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Earth System Dynamics
Discussions

Interactive comment on "Changing trends and abrupt features of extreme temperature in mainland China during 1960 to 2010" *by* S. Fang et al.

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Response to Anonymous Referee #2 Received and published: 13 June 2015 General comments: This paper analyzed trends and abrupt change points in trends in annual temperature extreme series derived from observed daily maximum and minimum temperatures at 591 Chinese stations for 1960-2010. The authors first defined four temperature indices by counting percentage of days when daily maximum (minimum) temperature exceed (below) its 99th and 95th (1st and 5th) percentiles respectively. They then analyzed trends and abrupt change points in trends for the annual series of the four indices. While I found the topic of this analysis is potentially interesting

to Earth System Dynamics readership, the paper is poorly written, lacks critical detail and pre-mutual. As a result, the paper does not appeal to have sufficient quality for publication.

A: We thank the reviewer for the feedback, we replied in green within the manuscript to the reviewer's feedback.

I have multiple concerns: 1) Methods: The authors defined four percentile-based temperature indices in a sway similar to the widely used ETCCDI indices. However, the authors did not give any detail and it is thus impossible to know exactly how these indices were calculated. Indices computed in a different manner may mean very different things (see Zhang et al. 2011). Additionally, the percentile-based temperature indices need to be carefully calculated to avoid artificial inhomogeneity (Zhang et al. 2005). For example, the ETCCDI indices software RClimDex uses data samples from a 5-day moving window centered on a calendar day to estimate the temperature percentiles and a bootstrap procedure to remove data inhomogeneity in the indices series. On the other hand, some people compute the percentiles based on all daily data within the base period. The indices computed with these two different methods mean quite different things. Unfortunately, there is no information whatsoever how the authors computed their indices, it is thus impossible to interpret the results shown in the paper. The authors also mentioned trend estimation and the estimation of change points in trends. However, the corresponding methods are equally unclear. The authors must spell other in detail how they computed the indices, and how they detected the change points, and how they tested the relevant statistical significance.

A: We thank the reviewer for the good suggestions. We have given the details about how we calculated these indices (from page 6 line 19 to page 7 line 6).

The thresholds for the temperature extremes at each station are set at the 95th & 99th percentiles of daily Tmax and at the 5th & 1th percentiles of daily Tmin. We calculated the percentile values and defined the thresholds with respect to the period of 1971−

2000 (Zhang et al., 2005;Frich et al., 2002;Zhou and Ren, 2011). In the calculation of these indices, the 95th (5th) and 99th (1st) percentiles of the daily maximum (minimum) temperature data at a certain station in the period 1971−2000 was taken as the upper (lower) threshold. If a daily maximum temperature was greater (less) than the upper (lower) threshold, then it was considered a warm (cool) day event. The largest numbers of missing data were less than 2% in all the stations, so the missing values were ignored when the percentile thresholds were estimated. According to the percentile thresholds, the temperature indices are classified as cold-related indices TN05p (cold nights) & TN01p (freezing nights) and warm-related indices TX95p (warm days) &TX99p (hot days).

2) Data: Data homogeneity issues in Chinese climate data have been carefully examined by many people. For example, Xu et al. (2013) developed a homogenized daily maximum and minimum temperature dataset at 825 stations for China. They showed that among all stations, about 43.5% and 56% of stations contain at least one shift for daily maximum and daily minimum series respectively. Other studies also find significant data homogeneity issues with Chinese temperature data. It is a surprise that the authors stated "In this study, no direct relationship between the year of data inhomogeneity and metadata was found and no adjustment was attempted for any stations." This leads me to question if the authors actually examined data homogeneity issue using RHtest or if the authors used it properly.

A: We thank the reviewer for the feedback. We fully agree with the reviewer about the importance of data homogeneity. We had described the data set so simple that the reviewer thought we had used inhomogeneity data set in previous manuscript. In fact we used a homogenized temperature data set of China. We have revised and embody the data set in detail (from page 5 lines 5-15) as followed.

