Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-116-AC4, 2020

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Risk of crop failure due to compound dry and hot extremes estimated with nested copulas" *by* Andreia Filipa Silva Ribeiro et al.

Andreia Filipa Silva Ribeiro et al.

afsribeiro@fc.ul.pt

Received and published: 24 June 2020

Editor: (1) The three reviewers agree on the clear purpose and structure of the manuscript and are all supportive to publication of this manuscript subject to minor edits. Some refer to justification of (implicit) choices made, some ask for some extra clarification. I would recommend to reply to all review comments that are raised.

Author's Reply (1): Thank you. We have answered to all the review comments individually and in detail.

Editor: (2) For me the most significant comments are:

Printer-friendly version

Discussion paper

Additional justification regarding:

- The choice of the 3-month averaging window for the meteorological quantities

- The processing of the negative dependence (why not use a rotated copula, as suggested by a reviewer)

- Availability of the code (and data if that is open)

Author's Reply (2): Thank you. We have addressed these points in detail and we agree to publish the code in a repository.

Editor: (3) Some further explanation concerning:

- The copula parameter theta

- The implication of C being lower than the AIC

- The choice of the marginals in section 2.3

- The reconstruction of the correlation between yield and temperature for wheat 2

- The physical interpretation, not only of the notion that drought and heat alone can give stronger effects than their combination, but in general sense: why would the combination of environmental drivers lead to stronger yield reductions? Is this physiologically explainable?

Author's Reply (3): Thank you. These points where properly addressed. Moreover, in the general sense, the biophysiological explanation for the combination of environmental drivers leading to stronger yield reductions relates with the crop's requirements of water and thermal conditions during the key phenological stage in analysis. The selection of the climate variables during spring corresponds to the reproductive phase of the plant's and when vegetation is photosynthetically more active, and the combined effect of water and heat stress during this period is critical for crop's health leading to yield decrease. During this stage of formation of the grains the compound dry and hot

Printer-friendly version

Discussion paper

extremes may accelerate the maturation reducing the size, number and weight of the grains and consequently reducing crop's harvests in quantity and quality (Balla et al., 2011; COPA-COGECA, 2003; Nicolas et al., 1984; Qaseem et al., 2019; Talukder et al., 2014).

In the revised version we will add the following text to the Discussion section:

"Nevertheless, the best estimates (bars in Figures 8 and A.3) show indeed that compound dry and hot extremes contribute to increased yield loss. In the general sense, the biophysiological explanation for the combination of environmental drivers leading to stronger yield reductions relates with the crop's requirements of water and thermal conditions during the key phenological stage in analysis. The selection of the climate variables during spring corresponds to the reproductive phase of the plant's and when vegetation is photosynthetically more active, and the combined effect of water and heat stress during this period is critical for crop's health leading to yield decrease. During this stage of formation of the grains the dry and hot extremes may accelerate the maturation affecting the size, number and weight of the grains and consequently affecting crop's harvests in quantity and quality (Balla et al., 2011; COPA-COGECA, 2003; Nicolas et al., 1984; Qaseem et al., 2019; Talukder et al., 2014).

References:

Balla, K., Rakszegi, M., Li, Z., Békés, F., Bencze, S. and Veisz, O.: Quality of winter wheat in relation to heat and drought shock after anthesis, Czech J. Food Sci., 29(2), 117–128, doi:10.17221/227/2010-cjfs, 2011.

Nicolas, M. E., Gleadow, R. M. and Dalling, M. J.: Effects of drought and high temperature on grain growth in wheat., Aust. J. Plant Physiol., 11(6), 553–566, doi:10.1071/PP9840553, 1984.

Qaseem, M. F., Qureshi, R. and Shaheen, H.: Effects of Pre-Anthesis Drought, Heat and Their Combination on the Growth, Yield and Physiology of diverse Wheat (Triticum

aestivum L.) Genotypes Varying in Sensitivity to Heat and drought stress, Sci. Rep., 9(1), 1–12, doi:10.1038/s41598-019-43477-z, 2019.

Talukder, A. S. M. H. M., McDonald, G. K. and Gill, G. S.: Effect of short-term heat stress prior to flowering and early grain set on the grain yield of wheat, F. Crop. Res., 160, 54–63, doi:10.1016/j.fcr.2014.01.013, 2014.

Editor. (4) Some editing would be recommended regarding:

- The renaming of “cluster” to “region” (as “cluster” does not have a strong geographical association)

- The labeling of heat percentiles in Figure 7.

Author’s Reply (4): Thank you. We will change “cluster” to “region” in the revised version and relabel the heat percentiles in Figure 7 properly, as also suggested by the reviews.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-116, 2020.

Printer-friendly version

Discussion paper