*A detailed, point-by-point response to the review comments is given below. Each review comment is repeated in **Bold** followed with our action to modify the manuscript. All Page and Line numbers correspond to locations in the revised manuscript.*

COMMENTS FROM EDITORS AND REVIEWERS

Dear authors,

Thank you for your submission to HESS.

After having looked at your manuscript, I would suggest for the revision phase to not only focus on statistical comparisons of the data but also to model your isotope data, e.g. see Sahraei et al. 2021 (https://www.frontiersin.org/article/10.3389/frwa.2021.652100). This would highly improve the manuscript and a potential reader circle. For now, I will open the discussion phase.

Response: We appreciate the constructive comments from the editor and have revised the manuscript accordingly. For the comments to model our isotope data, we added a new section "3.3 Model analysis" to improve the model analysis of our manuscript, and the details were shown as follows:

First, we model the hydrometeorological factors including air temperature, precipitation amount, and evaporation and precipitation isotopes in the surrounding regions based on the isotopic Atmospheric Water Balance Model (iAWBM) and the model was introduced in section 3.3: "Because the samplings of precipitation and river water and the observation of hydrometeorological factors were conducted at the Changsha site, it is necessary to verify the representation of the Changsha site in the Xiangjiang River basin. For the aims to support the foundation and reduce the uncertainty of this study, a spatial correlation analysis was conducted between the

Changsha site and the surrounding regions based on data from 1979 to 2021, including precipitation isotopes, precipitation amount, evaporation, and air temperature. The analysis employed the simulated precipitation isotope data generated by the isotopic Atmospheric Water Balance Model (iAWBM) as detailed by Zhang et al. (2015), which has a spatial resolution of 1.5° × 1.5°, while the air temperature, evaporation, and precipitation amount data from the ERA5 reanalysis dataset (https://cds.climate.copernicus.eu) published by the European Centre for Medium-Range Weather Forecasts (ECMWF), which has a spatial resolution of 1° × 1°. Overall, all the data employed in this spatial correlation analysis was integrated into a 5-day interval" (Line 207-220). The results of the iAWBM are shown in Fig. 11 below and the relevant descriptions and discussion were: "The results of spatial correlation analysis revealed a high correlation between the reanalysis data of air temperature and evaporation at the Changsha site and those in the surrounding regions, with correlation coefficients above 0.8 and $p < 0.001$ for the grid points in the Xiangjiang River basin (Fig. 11a and 11b). Furthermore, while the relationship between the reanalysis data of precipitation amount and simulated precipitation isotopes at the Changsha site and in the surrounding regions is not as strong as that for air temperature and evaporation, the correlation is still high (Fig. 11c and 11d). For instance, the correlation coefficients between the Changsha site and the grid points in the Xiangjiang River basin exceed 0.7 with $p < 0.001$ for both the reanalysis data of precipitation amount and simulated precipitation isotopes (Fig. 11c and 11d).

Overall, the high correlation coefficients for these factors support the time consistency between the Changsha site and the surrounding regions, while the high spatial consistency is characterized by the large area of the high correlation coefficients, which covers the whole Xiangjiang River basin. These may be related to the fact that the

Xiangjiang River Basin as a whole is located in the subtropical zone of southern China, which makes the meteorological elements (precipitation, evaporation, temperature) of the basin have a certain consistency. Moreover, the precipitation isotope of the basin also has a high correlation, which can be attributed to the uniform water vapor source, precipitation form, and atmospheric circulation within the Xiangjiang River basin (Zhou et al., 2019; Liu et al., 2023). These spatial correlation analyses provide support for the study basis of using the observations at the Changsha site in representative for the Xiangjiang River basin" (Line 701-723).

