Editor:

The MS is still subject to revisions and further reviewed by editor and referees.

Response: We are grateful to the editor and the reviewers for their constructive and detailed feedback, which has been invaluable in improving our work. We have carefully revised the manuscript accordingly, primarily focusing on enhancing the manuscript's clarity and providing a more thorough elaboration on the validity of our methodology.

In terms of manuscript presentation, we have made targeted adjustments to the display of figures, improving the clarity of those that were previously unclear. In the revised manuscript, we have optimized the color configuration logic for figures, simplified originally complex multi-panel figures by splitting them, and adopted a combined presentation of figures and tables to showcase research outcomes more clearly. We have also provided the original data on the simulated DFAA possibilities under natural and reservoir scenarios in the Supplementary File for readers' reference and comparison. Additionally, we aligned all paragraphs to full justification and unified the indentation of all equation numbers.

In terms of methodological validity, we have supplemented the hydrological parameters involved in calibrating the THREW model, as well as their value ranges, as presented in Table 2 of the revised manuscript. Moreover, we have elaborated on the effectiveness of the SOP operation rule in reflecting the impact of reservoirs on extreme drought and wet hydrological events We have also provided a rationale in the Supplementary File for adopting the Gamma distribution to assess DFAA events.

To enhance the readability of our response, we use black text for the feedback from editors and reviewers, blue text for our response to the comments, and red text for citations from the revised manuscript.

We trust that the revisions made to the revised manuscript will address the concerns raised by the editors and reviewers regarding the previous draft. We hold the conviction that their expert recommendations will substantially improve the quality of the paper. We would like to take this opportunity to express our sincere gratitude to the editors and reviewers again.

Reviewer #1:

This manuscript focuses on the Lancang–Mekong River Basin, an important transboundary watershed, and investigates the scientific issue of drought–flood abrupt alternation under climate change, with particular emphasis on the regulatory role of the reservoir operation. The topic is interesting, but the presentation of the content still requires improvement. My comments are as follows.

Response: We greatly appreciate your constructive comments, which are invaluable in helping us to further refine the manuscript. Please find our detailed response to your comments below.

1. **Some figures in the manuscript are densely packed with very small text, which makes them difficult to read. Moreover, many numerical values mentioned in the text are difficult to locate within the figures. In addition, when the text contains large amounts of numerical values, it becomes challenging for readers to grasp the main points the authors are trying to convey. Overall, I recommend presenting key results in tables, improving figure layouts, and, if needed, splitting complex figures to clearly highlight the main findings and enhance overall readability.**

Response: Thank you very much for your comment on figure display.

In the revised manuscript, we have fully incorporated this feedback. Specifically, we enlarged the text in the figures, added guidelines and harmonized the color scheme for the different seasons and periods. To enhance readability and facilitate information extraction, we also distinguished the legend colors for climate change and human activity impact. Additionally, the originally complex Figure 5 from the previous manuscript has been split into Table 4 and Figure 5 in the revised manuscript, providing a more organized and accessible layout. The revised Table 4 and Figure 5 are displayed as follows.

Table 4: The year-round DFAA probability averaged across five GCMs during each period under the natural scenario.

Natural	Station	History	Near Future			Far Future		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
DTF	JingHong	1.67%	2.04%	1.71%	1.63%	1.67%	1.75%	1.21%
	Nong Khai	1.52%	1.71%	2.08%	1.17%	1.96%	2.25%	1.71%
	Pakse	2.24%	2.38%	3.13%	1.83%	2.67%	2.75%	2.04%
	Kratie	2.33%	3.17%	2.83%	2.08%	3.04%	2.92%	2.54%
FTD	JingHong	0.72%	0.83%	1.17%	0.63%	0.79%	1.25%	0.54%
	Nong Khai	1.10%	1.25%	1.42%	0.71%	1.13%	1.12%	0.67%
	Pakse	2.10%	1.33%	2.04%	1.54%	1.58%	1.71%	1.17%
	Kratie	1.86%	1.71%	1.92%	1.33%	2.04%	1.87%	1.75%

