Note: The comments are in black, and our replies in blue.

Referee #1

Cai et al. investigate moisture sources and dynamics over the southeastern Tibetan Plateau (TP) using three-year near-surface water vapor isotopes ($\delta^{18}O$, d-excess) and back trajectory analysis. Their findings reveal that correlations between d-excess and oceanic evaporation conditions are driven by seasonal covariation rather than direct moisture sourcing. During the non-monsoon season, high d-excess reflects dry, cold air intrusions from the westerlies, while monsoon-season isotopes are shaped by raindrop evaporation during transport. The authors also challenge interpretations of TP ice core d-excess as proxies for oceanic humidity, emphasizing instead the role of local moisture recycling, air mass mixing, and rain-vapor interactions. These insights refine understanding of TP hydroclimate drivers and caution against oversimplified linkages between terrestrial isotopes and remote oceanic processes. This is an very interesting research. However, the authors need to address several issues, including both scientific and English language aspects, before being considered for publication.

Re: We sincerely thank the referee for the thorough and constructive comments on our manuscript. We appreciate the detailed insights provided in the annotated PDF file, as well as the broader feedback offered. These comments and suggestions have been invaluable in guiding us to improve the quality and clarity of the manuscript. We have carefully addressed all the scientific issues and English language aspects raised by both referees, ensuring that these improvements enhance the overall presentation and understanding of our research.

There is room for improvement in the English language of this article. Some sections need significant rephrasing or reorganizing, particularly Introduction. Paragraphs in Introduction section appears lacking logical connection, and even its sentences are not logically related. In the first paragraph, the authors point out that the TP's water balance has undergone significant changes, such as a drying trend in the southeastern TP and wetting in the northern TP. However, they didn't provide our current understanding of the mechanisms of this water imbalance. Stable isotope approach is just one of the techniques that can be used to understand this. What are other methods and what are the advantages of examining vapor over other methods? What is the importance of understanding water imbalance in TP or the urgency of studying vapor dynamics? This will be the motivation of this study. In the last sentence of the first paragraph, the authors introduce atmospheric water vapor and point out the important role of vapor dynamics in understanding water imbalance. Logically, the authors should start the second sentence with the research about water vapor. Instead, they talked about precipitation isotopes. I would suggest the authors to rewrite the Introduction with a focus on vapor and vapor isotopes.

Re: We acknowledge your comments about the Introduction section and agree that it required reorganization to enhance clarity and logical flow. Following your suggestions and the suggestions from the other referee, we have reorganized and rewritten significant portions of the Introduction. We now begin by focusing on water vapor research. The first paragraph has been revised to emphasize the drying trend in the southeastern Tibetan Plateau and the urgency of understanding moisture sources and dynamics. We have also incorporated context about the current understanding

of the mechanisms driving this drying trend and the ongoing debates regarding its causes and methodologies. At the end of the current first paragraph, we introduce the water isotopes as an addition to understand vapor dynamics and the research gap. In addition, we have streamlined our discussion on precipitation isotopes, condensing two paragraphs into one to maintain focus on vapor and vapor isotopes. The revised Introduction underscores the importance of studying vapor dynamics and positions stable isotope approaches within the broader context of available methods, emphasizing their unique advantages. Furthermore, we have reorganized the structure of the Results and discussion to enhance the overall flow of the manuscript. Please find further details regarding these changes in our response to the annotated PDF comments.

Introduction is different from Abstract. There is no need to present your major findings in the Introduction. What you should present in this section is what you did with what approaches, and what are your objectives of this study.

Re: Points taken. We have removed the part that described our major findings, ensuring that the Introduction now focuses on outlining our study's goals, approaches, and objectives. The last paragraph of the Introduction summarizes what we did, the key methods employed, and the main objectives of our research. Please refer to our response to the detailed comments in the annotated PDF file for further specifics regarding these changes.

Section 4.2 is also very difficult to follow, as the discussions in this section are not systematically presented. How Fig 7 supports the arguments is not clearly explained. The authors use composite analysis in the section. However, they did not include a brief introduction of this analysis in Data and Method section for the convenience of readers.

Re: Section 4.2 is now reorganized as Section 3.4. We agree that Section 4.2 was not as clear as it could be, and we appreciate your feedback on how to improve it. We have refined the text to enhance clarity in interpretating and discussing key results in this section. In addition, we have incorporated a brief introduction of the composite analysis method into Section 2.2 of the Data and methods section, ensuring that readers are fully informed about our methodologies.

