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Comment on hess-2020-627

Anonymous Referee #3

Referee comment on "Untangling irrigation effects on maize water and heat stress alleviation using satellite data" by Peng Zhu and Jennifer Burney, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-627-RC3, 2021

This paper proposes, based on a series of LST measurements derived from Modis, to analyse the effects of thermal and water stress by considering a big data set over a large territory and a long time series 2003-2016. The originality of this work, beyond the considerable corpus of data, is to analyse the contributions of both types of stress.

The approach nevertheless presents an important methodological flaw in the separation of thermal and hydric effects. Indeed, water stress leads to a decrease in photosynthesis and therefore in yields, but also to an increase in temperature, which itself can have an effect on yield. Therefore, to separate the thermal effect it is necessary to be able to control the water stress. This is the case with irrigated conditions and Figure 8b does not show a clear effect of heat stress under these conditions. The authors use an empirical model (eq 8) which is not at all suitable for separating the temperature and water effects or it should be demonstrated. Therefore i found that the conclusions (as the 65% and 35%, heat) cannot be supported by such methodology and probably the author give too much importance to the heat stress.

In fact this study does not refer to existing knowledge in ecosphysiology on heat stress on field crops which would have allowed a better understanding of the periods and impact of heat stress on yields. This is reflected in the choice of crop models, which is documented in a much too summary manner. Because of the strong link between water stress and temperature, on the one hand, and the pre-eminence of water stress on yields, it seems difficult to isolate the effect of heat stress on yield with a simple statistical analysis as is done in the paper. Moreover, the choice of explanatory variables aggregated over two parts of the cycle does not help to analyse phenomena that occur over short periods of time linked to climatic variability and the sensitivity of the yield to heat stress.

Because of the unsuitable approach to adress thermal stresses which would have been the true originality of this work, I do not recommend the publication of this article. Moreover, it has some formal defects:

The authors could describe a little better the sources of performance data

L126 what is a MODIS sinusoidale projection

L141-144 : better describe how phenology is retrieved. Site observations in Figure 4c show that the phenology was not well characterized (gap of 20 days with VP this gap might have commented

L176-180 : I guess that met data are obtained hourly, why using sine function (is the fact of using sine function has an impact on GDD and EDD

L301 not clear

L328-329: are irrigated and non irrigated using varieties. Probably not and we can expect that phenological characteristics might be different. This can explain shorter cycle with non irrigated crop.

L390-403 : in Agmip there several models that compute crop temperature (STICS for instance), wihy not using them. Are sure that LPJ-guess do no not compute crop temperature.