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Interactive comment on "Spatiotemporal Changes of Heat Waves and Extreme Temperatures in Main Cities of China from 1955 to 2014" *by* Kuo Li and Gyilbag Amatus

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Dear reviewer,

Thanks very much for the review. The suggestions are very important for our manuscript. We have tried our best to revise the manuscript according your advices and explain the questions as much as we can. The details are listed as following which are also listed in the attached .pdf supplement file.

Best wishes,

Authors

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Discussion paper

(1) comments from Referees

The manuscript is interesting, well written, well structured and easily understood by the reader. The authors introduce Heat Wave and Hot Year Indices in order to define and study heat waves in China. The statistical methodology is relatively simple, but useful and leads to interesting conclusions. However, I think that the authors could try to link the trends in heat waves to the corresponding variations/trends in the large-scale temperature and circulation characteristics over the region. For example, they could use grid point temperature, sea-level pressure and/or geopotential height data for the lower troposphere obtained from any of the known worlwide data sets (e.g NCEP/NCAR) in order to further support the justification analysis made in the last paragraph of the discussion section. This would be useful, taking into account that meteorological data obtained from surface meteorological stations located in (or near) cities are possibly affected by urbanization. I do not suggest an extensive analysis about this issue, taking into account that this case the manuscript would become huge, but 1-2 figures and a paragraph refering to such comparison could be useful.

Minor comments:

1. Page 5, Data and Methods, lines 112-115: Please explain more analytically the procedure used for the division of China into the 8 climate regions, or alternatively provide appropriate references. 2. Pages 6-8, Data and Methods, lines 143-180: Please provide a simple sensitivity analysis of the defined indices. For example, what are the ranges of the indices' values and how are these values affected by specific changes of CD, AD etc. The authors give some answers about this issue later in the results, but in my opinion the methodology section is the proper section to analyze this. 3. Figs 3 and 6: Please explain either in the caption or in the text what are the lines, boxes, points etc. in the diagram. 4. Lines 111 and 122: The number of the titles are the same (2.2). Please correct.

(2) Author's response:

1. The related reference about the division of China into the 8 climate regions are added in the part of Data and Methods, Pages 5, lines 113-114.

2. We have added a simple sensitivity analysis of the defined indices in the part of Data and Methods, Pages 7-8, lines 156-163 and lines 190-197.

3. The explains of the lines, boxes and points in the caption and the text of Fig 3 and 6 are added in Pages 23-24, lines 566-571 and lines 583-589.

4. The numbers of the titles are corrected in Pages 5-7, line 122, line 142 and line 173.

(3) Author's changes in manuscript

According to the reviewer's suggestion, we try to link the trends in heat waves to the corresponding variations/trends in the large-scale temperature and circulation characteristics over the region. Taking into account that this case the manuscript would become huge, we do not carry out a detailed analysis on the relationship of heat waves and the large-scale circulation; there are many literatures which have done extensive analysis about this issue and revealed the driving factors of heat waves in different regions of China. So we quoted the published results in the part of Discussion, Page 16-17, lines 378-387 to clarify the control factors of spatial distribution of heat waves.

For advice 1, we have cited the reference from Yang QY et al, which introduced the method, principle and process on the division of China into the 8 climate regions. The reference is as follow:

Yang, Q.Y., Wu, S.H., Zheng, D.,: A retrospect and prospect of researches on regional physio-geographical system (RPGS), Geo. Res., 21(4), 407-417, http://doi:10.1080/12265080208422884, 2002.

For advice 2, we have added the ranges of the indices' values and how are these values affected by specific changes of CD, AD etc. The content is as follow:

For HWI, there are two extreme situations. If there are no heat waves in one year, the

value of HWI would be 1. If there are 92 continuous days of a year in which Tmax exceeds 40âĎČ, the value of HWI would reach the biggest, 33792; for the real world, the second extreme situation would rarely occur except extreme catastrophe shocking. According to the statistics from 1955 to 2014 in China, the most serious heat wave event occurred in Changsha city in 2013 for which the value of HWI is no more than 140. The value of HWI is mostly determined by the number of continuous days in which Tmax exceeds 37âĎČ, even 40âĎČ. If the extreme hot days continue longer, HWI would be more serious.

For HYI, there are also two extreme situations. If there are no heat waves or hot days in one year, the value of HYI would be 1. The value of HYI is largely determined by the value of AHWI, which would reach 33792 at most; in other word, the intensity and frequency of heat wave events in one year is bigger, the hot year index would be more severe. There is insignificant impact on HYI for discontinuous days in which daily Tmax exceeds 35âĎČ, comparing with heat wave events. According to the statistics, the hottest year is also in Changsha city in 2013, which contained the most serious heat wave event from 1955 to 2014 in China.

For advice 3, we have added explanation of the boxes, lines and points in the titles of Fig.3 and Fig.6. The content is as follow:

Fig. 3 Distribution of D35 in 29 cities from 1955 to 2014 (Green color: NE; Blue color: NW; Red color: NC; Purple color: CC; Black color: EC; Orange color: SC; Cyan color: SW; Yellow color: QT); Boxes indicate the interquartile spread (25th and 75th quantiles) with the horizontal line indicating the ensemble median and the whiskers showing the extreme range of D35 in 29 cities Notes: There are no high temperature weather in which daily Tmax exceeds 35âĎČin Kunming and Lasa cities in the past 60 years. Therefor there are 29 cities shown in this figure.

Fig. 6 Distribution of amounts and frequencies of HWs in 29 cities from 1955 to 2014 (upper graph: amounts of HWs; lower graph: Frequency of HWs. Green color: NE;

Blue color: NW; Red color: NC; Purple color: CC; Black color: EC; Orange color: SC; Cyan color: SW; Yellow color: QT); Boxes indicate the interquartile spread (25th and 75th quantiles) with the horizontal line indicating the ensemble median and the whiskers showing the extreme range of HWs frequencies and amounts in 29 cities Notes: There is no high temperature weather in which daily Tmax exceeds 35âĎČin Kunming and Lasa cities in the past 60 years. Therefor there are 29 cities shown in this figure.

For advice 4, the title “2.2 Method” has been corrected into “2.3 Method”; the title “2.2.1 Heat wave index” has been corrected into“2.3.1 Heat wave index”; the title “2.2.2 Hot year index” has been corrected into“2.3.2 Hot year index”.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-335/nhess-2019-335-AC1-supplement.pdf

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Discussion paper