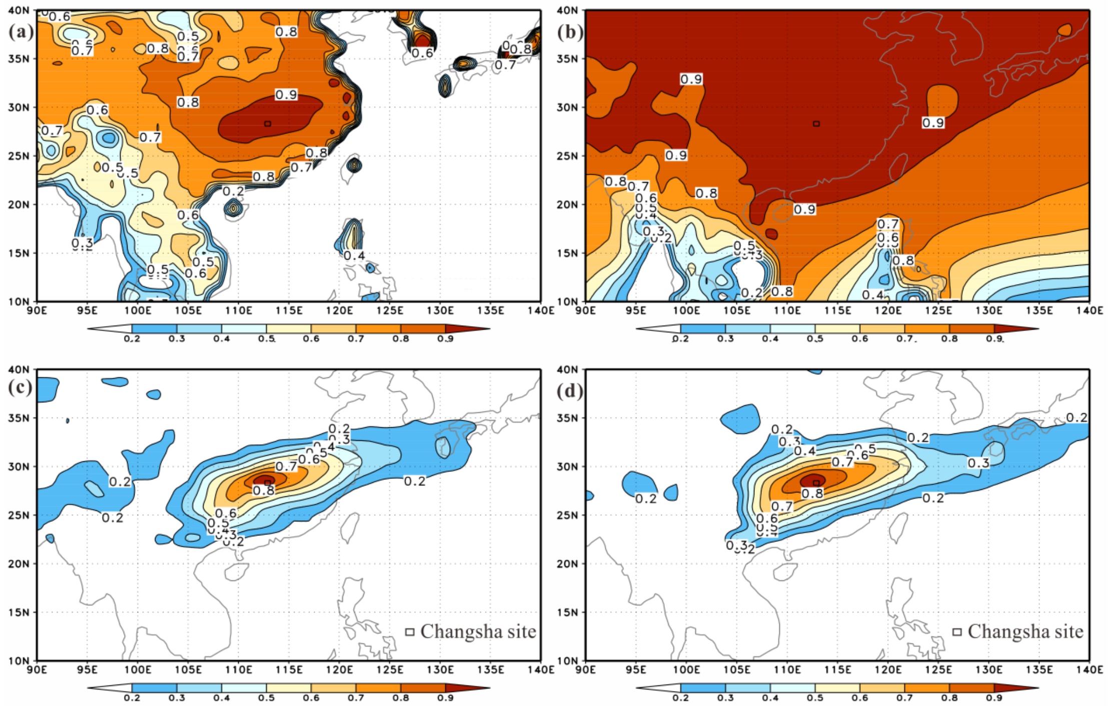

Figure 11. Spatial correlation analysis of the air temperature (a), evaporation (b), precipitation amount (c), and precipitation isotope (d) between the Changsha (CS) site and the surrounding regions at 5-day interval, this analysis employed the simulated precipitation isotope data generated by the isotopic Atmospheric Water Balance Model (iAWBM) (Zhang et al., 2015) and the air temperature, evaporation, and precipitation amount data from the ERA5 reanalysis dataset.

Second, we have published a paper, that simulates the river water isotope data through the periodic regression model, and the young water fraction, the mean residence time, and the seasonal origin of the river water were estimated throughout three hydrological years. Moreover, in another published paper, we simulated the water sources of the Xiangjiang River that originate from different flow pathways using the end-member mixing analysis and water chemistry information. However, we did not put these model analyses in this manuscript because this study mainly focused on the relationship between the river water isotopes and the hydrometeorological factors. According to the comments and suggestions from Reviewer #1, we discussed and linked more with these existing results and published papers in the results and discussion section of this paper, details can be found in the responses to Reviewer #1.

Third, for the aims to build the empirical relationships between the river water isotopes and the hydrometeorological factors and to identify the controlling factor that influences the river water isotopes, we added the Multiple Linear Regressions (MLRs) in the manuscript: "The independent variable including volume-weighted precipitation isotopes (δ^2H_P), accumulated precipitation (P), accumulated evaporation (E), changes in runoff depth (ΔR), average air temperature (T_{ave}), maximum air temperature (T_{max}), and minimum air temperature (T_{ave}) were used to build the prediction model of the dependent variable (i.e., the river water isotopes). According to the correlations between the river water isotopes and the hydrometeorological factors (Fig. 4-8), the changes in the δ^2H_R ($\Delta\delta^2H_R$) and a 15-day time interval were used as the dependent variable and the time step of all the variables in the MLRs, respectively. As indicated by the regression equations in different runoff periods (Eq. 2-5), the river water isotopes showed strong seasonality and were controlled by different factors. For instance, in the major flood period and summer drought period, the δ^2H_R usually reflected heavy precipitation inputs with depleted isotopes, as supported by the negative correlation between the $\Delta\delta^2H_R$ and ΔR or accumulated precipitation (Eq. 2 and 3), indicating the "amount effect" by the precipitation input. The "amount effect" of water stable isotopes was widely observed around the world, especially in the regions with flash input of depleted precipitation (e.g., Dansgaard, 1964; Zhou et al., 2019). Specifically, the precipitation isotopes were relatively depleted in these two periods (Fig. 3b), while the river water isotopes captured the precipitation input signal particularly when the accumulated precipitation exceeded the threshold precipitation amount (Fig. 5). Additionally, the extreme precipitation events mainly occurred in the major flood period, resulting in relatively isotope-depleted precipitation that was reflected as negative records in the δ^2H_R (Fig. 2, Fig. 10, Eq. 2).

$$\delta^2H_R \text{ in MF} = (0.098 \pm 0.012)\delta^2H_P + (0.098 \pm 0.022)E - (0.027 \pm 0.007)\Delta R - (3.01 \pm 0.861), r = 0.56, p < 0.001, n = 226 \quad (2)$$

$$\delta^2H_R \text{ in SD} = -(0.064 \pm 0.01)\Delta R - (0.02 \pm 0.008)P + (0.497 \pm 0.479), r = 0.51, p < 0.001, n = 161 \quad (3)$$

$$\delta^2H_R \text{ in RL} = -(0.041 \pm 0.008)\Delta R + (0.01 \pm 0.004)\delta^2H_P + (0.957 \pm 0.152), r = 0.29, p < 0.001, n = 384 \quad (4)$$

$$\delta^2H_R \text{ in SF} = (0.055 \pm 0.013)\delta^2H_P + (0.013 \pm 0.003)P - (0.092 \pm 0.031)T_{max} + (2.773 \pm 0.702), r = 0.43, p < 0.001, n = 155 \quad (5)$$

In the rainless period, the δ^2H_R values were more positive compared to the summer drought period (Fig. 3b), possibly influenced by the input of more enriched precipitation and evaporation enrichment along with the decreases of ΔR (Eq. 4). Besides, the δ^2H_R reached the highest positive values in the spring flood period, influenced by the precipitation input with relatively depleted isotopes (Fig. 2, Fig 3), while "inverse amount effect" and "inverse temperature effect" were found in this period, as indicated by the positive correlation between the $\Delta\delta^2H_R$ and accumulated precipitation and the negative correlation between the $\Delta\delta^2H_R$ and air temperature (T_{max}) (Eq. 5), and the reasons can be attributed to the seasonality of precipitation isotopes and air temperature as discussed in section 4.3. Overall, the river water isotopes in the Xiangjiang River basin are controlled by various complex factors in different runoff periods, while such findings in the controlling factors that influence river water isotopes may be beneficial in paleoclimate reconstruction and establishment of isotope hydrologic models" (Line 585-624).