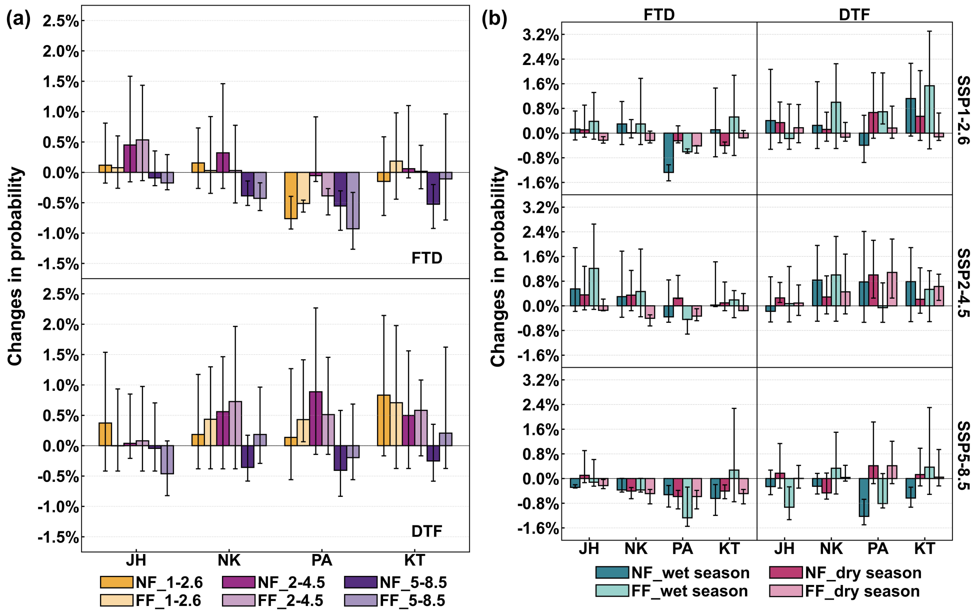

Figure 5: DFAA under the natural scenario. (a) The annual change in DFAA probability averaged across five GCMs and their ranges in the near and far future periods with respect to the history period under three SSPs. (b) The seasonal change in DFAA probability averaged across five GCMs and their ranges in the near and far future periods with respect to the history period during wet and dry seasons under three SSPs. Here, JH, NK, PA, and KT respectively denote JingHong, Nong Khai, Pakse, and Kratie stations. NF and FF represent the near future period and the far future period. 1-2.6, 2-4.5 and 5-8.5 respectively denote SSP1-2.6, SSP2-4.5, and SSP 5-8.5 scenarios. Please note that this figure illustrates variations in DFAA events under climate change. The annual and seasonal probabilities of DFAA under the natural scenario are presented in Table 4 and Table S1, respectively.

To visually highlight the differences between DTF and FTD events and the evolving patterns of the two DFAA event types over various periods, we have maintained the use of figures in the revised manuscript. Concurrently, we have listed the probabilities of DFAA events under both natural and dammed scenarios for each period in Tables S1 to S4 of the Supplementary File, thereby clarifying key numerical values and facilitating readers' access and citation. Tables S1 to S4 are presented as follows:

Table S1: The seasonal probability of DFAA under the natural scenario, averaged across five GCMs, during the history period (1980-2014), the near future (2021-2060), and the far future (2061-2100), as well as under three SSPs.

Natural	Station	History	Near Future			Far Future		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Wet season								
DTF	JingHong	2.10%	2.50%	1.92%	1.83%	1.92%	2.17%	1.17%
	Nong Khai	2.00%	2.25%	2.83%	1.75%	3.00%	3.00%	2.33%
	Pakse	3.81%	3.42%	4.58%	2.58%	4.50%	3.75%	3.00%
	Kratie	3.71%	4.83%	4.50%	3.08%	5.25%	4.25%	4.08%

FTD	JingHong	0.95%	1.08%	1.50%	0.67%	1.33%	2.17%	0.83%
	Nong Khai	1.62%	1.92%	1.92%	1.25%	1.92%	2.08%	1.25%
	Pakse	3.52%	2.25%	3.17%	3.00%	2.92%	3.08%	2.25%
	Kratie	3.14%	3.25%	3.17%	2.50%	3.67%	3.33%	3.42%
Dry season								
DTF	JingHong	1.24%	1.58%	1.50%	1.42%	1.42%	1.33%	1.25%
	Nong Khai	1.05%	1.17%	1.33%	0.58%	0.92%	1.50%	1.08%
	Pakse	0.67%	1.33%	1.67%	1.08%	0.83%	1.75%	1.08%
	Kratie	0.96%	1.50%	1.17%	1.08%	0.83%	1.58%	1.00%
FTD	JingHong	0.48%	0.58%	0.83%	0.58%	0.25%	0.33%	0.25%
	Nong Khai	0.57%	0.58%	0.92%	0.17%	0.33%	0.17%	0.08%
	Pakse	0.67%	0.42%	0.92%	0.08%	0.25%	0.33%	0.08%
	Kratie	0.57%	0.17%	0.67%	0.17%	0.42%	0.42%	0.08%

Table S2: The DFAA probability at different intensities under the natural scenario, averaged across five GCMs, during the history period (1980-2014), the near future (2021-2060), and the far future (2061-2100), as well as under three SSPs.

Natural	Station	History	Near Future			Far Future		
			SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Mild events								
DTF	JingHong	1.39%	1.63%	1.29%	1.38%	1.38%	1.46%	1.08%
	Nong Khai	1.29%	1.29%	1.21%	0.71%	1.67%	1.75%	1.38%
	Pakse	1.71%	1.67%	2.29%	1.33%	2.13%	2.00%	1.46%
	Kratie	1.39%	2.21%	1.88%	1.46%	2.38%	2.04%	1.79%
FTD	JingHong	0.52%	0.75%	1.00%	0.63%	0.75%	1.08%	0.54%
	Nong Khai	1.00%	1.08%	1.25%	0.67%	1.00%	1.00%	0.54%
	Pakse	1.90%	1.00%	1.67%	1.21%	1.42%	1.50%	1.00%
	Kratie	1.53%	1.46%	1.67%	1.29%	1.83%	1.46%	1.46%
Moderate events								
DTF	JingHong	0.19%	0.33%	0.42%	0.13%	0.21%	0.25%	0.08%
	Nong Khai	0.19%	0.29%	0.67%	0.33%	0.29%	0.42%	0.29%
	Pakse	0.38%	0.42%	0.46%	0.29%	0.42%	0.46%	0.42%
	Kratie	0.76%	0.67%	0.58%	0.50%	0.50%	0.75%	0.42%
FTD	JingHong	0.05%	0.08%	0.17%	0.00%	0.04%	0.17%	0.00%
	Nong Khai	0.14%	0.17%	0.17%	0.04%	0.13%	0.13%	0.13%
	Pakse	0.10%	0.33%	0.29%	0.33%	0.17%	0.21%	0.13%
	Kratie	0.33%	0.21%	0.21%	0.04%	0.21%	0.42%	0.29%
Severe events								
DTF	JingHong	0.08%	0.08%	0.00%	0.13%	0.08%	0.04%	0.04%
	Nong Khai	0.33%	0.13%	0.21%	0.13%	0.00%	0.08%	0.04%
	Pakse	0.67%	0.29%	0.38%	0.21%	0.13%	0.29%	0.17%
	Kratie	0.67%	0.29%	0.38%	0.13%	0.17%	0.13%	0.33%

