

Dear reviewers and editors:

Thanks very much for your suggestive comments. We reply to them one by one as follows and modify the manuscript. These comments have significantly enhanced the scientific rigor of the manuscript. Black text is reviewer's comments and blue text is the reply.

Best wishes,

The authors

Based on the China daily-scale meteorological drought index, this manuscript revealed a double-logarithmic relationship between drought duration and occurrence frequency, and proposed that a single parameter can characterize this nonlinear feature. The findings provide quantitative evidence for water resource management, agricultural planning, and drought disaster prevention and mitigation. The following issues need to be corrected.

General comments

1. Page3: The manuscript mentions “Qinghai-Tibet Plateau (gray area in Fig. 1) region is not included in our study due to sparse station data”, and “the selected stations distribute in most regions of China except Hainan and Taiwan”. However, the impact of such exclusion on the representativeness of conclusions at the national scale was not discussed.

REPLY: The omission of observation stations on the Qinghai-Tibet Plateau has indeed constrained the investigation of drought nonlinearities in this region. However, the scarcity of high-quality, long-term observational records in these areas currently precludes their reliable inclusion; utilizing such data would likely introduce substantial uncertainty and potentially compromise the robustness of the findings. While, Taiwan and Hainan — characterized by insular climate regimes distinct from continental patterns — were excluded due to data limitations. Their exclusion is not expected to materially affect the conclusions of this study, given their climatic dissimilarity to the mainland focus. Future research may incorporate these regions as

enhanced observational capabilities and methodological advances become available.

2. Page4: Formula (2) uses \log_2 instead of natural logarithm or common logarithm. There is no justification for selecting base 2. It is recommended to briefly explain the rationale for this choice in the text or to uniformly use natural logarithm.

REPLY: This is a good question. Indeed, the study by Şişman (2020) employed the natural logarithm. However, in this manuscript, we adopt base-2 logarithm. When analyzing drought duration processes, we use x^t (where x represents either e or 2). As showing in figure 3b (as follows), when using a logarithmic function with base 2, the x-axis represents duration more precisely and clearly. When using a logarithmic function with base e , the x-axis represents duration more roughly. For other quantitative relationships in this manuscript, only the parameter values change; this does not alter the nonlinear relationship derived from the quantification.

REF: Şişman E.. Self-similar characteristics of drought duration, total deficit, and intensity curves. Arabian Journal of Geosciences. 13:8, 2020. DOI:<https://doi.org/10.1007/s12517-019-4977-9>

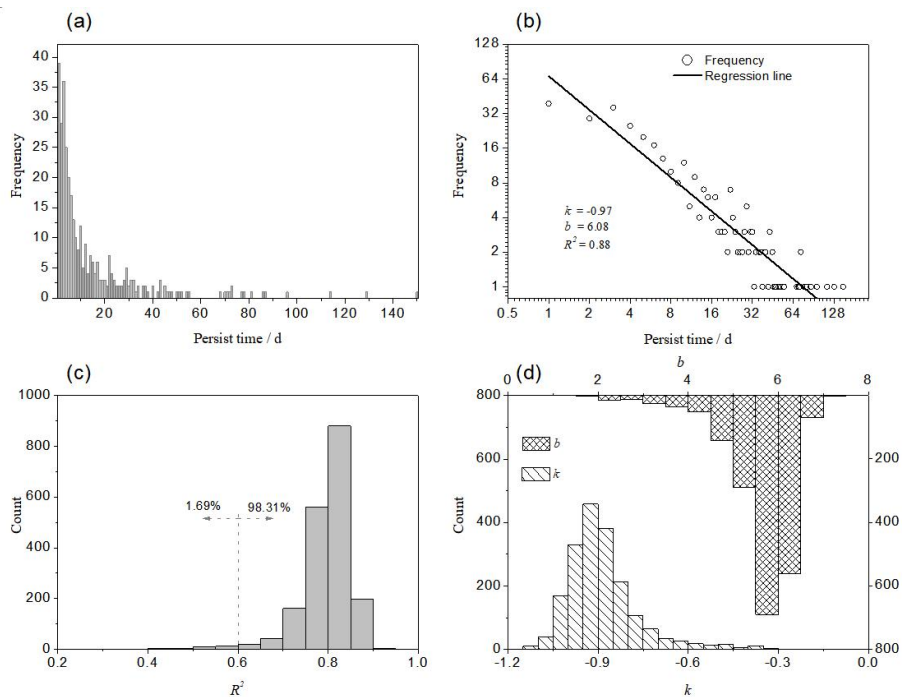


Figure 3. Linear relationship of frequency and drought duration and the PDF of parameters of relationship. (a) the frequency of drought persist time. (b) the linear relationship between the frequency and drought persist time. (c) the PDF of R^2 . (d) the PDF of parameters k and b .

3. Page12: The article states that parameter k/b can independently characterize

the relationship between drought duration and occurrence frequency (page 8), but Figure 5a shows a highly linear correlation between k and b ($R^2=0.95$). This does not imply that k itself contains all information, but rather indicates a strong linear relationship between the two. It is recommended to phrase more cautiously as “in practical applications, k can be used alone for regional comparisons.”

REPLY: Thanks for the useful suggestion. We have modified the manuscript as follows in page 12:

..., meaning that either parameter can be used independently for regional comparisons in studying the nonlinear association between drought duration and frequency.

4. Page12: In practical drought management, mild and frequent short-duration droughts have significantly different socioeconomic impacts compared to rare long-duration droughts. It is recommended to supplement the conclusions or discussion with the implications of these findings in this regard.

REPLY: In section 4 (discussion) of the original manuscript, we clearly outlined the significant implications of this conclusion. In this version, we have expanded and reinforced this perspective as follows:

Quantifying the relationship between drought duration and occurrence frequency provides critical insights for optimizing water resource management, agricultural planning, and disaster mitigation strategies, thereby enhancing societal resilience to drought impacts. In particular, the revealed nonlinear relationship not only quantifies the characteristics between drought duration and frequency, but also provides new insights for research on drought predictability and disaster severity.

Text and Formatting Issues

1. Page 2, line 35: “Generally, drought events occur on various time scales, including inter-decadal(Xu et al., 2017), inter-annua(e. g. Wang et al, 2018; Zhang et al, 2020)” → “inter-annua”should be “inter-annual”.

REPLY: We have corrected the mistake.

2. Page 2, line 45: “As it can be seen, droughts occurring on different time

scales...” → is recommended change to be “Thus, droughts occurring on different time scales...”.

REPLY: We modify the description about this part as follows.

As it can be seen, This demonstrates that droughts can occur across different time scales, with shorter drought events expected to occur more frequently, while prolonged droughts should be relatively rare.

3. Page 9, Figure 7: The title is written as “Distribution of parameter k (a) and the relationship... (a)” → The second "(a)" should be corrected to "(b)", and Figure 7b is described as Figure 7b in the main text but lacks a title. It is recommended to maintain consistency.

REPLY: We have corrected the mistake.

4. Page13-14: Some references include DOI, while others do not. It is recommended to standardize the format or complete the DOI information for all references.

REPLY: We have supplemented the DOI numbers for all references except The People's Republic of China National Standard.