Comments from Reviewer #1:

This study highlighted the influences of hydrometeorological factors on river water isotopes, with their effort on the long-term sampling with relatively high frequency (daily for precipitation samples and hydrometeorological factors and 5-day interval for river water spinning 13 years) and the detailed statistical interpretation, the authors identified the relationship between the hydrometeorological factors and the stable isotopes in river water. For instance, the changes in the river water isotopes are strongly influenced by the corresponding precipitation, evaporation, and runoff discharge, while the river water isotope signals may record the input of heavy and depleted precipitation input and extreme drought events. Moreover, this study found that the most depleted and enriched river water isotopes were controlled by the seasonality of precipitation isotopes and the basin wetness conditions. These findings were revealed based on the 13-year observations in the Xiangjiang River basin, which is a typical basin located in the East Asian monsoon region. Therefore, the results of this study help achieve a better understanding of the seasonal variation and influence factors of the river water isotopes, which may be a very meaningful implication for the water cycle processes and paleoclimate reconstruction in the East Asian monsoon regions. I think this is a relatively well-constructed paper that presents interesting data and reasonable analysis, thus could make a nice contribution and be of interest to many different groups ranging from hydrologists to meteorologists or even paleo-climatologist. Overall, I have some issues that need to be taken into consideration by the authors to help improve their manuscript, while this manuscript could be acceptable for publication in the Hydrology and Earth System Sciences with some moderate revisions.

Response: We appreciate the positive comments from the reviewer and have revised the manuscript accordingly, the details can be found in the responses to the specific concerns.

My specific concerns are:

I notice that the authors have published two papers that focused on the Xiangjiang River water, that is, Xiao (2022a), which used the periodic regression model to estimate the young water fraction, the mean residence time and the seasonal origin of the river water; Xiao et al. (2023) entitled "Identifying river water sources using end-member mixing analysis in a subtropical monsoon basin China", which used the end-member mixing analysis and water chemistry information to estimate the water sources of the Xiangjiang River that origins from different flow pathways. I suggest discussing and linking more with these existing results and published papers in the discussion section of this paper.

Response: We appreciate the constructive comments from the reviewer and discussed and linked more with these existing results and published papers in the result and discussion section of this paper, and the detailed descriptions and discussions were: "considering that the sampling interval for river water was set at five days, and previous studies have indicated that it may take 3-5 days for precipitation (new water) to significantly contribute to river water (Yao et al., 2016; Xiao et al., 2022a), the precipitation isotopes were volume-weighted in the 5-day interval within this study"

(Line 165-169), "This is likely due to the processes that precipitation undergoes before recharging river water, such as evaporation and mixing with older waters in the subsurface, which significantly reduce the variability in δ^2H_R (Xiao et al., 2022a; 2023)" (Line 290-293), "after precipitation falls in the basin and the new input precipitation within 5 days may influence the δ^2H_R to some extent, however, it tends to mix with old waters, such as groundwater, soil water, and river water consisting of a high proportion of older water components in the subsurface flowpaths (Xiao et al., 2023), thereby attenuating the impact of precipitation input and predominantly shape the river water isotopes" (Line 313-318), "Because of the confluence processes of the river water from upstream to downstream and the mixing processes between the new and old waters in the subsurface, river water may consist of a certain proportion of old water with a relatively long residence time (Xiao et al., 2022a; 2023), thus we analysis the relationship between the river water isotopes and the hydrometeorological factors at a longer time interval" (Line 410-415), and "as indicated by Xiao et al. (2022a; 2023), the relatively weak influence of evaporation on river water isotopes observed at short intervals (Fig. 6 and 7) can be attributed to the significant influx of precipitation input (i.e. new water) rapidly flowing into the river network, which experiences limited evaporation effects in the relatively short residence time" (Line 574-578).

Line 9-35: The authors have done a very good job of identifying the relationship between the precipitation partition and precipitation during different time intervals. Please mention these time intervals in the abstract.

Response: We appreciate the comments from the reviewer and have added the time intervals in the abstract: "This investigation involved comprehensive sampling of daily precipitation and river water with 5-day interval" (Line 11-12) and "The correlations of the δ^2H_R with corresponding hydrometeorological factors with a 5-day interval were commonly weak, due to the seasonality of precipitation isotopes and mixing of various water bodies within the basin, but the changes in the runoff (ΔR) and δ^2H_R ($\Delta\delta^2H_R$) between two contiguous samplings with 5-day or higher intervals showed significant responses to the corresponding accumulated precipitation and evaporation" (Line 18-23).

Line 125: Please include specific (and relevant) information in the current manuscript (about sample collection), do not just refer to additional work.

Response: We appreciate the comments from the reviewer and have added the specific and relevant information about the water samples collection and analysis: "To ensure proper preservation, both the river water and precipitation samples were transferred to clean, sealed, polyethylene bottles (30 ml) and stored in a refrigerator at 0 °C. However, few precipitation and river water samples were lost, resulting in some missing data. The isotopic composition of the samples was determined using the off-axis integrated cavity output spectroscopy method, specifically conducted with equipment from Los Gatos Research in the USA. The stable isotopic values are represented by the δ (per mil) value of the sample relative to Vienna Standard Mean Ocean Water (V-SMOW) as follows:

$$\delta^2 H \text{ or } \delta^{18} O = \left[R_{sample} / R_{V\text{-}SMOW} - 1 \right] ‰ \quad (1)$$

where R is the $^2H/^1H$ or $^{18}O/^{16}O$ ratio.