FTD	JingHong	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Nong Khai	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Pakse	0.10%	0.00%	0.08%	0.00%	0.00%	0.00%	0.04%
	Kratie	0.10%	0.04%	0.04%	0.00%	0.00%	0.00%	0.00%

Table S3: The year-round and seasonal probability of DFAA under the dammed scenario, averaged across five GCMs, during the near future (2021-2060) and the far future (2061-2100), as well as under three SSPs.

Dammed	Station	Near Future			Far Future		
		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Year-round							
DTF	JingHong	1.17%	1.00%	0.63%	1.13%	1.33%	0.83%
	Nong Khai	1.83%	2.04%	0.92%	1.83%	1.63%	1.58%
	Pakse	2.08%	2.83%	1.54%	2.29%	2.04%	1.83%
	Kratie	2.50%	2.33%	1.58%	2.50%	2.04%	2.25%
FTD	JingHong	0.46%	0.67%	0.21%	0.42%	0.33%	0.17%
	Nong Khai	1.46%	1.46%	0.58%	1.46%	1.17%	0.46%
	Pakse	1.38%	2.13%	1.37%	1.67%	1.33%	1.00%
	Kratie	1.58%	1.75%	1.17%	1.58%	1.83%	1.54%
Wet season							
DTF	JingHong	1.92%	1.75%	1.00%	1.83%	1.75%	0.83%
	Nong Khai	2.67%	2.75%	1.25%	2.58%	2.33%	2.08%
	Pakse	3.17%	4.33%	2.58%	4.08%	3.33%	2.83%
	Kratie	4.08%	4.17%	2.67%	4.75%	3.67%	3.92%
FTD	JingHong	0.75%	1.17%	0.42%	0.75%	0.67%	0.33%
	Nong Khai	1.83%	1.58%	0.58%	2.08%	1.17%	0.83%
	Pakse	2.42%	3.25%	2.25%	2.67%	2.42%	1.83%
	Kratie	2.83%	3.17%	2.08%	2.92%	3.17%	2.83%
Dry season							
DTF	JingHong	0.42%	0.25%	0.25%	0.42%	0.92%	0.83%
	Nong Khai	1.00%	1.33%	0.58%	1.08%	0.92%	1.08%
	Pakse	1.00%	1.33%	0.50%	0.50%	0.75%	0.83%
	Kratie	0.92%	0.50%	0.50%	0.25%	0.42%	0.58%
FTD	JingHong	0.17%	0.17%	0.00%	0.08%	0.00%	0.00%
	Nong Khai	1.08%	1.33%	0.58%	0.83%	1.17%	0.08%
	Pakse	0.33%	1.00%	0.50%	0.67%	0.25%	0.17%
	Kratie	0.33%	0.33%	0.25%	0.25%	0.50%	0.25%

Table S4: The DFAA probability at different intensities under the dammed scenario, averaged across five GCMs, during the near future (2021-2060) and the far future (2061-2100), as well as under three SSPs.

Dammed	Station	Near Future	Far Future

		SSP1-2.6	SSP2-4.5	SSP5-8.5	SSP1-2.6	SSP2-4.5	SSP5-8.5
Mild events							
DTF	JingHong	0.88%	0.67%	0.50%	0.96%	1.25%	0.83%
	Nong Khai	1.42%	1.33%	0.79%	1.42%	1.21%	1.25%
	Pakse	1.29%	1.83%	1.33%	1.79%	1.42%	1.29%
	Kratie	1.42%	1.54%	1.21%	1.67%	1.50%	1.29%
FTD	JingHong	0.46%	0.63%	0.21%	0.42%	0.33%	0.17%
	Nong Khai	1.29%	1.46%	0.54%	1.38%	1.00%	0.38%
	Pakse	1.13%	1.79%	1.12%	1.50%	1.04%	0.83%
	Kratie	1.42%	1.54%	1.17%	1.37%	1.54%	1.42%
Moderate events							
DTF	JingHong	0.21%	0.33%	0.13%	0.08%	0.04%	0.00%
	Nong Khai	0.29%	0.58%	0.04%	0.42%	0.38%	0.29%
	Pakse	0.54%	0.67%	0.08%	0.42%	0.42%	0.33%
	Kratie	0.71%	0.42%	0.25%	0.75%	0.54%	0.71%
FTD	JingHong	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%
	Nong Khai	0.17%	0.00%	0.04%	0.08%	0.17%	0.08%
	Pakse	0.21%	0.25%	0.25%	0.17%	0.29%	0.13%
	Kratie	0.17%	0.17%	0.00%	0.21%	0.29%	0.13%
Severe events							
DTF	JingHong	0.08%	0.00%	0.00%	0.08%	0.04%	0.00%
	Nong Khai	0.13%	0.12%	0.08%	0.00%	0.04%	0.04%
	Pakse	0.25%	0.33%	0.12%	0.08%	0.21%	0.21%
	Kratie	0.38%	0.38%	0.13%	0.08%	0.00%	0.25%
FTD	JingHong	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Nong Khai	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Pakse	0.04%	0.08%	0.00%	0.00%	0.00%	0.04%
	Kratie	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%

