Earth System
Dynamics
Discussions

Interactive comment on "Population exposure to droughts in China under 1.5 °C global warming target" *by* Jie Chen et al.

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Response to reviewer #1

Dear Editors and Reviewers:

Thank you for your letter and for the reviewer's comments concerning our manuscript entitled "Population exposure to droughts in China under 1.5°C global warming target" (ID: esd-2017-100). Those comments are all valuable and very helpful for revising and improving our manuscript. We studied comments carefully and made corrections in the manuscript. The response to the reviewer's comments are as follow:

1. Please define "risk" and "exposure" in introduction.

Authors' response: Thanks for your suggestions. We have supplemented the definition of "risk" and "exposure" in P1 Line 30 (Section 1 Introduction). The statement is: "Risk is often represented as the probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur, it results from the interaction of hazard, exposure, and vulnerability (Field et al., 2014). Therefore, exposure assessment is one of the most important aspect of disaster risk assessment. Exposure usually refers to the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected (Field et al., 2014)."

2. Rephrase P3 Line 12 to 13.

Authors' response: Thanks for your advice. The statement was rephrased to "Combined the characteristics of the Standardized Precipitation Index (SPI) (McKee et al., 1993) at multiple scales and Palmer Drought Severity Index (PDSI) (Palmer, 1965) which is sensitive to warming, SPEI was proposed by Vicente-Serrano et al. (2010)."

3. Please give more details on SPEI calculation.

Authors' response: Thank you. We have added the statement "The SPEI reflects the change in water deficit using the Log-logistic probability distribution function, and obtains the drought index value by normalized normalization." and "The radiation coefficient used is based on the radiation calibration results in China provided by Yin et al. (2008)". In Addition, detailed calculation process of potential evapotranspiration as well as procedure used to derive the SPEI and the set parameters were also supplemented in Section 2.2.

4. Please define the "Hu line" and provide a brief introduction

Authors' response: Thanks for your suggestions. We have supplemented the definition and a brief introduction of "Hu line" in Section 3.1. The statement is "(The variation in

demographic change is clear when comparing the two sides of the Hu line), which is an imaginary line that diagonally divides the area of China into two parts, stretching from the city of Heihe in Heilongjiang Province to Tengchong in Yunnan Province. It is also called the "geo-demographic demarcation line"; the west of the line occupies 56.2 % of the area of China, but only 5.9 % of the population, while the east of the line occupies 43.8 % of the area, but 94.1 % of the population (Fig. S3)." In addition, we have added the Hu line in Fig 2, Fig S3 and S4 so that the statement and figures would be easily understood.

5. P5 Line 5, two scenarios?

Authors' response: Sorry for our incorrect writing of "two scenarios". We have corrected the statement to "the reference period and the 1.5°C global warming scenario".

6. Figure 5, figure (a) and figure (b) almost the same, so I suggest to add a total number of population.

Authors' response: Thanks for your suggestions. Figure 5 shows the cumulative probability projected change drought frequency and population exposure in order to reflect the change of frequency and exposure of the three grades of droughts. Therefore, the change of population is not included. Figure (a) and figure (b) are similar because most of the probabilities of increase in frequency (a) and exposure (b) are near 50%, but there are some differences between the two figures. For example, the probability of decrease of extreme droughts in frequency and exposure is 61.77% and 71.83 % respectively. Besides, we have shown the change of population both in number and percentage in Fig S4. Of course we also think the number of population is important, the suggestion is valuable, so we added the spatial distribution of population of China in reference period in Fig S3.

7. P7 "Results suggest that reaching the 1.5°C target is a potential mechanism for mitigating the impact of climate change on droughts." It is not very clear.