Comparison of the measured stable isotope values of 160 replicate samples of ultrapure water and its standard composition (known $\delta^2H = -128‰$, $\delta^{18}O = -16.3‰$ V-SMOW) showed that the measurement precision was < 1‰ for δ^2H and < 0.3‰ for $\delta^{18}O$ (Lis et al., 2008)" (Line 170-183).

Line 128-133: Why was the sampling interval 5 days? Just for logistics or was there a reason? Daily sampling is indeed challenging but is there a reason for the selection of 5 days? Depending on the precipitation amount and intensity, this 5-day sample interval likely leads to a dampening of the signal (e.g., from precipitation to the river).

Response: We appreciate the helpful comments of the reviewer. The sampling interval (5 days) was first related to the logistics and the fact that it is difficult to sample daily over 13 years. Second, the pentad (5 days) is the Chinese ancient unit of time, and the sampling date can be the 1, 6, 11, 16, 21, and 26^{th} days of the month; thus six samples were taken in each month. Moreover, the 5-day interval is reasonable because "considering that the sampling interval for river water was set at five days, and previous studies have indicated that it may take 3-5 days for precipitation (new water) to significantly contribute to river water (Yao et al., 2016; Xiao et al., 2022a)" (Line 165-168). Furthermore, we demonstrated that "the more extensive sampling of river water (e.g., daily sampling) should be conducted in future fieldwork, for the aim of a more detailed depiction and interpretation of the seasonal variation and influence factors of river water isotopes" (Line 759-761).

Line 143-144: Were snow samples collected off the ground or in a collector? How long after the event were they collected?

Response: The snowfall samples were collected using a siphon rain gauge immediately after each snowfall event, and the snow sample was transferred to the glass bottle for sealing at room temperature. Because the glass bottle is sealed and the collection process is completed quickly, the evaporation of precipitation samples is effectively prevented. We revised the related sentences to: "Snowfall samples were carefully packed in sealed plastic bags and transferred to the glass bottle, which was later melted at room temperature, because the glass bottle is sealed and the collection process is completed quickly, thus the evaporation of precipitation samples is effectively prevented" (Line160-164).

Fig. 2: The river water showed abnormally depleted signals during the summer of 2013 and 2017, while the most enriched signals of the river water isotopes occurred in the spring of 2014, what causes these? Have you mentioned or explained these extremum signals?

Response: We appreciate the helpful comments of the reviewer. The abnormally depleted signals during the summer of 2013 and 2017 were related to the input of heavy precipitation with depleted isotopes. For instance, we mentioned and explained these extremum signals: "Similarly, from June 21 to July 1, 2017, the runoff discharge and river water isotopes exhibited significant fluctuations and depletion under the influence of precipitation input (Fig. 10f). For instance, the runoff discharge increased from 3961 m^3/s to 18237 m^3/s, while the δ^2H_R decreased from −29.3‰ to −56.8‰, which represents the third lowest δ^2H_R value among the 13-year observations" (Line 534-539), "This indicates that the input of extreme precipitation leads to rapid decreases in δ^2H_R. For instance, in the extreme precipitation process of June 2011, the δ^2H_R was reduced by −15.7‰ under a precipitation input of 144.7 mm from June 5 to June 16, while the δ^2H_R decreased by −27.5‰ with a precipitation input of 487.1 mm in the extreme precipitation process from June 21 to July 1, 2017" (Line 542-546), and "When the basin is relatively dry—that is, the reserves of soil water, groundwater, and river water are limited, the river water may be influenced by a medium precipitation amount, resulting in a highly depleted river water isotope signal observed in this extended river water sample series. For instance, following a precipitation input of 53.5 mm with a δ^2H_P of −68.1‰ on August 23, 2013 (Fig. 9c), the river water isotopes exhibited a significant depletion (Fig. 9e). Notably, the δ^2H_R rapidly declined from −35.7‰ on August 21 to −63.7‰ on September 1, representing the most negative δ^2H_R value observed over the 13-year observations" (Line 553-561).

For the most enriched signals of the river water isotopes occurred in the spring of 2014, we demonstrated that "it is noteworthy that the δ^2H_R range (−63.7‰ to −21.7‰) mentioned earlier includes the most positive δ^2H_R values influenced by the extreme drought events in 2013 and 2022 (Fig. 2d), while the most isotope-enriched river water occurred on May 21, 2014 (Fig. 2d) and most isotope-enriched precipitation occurred in the spring flood period (Fig. 3b), this indicates that the input of relatively enriched spring precipitation isotopes plays a crucial role in controlling the isotopic enrichment of river water" (Line 505-511).

It is stated that because the variation of $d^{18}O$ and d^2H were similar in the river water and precipitation, only the d^2H values are discussed. Generally, just looking at $d^{18}O$ or d^2H will present a different parameter than combining them in some way. Further, the very next section explains how the bi-variate plot and water line (Figure 3) are used in the analyses, which use both $d^{18}O$ and d^2H. What analyses only use d^2H and why?

Response: We appreciate the comments from the reviewer. The title of the manuscript "Seasonal variation and influence factors of river water isotopes in the East Asian monsoon region: A case study in Xiangjiang River basin spanning 13 hydrological years" (Line 1-3) and the bi-variate plot shown in Fig. 3 indicate that both δ^2H and $\delta^{18}O$ were used and discussed in this manuscript, thus we have deleted the sentence: "Because the δ^2H and $\delta^{18}O$ of river water and precipitation samples were very similar, for the aims to keep with the previous analysis of the Xiangjiang River water isotopes (i.e. Xiao et al., 2022a) the temporal variations of δ^2H values are mainly discussed in this paper".

