1. Introduction about the revision

Based on the suggestions and comments from reviewers, the paper has been substantially improved again. In this revision, a great deal of time has been spent for improving the language and general presentation. And what's more, we have carefully rested on the introduction, discussion and conclusion， according to the suggestions of reviewers. All the changes are highlighted in red.

2. Response to reviewer comments

Response to Reviewer#1

This study conducted a detailed analysis on the soil water in the Three-river Headwaters Region, including its spatiotemporal variation, water sources and influence factors. The end member mixing analysis was adopted to determine the contributions of multiple soil water sources, based on the isotope data of different water bodies. The results are based on large amount of field measurement data, and could provide useful information about the soil water in this region, making it worth publishing in HESS. However, there are some issues not clear enough to me, which should be clarified before acceptance. I also recommend to improve the English writing thoroughly with the aid of a native speaker or professional English editing service.

Thank you very much for your comments. We have spent a great deal of time for improving the language and general presentation with the help of professional English editing service.

-Introduction: Please introduce the definition and importance of soil water sources, and reduce the references not related to this topic. It seems that the authors are introducing the research background of soil water (e.g., estimation of soil water, the change of soil water under climate change), but suddenly draw the conclusion that the research on the soil water sources is important. In my opinion, they are two different issues.

Thank you very much for your comments. We have revised the introduction as suggested, focusing on the definition and importance of soil water. On the other hand, we had removed sentences and references that are not relevant to the topic. The revised introduction is as follows "Soil water is an important water resource, forming a link between precipitation, surface water, and groundwater, and is an essential component in the formation, transformation, and consumption of water resources. It substantially impacts regional water resource distribution patterns, the ecosystem, and river runoff as key factors in terrestrial hydrological cycles and environmental succession (Gao et al., 2017; Sazibet et al., 2020; Hai, 2020; Liu et al., 2023). Soil water plays a fundamental role in controlling the exchange of water and heat between the land surface and atmosphere, which has been widely applied to study regional microclimates, energy, and material balance, and global climate change (Spennemann et al., 2017; Sprenger et al., 2017; Lin et al., 2023). Moreover, soil water is directly involved in physiological activities and promotes productivity and carbon sequestration capacity. It is sensitive to the interactions between soil and vegetation that alters soil physicochemical properties, internal structures, and material composition (Marchionni et al., 2021). Consequently, soil water sources can be affected by many factors, such as climate, vegetation, soil type, and topography (Martinez Garcia et al., 2014; Sun et al., 2023). Understanding the spatial-temporal changes in soil water sources is essential for better protection of water and the environment. Thus, studying soil water sources has become a hot topic in international hydrology and soil science.

Research on soil water has progressed in a series of studies related to hydro-meteorological, hydro-climatological, ecological and biogeochemical processes. Permafrost can affect inter-annual changes in soil water, and its degradation, including the increasing active layer thickness and disappearance, would decrease ecosystem resilience (Liu et al., 2021; Zachary et al., 2013). Soil water has also been extensively studied in the Three-Rivers Headwater Region (TRHR) (Li et al., 2020; Wang et al., 2012; Song et al., 2019). Cao and Jin (2021) analyzed the distribution characteristics of soil water and its relationship with temperature and precipitation in the TRHR. Precipitation has a more pronounced impact on soil water in the alpine steppe compared to the alpine meadow, particularly in lower-altitude areas (Li et al., 2022). Chen et al. (2021) constructed the spatial-temporal changes in soil water and its influencing factors from 2003 to 2020. Huang et al. (2022) studied the variation of surface soil water in an alpine meadow with different degradation degrees in the study region. Xing et al. (2016) analyzed the groundwater storage changes and their influence on soil water in the TRHR. Guo et al. (2022) concluded that the main factors influencing soil water changes in the headwater region of the Yellow River were the normalized vegetation index (NDVI) and precipitation, followed by air temperature and wind speed. Land degradation significantly reduced soil water by 4.5-6.1% at a depth of 0-100 cm and increased the annual mean soil surface temperature by 0.8 °C under global warming in this region (Xue et al., 2017).