2. **Section 3.4 presents extensive numerical simulation results illustrating the impact of reservoirs on drought–flood abrupt alternation. However, the representation remains largely descriptive and does not explain the underlying mechanisms, which reduces the depth and persuasiveness of the conclusions.**

Response: Thank you for your thorough review of the manuscript. We sincerely appreciate your insightful comment.

While drafting the manuscript, we structured the presentation of results and findings to guide readers from fundamental observations to deeper insights. Section 3 (Results) emphasizes a descriptive account of the findings, whereas Section 4 (Discussion) concentrates on a mechanistic interpretation of those results.

In Section 3, the descriptive elaboration serves to present the research results in an accessible manner, helping readers recognize the overall trends in DFAA events under the changing climate and fostering a factual and conceptual appreciation of reservoirs' potential role in mitigating these events.

Further interpretation of the underlying mechanism is provided in Section 4. Section 4.1 thoroughly examines the characteristics of DTF and FTD events, building on the information in Sections 3.3 and 3.4. It also clarifies why reservoirs exert different levels of control over these two types of DFAA events.

To help readers better grasp the connection between Section 3.4 and Section 4.1, we have added explanatory sentences in lines 509 to 512 of Section 3.4, which are listed below:

The distinct controlling role of reservoirs on DTF risk versus FTD risk is associated with the consistency between these two types of DFAA events and the logic of reservoir operation. Section 4.1 will delve into the mechanistic details.

We believe that through the descriptive elaboration in Section 3 and the mechanistic discussion in Section 4, readers will gain a comprehensive understanding and profound insight into two essential issues: the variation in the occurrence probability of DFAA events under climate change, and the contribution of reservoir operation to mitigating the impact of climate change on these events.

3. **Supplement to Comment 1. The presentation of Figure 3 also has issues. While it is useful for the authors to compare the effects of bias correction, panels c and f appear almost blank. I recommend improving the colorbar of the figure. In addition, the manuscript states that the original data have a precipitation bias of 1800 mm and a temperature bias of 12 ℃, which are reduced to 120 mm and 0.2 ℃, respectively, after correction. However, these specific values do not seem to be directly accessible in the figure. The authors might consider adding a table to present the key numerical values or including appropriate text annotations within the figure to help readers better understand the results.**

Response: Thank you for your detailed revision comments, which will help us enhance the intuitive expressiveness of the manuscript and raise its quality level.

In the previous version of the manuscript, we maintained identical color bars for the pre- and post-correction plots to provide readers with a direct visual comparison of the significant correction effect, and to prevent visual confusion caused by different color bars.

We appreciate your recommendation to refine the color bars. Accordingly, we have modified the color bars in sub-figures (c) and (f) of the revised manuscript. In addition, we have added labels to all sub-figures (a) through (f) to indicate the locations of the maximum and minimum values, along with their respective numerical values. We hope that these revisions make Figure 3 more informative. The revised Figure 3 is shown below.