In lines 122-123, the sentence suggests that only one standard is used for the calibration of isotope results. The common practice is to use at least two in-house standards, which are normalized to VSMOW-SLAP scale. Please provide a brief description of how the calibration of water isotope results.

Re: Yes, three in-house standards were used for calibrating the measured isotope values, and we apologize for any confusion caused by the original text. These standards were normalized to the VSMOW-SLAP scale. For a detailed description of the calibration procedure, we refer readers to Text S1 from our previous publication, which provides a comprehensive explanation of our methods. This reference is now clearly indicated in the manuscript for ease of access. Please also refer to our response to the detailed comments in the annotated PDF file for further details on the revision.

There are quite a few sentences that should be rephrased; they are either poorly presented or have

grammatic errors. For details, please check the attached annotated file. This file includes more comments and suggestions.

Re: We sincerely appreciate the reviewer's detailed comments and suggestions provided in the annotated PDF file. The feedback is instrumental in refining our manuscript. We have carefully reviewed each of your comments and suggestions, and we are pleased to provide a point-by-point response below for your reference.

Comments and suggestions in the attached PDF file:

L14-15 opposite changes: what is "opposite changes"? Please explain it.

Re: The Abstract is now more focused on the southeastern Tibetan Plateau, and this sentence has been removed.

L15 moisture is vital: critical for what? What is the logical connection between the first part and the last part of the sentence?

Re: This sentence has also been removed.

L15 To: Something is missing between this sentence and the sentences before it. Why is it important to do this investigation, i.e., why yo are doing this study? There is no logical connection of this sentence and what the previous sentences deliver. This is because you didn't point out the scientific questions that your investigation will answer.

Re: The previous sentence now reads as follows:
"Water vapor isotopes are valuable tracers of the atmospheric water cycle, yet their interpretation is hindered by ambiguities in atmospheric controls."

L20: variance → variations

Re: The word has been removed.

L23-24 evaporation on humidity: what is "evaporation on humidity"? Please explain

Re: It means the effect of raindrop evaporation on the atmospheric humidity or atmospheric vapor. To avoid confusion, we have removed "on humidity".

L26 improve the: I would use "contribute to our understanding"

Re: Agree, and we have now used the suggested version.

L30: also termed → know as

Re: modified.

L31: that → . These regions exert significant influence on

Re: To shorten the manuscript, this sentence has been removed.

L32: formation → development

Re: This sentence has been removed.

L34: systems in Asia: please name them

Re: We have added "*, including the Mekong, Salween, Ganges, Yarlung Zangbo, among others*" to name some of them.

L34-35: Then, what? What is the current understanding of this issues in TP and what are the scientific questions? This will be the motivations or significance of your investigation. You need to rewrite this paragraph, as it is the most important part of the introduction. In another word, what is the urgency to investigate vapor dynamics in TP. Stable isotope technique is just one of the methods that could be used on the investigation.

Re: These parts have now been rewritten as:
"Atmospheric water vapor is the primary input to the hydrological system, making it essential to understand its sources and dynamics to diagnose regional water imbalances. Using a Lagrangian vapor tracking method, Zhang et al. (2023) suggested that the drying trend is associated with meteorological droughts propagating from moisture source regions. However, their conclusions and methodology are subjects of ongoing debate (Zhang et al., 2025; Zhao et al., 2025). Water stable isotopes are natural tracers of the water cycle, offering valuable insights into moisture sources and dynamics (Bowen et al., 2019; Galewsky et al., 2016). These isotopes have been intensively studied on the TP in precipitation, surface water, and ice cores (Yao et al., 2013; Thompson et al., 2024; Bershaw, 2018). However, the interpretation of these isotopic signals remains challenging due to complex fractionation processes and shifting circulation systems between summer monsoon and westerlies."

L35-36: rewrite as: Because atmospheric water vapor is the primary input to the hydrological system, understanding its sources and dynamics is critical to diagnosing the causes of regional water imbalances.

Re: Agree and we have slightly modified the suggested version. Please see the above comment for details.

L39 Water stable isotopes: the second paragraph seems no logical connection with the first paragraph. You should start with other methods used for understanding the problems mentioned in the first paragraph, and point out of water isotopes have its own advantages. Then briefly review

precipitation isotope application and its limitation, and at last, focus on vapor isotopes and problems this study is trying to resolve.

