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Interactive comment on "Ideas and perspectives: Heat stress: more than hot air" *by* Hans J. De Boeck et al.

Anonymous Referee #1

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"Ideas and perspectives: Heat stress: more than hot air", by De Boeck et al.

De Boeck et al. provide a nice and concise manuscript discussing the importance of the use of leaf temperatures rather than air temperatures for addressing heat stress. The study applies a leaf temperature model published in De Boeck et al. (2012) for a set of sensitivity tests to address the importance of wind speed, relative humidity, radiation levels and leaf size for leaf temperatures. These sensitivities are used to discuss the variations in leaf temperature that can arise through meteorological conditions. In addition, leaf temperature measurements from a young grass stand are analysed to address the importance of drought for leaf temperatures.

The manuscript is nice and short, and although very concise, I consider the setup chosen here (discussion of the importance illustrated with an idealized set of sensitivity

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simulations), appropriate to emphasize the authors' opinion. However, the analysis of the leaf temperature measurements that are used to illustrate the drought impact need further attention - these can be used potentially to validate the model and to emphasize the conclusions drawn from the modelling, but in its current form they are not analyzed in great depth, nor quantitatively compared with the modelling. I would recommend to use these to a greater extent (further comments below).

If the measurements can be integrated more in the rest of the manuscript, I expect this manuscript to be an attractive contribution to the discussion on analysis of heat stress and an important message for impact studies.

Major comments:

The data set of leaf temperature is an interesting contribution to the manuscript, but its analysis and the comparison with the modelling is too concise in its current form. I would recommend the following: (1) a statistical analysis of the two sets (with and without irrigation) to determine whether the difference is significant; (2) a validation of the model by using the measured energy fluxes and air temperature to simulate leaf temperature, which can be subsequently compared with the observations (if all model parameters are available or can be estimated); (3) a derivation of the theoretical relationship between the temperature difference and RH using the model, possibly even for different cases (e.g., high/low wind speed), to determine whether the slope found by linear regression reflects the (range of the) theoretical behaviour; (4) clarifying the figure caption of Fig. 2: Is the linear regression for the entire data set, or only for the irrigated days? If the two sets differ significantly, there could be separate regression lines for the two; (5) a discussion on the cause of the high scatter in the observed temperature differences: Are these measurement uncertainties, or can they be explained by the other variables not separated in the figure (stomatal conductance, wind speed).

It is striking to see that there may indeed be a smaller latent cooling for the non-irrigated day (this would need to be confirmed by statistical analysis - the spread is large), but

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that there is little impact on the range of observed temperature differences, so the response to other factors that cause the spread may not be affected that much.

Minor comments:

- p. 2, l. 17: the sensible heat flux is not mentioned in the discussion of the components of the energy balance.

- p. 3, l. 7: Please provide more information on the setup with the custom-made non-contact thermometer. I presume it measures infrared radiation? How do you ensure that you measure leaf temperature and not ground temperature? A five-week old and 10 cm high grassland will presumably have a rather low LAI (if LAI was measured, it would be great to have it reported in the manuscript of course).

- p. 3, l. 15: "without extra energy" is somewhat misleading here: This is used to describe the low radiation case (100 W/m2), which of course does resemble a low level of solar energy. A case without extra energy (darkness) would have yet a different response due to the closure of stomata. The sentence should be rephrased to clarify this.

- p. 3, l. 26: The description of wind impact is misleading: High wind speed does indeed cause a stronger coupling, so it simply dampens the difference, both in case of Tl>Ta and in case of Tl<Ta. Hence, larger wind speed does not counteract the "benefits" of other variations, but it causes the responses to be dampened. The alleviating effect of these variations under high wind speed (so stronger coupling) is simply less, because of the overall smaller temperature difference.

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