Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2021-19

Anonymous Referee #2

Referee comment on "Vulnerability of European ecosystems to two compound dry and hot summers in 2018 and 2019" by Ana Bastos et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-19-RC2, 2021

Review of "Increased vulnerability of European ecosystems to two compound dry and hot summers in 2018 and 2019" by Bastos et al (esd-2021-19)

The manuscript by Bastos et al explores the existence and extent of compound effects of subsequent dry and hot summers on vegetation, using the case of 2018 and 2019 in Europe.

The manuscript is of general interest to a large audience, across several disciplines. Overall, the manuscript is generally well-written and clear (but see below).

I have however three main suggestions:

1) The manuscript is dense, both in terms of methods and results. The results and even more so discussion are thus inevitably complex, but, unfortunately, at times not very clear, with apparently contrasting statements. A general suggestion would be to give descriptive names to the four clusters, to facilitate the reader throughout the text. Further, I list here some examples of apparently contrasting statements or unclear sentences, but I suggest that the entire discussion is revised for better clarity.

L313: Isn't the high correlation in contrast with the statement in L 305?

L322-324: This is an important point, but it is not at all clear in the text.

L349: I think this is a potentially controversial point. Deeper roots are an advantage, if the off season has provided water recharge.

L354-355: On which basis can it be stated that this is 'consistent'?

L356: Why is the vulnerability increased? Is this because of heat? Isn't this in contrast to L350? Does this apply just to 2019? And, even if so, how could an opposite response in the two years be justified?

2) I find of particular relevance the question of the responses of different land uses. This point is relatively prominent in the abstract, but then only briefly touched upon in the results and discussion. I think the manuscript would gain in terms of impact (and interest within a broader audience) should this question be explored in more detail. To this aim, I would suggest redoing the analyses at the basis of Figure 6, but separating land uses. This could give some insights in how the different vegetation types respond to temporal compound events. Of particular relevance would be the correlation with previous year's EVI anomalies, temperature, soil moisture and soil available water capacity. This additional analysis would for example reduce the speculation behind statements like that in L349, by allowing exploring the effects of available soil water.

3) One could expect that crops, by being mostly annual plants, would have a radically different response to temporal compound events from all other perennial vegetation. Specifically, one could expect no substantial legacy effects, or even a positive EVI anomaly in 2019, as the result of reduced nutrient use and losses via leaching in the previous year, characterized by low production and low soil moistures. While the discussion is definitely more focused on vegetation dominated by perennial plants, there are few hints at crops also having some legacy effects. I think it would be helpful to discuss in more detail why this is the case (if this is the case), thus better grounding the results in our ecophysiological understanding of plant and ecosystem response to (repeated) heat and drought. The additional analysis suggested above could shed some clarity on this matter, making the discussion less speculative. Authors could also consider how the LSM performance in 2019 is affected by land use: it could be expected that, if LSMs fail to represent the carry over effects, then they would be performing better in ecosystems where carry over effects are intrinsically more limited.

Minor comments:

There are several imprecisions in the text (missing or misplaced blank spaces, inconsistencies in symbols, etc.), in particular in the results and discussion sections.

The readability of Fig 3 would be greatly improved if it was bigger (in particular the right panels). Also, could a different set of colors be used, to highlight differences in the map? C2 and C3 are difficult to distinguish now.

Also Fig. 4 could be a bit bigger, possibly with larger and differently shaped symbols for 20018 and 2019 (which are anyhow outside the regression).

L131: Why not also June-August 2019?

L172: In which sense there is an acclimation to drought, at the scale of one-to-two years?

L244: I think the term 'recovery' is not necessarily correct, at least not in all ecosystems. So, I suggest using a more neutral 'less negative EVI anomalies'.

L 285: 'stronger' with respect to what? DH2018?

L357: I find the term 'natural ecosystems' potentially confusing here. I suppose it is used to contrast forests/grasslands to croplands, but, in Europe, very few forests can be considered natural (in the sense of unmanaged) ecosystems. Their response to heat and drought is certainly mediated by species choice and other aspects of management.