Review of "The impact of atmospheric blocking on the compounding effect of ozone pollution and temperature: A copula-based approach," by Otero et al.

In this paper, Otero et al. apply a copula-based statistical method to examine the joint dependence of temperature and surface ozone on atmospheric blocking conditions over Europe. The copula approach allowed the authors to model the dependence between two variables, independent of their marginal distributions. Using a 17-year dataset (1999-2015), the authors found that blocks enhance the probability of compound ozone and temperature events by 20% for many stations, especially in central Europe. The presence of an atmospheric block also increases the probability that either an ozone or a temperature exceedance occurs by 30%. Finally, the authors determined that in north-western Europe, given high surface temperatures, blocking increases the probability of ozone exceedances by 30%.

The represents a useful addition to the literature on the influence of meteorology on ozone and surface temperature. I recommend acceptance after key issues are addressed.

**Major comments.**

1. The authors should do more to emphasize how their work builds on that of previous work linking surface ozone over Europe to block episodes. For example, Ordonez et al. (2017) presented a detailed analysis of the impacts of high-latitude blocks on surface ozone in this region. What knowledge gaps occur in the Ordonez et al. (2017) analysis that the current paper begins to fill in?

2. The paper often lacks convincing explanations for the results that emerge from their analysis. Why is surface ozone in some regions so much more sensitive to blocking than in other regions? Do local emissions play a role or typical meteorological conditions? How do the magnitudes of extremes differ across regions and why? What role does geography play – i.e., altitude, latitude, or proximity to oceans?

3. The reader is curious whether trends in ozone, temperature, or blocking episodes have occurred over the 17-year period. Were these trends taken into account when calculating anomalies? How do such trends affect the analysis? Also, were the anomalies calculated with respect to particular days or to the entire season? Was the seasonal cycle somehow accounted for in the different variables?

4. What are the implications of the results? The discussion should consider what impacts anthropogenic climate change will have on the frequency or duration of blocking events. For example, are such events tied to what is known as Arctic Amplification, in which the decrease of the meridional temperature gradient leads to disturbances in the polar jet stream? The issue of Artic Amplification is controversial. For example, see Barnes (2013) and Mann et al. (2018).

Barnes, E .A. (2013), Revisiting the evidence linking Arctic amplification to extreme weather in midlatitudes, *Geophys Res Lett. 40,* (17), 4734–9.

Mann, M. E. (2018), Projected changes in persistent extreme summer weather events: The role of quasi-resonant amplification, *Sci. Adv, 4,* eaat3272.

5. The paper is generally well-written and clear, but lapses in English occur with a frequency of about 4-5 per page.

**Minor comments.**

Abstract. The text should state the time period examined.

Line 29. Over what region did Zhang et al. (2017) perform their analysis?

Lines 66-76. Here the authors should state more clearly how their analysis builds on previous research.

Line 114. References for the different copula functions applied (Clayton, Gumbel and Joe) would be helpful. Another useful reference for the reader unfamiliar with copula functions is Tilloy et al. (2019).

Tilloy, A. (2019), A review of quantification methodologies for multi-hazard interrelationships, *Earth-Science Reviews, 196*, 102881.

Line 117. The reader wonders why it is important to capture lower-tail dependence when the focus of the paper is on extremely high ozone and temperatures.

Line 118. The text should make clear that the best-fit copula function is chosen separately for each measurement site.

Table 1. Symbols used in this table should be defined in a footnote.

Lines 166- 167. The reader is curious if the authors took into account the long-term trends in calculating the anomalies. Also, are the anomalies with respect to particular days or to the entire ozone season? Are the values in Figure 1 the average anomalies at each site calculated over all B1 days in the 17-year time period?

Line 169. Many readers are more familiar with surface ozone reported in ppbv. The authors should consider providing approximate equivalents between μg $m^{-3}$ and ppbv in a few places.

Figure 1. The caption should indicate that these are average anomalies over the 1999-2015 period. It looks like the anomalies at all sites show statistically significant differences with the mean. Is that right? If yes, is the black contour needed?

Line 181. The text states: "The percentage of Tmax extremes coincident with blocks increases north and eastwards, [which] is consistent with subsidence processes and clear-sky radiative forcing associated with summer blocking events." This is the first of many incidences in which the text fails to really explain why spatial differences in the response to blocking arise.

Figure 2. Numbers in the color bar shows too many digits.

Lines 210-211. Why are certain copula functions exhibit the best fit for some sites, and other functions at other sites? What can we learn from the function selection?

Line 218. Not all readers will know what Benelux refers to.

Lines 233-235. In discussing the strong sensitivity of surface ozone and temperature over the UK to blocking events, the text states "our results also indicate that such combination mainly occurs under blocks likely due to the clear-sky radiative forcing as pointed out by earlier work (Brunner et al., 2017) and subsidence processes associated with the anticyclonic circulation." Again, what is special about the UK compared to other regions?

Supplement. The captions in the supplement are not very explanatory. Units are missing. Figure labels are mostly too tiny to read.