The TRHR is undergoing a glacier retreat, permafrost degradation, precipitation increase, snowfall decrease, water conservation decrease and soil erosion intensification with global warming (Li et al., 2021a, b). These changes have caused large fluctuations in soil water, bringing great uncertainty to vegetation growth and causing challenges in vegetation restoration. Thus, there is an urgent need to quantify soil water sources to improve the effectiveness of ecological restoration in permafrost regions.

However, field observations are too sparse to satisfy the need for quantifying soil water sources in the TRHR. As natural tracers, stable isotopes can be applied in water cycle studies to trace precipitation, soil water, groundwater, and plant water (Zhang et al., 2017; Wang et al., 2018; Yang et al., 2019; Li et al., 2022; Wang, 2021). Monitoring the stable isotope characteristics of soil water could provide information about water sources, changes in soil water, and moisture cycling (Sprenger et al., 2017). Using 2451 samples of soil water, precipitation, river water, ground ice, supra-permafrost water, and glacier snow meltwater collected in June, August, and September 2020, this study (a) analyzed the spatiotemporal distribution of δ^2H and $\delta^{18}O$ in soil water at different ablation stages; (b) determined the hydrological processes of soil water and its variation; (c) quantified the major sources and their contributions to soil water; and (d) confirmed the corresponding implications for ecosystem protection. The result presents new observational evidence of soil water sources in the "Chinese Water Tower." It provides a scientific basis for establishing a complex interplay between soil, water and vegetation as a theoretical basis for developing water-soil conservation and vegetation restoration programs in cold regions, especially in the permafrost region."

-Method: The definition of soil water sources is confusing. The authors collected soil water, precipitation, ground ice, river water, supra-permafrost water and glaciers snow meltwater, but only calculated the contributions of precipitation, ground ice and glaciers snow meltwater in the results section. So was the isotope data of river water and supra-permafrost water used in the calculation? Please clarify.

Thank you very much for your comments. River water and permafrost water are used to help us determine the relationship and transformation of various water bodies in the study region. For example, in Figure 5, through the clustering relationship of stable isotopes for water bodies, we can better identify the relationship between water bodies and verify the rationality of the research results through this relationship. At the same time, we will also elaborate on the role of such data in the revised manuscript.

Discussion:

- The authors calculated the correlation between soil moisture and meteorological/vegetation variables in this section, which is not clear to me. If I understand correctly, the soil moisture data was obtained by measuring the soil samples. However, the soils were sampled in a spatially distributed way, which means that they were sampled at several sites in a one-time field work, rather than sampled continuously during a long period, so there is only one soil moisture data in each site/grid in one month. It is confusing for me how to calculate the correlation between the one-time soil water data and the continuous meteorological/vegetation data. Please clarify this in the method section.

Thank you very much for your comments. Although we sampled in a one-time field work, however, our sampling points (2451 samples) cover almost the whole area of the study area. More importantly, we will measure the corresponding soil temperature, soil moisture and other data when collecting each soil sample. In other words, all data, including soil stable isotopes, soil temperature, soil moisture are contemporaneous on points, but we have many of these points, so we put them in one space and did their correlation.

- The authors described the correlation analysis results in details in this section. However, given that this paper focused on the soil water sources, I think there should be discussions about the relations between the isotope-based results and the correlation analysis results. Meanwhile, the connection between the water source results and the implications on vegetation restoration is not clear. I suggest the authors to do some analysis on the influence of soil water sources on vegetation, to combine them together.