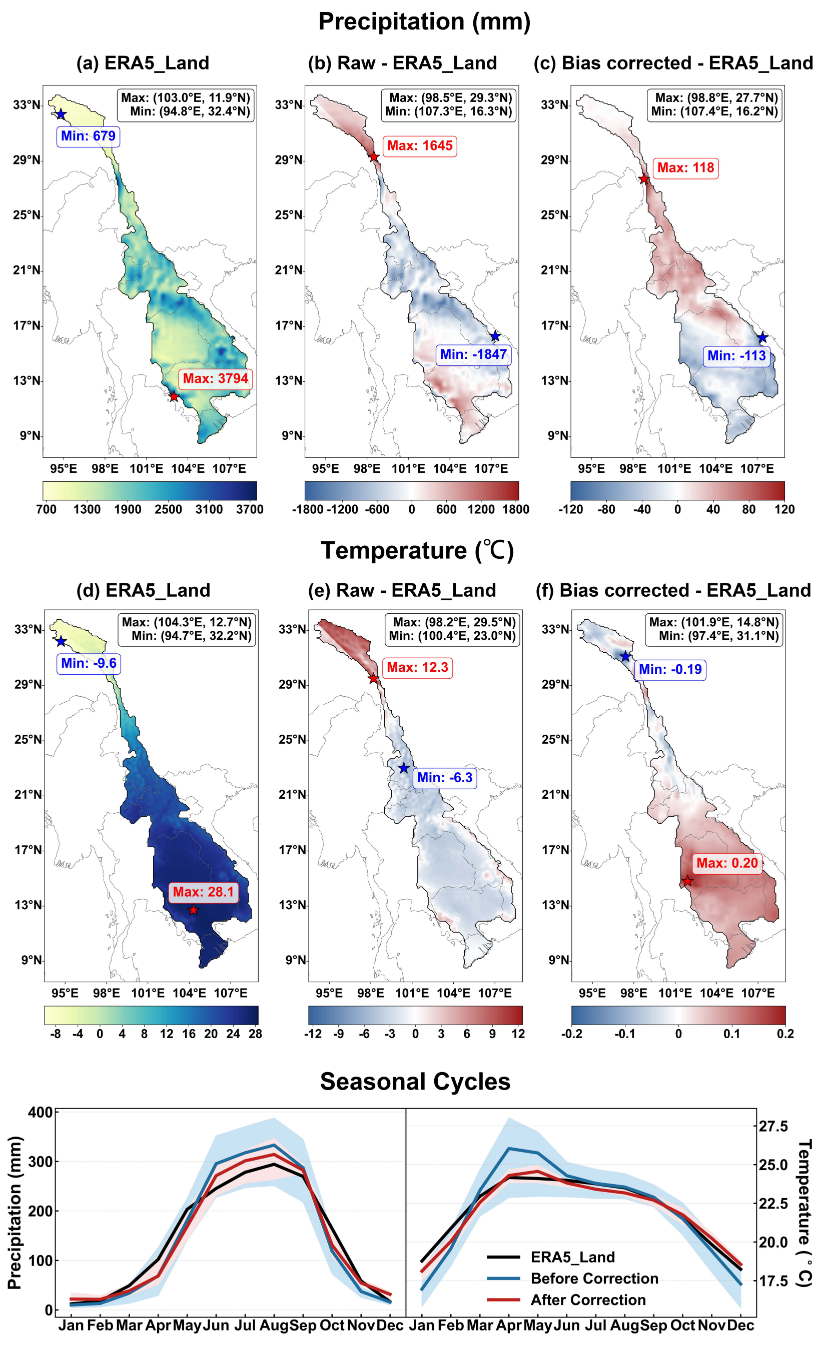

Figure 3: Averaged meteorological data of 5 GCMs for the history period (1980-2014). Here, 5 GCMs are corrected separately. The red and blue star symbols respectively indicate the locations of the maximum and minimum values in (a) to (f). (a) to (c) present the spatial distribution of precipitation based on respectively ERA5_Land, raw CMIP6 (raw CMIP6 minus ERA5_Land) and bias-corrected CMIP6 (bias-corrected CMIP6 minus ERA5_Land). (d) to (f) illustrate the spatial distribution of temperature based on ERA5_Land, raw CMIP6 (raw CMIP6 minus ERA5_Land) and bias-corrected CMIP6 (bias-corrected CMIP6 minus ERA5_Land). (g) shows seasonal cycles of temperature and precipitation from ERA5_Land, raw and bias-corrected CMIP6, as well as their corresponding range.

4. **The manuscript exhibits inconsistent formatting. For example, Section 2.3 uses left-aligned text, whereas other sections are justified, and the indentation of equation numbers on the right is also inconsistent. I recommend that the authors standardize the formatting throughout the manuscript to improve readability and professionalism.**

Response: We sincerely appreciate your attention to the formatting issues. Your rigor and thoroughness have greatly contributed to improving the manuscript quality.

The previous manuscript did have problems with its layout. This was our oversight. We are very sorry about this.

In the revised manuscript, we have carefully reviewed the entire manuscript to ensure full justification throughout. We have also corrected the indentation of each equation number to ensure consistent formatting across the manuscript.

We believe that the formatting of the revised manuscript has improved significantly. We would like to express our gratitude once again for your valuable comments.

5. **In lines 230–237, regarding the model calibration section, I recommend that the authors provide a list of the parameters to be calibrated along with their respective value ranges, so that readers can better understand the basis and scope of the model adjustments.**

Response: Many thanks for raising the question on model calibration.

We have included the hydrological parameters used for THREW model calibration in Table 2 of the revised manuscript, along with explanations of the parameters and their value ranges.

This table is also listed below for your reference.

Table 2: Calibrated hydrological parameters and their ranges.

Parameter	Explanation	Range
kv	Fraction of potential transpiration rate over potential evaporation	0-10
nt	Roughness of slope	0-2
KKA	Exponential coefficient in subsurface runoff calculations	0-100
nr	Roughness of river channel	0-1
KKD	Linear coefficient in subsurface runoff calculation	0-1
B	Shape coefficient	0-1
WM	Average water storage capacity (m)	0-5
K	Storage factor in Muskingum Method	0-1
X	Flow ratio factor in Muskingum Method	0-0.5

Reviewer #2:

Overall, I think the authors have made a valuable contribution and have responded constructively to most of the comments from previous reviewers. The study addresses an important and challenging question, and the manuscript is now clearer in both structure and narrative.

Speaking from my own experience working on climate-change impact assessments and hydrological simulations, I am very aware that this chain-type modelling framework (i.e., from GCM to hydrological model to impact indicator) requires a balance between simplicity and effectiveness. The methods need to be simple enough to keep the overall uncertainty under control, yet effective enough to capture the key mechanisms without losing physical or engineering reality. From this perspective, I have two comments for the authors' consideration.

Response: We would like to express our sincere gratitude for your supportive comments on our research. Your constructive suggestions concerning the modeling framework will substantially enhance the reliability of our research methodology. The following provides our detailed responses to your specific recommendations.