Line 155-160: An important aspect that puzzles me, conceptually speaking, is why no chemistry information was considered in the analysis. Even Electric conductivity or pH. Is that there were no data? Please address.

Response: We appreciate the comments from the reviewer. Water chemistry data would have been useful for identifying the major flow pathway of the catchment, the major water sources of the river water, etc. In the previous research (i.e. Xiao et al., 2023), we applied the measurements of electrical conductivity and the major ions of the different water types, and the water sources of the Xiangjiang River that origins from different flow pathways were determined by the end-member mixing analysis. However, we only have the water chemistry data throughout two hydrological years from 2020 to 2021, we did not put such data in the analysis of this manuscript because of the availability and consistency of the data.

In the correlations between the influence factors and river water isotopes, some relationships showed non-significant correlations, that is, $p > 0.05$, I strongly suggest the authors redo the statistical analysis and find the correlations with $p > 0.05$ and $p < 0.1$ because that means there is still some degree of the positive or negative correlations although non-statistically significant was found.

Response: We appreciate the constructive comments from the reviewer and redo the statistical analysis in the figures with the non-significant correlations (i.e., $p > 0.05$), please find Fig. 4, Fig.5, Fig. 6, Fig. S1, and Fig. S4 in the revised manuscript. In the main text, we revised the relevant descriptions about the revised figures: "the δ^2H_R

exhibited relatively weak correlations with the corresponding 5-day accumulated precipitations in the rainless period, major flood period, and summer drought period, as indicated by low correlation coefficient values and $p > 0.1$ (Fig. 4a, 4i, 4m)" (Line 306-309), "in the spring flood period and summer drought period, the δ^2H_R demonstrates either a highly significant ($p < 0.001$) or non-significant ($0.1 > p > 0.05$ or $p > 0.1$) positive correlation with the corresponding 5-day average air temperature and accumulated evaporation (Fig. 4g-h and 4o-p)" (Line 330-333), "these relationships may be somewhat misleading due to the positive correlation observed between the 5-day volume-weighted δ^2H_P and the corresponding average air temperature in the spring flood period ($p < 0.05$) and summer drought period ($p > 0.1$) (Fig. S1d and S1h)" (Line 356-360), "The weak correlation ($p > 0.1$) between the $\Delta\delta^2H_R$ and corresponding 5-day accumulated precipitation below the threshold value of 19.0 mm supports this observation (Fig. 5c)" (Line 394-396), "The results revealed a weak and statistically non-significant correlation ($p > 0.1$) between the $\Delta\delta^2H_R$ and corresponding accumulated evaporation at the 5-, 10-, 15-, and 20-day intervals (Fig. 6a-d)" (Line 419-422), and "according to the analysis on an annual scale based on the 13-year observations, the volume-weighted δ^2H_R values in the different runoff periods exhibited non-significant correlations ($0.1 > p > 0.05$ or $p > 0.1$) with the corresponding total precipitation, average runoff discharge, average air temperature, and total evaporation (Fig. S4)" (Line 670-674).

The authors talk about the runoff discharge data of the river. However, discharge data are not used in the analyses. Instead, runoff depth (mm) is used (e.g., Figure 8). If discharge data are available, why weren't they used here? This likely would not change the relationships much, but they would be more useful to see here. Especially as the paper is talking about the influences of river discharges on river water isotopes. Why are the discharge values explained, but not used?

Response: We appreciate the comments from the reviewer. The runoff depth (mm/d) data in the study were calculated by dividing discharge data (m^3/d) by the catchment area (m^2). The main reason for doing this was to make it easier to compare streamflow with precipitation and evaporation. We have mentioned the relevant description of the calculation of the runoff depth in section "3.2 Hydrometeorological observations": "To facilitate the comparison of runoff discharge with precipitation and evaporation, the daily runoff discharge data (in m^3/d) are normalized by dividing them by the basin area (in m^2) of the measuring cross-section. Consequently, the runoff depth (in m/d or mm/d) and runoff discharge data (in m^3/d) are computed and utilized in the subsequent analysis" (Line 201-205) and in section 5.1 "5.1 Factors that influence the seasonality in river water isotopes": "The independent variable including volume-weighted precipitation isotopes (δ^2H_P), accumulated precipitation (P), accumulated evaporation (E), changes in runoff depth (ΔR), average air temperature (T_{ave}), maximum air temperature (T_{max}), and minimum air temperature (T_{ave}) were used to build the prediction model of the dependent variable (i.e., the river water isotopes)" (Line 585-589).

Although the manuscript is generally well-written, it could benefit from thorough proofreading to fix some grammatical errors and typos. I will not list all instances here, but the authors should go through the manuscript carefully to make sure there are no grammatical errors or typos.

Response: We appreciate the comments from the reviewer and went through the manuscript and made a few revisions about grammatical errors or typos. For instance, the sentence "with the most positive and negative δ^2H_R occurring in the spring flood period and summer drought" was revised to "with the most positive and negative values occurring in the spring flood period and summer drought period" (Line 16-17); The sentence "have relatively a close slope of 8.3 and 8.05" was revised to "have relatively close slopes of 8.3 and 8.05" (Line 228); The sentence "such as groundwater, soil water, and river water consists of a high proportion of older water components in the subsurface flowpaths" was revised to "such as groundwater, soil water, and river water consisting of a high proportion of older water components in the subsurface flowpaths" (Line 315-317); We revised the "the second raw (e, f, g, and g)" in the figure caption of Fig. 4 to "the second raw (e, f, g, and h)" (Line 324); The sentence "As there is a strong consistency between evaporation and air temperature" was revised to "As there is a strong consistency between evaporation and air temperature" (Line 349-350); The sentence "exerts influence on the hydrologic and isotope mass balance of Dongting Lake" was revised to "exerts an influence on the hydrologic and isotope mass balance of Dongting Lake" (Line 627-628); The sentence "Both the δ^2H_P and δ^2H_R displayed significant seasonal variation throughout the year" was revised to "Both the δ^2H_P and δ^2H_R displayed significant seasonal variation throughout the year" (Line725-726).