Authors' response: Thanks for your comments. The statement is based on the results from our study. To make it more clear, we have rewritten this statement to "Fourth, probabilities of increasing or decreasing total drought frequency are approximately equal (49.86 % and 49.66% respectively), while the frequency of extreme drought is likely to decrease (71.83 % probability) in 1.5°C global warming scenario. Results suggest that in the 1.5°C global warming scenario, the contribution of climate change is significantly less than demographic change and drought frequency will not increase distinctly compared to reference period, which indicates that reaching the 1.5°C target is a potential mechanism for mitigating the impact of climate change on both droughts and population exposure." in Section 5.
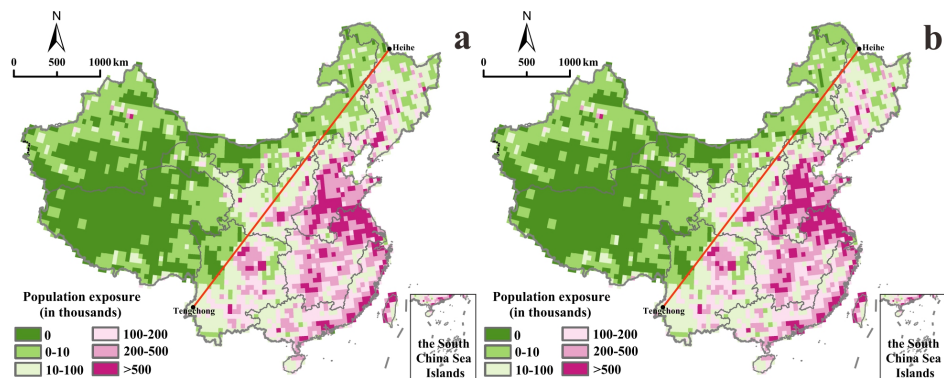
Fig. 1. Figure 2. Spatial distribution of population exposure to droughts in (a) the reference period (1986-2005) and (b) 1.5 °C global warming scenario (2020-2039 in RCP2.6).
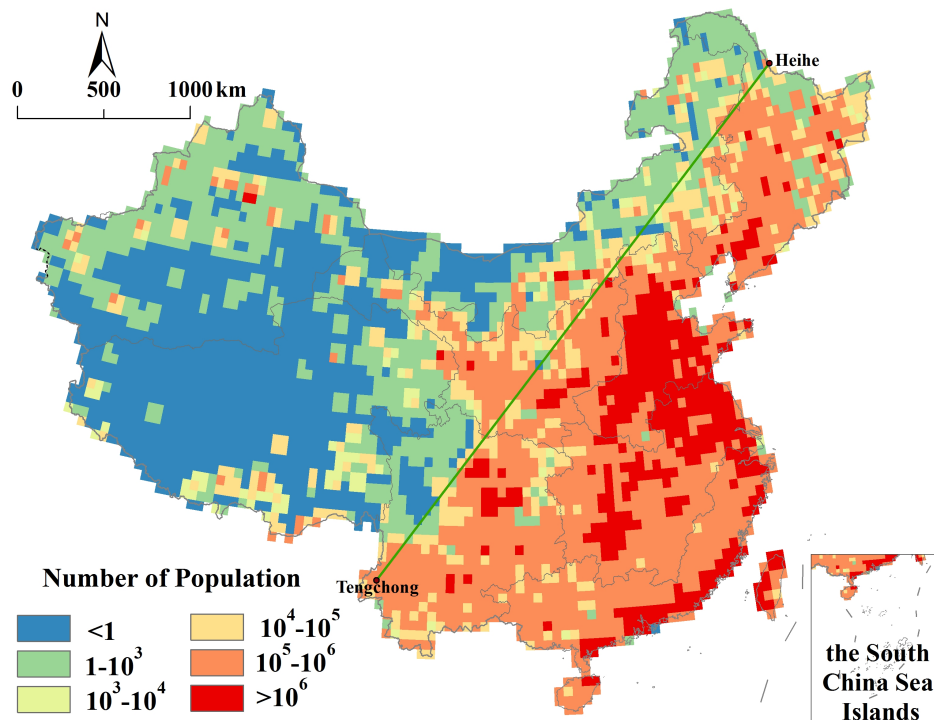
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Fig. 2. Fig. S3 Spatial distribution of population and geo-demographic demarcation line (Hu line) of China in reference period.
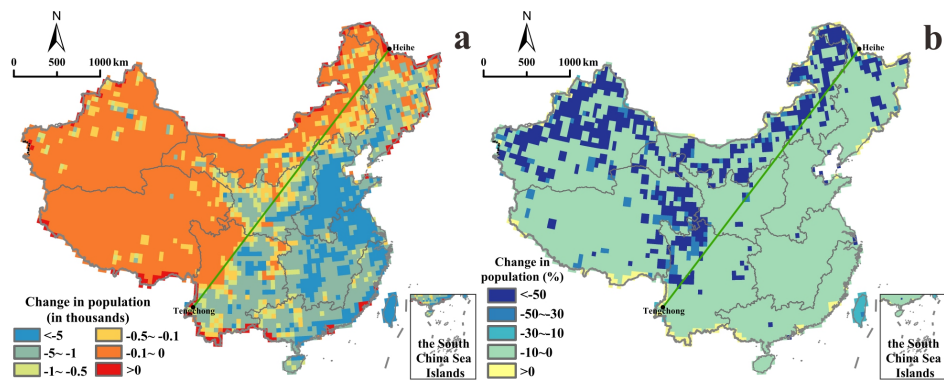
Fig. 3. Fig. S4 Change in population, in number (a) and percentage (b), between the reference period and 1.5 °C global warming scenario.

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