1. **First, the integration of a standard operating policy (SOP) with the hydrological model is, in my view, methodologically simple. However, it remains unclear whether this setup is also effective in capturing the key mechanisms of reservoir regulation under flood and drought conditions, and thus the essential dynamics of DFAA. The current validation focuses primarily on simulated streamflow. For a study focusing on DFAA behaviors, I would strongly encourage the authors to go one step further and validate the simulated historical R-SDFAI series themselves, rather than only the streamflow. This would greatly enhance the reliability of the modelling chain.**

Response: We are grateful for your comments concerning the validation of the simulation approach.

Our adoption of SOP operation rules to simulate reservoirs' operation and their impacts for DFAA events was guided by a prudent review of existing research. As demonstrated in the extant literature, the SOP rules effectively capture flood and drought events under reservoir operation and perform satisfactorily in the LMR Basin, which constitutes the core justification for adopting SOP in our study. For instance, Wang et al. (2017) used an SOP-based reservoir model to investigate the effects of reservoir regulation on flood frequency curves across the United States. Yun et al. (2020) utilized the VIC model integrated with SOP rules to evaluate changes in flood scale and frequency due to reservoir operations in the LMR Basin during period from 2008 to 2016. Yun et al. (2021a) assessed future extreme dry and wet events under reservoir regulation in the same basin using the VIC-SOP framework. Yun et al. (2021b) investigated trade-offs between hydropower benefits and flood control in the LMR Basin using the SOP-integrated VIC model.

We have added an explanation regarding the effectiveness of the SOP operation rules in Section 2.4, lines 272 to 274, as detailed below:

The SOP operating policy is proven to effectively capture floods and droughts under reservoir regulation (Wang et al., 2017a; Yun et al., 2020; 2021a; 2021b).

Furthermore, the THREW hydrological model has demonstrated its capacity to reliably simulate extreme wet events in natural scenarios, i.e., in the absence of the reservoir module being coupled. This assertion is corroborated by Hou et al. (2021), who utilized the THREW model to generate representative flood hydrographs at multiple recurrence intervals for major control stations in the LMR Basin.

As outlined in lines 52 to 54 of the introduction, the LMR Basin has witnessed multiple dry-season floods and wet-season droughts in recent years, thereby underscoring the basin's potential for DFAA events. However, substantiated reports or documented instances of such specific events in the LMR Basin are exceptionally scarce. It appears that they are entirely deficient, at least to our knowledge. This gap arises due to the fact that DFAA events represent an emerging field of study, with minimal prior investigation or reporting from this standpoint. In the LMR Basin, principal organizations such as the Mekong River Commission and governmental institutions have not yet incorporated DFAA monitoring into their reporting. They typically highlight the most significant annual flood and drought events rather than individual occurrences. This scarcity significantly complicates the task of validating historical DFAA occurrences and the performance of the R-SDFAI metric.

Despite these constraints, the R-SDFAI indicator remains a reliable tool for DFAA assessment. This confidence is based on the SRI's established capacity to quantify runoff deviations and represent extreme dry/wet episodes (Shukla and Wood, 2008). The R-SDFAI further enhances this by quantifying the transition intensity between SRI-derived drought and wet states to identify and probabilistically assess DFAA events (Song et al., 2023). This theoretically grounded process enables the R-SDFAI to consistently capture transitions from flood to drought events and from drought to flood events.

Reference:

Hou, S., Tian, F., Lu, Y., Ni, G., Lu, H., Liu, H., Wei, J.: Potential role of coordinated operation of transboundary multi-reservoir system to reduce flood risk in the Lancang-Mekong River basin. Advances in Water Science, 32(1), 68-78. https://doi.org/10.14042/j.cnki.32.1309.2021.01.007, 2021. (in Chinese).

Shukla, S., and Wood, A.W.: Use of a standardized runoff index for characterizing hydrologic drought. Geophys. Res. Lett. 35 (2). https://doi.org/10.1029/2007gl032487, 2008.

Song, X., Lei, X., Ma, R., Hou, J., Liu, W.: Spatiotemporal variation and multivariate controls of short-cycle drought–flood abrupt alteration: A case in the Qinling-Daba Mountains of China. International Journal of Climatology, 43(10), 4756–4769, https://doi.org/10.1002/joc.8115, 2023.

Wang, W., Li, H. Y., Leung, L. R., Yigzaw, W., Zhao, J., Lu, H., Deng, Z., Demisie, Y., Blöschl, G.: Nonlinear filtering effects of reservoirs on flood frequency curves at the regional scale, Water Resour. Res., 53, 8277–8292, https://doi.org/10.1002/2017WR020871, 2017.

Yun, X., Tang, Q., Wang, J., Liu, X., Zhang, Y., Lu, H., Wang, Y., Zhang, L., Chen, D.: Impacts of climate change and reservoir operation on streamflow and flood characteristics in the Lancang-Mekong River Basin. J. Hydrol. 590, 125472, https://doi.org/10.1016/j.jhydrol.2020.125472, 2020.

Yun, X., Tang, Q., Li, J., Lu, H., Zhang, L., Chen, D.: Can reservoir regulation mitigate future climate change induced hydrological extremes in the Lancang-Mekong River Basin? Sci. Total Environ. 785, https://doi.org/10.1016/j.scitotenv.2021.147322, 2021a.