Section 5.1 and 5.2: The discussion is very detailed on the environmental significance of the results obtained by the detailed statistical interpretation and well synthesize/integrate their findings with the existing findings from literature from other regions. Especially, the discussion on the potential influence of extreme precipitation or drought events on the river water isotopes and the downstream lakes will be an interesting read for the Hydrology audience.

Response: We appreciate the positive comments from the reviewer. We discussed the potential influence of extreme precipitation or drought events on the river water isotopes and the downstream lakes: "the period from late June to mid-August 2013 witnessed rare precipitation, high evaporation rates, and elevated air temperatures. Consequently, the runoff discharge gradually decreased from 2699 m^3/s on June 30 to 415 m^3/s on August 16. Simultaneously, the δ^2H_R progressively increased from −42.0% to −34.8% (Fig. 9e). Similarly, from mid-July to early November 2022, only 72.6 mm of precipitation was recorded, resulting in a gradual decline in runoff discharge until early September. In this process, the δ^2H_R increased from −53.1% on July 16 to −37.9% on September 6 (Fig. 9f). Subsequently, the Xiangjiang River maintained low runoff discharge and raised δ^2H_R levels until the end of December, and the δ^2H_R increased by up to 20.2‰ from −53.1% on July 16 to −32.9‰ on November 26, 2022 (Fig. 9f). These findings align with the results obtained in the previous section, indicating that decreases in runoff discharge and higher evaporation rates in long rainless days contribute to the gradual enrichment of river water isotopes" (Line 493-505), "This indicates that the input of extreme precipitation leads to rapid decreases in δ^2H_R. For instance, in the extreme precipitation process of June 2011, the δ^2H_R was reduced by −15.7‰ under a precipitation input of 144.7 mm from June 5 to June 16, while the δ^2H_R decreased by −27.5‰ with a precipitation input of 487.1 mm in the extreme precipitation process from June 21 to July 1, 2017" (Line 542-546) and "Through the analysis of river water isotopes and various hydrometeorological factors on a seasonal scale, it becomes evident that the $\Delta\delta^2H_R$ can reflect the corresponding accumulated evaporation and precipitation input (Fig. 5, 6, and 7) and the decline in runoff discharge (Fig. 8) at the observed time intervals. Moreover, river water isotopes entering the lakes can record signals of extreme precipitation (Fig. 10) or exhibit gradual isotopic enrichment under the influence of evaporation in relatively dry periods spanning tens of days or even several months without precipitation (Fig. 9). Besides, the isotopic characteristics of precipitation are governed by large-scale factors such as moisture sources, upstream effects, and circulation patterns, and are less influenced by local meteorological factors (Aggarwal et al., 2016; Zhou et al., 2019), thus the river water isotopes are better suited to reflect local environments. Consequently, in comparison to the isotopic characteristics of precipitation, the river water isotopes may provide valuable insights into the relationship between the proxy indicators and the local environments" (Line 637-647).

Section 5.3: In my reading process, I have always had a question, that is, the collection of precipitation samples and the observation of meteorological factors were carried out in Changsha site, while the analysis done in this paper is on the Xiangjiang River basin scale. Whether the sampling at the study site can represent the basin scale with large area has always been a problem in hydrology research, that is, downscaling or upscaling. I think this section solves this question well, at least the analysis in this paper is based on a relatively reliable basis, which may be related to the fact that the Xiangjiang River Basin as a whole is located in the subtropical zone of the southern China, which makes the meteorological elements (precipitation, evaporation, temperature) of the basin have a certain consistency.

Response: We appreciate the comments from the reviewer and added the implications of the reviewer mentioned in the manuscript as: "the scale effect and spatial heterogeneity have always been a problem in the hydrological model research (Seyfried and Wilcox, 1995; Blöschl, 2006; Pechlivanidis et al., 2011; Devia et al., 2015), for example, the representation of the observations at limited sampling sites in the whole basin scale with a large area" (Line 81-85) and "These may be related to the fact that the Xiangjiang River Basin as a whole is located in the subtropical zone of southern

China, which makes the meteorological elements (precipitation, evaporation, temperature) of the basin have a certain consistency" (Line 715-718)

Moreover, the precipitation isotope of the basin also has a high correlation, which can be attributed to the similar water vapor source, precipitation form and atmospheric circulation form with the Xiangjiang River basin. I think this and the previous comment should be described and supplemented where appropriate in the manuscript.

Response: We appreciate the constructive comments from the reviewer and added the relevant description in the manuscript: "Moreover, the precipitation isotope of the basin also has a high correlation, which can be attributed to the uniform water vapor source, precipitation form, and atmospheric circulation within the Xiangjiang River basin (Zhou et al., 2019; Liu et al., 2023)" (Line 718-721).

These are some places in the discussion section I would have liked to see statements backed by figure references and/or citations. Please go through the manuscript and improve the literature citations of this paper.

