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## Reply on RC2

Chloe Brimicombe et al.

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Author comment on "Characteristics of Heatwaves in Africa: Morocco 2000 and South Africa 2015/16" by Chloe Brimicombe et al., Nat. Hazards Earth Syst. Sci. Discuss.,  
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This paper discusses heat waves in Africa, and provides a list of African heat wave events compiled from peer reviewed literature, as well as grey literature and media reports. Case studies of two heatwaves is provided, with discussion of air temperature, UTCI, and pressure systems.

Thank you for your comments.

This paper is important because the impacts of heatwaves in sub-Saharan Africa are possibly under-reported.

Yes however sub-Saharan African Heatwaves are under-reported.

Before publication, the method of the literature search needs to be more thoroughly described.

We agree and will clarify in the methods: . A systematic search was carried out using google scholar whereby chosen literature had to meet the criteria of having a focus on historic heatwaves in Africa and include either a physical characteristic of the heatwave or impact.

There are a few sentences that are confusing. The text is well organized and about the right length. It refers to appropriate related literature.

Thank you, all co-authors have read the paper again to avoid confusing sentence structure.

It is not explained how the 21 academic papers and grey literature were arrived at. Typically, if a paper relies on a systematic search of the literature, then the search engine and search terms used should be given. The reader is not able to judge whether the search was systematic or totally ad-hoc, and therefore whether or not the search is exhaustive.

As above we will clarify this.

The only rows in the table that have human impacts have a reference to CRED. Are all of the human impacts from CRED? Do none of the reports from other sources mention human impacts? If so, this should be highlighted.

They were reports that supported the evidence of impacts in em-dat and they are also referenced.

Page 14 line 236. "This is the first time heatwaves from two different African regions have been presented and compared using both their physical characteristics and reported impacts" The impacts are barely discussed in this paper. They are stated in the table, but the information comes directly from EM-DAT and no further information is added. No comparison is made between the impacts of the heatwaves.

We will add a discussion comparing the reported impacts.

Considering that our analysis shows positive anomalies in air temperature of up to 2°C and heat stress indicated by the UTCI of up to 4°C, we hypothesise that impacts of the South Africa heatwaves have been underreported. For the Morocco heatwave

the reported impacts are 4 million chickens dying leading to up to 809,000 USD of damages (table 1). Interestingly, this is the only heatwave with an economic loss associated with it. This reiterates the complexities of identify loss and damage due to heat extremes, especially for Africa where research on heat-related impacts is still limited (Campbell et al 2018).

Page 11, figure 1. During the heatwave, it does not appear that temperatures are really higher than usual in South Africa, whereas there is a high temperature anomaly over Namibia. Perhaps this is something to do with the resolution of the image, or the choice of color scale. Actual values for the temperature anomaly during the heatwave are not given in the text, and the reader is left wondering if temperatures were actually anomalously high during this period according to the reanalysis.

There is a temperature anomaly of up to 2C across parts of South Africa. We will clarify also that reanalysis will not give the same values as those reported.

Is there any reporting for this time period in Namibia? It might be good to point out the discrepancy in reporting.

Namibia is a region that we would like to look into further it is not the focus of heatwave studies or any reports we found.

The figures are quite hard to view in the format given. It is difficult to compare different time steps in the same variable as they are not adjacent. The maps are tiny, so appear low resolution in the PDF version.

This was due to NHESS peer-review requirements.

The word "mandate" is used a few times to mean a motivation for further study - I am not sure this is a correct use of the word.

We have reviewed the use of the word.

On page 3, line 66 the phrase "between 1980 and 2020 to date" is confusing. Does the author mean 2020 up to the date at which they are writing? They should instead say when that date was specifically.

We will clarify this to be up to the end of 2020.

EM-DAT is first mentioned in section 2.1, but is not defined or referenced. Thank you we have now referenced EM-DAT.

On page 4, line 90. "It [UTCI] has further been shown to be able to forecast heatwaves internationally (Pappenberger et al 2015)". The phrasing suggests that UTCI in isolation is able to create international forecasts. The referenced paper retrospectively shows that a NWP forecast of UTCI could have been used to forecast the 2010 Russia heatwave. The point is that UTCI forecasts can be used, not that UTCI produces forecasts.

Thank you we have changed the phrasing:

It has further been shown that the UTCI as a thermal index can be used to forecast heatwaves internationally (Pappenberger et al 2015)

Page 5, line 118. Hard to read sentence. "Academic Literature and reports for Africa show that 39 heatwaves are reported for somewhere in Africa almost every year since 1980." This reads as if each year 39 heatwaves are reported somewhere.

We have re-worded this sentence:

Academic Literature and reports show that 39 heatwaves have been reported since 1980 in Africa.

Page 8, in the table. "Was the warmest April to date at the time in the Sahel" is in the "Heatwave Impacts" column, it should be in the "Heatwave Characteristics" column.

Thank you this is a typo we have moved this to the correct column.

Page 12, line 205. The phrase "heat stress" is used instead of "UTCI" making it unclear what is being measured.

We have changed this to be UTCI.

Page 14 line 222, "suggesting that international databases such as EM-DAT (CRED 2020) are not accurately recording heatwaves for Africa". These other studies are not suggesting that EM-DAT is not accurate, rather that it is not complete. Harrington & Otto make no mention of accuracy.

We have changed to in-complete instead of accuracy to clarify our meaning.

Page 14 line 222. "our study supports others (i.e. Harrington and Otto, 2020; van der Walt and Fitchett, 2021) suggesting that international databases such as EM-DAT (CRED 2020) are not accurately recording heatwaves for Africa including sub-Saharan Africa only including 7 out of our 39 listed heatwaves in their records, which is less than 20%." This sentence is hard to read. Break it into two sentences.

We agree: Further, our study supports others (i.e. Harrington and Otto, 2020; van der Walt and Fitchett, 2021) suggesting that international databases such as EM-DAT (CRED 2020) are not recording all heatwaves for Africa. For Example, sub-Saharan Africa only including 7 out of our 39 listed heatwaves in their records, which is less than 20%. However, it's important to acknowledge there are some heatwave warning systems (Hafez and Almazroui 2016, Boubaker 2010) and there is some reporting

in place for African Nations that is not always captured at an international scale within reports or databases (Table 1).

Page 14, line 229. "However, there are some heatwave warning systems (Hafez and Almazroui 2016, Boubaker

Yes – Tunisia and Egypt. We have included this in the text (i.e. Tunisia and Egypt)

230 2010)" Are these systems another potential source for identifying heatwaves? Were the heatwaves in your study identified by these systems?

Page 14, line 225 to 228 repeats points already made in lines 221-224.

Thank you, we have removed this.

Page 14, line 231. "and there is some reporting in place for African Nations that is not always captured at an international scale" what is meant here by the "international scale"? Does it mean the international databases referenced above?

We mean International Databases and Reports we have now clarified this.

Page 15, line 250 - 253. The evidence provided on lines 250-252 does not directly support the hypothesis on line 253. Comparing an air temperature mortality effect with a UTCI anomaly in this way is misleading. We can see from figure 1 that the UTCI anomaly was large during the

We have clarified this so that it is not misleading. As above there is an air temperature anomaly for south Africa. In addition UTCI has been shown to cause a rise in mortality.

South Africa heatwave, but we cannot see that the air temperature anomaly is large. You should state what the air temperature anomaly was. This probably still leads to more deaths than the 11 reported.

Considering that our analysis shows positive anomalies in air temperature of up to 2°C and heat stress indicated by the UTCI of up to 4°C, we hypothesise that impacts of the South Africa heatwaves have been underreported.