Yun, X., Tang, Q., Sun, S., Wang, J.: Reducing climate change induced flood at the cost of hydropower in the Lancang-Mekong River Basin. Geophysical Research Letters, 48, e2021GL094243, https://doi.org/10.1029/2021GL094243, 2021b.

2. Second, compared with more traditional DFAA metrics, R-SDFAI can be considered simple as it only uses streamflow as inputs. However, some additional steps are needed to better demonstrate its effectiveness. For instance, the computation of R-SDFAI assumes a Gamma distribution for streamflow; this assumption should be supported with a statistical test for key stations and periods. Additionally, when calculating R-SDFAI in the historical period, it would be helpful to cross-check the identified major DFAA events against those documented in paper, newsletters or covered by media that led to notable socio-economic impacts. This would strengthen the claim that R-SDFAI has real engineering relevance and can inform future reservoir operation and planning.

Response: Thank you very much for your insightful suggestion concerning the validation of the R-SDFAI indicator. This recommendation has substantially enhanced the reliability of the methodological approach presented in the manuscript.

The use of indicators based on the Gamma distribution assumption to examine extreme events in the LMR Basin is a common approach. For instance, Dong et al. (2022) applied Gamma-based SPI and SPEI to analyze meteorological droughts in the basin, while Li et al. (2021) employed Gamma-based SPI and SRI to explore the linkage between meteorological and hydrological droughts in the same region.

In addition, we acknowledge the importance of investigating the hypothesis that runoff data follow a Gamma distribution. Consequently, we evaluated the runoff distribution at key mainstream hydrological stations of the LMR Basin using simulated values from the THREW model for the calibration period (2000–2009). The findings indicate that the simulated runoff follows a Gamma distribution. This provides a robust basis for using the Gamma distribution to calculate the SRI and R-SDFAI indicators. The verification process for the simulated runoff distribution has been appended to Appendix 1 of the Supplementary File, which reads as follows:

This study investigates the runoff distribution at principal mainstream hydrological stations in the Lancang-Mekong River (LMR) Basin using simulated outputs from the THREW (Tsinghua Representative Elementary Watershed) model over its calibration period (2000–2009). An evaluation of five common statistical distributions is conducted. The models under consideration are the Gamma, Log-Normal, Weibull, Generalized Extreme Value (GEV), and Log-logistic (see Fig. S1). The analysis demonstrates that the simulated runoff at the LMR Basin's four mainstream stations is most accurately represented by the Gamma distribution.

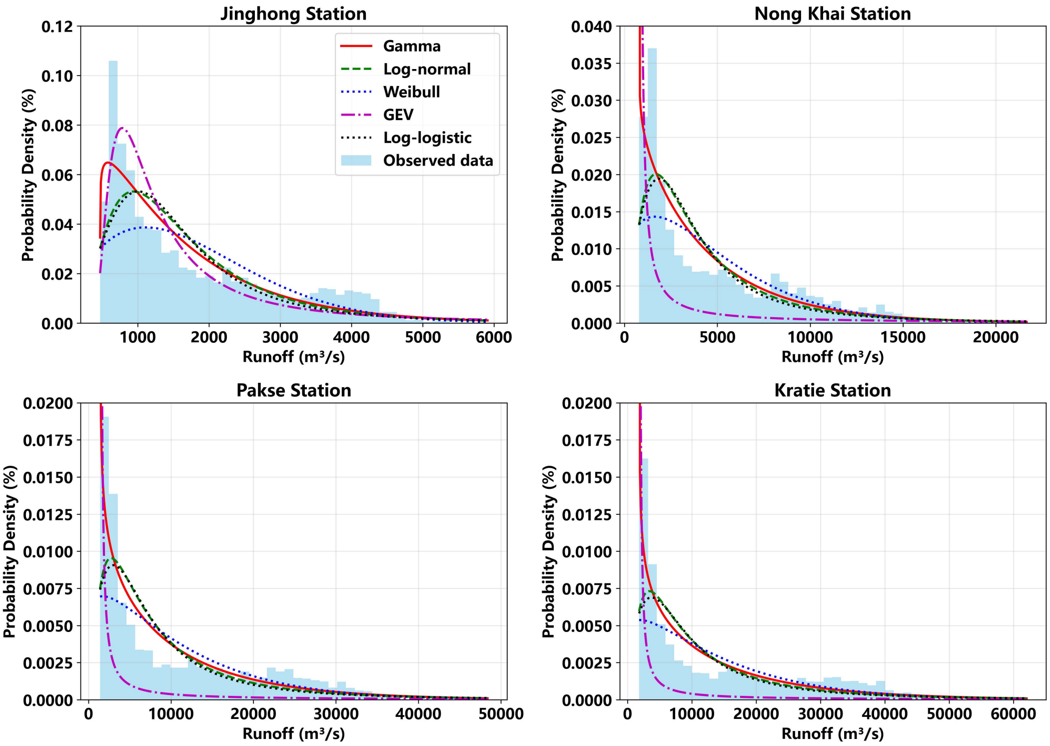

Figure S1: Distribution of simulated runoff at four major mainstream hydrological stations during the calibration period (2000-2009).

Furthermore, the Akaike Information Criterion (AIC) (Akaike, 1974) is employed in this study to identify the distribution that most accurately reflected simulated runoff in the calibration period. The AIC method is a widely utilized approach for conducting relative comparisons among multiple candidate distributions. The distribution that corresponds to the minimum AIC value is regarded as the optimal one. The calculation formula for AIC is provided in Eq. S1.

$$AIC=2k+n\ln\left(\frac{SSR}{n}\right) \quad \text{(S1)}$$

Where, k is the number of parameters n is the number of data sequences, and SSR denotes the sum of squared residuals.