Response: We appreciate the comments from the reviewer and complemented the literature citations in the manuscript. For instance, we added the literature citations in "Conversely, as indicated by Xiao et al. (2022a; 2023), the relatively weak influence of evaporation on river water isotopes observed at short intervals (Fig. 6 and 7) can be attributed to the significant influx of precipitation input (i.e. new water) rapidly flowing into the river network" (Line 574-577), "The "amount effect" of water stable isotopes was widely observed around the world, especially in the regions with flash input of depleted precipitation (e.g., Dansgaard, 1964; Zhou et al., 2019)" (Line 598-601), and "the precipitation isotope of the basin also has a high correlation, which can be attributed to the uniform water vapor source, precipitation form, and atmospheric circulation within the Xiangjiang River basin (Zhou et al., 2019; Liu et al., 2023)" (Line 718-721).

Line 509-511: Is this a new finding by this study or it is already known from the literature?

Response: This is a general finding that was already known from the literature, thus we added relevant descriptions in the manuscript: "The "amount effect" of water stable isotopes was widely observed around the world, especially in the regions with flash input of depleted precipitation (e.g., Dansgaard, 1964; Zhou et al., 2019)" (Line 598-610).

Comments from Reviewer #2:

This study entitled "Seasonal Variation And Influence Factors Of River Water Isotopes In The East Asian Monsoon Region: A Case Study In Xiangjiang River Basin Spanning 13 Hydrological Years" reported the significant seasonal variation of River water δ^2H (δ^2H_R) with the most positive and negative δ^2H_R occurring in the spring flood period and summer drought, respectively, and generally aligned with those observed in precipitation. I found that the manuscript is interesting, and the work presented here justifies the title and objective of this research. It is therefore valuable to be published in the Journal of Hydrology and Earth System Sciences (HESS). However, a few things need to be modified before the manuscript can be revised to be accepted in HESS.

Response: We appreciate the positive comments from the reviewer and have revised the manuscript accordingly, and the details can be found in the responses to the specific comments.

Abstract needs to modify: the abstract should contain Objectives, Methods/Analysis, Findings, and Novelty /Improvement.

Response: We appreciate the constructive comments from the reviewer and revised the Abstract accordingly, the Objectives were "Seasonal variation and influencing factors of river water isotopes were investigated in the Xiangjiang River basin, located in the East Asian monsoon region" (Line 9-10); The Methods/Analysis were revised to "This investigation involved comprehensive sampling of daily precipitation and river water with 5-day interval, as well as observing hydrometeorological factors spanning 13 hydrological years from January 2010 to December 2022, combining with the temporal and spatial correlation analyses based on linear regression and the isotopic Atmospheric Water Balance Model" (Line 11-15); The Findings of this study were "River water δ^2H (δ^2H_R) exhibited significant seasonal variation, with the most positive and negative values occurring in the spring flood period and summer drought period, respectively, in align with those observed in precipitation. The correlations of the δ^2H_R with corresponding hydrometeorological factors with a 5-day interval were commonly weak, due to the seasonality of precipitation isotopes and mixing of various water bodies within the basin, but the changes in the runoff (ΔR) and δ^2H_R ($\Delta\delta^2H_R$) between two contiguous samplings with 5-day or higher intervals showed significant responses to the corresponding accumulated precipitation and evaporation. Prolonged rainless intervals with high evaporation rates in 2013 and 2022, as well as significant precipitation events in major flood periods in 2011 and 2017, had a significant impact on the δ^2H_R and runoff discharge. However, the most positive δ^2H_R values were primarily influenced by precipitation input with the most enriched isotopes in the spring flood period, while the moderately isotope-depleted precipitation during limited wetness conditions led to the most negative δ^2H_R. The spatial correlation analysis between water isotopes and hydrometeorological factors at the observing site and in the surrounding regions supported the representation of the Changsha site in the Xiangjiang River basin" (Line15-32); The Novelty/Improvement of this study were "These results underscore the potential of $\Delta\delta^2H_R$ as a proxy that reflects the seasonal variations in local environments, while caution is advised when interpreting extreme isotopic signals in river water. Overall, this study provides insights into the seasonal variation, extreme signal interpreting, and controlling factors of δ^2H_R in the study area, which was valuable for paleoclimate reconstruction and establishment of isotope hydrologic models" (Line 32-37).

In the introduction, it would strengthen the argument on the methodology if it would be clearly stated what is innovative about this specific methodological development.

Response: We appreciate the constructive comments from the reviewer and strengthened the argument on the methodology accordingly. First, we stated the application of the stable isotopic method: "the stable isotope techniques were widely used to indicate the water cycle processes (Boral et al., 2019; Xiao et al., 2020; Wu et al., 2021), find extensive application in hydrometeorology modeling and diagnosis (e.g., Aggarwal et al., 2016; Sinha et al., 2019; Zhiña et al., 2022), and in the paleoclimate reconstruction (e.g., Steinman et al., 2010; Jiménez-Iñiguez et al., 2022; Emmanouilidis et al., 2022)" (Line 61-66); Second, we introduced the linear regression that used to identify the relationship between stable isotopes in river water and specific environmental factors: "However, in regions where new water mixes thoroughly with old water, the river water isotopes exhibit dampened signals, indicating that old water dominates the composition of stream water and that the response of river water isotopes to hydrometeorological factors is sluggish (Munoz-Villers and McDonnell, 2012; Streletskiy et al., 2015). Moreover, extreme precipitation and drought events have become more frequent under the background of global climate changes, as evidenced in numerous regions worldwide (Nkemelang et al., 2018; Cook et al., 2018; Grillakis, 2019; Marengo et al., 2020; Cardoso et al., 2020). Furthermore, the scale effect and spatial heterogeneity have always been a problem in hydrological model research (Seyfried and Wilcox, 1995; Blöschl, 2006; Pechlivanidis et al., 2011; Devia et al., 2015), for example, the representation of the observations at limited sampling sites in the whole basin scale with a large area. These introduce additional complexities and uncertainty in identifying the seasonal variation and influence factors of river water isotopes on a basin scale" (Line 74-87). Therefore, we stated the innovation of this manuscript about the stable isotopic method as: "thus the interpreting of the extreme isotopic signals and the variations in river water isotopes and the representing of the site observation based on the spatial correlation analysis become necessary (Uchiyama et al., 2017; Boutt et al., 2019; Saranya et al., 2020)" (Line 87-90).