Thank you very much for your comments. We have supplemented the relations between the isotope-based results and the correlation analysis as you suggested on the one hand. On the other hand, the relevant analysis is supplemented about the influence of soil water sources on vegetation. The revised discussion section is as follows "The above analysis shows that there are multiple sources of soil water. For the same reason, various factors influence soil water sources, including temperature, precipitation, vegetation, evapotranspiration, and the freeze-thaw cycle. As mentioned above, soil water is mainly recharged by precipitation and ground-ice meltwater. The amount of ground ice is challenging to measure, but it can be estimated by high or low ground temperatures. As supplemental Fig. 1 shows, spatial correlations of soil moisture with air and ground temperatures were analyzed during the sampling period. Interestingly, there was a positive correlation in the early ablation period because the active layer of permafrost was in the process of melting. The higher the ground temperature, the faster the ground ice melts, causing an increase in soil water, especially at lower altitudes. The liquid water produced by ground ice melting and the snow meltwater on the surface would move down to the upper limit of permafrost, and the precipitation will also move downward when the active layer completely melts, which increases the soil water in the active layer (Jiao et al., 2014). Liquid soil water increased in the cold months under increasing soil temperature and ground ice melting, while changes in the warm months were the results of competition between positive precipitation and adverse soil temperature effects in permafrost regions (Lan et al., 2015). The active permafrost layer melted slowly at higher altitudes, and evaporation increased with higher ground temperatures. Wen et al. (2020) also reported that temperature increases reduced the shallow soil water in cold regions. In the heavy ablation period, soil water exhibited a clear negative correlation with ground temperatures, with the end of thawing the active permafrost layer and the weakening effect of permafrost ground ice on soil water, and the higher the temperature, the stronger the evaporation and lower the soil water. Most regions displayed a clear positive correlation in September, with only a few lower-altitude areas showing a negative correlation. Two phenomena can account for this: (1) the top layer of soil at higher altitudes starts to freeze at night and thaws during the day, thus increasing soil water; (2) soil water at lower altitudes is affected by evaporation and decreases again. These facts also indicate that changes in freeze-thaw processes have an important influence on the evolution of soil water. During the thawing phase of the active permafrost layer, the increase in precipitation or soil water led to an increase in the thawing rate of frozen soil, accompanied by an increase in water infiltration as the frozen soil continued to thaw, leading to an increase in deep soil water and a decrease in surface soil water (Ma et al., 2021). Under freeze-thaw cycles, the adequate soil water in the root layers of different alpine meadows was ranked as follows: non-degraded meadow > moderately-degraded meadow > seriously degraded meadow (Lv et al., 2022). Xue et al. (2017) found that permafrost degradation significantly reduced soil water by 4.5–6.1% at a depth of 0–100 cm and increased the annual mean surface soil temperature by 0.8 °C in the headwater region of the Yangtze River.

Precipitation infiltration is considered the primary source of soil water in the active permafrost layer during the freeze-thaw process, which is considered a major factor and imposes limitations (Cao et al., 2018). In June, the spatial variation of soil water and precipitation in most regions, especially at high altitudes, showed a negative correlation, while only a few low-altitude regions showed a positive correlation (supplemental Fig. 2). On the one hand, this indicated that precipitation in high-altitude regions was mainly in the form of snowfall, which does not easily recharge soil water directly, and that the active permafrost layer melts slowly. There is also the phenomenon of alternating between freezing and thawing, such that the more precipitation there is, the less the soil water changes. On the other hand, all the permafrost in low-altitude regions melted by June, and soil water was mainly recharged by precipitation, such that the more precipitation there was, the higher the soil water. The correlation between soil water and precipitation was low during the warm season in permafrost areas and high in seasonal frozen areas because permafrost may help maintain soil water stability. In contrast, permafrost degradation would reduce the regulating capacity of soil water, affecting the Tibetan Plateau ecosystem and hydrological cycle (Wu et al., 2021).

Soil water changes in August exhibited a negative correlation with precipitation. During this period, the active layer of permafrost melted. However, the source of soil water was mainly precipitation. More precipitation resulted in a higher quantity of soil water (supplemental Fig. 2). Most areas showed a positive correlation in September. Only a few high-altitude areas displayed a negative correlation; due to the lower temperature, precipitation in high-altitude areas was mainly snowfall, which had less effect on soil water recharge, while the lower-altitude areas still showed a positive correlation with rainfall, which directly recharged soil water. Deng et al. (2020) also indicated that soil water increased with precipitation in most regions of the TRHR. Based on observations in the TRHR, the soil water at 10 cm, 20 cm, and 30 cm increased by 0.47%, 0.46%, and 0.41%, respectively, when the precipitation increased by 1 mm, while the soil water at 10 cm, 20 cm, and 30 cm decreased by 3.8%/d, 3.3%/d, and 2.3%/d, respectively, when the number of days without precipitation increased by 1 d (Li et al., 2022). The average soil water during 2003–2020 was 20%, increasing at a rate of 0.5%/10a, and its changes were influenced by precipitation and temperature in the TRHR (Chen et al., 2021). In addition, the effect of snow cover on soil water thawing was greater than that on freezing, and the effect on shallow swamp soils was greater than that on shallow meadow soils (Chang et al., 2012).

