Review #5

This work developed a statistical emulator based on training data from a complex energy balance approach (EBSC) and applied the emulator at LPJmL model and hence enable canopy temperature simulation. The authors showed such approach could reproduce observed canopy heating and cooling effects as site observations. This work demonstrated a very interested way to develop empirical functions within land surface models. The overall manuscript is well written. There are only minor revisions are required before considering for publications.

Thank you very much for the positive and constructive feedback. Below we provide responses to the individual points and suggested changes to improve the manuscript.

Minor comments:

Please be specific how many grids for which crops and which years are used for the 90000 entries. Are they evenly distributed geographically?

Thanks a lot for this comment. We will include the information in the revised manuscript.

Lin 113-115. Please define the logics behind the selection of LAI of 33 days and 11 years, as well as 40 days of 9 future years. Based on several tests or what else? Is that based on the threshold of LAI >1.5, temperature > 273.15K and solar radiation <50W.m-2? If so, please restructure the flow of the paragraph.

We are sorry that we did not sufficiently explain the selection of DOYs for the historic and future periods. We will restructure the *EBSC input and modeling protocol* section and will provide a more comprehensive description.

Please show R2 in figure 1.

Thank you for this suggestion. We will include the missing R2 in figure 1.

The validation focused on the temperature differences rather than canopy temperature simulation. I think it is also very important to show the canopy temperature validations. Please add another plot to show the comparison of observed and simulated canopy temperature in Figure 3. Furthermore, how well the method capture the monthly or interannual variation of canopy temperature at the sites?

For the evaluation of simulated canopy temperatures with experimental data, we decided to show temperature differences because we do not expect to exactly reproduce observed canopy temperatures but aim to capture heating and cooling effects at the canopy level compared to air temperatures at 2 m height. Adding the same 2 m air temperature to both simulated and observed canopy temperatures makes the differences less visible. Additionally, showing the temperature differences as was done in Webber et al. (2016) and Webber et al. (2017) is very useful to compare the performance of our emulator modeling approach with the original EBSC approach.

In order to give insights into the reproduction of monthly and interannual variation of canopy temperatures at the sites we will add two figures, one showing the results per year and one showing the results per month.

The main results of the global simulation is still a scatter plot, how about show a global spatial distribution of simulated canopy temperature versus ERA5 skin temperature?

Thank you very much for this suggestion. Compared to global maps, scatter plots can visualize daily global data in one plot. In contrast, global maps require either a division into many sub-plots for each day of the growing season or a temporal aggregation to show mean values per month or per growing season. The aggregation can make it hard to draw meaningful conclusions. We will create such plots and include them in the revised manuscript if we think they are informative.

Bibliography

Webber, H., Ewert, F., Kimball, B., Siebert, S., White, J. W., Wall, G., Ottman, M., Trawally, D., and Gaiser, T.: Simulating canopy temperature for modelling heat stress in cereals, Environmental Modelling & Software, 77, 143–155, 2016.

Webber, H., Martre, P., Asseng, S., Kimball, B., White, J., Ottman, M., Wall, G. W., De Sanctis, G., Doltra, J., Grant, R., et al.: Canopy temperature for simulation of heat stress in irrigated wheat in a semi-arid environment: A multi-model comparison, Field Crops Research, 202, 21–35, 2017.