In line with the latter, also balance and articulation of the methodological approach needs to be improved so that the application can be actually demonstrative of the validity of the methodology.

Response: We appreciate the constructive comments from the reviewer and the balance and articulation of the methodological approach. First, we introduce the stable isotopic method: "due to varying degrees of evaporative enrichment and mixing processes experienced by different water bodies within a basin, the river water isotopes markedly differ from those of the precipitation input and exhibit distinct seasonality (Jiang et al., 2021; Sun et al., 2021; Das and Rai, 2022). This disparity forms the basis for employing stable isotope techniques to investigate river water generation processes in basins" (Line 56-61); Second, we introduced the model analysis method used in this manuscript: "Linear regression is an effective tool to build the empirical relationships between hydrometeorological factors and river water isotopes, while numerous empirical formulas have been developed and used for paleoclimate reconstruction and interpretation based on these empirical relationships (Kendall and Coplen, 2001; Nan et al., 2019)" (Line 70-74) and "Extensive sampling of river water with 5-day interval and daily precipitation, along with the monitoring of hydrometeorological factors, was conducted over 13 complete hydrological years from January 2010 to December 2022, while the simple and multiple linear regression was used to identify the temporal correlation between the hydrometeorological factors and the river water isotopes, and the isotopic Atmospheric Water Balance Model (iAWBM) was used to simulate the spatial distribution of the precipitation isotopes and the hydrometeorological factors such as air temperature, evaporation, and precipitation amount" (Line 107-115). Besides, in the section "3. Methods and materials", we introduced the model analysis in detail: "Because the samplings of precipitation and river water and the observation of hydrometeorological factors were conducted at the Changsha site, it is necessary to verify the representation of the Changsha site in the Xiangjiang River basin. For the aims to support the foundation and reduce the uncertainty of this study, a spatial correlation analysis was conducted between the Changsha site and the surrounding regions based on data from 1979 to 2021, including precipitation isotopes, precipitation amount, evaporation, and air temperature. The analysis employed the simulated precipitation isotope data generated by the isotopic Atmospheric Water Balance Model (iAWBM) as detailed by Zhang et al. (2015), which has a spatial resolution of 1.5° × 1.5°, while the air temperature, evaporation, and precipitation amount data from the

ERA5 reanalysis dataset (https://cds.climate.copernicus.eu) published by the European Centre for Medium-Range Weather Forecasts (ECMWF), which has a spatial resolution of 1° × 1°. Overall, all the data employed in this spatial correlation analysis was integrated into a 5-day interval.

For the aims of building the empirical relationships between the river water isotopes and the hydrometeorological factors and to identify the controlling factor that influences the river water isotopes, Multiple Linear Regressions (MLRs) were used to build the prediction model of the river water isotopes. The variables include the precipitation isotope and the hydrometeorological factors such as precipitation amount, air temperature, evaporation, and runoff. Linear regression and a stepwise regression method were applied in MLRs using SPSS for Windows Version 22.0 (SPSS Inc., SPSS Statistics 22.0). All the variables were taken as input variables and one or more independent variables were retained in the prediction models" (Line 207-229).

Please make sure your conclusions section underscores the scientific value added to your paper, and/or the applicability of your findings/results, as indicated previously. Please revise your conclusion part into more detail. Basically, you should enhance your contributions, and limitations, underscore the scientific value added to your paper, and/or the applicability of your findings/results and future study in this session.

Response: We appreciate the constructive comments from the reviewer and revised the conclusion section accordingly. First, we underscore the scientific value our findings: "The main contributions and scientific values of these findings can be concluded as follows: (1) Better than δ^2H_R, the $\Delta\delta^2H_R$ can be served as a proxy that was influenced by the local environment; (2) Caution is advised when interpreting extreme isotopic signals in river water due to complex influences of hydrometeorological factors; (3)

River water isotopes were controlled by various complex factors, which may show "amount effect" and "inverse amount effect" in different runoff periods; (4) The spatial correlation analysis based on the iAWBM confirms the representation of site observations in representative for the Xiangjiang River basin" (Line 746-753); Second, we introduced the implication of our findings for the future study: "These implications may be valuable for water stable isotopes applied in the future paleoclimate reconstruction and establishment of the isotope hydrologic models" (Line 753-755); Third, we demonstrated the limitation and the future research: "To enhance the reliability of the observations and ensure their representativeness for the entire Xiangjiang River basinstudy, further spiatial measurements of hydrometeorological factors and sampling of precipitation samples are needed within the basin itself. Furthermore, the more extensive sampling of river water (e.g., daily sampling) should be conducted in future fieldwork, for the aim of a more detailed depiction and interpretation of the seasonal variation and influence factors of river water isotopes" (Line 755-761).

That is all from my side, I would recommend this paper, to be published in HESS with all the above-mentioned revisions.

Response: We appreciate the recommendation from the reviewer and have revised the manuscript accordingly.