Evapotranspiration is the reverse process of soil water recharge. Soil water, in general, showed a significant negative correlation with evapotranspiration in June, August, and September in the TRHR, indicating that stronger evapotranspiration results in less soil water (supplemental Fig. 3). Based on observations under simulated warming conditions at the Chengduo station in the TRHR, the soil temperature increased by 2.50 °C and 1.36 °C at the soil depth of 0–15 cm and 15–30 cm, respectively, while the soil water decreased by 0.07% and 0.09% at the soil depth of 0–15 cm and 15–30 cm, respectively (Yao et al., 2019). Cao and Jin (2021) also concluded that soil water is negatively correlated with air temperature and positively correlated with precipitation."

-Conclusions: Please shorten the conclusion section and summarize 3~4 points of most important messages.

Thank you very much for your comments. We have revised the conclusions as suggested. The revised conclusion is as follows "Based on 2451 samples of soil and surface water collected in the Three Rivers Headwater Region, China, the sources of soil water in different ablation periods were calculated. The results indicated that precipitation, ground ice, and snow meltwater accounted for approximately 72%, 20%, and 8% of soil water during the early ablation period, respectively, and that there is no snow meltwater recharge below 4000 m due to snow melting depletion. In the heavy ablation period, precipitation and ground ice contributed to 90% and 10% of soil water, respectively. The precipitation recharge decreased with increasing altitude, while ground ice gradually increased, accounting for about 94% and 6% of soil water from precipitation and ground ice, respectively, during the ablation end period, and the small amount of recharge from ground ice mainly occurred above 4000 m.

Soil water loss will further exacerbate vegetation degradation with global warming and pose a significant threat to the ecological security of the "Chinese Water Tower." So, it is urgent to build a real-time soil water observation network, construct a soil water-vegetation change-vegetation restoration early warning platform, determine the most suitable time for vegetation restoration, and apply appropriate soil water conservation and vegetation recovery programs."

-Please find the annotation in the attached pdf file for the minor issues, including comments on English writing, Figure and some specific questions.

Thank you very much for your comments. We have revised the manuscript carefully according to your suggestion in pdf file. It should be noted that we have not changed Figure 6. The main reasons are as follows: Precipitation is an input to the water cycle, Precipitation stable isotopes are a benchmark or a reference for other water stable isotopes, so we use uniform precipitation data.

Response to Reviewer#2

In this work, Zongxing et al., has quantified the soil water sources in the Three-River Headwater Region under different ablation periods used two thousand six hundred samples of soil water, precipitation, river water, ground ice meltwater, supra-permafrost water, and glacier snow meltwater samples. The topic of this paper was new and original and the method was reasonable. The analysis of this article also was perfect. In general, the outcome of this work can be interesting for the scientific community. I suggested that this manuscript should be published after moderate modifications.

1. In abstract ： Some sentences are too colloquial, please revise them. For examples the sentence of "So it is crucial to understand the spatial-temporal changes in soil water sources." and "So there is an urgent need to monitor soil water, warn of vegetation degradation associated with soil moisture loss, and identify reasonable water-soil conservation and vegetation restoration patterns."

Thank you very much for your comments. We have modified such sentences as suggested. The revised abstract is as follows: "Amid global warming, the timely supplementation of soil water is crucial for the effective restoration and protection of the ecosystem. It is therefore of great importance to understand the temporal and spatial variations of soil water sources. The research collected 2,600 samples of soil water, precipitation, river water, ground ice, supra-permafrost water, and glacier snow meltwater were collected in June, August, and September 2020. The goal was to quantify the contribution of various water sources to soil water in the Three-Rivers Headwater Region (China) at different ablation periods. The findings revealed that precipitation, ground ice, and snow meltwater constituted approximately 72%, 20%, and 8% of soil water during the early ablation period. The snow is fully liquefied during the latter part of the ablation period, with precipitation contributing approximately 90% and 94% of soil water, respectively. These recharges also varied markedly with altitude and vegetation type. The study identified several influencing factors on soil water sources, including temperature, precipitation, vegetation, evapotranspiration, and the freeze-thaw cycle. However, soil water loss will further exacerbate vegetation degradation and pose a significant threat to the ecological security of the “Chinese Water Tower.” It emphasizes the importance of to monitoring soil water, and addressing vegetation degradation related to soil water loss, and determining reasonable soil and water conservation and vegetation restoration models.”

