Response to Reviewer 1

1. **The introduction lacks sufficient discussion and comparison with recently published studies that examine the role of reservoir modules in hydrological modeling under climate projections.**

Thank you for your constructive comment. In the introduction part, we have discussed the role of reservoirs in mitigating hydrological impacts of climate change, such as controlling flood levels and reducing flood events. We will further elaborate on the functions of reservoir operation in addressing climate-related challenges in the revised version.

2. **Authors mentioned CMIP6 data collected from five GCMs, but only show the averaged meteorological data. Since each GCM may incorporate different assumptions and mechanisms for projecting climate variables, relying solely on the mean values could introduce bias or obscure important variability. If averaging is justified, please provide a clear rationale.**

We sincerely appreciate your comment. As each GCM possesses unique structure and assumptions, projections of climate change by a single GCM inherently possess uncertainties, which in turn introduce uncertainties in the simulation of hydrological outcomes (Kingston et al., 2011; Thompson et al., 2014). Thus, averaging across multiple GCMs is a crucial approach, as it minimizes model biases, eliminates outliers, reduces uncertainties, and ensures more robust and universally applicable outcomes (Lauri et al., 2012; Hoang et al., 2016; Wang et al., 2024; Yun et al., 2021b). This method has been extensively employed in prior studies (Dong et al., 2022; Li et al., 2021; Wang et al., 2022; Yun et al., 2021a). In Section 2.4, we have provided a concise overview of this method, and in the revised manuscript, we will expand on it with more comprehensive explanations. Furthermore, we will enhance the relevant results and provide a more thorough analysis of the extreme values in GCM outputs.

3. **Please list the equations to calculate the Standardized Runoff Index (SRI).**

Thank you for your comment. The formula for the Standard Runoff Index (SRI) is provided below and will be incorporated into the revised manuscript.

The probability density function that satisfies the Gamma distribution for runoff x at a given time period is:

$$g(x) = \frac{1}{\beta^{\alpha}\Gamma(\alpha)} x^{\alpha-1} e^{-\frac{x}{\beta}}, \quad x > 0$$

where, $\alpha > 0$ and $\beta > 0$ are respectively the shape and scale parameters. $\hat{\alpha}$ and $\hat{\beta}$ are the optimal values of α and β, obtained according to the maximum likelihood estimation method. $\Gamma(\alpha)$ is the gamma function.

$$\hat{\alpha} = \frac{1}{4A}(1 + \sqrt{1 + \frac{4A}{3}}$$

$$\hat{\beta} = \frac{\bar{x}}{\hat{\alpha}}$$

$$A = \ln(\bar{x}) - \frac{\sum \ln(x_i)}{n}$$

$$\Gamma(\alpha) = \int_0^{\infty} y^{\alpha-1} e^{y}\, dy$$

Where, x_i is the sample of runoff sequence, $\bar{x}$ is averaged runoff, and n is the length of runoff sequence.

Then the cumulative probability of runoff x is illustrated as follow.

$$G(x) = \int_0^{x} g(x)\, dx = \frac{1}{\hat{\beta}^{\hat{\alpha}}\Gamma(\hat{\alpha})} \int_0^{x} x^{\hat{\alpha}-1} e^{-\frac{x}{\hat{\beta}}} dx, \quad x > 0$$

4. It is unclear that how the probability calculates in equation (22).

We sincerely appreciate for your comment. The impact of reservoirs on DFAA probability in the certain period is quantified by subtracting the DFAA probability in that period under the natural scenario from that under the dammed scenario, as defined in Eq. (22). For instance, the impact of reservoir operation on DFAA during the near future can be assessed by finding the difference between the DFAA in the near future probability under the dammed scenario and that under the natural scenario.

Since this study focuses on DFAA events at the monthly scale, the probability of DFAA events during a specific period, as per Eq. (22), is determined by the ratio of months with DFAA events occurred ($|R - SDFAI| > 1$) to the total number of months in that period. More precisely, the proportion of months with DTF events ($R - SDFAI > 1$) to the total number of months signifies the probability of DTF events, whereas the proportion of months with FTD events ($R - SDFAI < -1$) to the total number of months indicates the probability of FTD events.

We will make the following adjustments to this formula in the revised version, and add detailed descriptions to enhance its clarity and precision.

$$P_{\text{Impact of Reservoirs},i,t} = P_{\text{Dammed},i,t} - P_{\text{Natural},i,t}$$

Where $P_{\text{Impact of Reservoirs},i,t}$ represents the impact of reservoirs on the probability of event t in period i. $P_{\text{Natural},i,t}$ denotes the probability of event t under the natural scenario in period i while the $P_{Dammed,i,t}$ denotes the probability of event t under the dammed scenario in period i. Period i refers to the near future period and the far future period. Event t indicates the DTF events, FTD events and DFAA events.

$P_{Natural,i,t}$ and $P_{Dammed,i,t}$ described above are calculated by the following formulas.

$$P_{Natural,i,t} = \frac{M_{Natura,i,t}}{TM_i}$$

$$P_{Dammed,i,t} = \frac{M_{Dammed,i,t}}{TM_i}$$

Where $M_{Natura,i,t}$ denotes the number of months in which event t occurs in period i under the natural scenario. $M_{Dammed,i,t}$ denotes the number of months occurred event t occurs in period i under the dammed scenario. TM_i refers to the total number of months in period i. Period i refers to the near future period and the far future period. Event t indicates the DTF events, FTD events and DFAA events.

5. While the results show changes in indicator probabilities across different scenarios and time scales, the influence of reservoir operations on DFAA remains unclear. Are the operations temporally and spatially variable? Further clarification is necessary to understand the extent and mechanism of reservoir operations.

Thanks for your comment. Reservoir operation rules remain consistent over time and space, as demonstrated in Eq. (2) - (21) within Section 2.4. The Standard Operation Policy hedging model is consistently applied to all reservoirs in the LMR Basin. The spatial distribution of reservoirs and their capacities is shown in Figs. 1a and 1c. Reservoirs mainly function as storage pools to mitigate DFAA events by controlling water storage and release. This function differently affects DTF and FTD events. During DTF events, reservoirs can release water during the drought phase and utilize low water levels to accommodate floodwaters later. However, managing FTD events presents challenges for reservoirs, as they must balance flood mitigation in the early phase with drought mitigation in the later phase. Therefore, we also further note in Section 4.2 that incorporating hydrological forecasts will improve the reservoir's ability to mitigate DFAA events. We will enhance the relevant sections in the revised version to improve readability and clarity.

6. Are the reservoirs operations the dominant factor of DFAA events in the Lancang-Mekong River Basin? Please comment it.

We appreciate your comment. According to our research findings, reservoir operation is not the dominant factor influencing DFAA events in the LMR Basin. In the natural scenario without reservoirs, DFAA will experience notable changes due to climate change, including increased annual DFAA risks under SSP1-2.6 and SSP2-4.5 scenarios, more significant increases in upstream FTD risks, and more pronounced increases in downstream DTF risks, as discussed in Section 3.3. These changes are entirely unaffected by reservoir operations. Furthermore, reservoirs significantly mitigate DFAA events, particularly by effectively reducing annual DTF risks, wet season's FTD risks, lowering the monthly probability peaks of DFAA, and decreasing the number of peak events, as described in Section 3.4. Our analysis indicates that while reservoir operations can effectively reduce the probability of DFAA events under climate change, they are not the primary factor responsible for the increase in DFAA events. We will provide further clarification on this in the revised version.

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