using daytime LST difference considering the relative contribution of water and high temperature stress alleviation to yield benefit has been analyzed using Eq. 8.

We have clarified the added value of using daytime LST as the explanatory variables in line 385: “Because the distribution of  $\Delta EDD$  was truncated for points with  $\Delta EDD > 0$  (Figure 8e), we explored an alternative model with quadratic functions of  $\Delta LST$  and  $\Delta ET/PET$  (Eq. (9)).”

Lines 317-318 and lines 346-347, could some explanations be found for the different performances between LST and air temperature?

We added an explanation for the identified different performances between LST and air temperature in line 324: “The difference between spatial-temporal patterns identified using LST and air temperature was mainly because LST reflects canopy energy partition between latent heat flux and sensible heat flux. Additional moisture provided by irrigation makes more heat transported as latent heat flux, resulting in a cooling effect.”