

Interactive comment on “Quantifying impacts of the drought 2018 on European ecosystems in comparison to 2003” by Allan Buras et al.

Anonymous Referee #1

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In this manuscript, the authors compare the climatological features of two intense drought events over Europe, the 2003 and 2018 heatwaves. From a climatological analysis, they carry on to analyze the effect of both events on European vegetation. The authors' results are based on a suite of statistical analyses of MODIS-based vegetation indices combined with a widely used land cover map. Their main conclusion is that the 2018 heatwave had a stronger effect on European vegetation than the 2003 one.

General comments Overall the manuscript is well written and follows a logic questioning line going from the climatology of the heatwave to the effect on vegetation. However, I am not convinced by the relevancy of the way the main question is addressed. From the first climatological data shown by the authors it is obvious that the 2003 and 2018

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events are very different in terms of location (baltic countries in 2018 versus central Europe in 2003) and timing (july was the beginning of the 2003 heatwave whereas it was the end of the 2018 one) and, even though it is not shown, in initial conditions. These crucial differences are however mostly ignored in the way the analyses are designed, potentially pointing to severe flaws in the results, that I detail below. This observation leads me to suggest more detailed analyses be carried out before publication.

Detailed comments Effect of heatwave timing, duration and legacy The analyses carried out, only encompassing the greenness index in july of both years, seem too superficial to draw the far-reaching conclusions the authors make. First on heatwave timing, the stronger NDVI signal in july 2018 compared to july 2003 could be the result of the difference in timing. This point is ignored when concluding that the 2018 heatwave had a stronger effect on European ecosystems than the 2003 one. Second, as mentioned as a discussion item, the legacy of water balance can be very important for heatwave effects on forests especially. Even though this is be a major point underlying the relevancy of the question asked, no data or analysis shown tries to compare the water conditions prior to both heatwaves. An analysis of both heatwaves time evolution and the comparison of each heatwave's end month, that could then be different from one to the other could be an option.

Heatwave location defining the ecosystems affected Another point that undermines the results presented is the comparison of vegetation types in absolute terms without a prior description of vegetation types affected in each case that might be very different. Even though this information is essential to make sense of a comparison of the effects on vegetation of two climatic events, it is hardly discussed and made very hard to see in the way the data are processed. For example the varying y-axis ranges in figure 5 hide the relative weights of each vegetation type with water deficit or water surplus. Figure S3 might be more explicit to this regard by considering relative vegetation cover.

Statistical indices Finally, another aspect of the manuscript that makes it less convincing is the choice of the figures and complex statistical indices derived. For example

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figure 5 is hard to interpret. What is the implication of high NDVIs combined with low CWB? In general, the methods section is very concise, making it easy to read but also lacking some key points to help the reader understand the many indices used. For example even though they are widely used NDVI and EVI should be defined. Also, heat load variable is not defined and is sometimes written heat load and sometimes heat-load. If it is simply Tmax call it this.

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