The AIC values for five commonly used distributions and the empirical distribution (derived from the histogram in Fig. S1) are calculated based on the simulated runoff at four major hydrological stations during the calibration period. The results are presented in Fig. S2. It can be observed that for all four major hydrological stations, the Gamma distribution provides the closest match. Therefore, under the assumption that runoff conforms to a Gamma distribution, employing the Gamma-based R-SDFAI index to evaluate Drought-Flood Abrupt Alternation (DFAA) events in the LMR Basin is a justifiable undertaking.

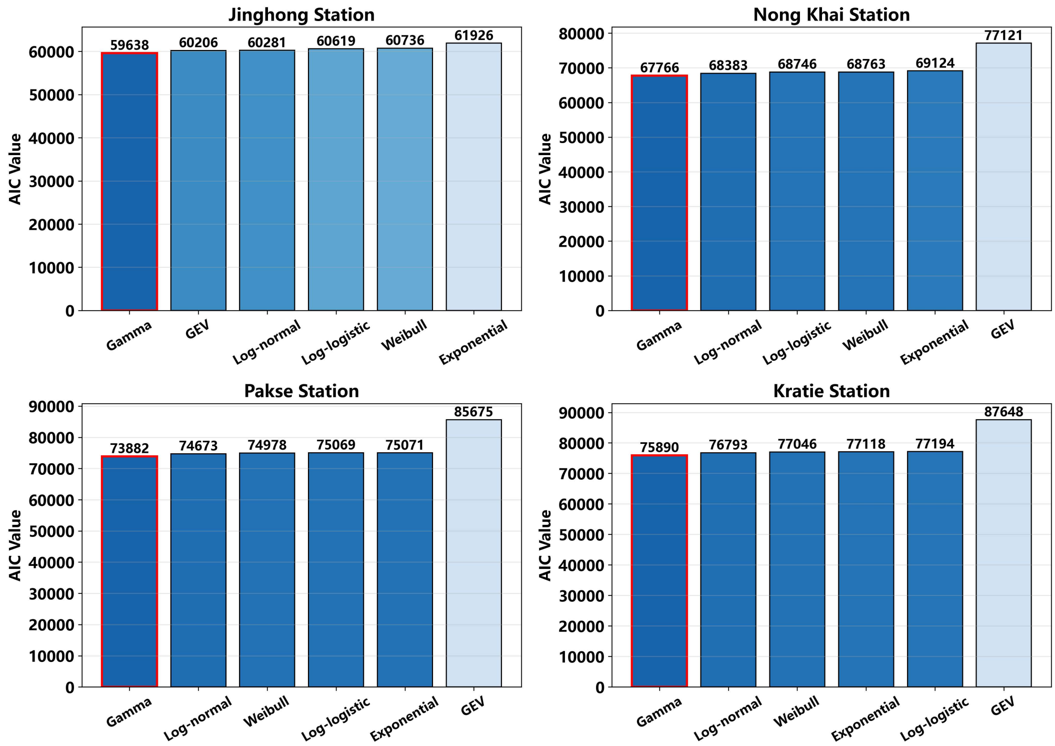

Figure S2: AIC values of five common distributions and the empirical distribution at four mainsrteam hydrological stations.

Furthermore, in lines 319 to 322 of the revised manuscript, we have elucidated the gamma-distributed nature of the simulated runoff, offering further support for the use of the gamma distribution in the index computation. The added text is presented below:

The runoff simulated by the THREW model for the LMR Basin conforms to a Gamma distribution, as detailed in Appendix 1 of the Supplementary File. Hence, the Gamma distribution is adopted to derive the SRI index.

Regarding your suggestion for cross-checking the identified major DFAA events against those documented in papers, newsletters, or covered by media, as noted in our response to Question 1, the various reports and publications currently available to us lack records or descriptions of historical DFAA events in the LMR Basin. As a result, it is challenging for us to verify the simulation results against such events. Nevertheless, as indicated in lines 77 to 83 of the manuscript, the absence of prior scientific and media attention to DFAA events in the LMR Basin highlights the importance of our work. Our work adopts the novel perspective of “DFAA (drought-flood abrupt alternation)”, revealing the trends of this distinctive extreme hydrological event under climate change in the LMR Basin. Furthermore, the study explores the potential of reservoir operations to mitigate the identified impacts. The findings of this study offer novel perspectives and profound insights to basin managers and relevant stakeholders.

Reference:

Dong, Z., Liu, H., Baiyinbaoligao, Hu, H., Khan, M., Wen, J., Chen, L., Tian, F.: Future projection of seasonal drought characteristics using CMIP6 in the Lancang-Mekong River Basin. J. Hydrol. 610, https://doi.org/10.1016/j.jhydrol.2022.127815, 2022.

Li, Y., Lu, H., Yang, K., Wang, W., Tang, Q., Khem, S., Yang, F., Huang, Y.: Meteorological and hydrological droughts in Mekong River Basin and surrounding areas under climate change, J. Hydrol.: Reg. Stud. 36, 100873, https://doi.org/10.1016/j.ejrh.2021.100873, 2021.