2. Line 36：Change “Soil water is a vital water resource, a link between precipitation, surface water, soil water, and groundwater” to “Soil water is an important water resource, also a link between precipitation, surface water, soil water, and groundwater”

Thank you very much for your comments. We have Changed “Soil water is a vital water resource, a link between precipitation, surface water, soil water, and groundwater” to “Soil water is an important water resource, also a link between precipitation, surface water, soil water, and groundwater”

3. Line 46: Change “Tetzlaff, & Soulsby” to “Tetzlaff and Soulsby”

Thank you very much for your comments. We have Changed “Tetzlaff, & Soulsby” to “Tetzlaff and Soulsby”

4. Line 107: Change “followed by air temperature and wind speed in the sources region of the Yellow river” to “followed by air temperature and wind speed in the source region of the Yellow River”

Thank you very much for your comments. We have Changed “followed by air temperature and wind speed in the sources region of the Yellow river” to “followed by air temperature and wind speed in the source region of the Yellow River”

5. 4．Line 117-118 Change “The TRHR is undergoing a glacier retreat, permafrost degradation, precipitation increase, snowfall decrease,

water conservation decrease” to “The TRHR is undergoing a glacier retreat, permafrost degradation, precipitation increase, snowfall decreases, water conservation decrease”

Thank you very much for your comments. We have Changed “The TRHR is undergoing a glacier retreat, permafrost degradation, precipitation increase, snowfall decrease, water conservation decrease” to “The TRHR is undergoing a glacier retreat, permafrost degradation, precipitation increase, snowfall decreases, water conservation decrease”

6. Line 122-123: Change “So there is an urgent need to quantify the soil water sources to improve the effectiveness of ecological restoration in permafrost regions.” to “Thus there is an urgent need to quantify the soil water sources to improve the effectiveness of ecological restoration in permafrost regions.”

Thank you very much for your comments. We have Changed “So there is an urgent need to quantify the soil water sources to improve the effectiveness of ecological restoration in permafrost regions.” to “Thus there is an urgent need to quantify the soil water sources to improve the effectiveness of ecological restoration in permafrost regions.”

7. Line 241: Change “**Glaciers snow meltwater**” to “**Glacier snow meltwater**”

Thank you very much for your comments. We have Changed “Glaciers snow meltwater” to “Glacier snow meltwater”

8. River names in manuscripts should be capitalized. For example “Lancangjiang River”

Thank you very much for your comments. We've capitalized all the river names that appear in the manuscript.

9. Line 298: Change “heavy ablation period” to “strong ablation period”

Thank you very much for your comments. We have Changed "heavy ablation period" to "strong ablation period"

10. Please change all tables to triple table.

Thank you very much for your comments. We have replaced all the tables in the manuscript with three-line tables.

Table.1 The average values of stable isotopes and relationship between $\delta^{18}O$ and d-excess for soil waters in TRHR