It is important in observational studies that the data used are homogeneous. The National Meteorological Information Center (NMIC) of the China Meteorological Administration (CMA) developed the first national homogenized temperature data set (Li

et al., 2009) and its updated version (Xu et al., 2013). To avoiding inhomogeneity in percentile-based indices of temperature extremes, the newly homogenized data sets of daily maximum and minimum temperatures over the period from 1951 to 2010 at 825 stations were chosen for this study. By using the RHtestsV3 software package (Wang and Feng, 2010),the penalized maximum t test with the first-order autocorrelation accounted for is used to detect the change points, and the quantile-matching (QM) algorithm is used to adjust the data time series to reduce discontinuities (Xu et al., 2013).

3) Another data related question is how the authors dealt with missing values. Missing values are unavoidable from observed time series, especially for hourly or daily data. This paper only indicated that "591 stations which had good quality data were chosen to use to analyze". So how do the authors define the "good quality"? How did the percentile threshold be estimated if there are missing values in the daily temperature series?

A: We thank the reviewer for the feedback. We added the description how to choose the stations and how to How to calculate the percentile threshold (page 5 lines 15-25), as followed:

Because much missing daily data was found in some stations, especially in the years before 1960, we chose time series in the period from 1960 to 2010. Further, according to the criteria that the series length should be no less than 51 yrs and that the missing data should be no more than 2% of the data points in every year at the stations, the data of 591 stations over the period from 1960 to 2010 were ultimately selected for analysis. In the data sets of the 591 stations, a total of 34776 missing daily data, accounting for 3.16‰ of the total data, were found at 95 of the 591 stations in the period from 1960 to 2010. The largest numbers of missing data were less than 2% in every year in all the stations, so the missing values were ignored in the following analyses. The 591 stations that had good quality data were chosen for the analysis (Fig.1).

4) Language: The paper is near impossible to understand and requires very careful editing perhaps by a native speaker. The authors also did not pay enough attention to what they write in the paper. For example, in para. 3.1, the authors used “+1.8 day/10 a” or “+0.62 day/10” on linear trend without defining “10 a” or “10”. In the caption of figure 2, the text is “Time series of annual occurrences of warm days : : :: : : during1956-2010” which dataset they used is “1960-2010”.

A: We thank the reviewer for the feedback. We refine the English of the manuscript by native speaker in the Webshop of Elsevier. A more careful examination on the units throughout the text was performed. All “a” changed into “yr” ãĂĄ “5a moving average”, changed to “5-year moving average”, and changed ” 1956-2010” into ” 1960-2010”. Other mistakes were also revised after carefully checking.

Reference

Frich, P., Alexander, L. V., Della-Marta, P., Gleason, B., Haylock, M., Klein Tank, A. M. G., and Peterson, T.: Observed coherent changes in climatic extremes during the second half of the twentieth century, Climate Research, 19, 193-212, 10.3354/cr019193, 2002. Li, Q., Zhang, H., Liu, X., Chen, J., Li, W., and Jones, P.: A Mainland China Homogenized Historical Temperature Dataset of 1951–2004, Bulletin of the American Meteorological Society, 90, 1062-1065, 10.1175/2009BAMS2736.1, 2009. Wang, X. L., and Feng, Y.: RHtestsV3 User Manual, UserManual. doc., Climate Research Division, Science and Technology Branch, Environment Canada, Toronto, Ontario, Canada. 26 pp. Available online at http://cccma.seos.uvic.ca/ETCCDMI/RHtest/RHtestsV3., 2010. Xu, W., Li, Q., Wang, X. L., Yang, S., Cao, L., and Feng, Y.: Homogenization of Chinese daily surface air temperatures and analysis of trends in the extreme temperature indices, Journal of Geophysical Research: Atmospheres, 118, 9708-9720, 10.1002/jgrd.50791, 2013. Zhang, X., Hegerl, G., Zwiers, F. W., and Kenyon, J.: Avoiding Inhomogeneity in Percentile-Based Indices of Temperature Extremes, Journal of Climate, 18, 1641-1651, 10.1175/JCLI3366.1, 2005. Zhou, Y., and Ren, G.: Change in extreme temperature event frequency over mainland China, 1961-2008, Clim Res, 50,

125-139, 10.3354/cr01053, 2011.

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