Electronic Supplementary Material to: Climatology of Tropical Cyclone Extreme Rainfall over China from 1960 to 2019*

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ESM to: Li, Y., and D. J. Zhao, 2022: Climatology of Tropical Cyclone Extreme Rainfall over China from 1960 to 2019. *Adv. Atmos. Sci.*, **39**(2), 320–321, https://doi.org/10.1007/s00376-021-1080-4.

In previous studies, Jiang et al. (2018) and Qiu et al. (2019) took the daily precipitation with a fixed threshold of 50mm as the criterion for TCER. Jiang and Qi (2016) used the 95-th percentile of TC rainfall as the criterion of TCER. China has vast territory with distinct climatic zones, and precipitation varies greatly in different regions. Therefore, regional differences should be taken into account when defining TCER in China. On the other hand, landfalling typhoons are often accompanied by torrential rainfall (≥50 mm). This paper aims to study those most extreme TCER cases in different regions of China. Therefore, the 99-th percentile TC rainfall is defined as the TCER, which is more stringent than the mentioned studies in terms of the selected percentile and the regional difference consideration.

Equation (1) was developed based on temperature (Bonsal et al., 2001). This formula was also used in some subsequent studies on extreme precipitation (Shi, 2021). The non-parametric method was used in this paper for the following two considerations:

(1) To keep more observational stations and obtain its extreme threshold when the sample size is smaller than 100. The threshold value of TCER obtained by the nonparametric method [Eq. (1)] is shown in Fig. 1a. There are 1572 stations. By contrast, there are only 1162 stations when using the directly retrieved 99-th percentile, as shown in the following Fig. S1.

(2) The threshold value obtained by the nonparametric method is basically the same as that obtained by the directly retrieved percentile method. Compared with Fig. 1a, the following Fig. S1 shows that the obtained extreme thresholds are consistent in spatial distribution except the former has more sites. Although there are differences in the methods for determining the threshold, there are 800 stations with the same threshold for TCER, accounting for 69% of the number of stations (1162 stations). The remaining thresholds determined by the directly retrieved percentile method were slightly smaller, with

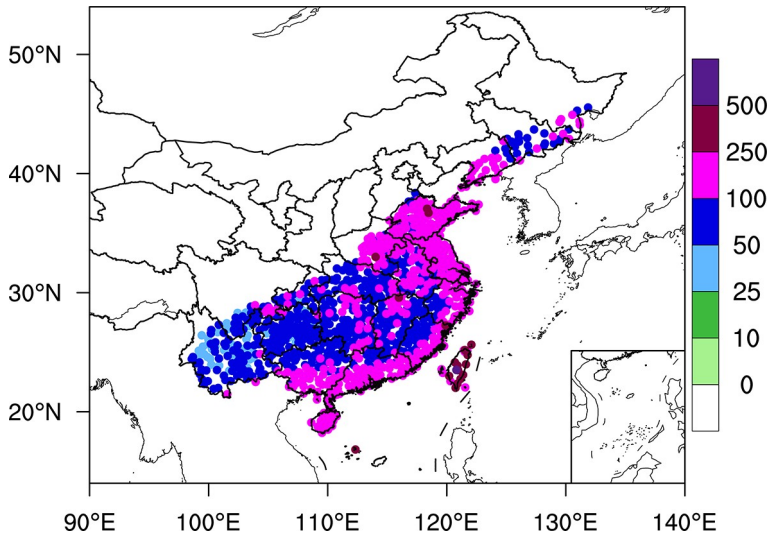

Fig. S1. Spatial distribution of the TCER threshold (mm d^{-1}) retrieved from the directly 99-th percentile method over China from 1960 to 2019.

*The online version of this article can be found at https://doi.org/10.1007/s00376-021-1080-4

217 stations (19%) having differences within 10 mm. Therefore, Eq. (1) is adopted in our study.

Taking the Sanya Station (59948) as an example, there are 1193 TC precipitation days in total, and we arranged all these TC precipitation records in ascending order, and F=99%. Then, M can be obtained through the calculation of Eq. (1), and it is 1181 and its corresponding threshold for TCER is 208.2 mm d^{-1}; If the directly retrieved percentile method is used, 1193 × 99% = 1181, thus the threshold values obtained by the two methods are basically consistent.

When the number of typhoon precipitation days is fewer than 100 days, the maximum value is generally taken according to Eq. (1). Taking the Beijing Station (54511) as an example, it has 60 days of TC precipitation in history. Here N=60, and all the TC precipitation is arranged in ascending order, F= 99%. M equals to 60 after calculation of Eq. (1) and its corresponding threshold for TCER is 156.2 mm d^{-1}.

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