	Relationship between $\delta^{18}O$ and d-excess/ R^2	average values for: $\delta^{18}O$, δ^2H and d-excess in June	average values for: $\delta^{18}O$, δ^2H and d-excess in August	average values for: $\delta^{18}O$, δ^2H and d-excess in Sepetember
All soil water samples	Y=-0.16x+3.87, R^2=0.0065	-12.00, -89.78, 6.30	-13.26, -100.0, 8.58	-13.04, -98.11, 6.24
0-20cm	Y=-0.43x+0.98, R^2=0.065	-11.91, -90.07, 5.18	-13.24, -101.44, 8.87	-14.23, -108.14, 5.71
20-40cm	Y=-0.4564x+0.7948, R^2=0.0392	-12.07, -90.74, 5.84	-12.96, -99.01, 11.23	-12.42, -92.72, 6.61
40-60cm	Y=-1.05x-7.33, R^2=0.1667	-12.38, -90.38, 8.68	-13.63, -101.46, 5.67	-12.33, -92.06, 6.55
60-80cm	Y=-0.32x+2.5781, R^2=0.0167	-11.36, -83.77, 7.09	-13.32, -98.51, 4.17	-12.42, -92.88, 6.45
Northern slope	Y=-1.1944x-7.3393,	-12.33, -90.61, 7.99	-13.07, -98.34, 12.45	-12.05, -91.64, 4.75
Eastern slope	R^2=0.1584	-11.96, -91.15, 4.54	-13.06, -99.61, 6.04	-18.163, -137.38, 7.93
Southern slope	Y=-0.7x-2.2479, R^2=0.0956	-11.31, -85.49, 5.028	-13.77, -103.422, 6.16	-12.17, -89.9, 7.47
Western slope	Y=-0.4337x+0.8866, R^2=0.0543	-12.62, -93.63, 7.36	-12.92, -96.89, 11.99	-12.2,-91.5, 6.15
Grassland	Y=-0.4921x-0.5722, R^2=0.0715	-10.39, -77.66, 5.45	-12.13, -89.28, 27.06	-9.62, -71.87, 5.13
Meadow	Y=-0.6067x+0.8133, R^2=0.0615	-12.15, -90.36, 6.87	-13.45, -101.94, 5.25	-12.82, -96.56, 6.02
Forest	Y=-1.4013x-12.706, R^2=0.2283	-13.6,-103.66, 5.1	-13.66, -103.16, 5.24	-15.82, -118.98, 7.60

Table.2 The LEL for soil waters in study region

	EL/ R^2 in June	EL/ R^2 in August	EL/ R^2 in September
2900-3500	$\delta 2H=5.7\delta^{18}O-21.18$ $R^2=0.90$	$\delta 2H=6.8\delta^{18}O-7.83$ $R^2=0.95$	$\delta 2H=7.43\delta^{18}O-2.59$ R2=0.98
3500-4000	$\delta^2H=7.58\delta^{18}O-1.34$ $R^2=0.83$	$\delta^2H=6.48\delta^{18}O-16.54$ $R^2=0.9$	$\delta^2H=7.67\delta^{18}O+3.1$ $R^2=0.97$
4000-4500	$\delta^2H=7.27\delta^{18}O-3.46$ $R^2=0.88$	$\delta^2H=6.5\delta^{18}O-15.09$ $R^2=0.93$	$\delta^2H=7.04\delta^{18}O-6.8$ $R^2=0.96$
4500-5100	$\delta^2H=6.05\delta^{18}O-12.4$ $R^2=0.85$	$\delta^2H=6.69\delta^{18}O-8.68$ $R^2=0.93$	$\delta^2H = 6.9\delta^{18}O - 6.6$ $R^2=0.87$
grassland	$\delta^2H=6.4\delta^{18}O-11.07$ $R^2=0.83$	$\delta^2H=6.62\delta^{18}O-9.07$ $R^2=0.96$	$\delta^2H=6.44\delta^{18}O-9.91$ $R^2=0.92$
meadow	$\delta^2H=6.55\delta^{18}O-10.67$ $R^2=0.84$	$\delta^2H=6.4\delta^{18}O-15.83$ $R^2=0.90$	$\delta^2H=7.14\delta^{18}O-5.05$ $R^2=0.95$
forest	$\delta^2H=6.97\delta^{18}O-8.9$ $R^2=0.73$	$\delta^2H=7.61\delta^{18}O+0.85$ $R^2=0.97$	$\delta^2H=7.46\delta^{18}O-0.97$ $R^2=0.97$
Northern slope	$\delta^2H=7.33\delta^{18}O-0.22$ $R^2=0.84$	$\delta^2H=6.8\delta^{18}O-9.46$ $R^2=0.91$	$\delta^2H=6.86\delta^{18}O-8.95$ $R^2=0.90$
Eastern slope	$\delta^2H=6.92\delta^{18}O-8.38$ $R^2=0.88$	$\delta^2H=6.33\delta^{18}O-16.9$ $R^2=0.89$	$\delta^2H=6.78\delta^{18}O-14.253$ $R^2=0.93$
Southern slope	$\delta^2H=6.44\delta^{18}O-13.22$ $R^2=0.81$	$\delta^2H=6.84\delta^{18}O-9.28$ $R^2=0.96$	$\delta^2H = 6.8\delta^{18}O - 7.0$ $R^2=0.93$
Western slope	$\delta^2H=6.14\delta^{18}O-16.14$ $R^2=0.91$	$\delta^2H=6.46\delta^{18}O-13.4$ $R^2=0.92$	$\delta^2H=7.33\delta^{18}O-2.07$ $R^2=0.98$

11. Line 300-301: Change “Again it becomes higher in September, while it exhibits an opposite trend for d-excess (Table.1).” to “It again becomes higher in September, while it exhibits an opposite trend for d-excess (Table.1).”

Thank you very much for your comments. We have Changed “Again it becomes higher in September, while it exhibits an opposite trend for d-excess (Table.1).” to “It again becomes higher in September, while it exhibits an opposite trend for d-excess (Table.1).”

12. Line 319: Give the terms “LWML” and “LEL” a definition when they first appeared

Thank you very much for your comments. “LWML” and “LEL” were defined on line 291: “In addition, the global meteoric water line (GMWL), local meteoric water lines (LMWLs), and evaporation line (LEL) have been used to analyze the relationship between soil water and other waters in the TRHR.”

13. Line 323-325 Change “The slope and intercept of LEL for the 0–40 cm layer were the lowest during the heavy ablation period” to “The slope and intercept of LEL for the 0–40 cm layer was the lowest during the heavy ablation period”

Thank you very much for your comments. We have Changed “The slope and intercept of LEL for the 0–40 cm layer were the lowest during the heavy ablation period” to “The slope and intercept of LEL for the 0–40 cm layer was the lowest during the heavy ablation period”

14. Line 354: “snow meltwater” or “glacier snow meltwater”?

Thank you very much for your comments. It is “glacier and snow meltwater”. We have modified it.

15. Line 354: “supra-permafrost” or “supra-permafrost water”?

Thank you very much for your comments. It is supra-permafrost water. We have modified it.

16. Line 437: please change “Based on the calculation, precipitation, ground ice, and snow meltwater account for approximately 72%, 20%, and 8% of soil water, respectively” to “Based on the calculation, precipitation, ground ice water, and glacier snow meltwater account for approximately 72%, 20%, and 8% of soil water, respectively”

Thank you very much for your comments. We have Changed “Based on the calculation, precipitation, ground ice, and snow meltwater account for approximately 72%, 20%, and 8% of soil water, respectively” to “Based on the calculation, precipitation, ground ice water, and glacier snow meltwater account for approximately 72%, 20%, and 8% of soil water, respectively"

17. Please make sure the citation appeared in the article are consistent with those listed in the Reference part.

Thank you very much for your comments. We have checked all the references to make sure that the manuscript is consistent with those listed.

18. The conclusion part is too long. I recommend rephrase this paragraph and state the importance of the findings.

Thank you very much for your comments. We will revise the conclusions as suggested. The revised abstract is as follows: "Amid global warming, the timely supplementation of soil water is crucial for the effective restoration and protection of the ecosystem. It is therefore of great importance to understand the temporal and spatial variations of soil water sources. The research collected 2,600 samples of soil water, precipitation, river water, ground ice, supra-permafrost water, and glacier snow meltwater were collected in June, August, and September 2020. The goal was to quantify the contribution of various water sources to soil water in the Three-Rivers Headwater Region (China) at different ablation periods. The findings revealed that precipitation, ground ice, and snow meltwater constituted approximately 72%, 20%, and 8% of soil water during the early ablation period. The snow is fully liquefied during the latter part of the ablation period, with precipitation contributing approximately 90% and 94% of soil water, respectively. These recharges also varied markedly with altitude and vegetation type. The study identified several influencing factors on soil water sources, including temperature, precipitation, vegetation, evapotranspiration, and the freeze-thaw cycle. However, soil water loss will further exacerbate vegetation degradation and pose a significant threat to the ecological security of the "Chinese Water Tower."

It emphasizes the importance of to monitoring soil water, and addressing vegetation degradation related to soil water loss, and determining reasonable soil and water conservation and vegetation restoration models."

19. Please refer to the journal requirements to modify the format of the references

Thank you very much for your comments. We will carefully modify the format of the references according to the requirements of the journal.

20. English writing: The English writing of this manuscript should be improved thoroughly. The issues include the choice of word, grammar issue and the structure of sentence.

Thank you very much for your comments. We have spent a great deal of time for improving the language and general presentation again.