Re: We have now pointed out the advantages of water isotopes at the end of the first paragraph, and please refer to the reply above. The second paragraph now reviews precipitation isotope applications and limitations. And the remaining parts of the Introduction are about vapor isotopes and problems this study is trying to resolve.

L60: rewrite the sentence as "The causes of the higher isotope ratios during the non-monsoon season remain controversial."

Re: To shorten the manuscript, this sentence has now been removed.

L60 Following the: How about: "While the regional amount effect (lower isotope values with higher precipitation) prevails during the monsoon season, this relationship weakens or reverses in the non-monsoon season, implying additional controls such as moisture source variability, kinetic fractionation, or shifts in atmospheric circulation patterns."

Re: Agree, and we have now used an adjusted version of this sentence to summarize the whole paragraph to save space:
"*While the regional amount effect prevails during the monsoon season, this relationship weakens or reverses in the non-monsoon season when it is dominated by westerlies. This variability suggests additional controls such as moisture source variability, kinetic fractionation, or shifts in atmospheric circulation patterns (Breitenbach et al., 2010; Cai and Tian, 2020; Guo et al., 2024; Yao et al., 2013).*"

L63: citation? I think a paper published EPSL from Nanjing University focuses on this topic, and you probably should cite it too.

Re: We cited two earlier papers on this topic. And we have now included the new paper in EPSL from Nanjing University. Please also see reply to the above comment.

L67: remove "the"

Re: The sentence has been removed.

L69-72: please rephrase it in a different way

Re: It has now been rephrased as follows:
"Further, limited precipitation during non-monsoon seasons makes it challenging to sstudy a full seasonal cycle of the atmospheric water cycle, which can be compensated by continuous monitoring of vapor isotopes."

L77-78: confusing statement and please rephrase it. Are you talking about TP or in general?

Re: Yes, we are talking about TP. We have removed this sentence.

L82: add “However, ”

Re: We have edited the previous sentence, and a “Moreover” is added at the beginning of this sentence.

L97-100: Introduction is different from Abstract. No need to present your major findings in the Introduction. What you should present in this section is what you did with what approaches, and what are your objectives of this study.

Re: Following your suggestions, it now reads as the follows:
“We aim to study the moisture sources and dynamics and their influence on vapor isotope compositions across different seasons. To achieve these goals, we explored the relationships between vapor isotopes and oceanic evaporation conditions, continental air mass intrusions, as well as rain-vapor interactions during different seasons. Finally, we discuss the implications of our findings for interpreting ice core records.”

L103: remove “Atmospheric water”

Re: removed.

L104-105: remove “pumping ambient air into”

Re: removed.

L105 a linked-ball-shaped glass cold trap: is it the further explanation of the cold trap, and if so, put in into a (), and replace ‘the’ with ‘a’.

Re: Yes, it is a further explanation of the cold trap. It now simply reads as “*…an air pump, a linked-ball-shaped glass cold trap, and an …*”

L108: add “collected” before “throughout”

Re: The sentence has been revised. It now reads as: “*The airflow rate was set to ~5 L/min, allowing the collection of 10-20 ml of water samples during each sampling session.*”

L122 calibrated: how many calibration standard waters used for calibration, three or two? The statement of this sentence is not accurate.

Re: Three calibration standard waters were used for calibration. The sentence has now been rephrased as “*The isotopic values were calibrated using three standard waters, with detailed calibration procedures described by Liu et al. (2024). The measurements are expressed relative to*

Vienna Standard Mean Ocean Water 2 (VSMOW2), with precisions of 0.1‰ for $\delta^{18}O$, 0.4‰ for $\delta^{2}H$, and 1.2‰ for d-excess."

L128-129: It is better to present the equation here.

Re: It involves a set of equations and these equations are available from atmospheric science text books. To reduce the length of the paper, we did not describe the detailed equations. Alternatively, we have provided a citation where the equations can be found.
Huang, J.: A Simple Accurate Formula for Calculating Saturation Vapor Pressure of Water and Ice, Journal of Applied Meteorology and Climatology, 57, 1265-1272, JAMC-D-17-0334.1, 2018.

L140 understood: better to use a different word, such as "simulated" or "predicted".

Re: We have now replaced the word with "*predicted*".

L170: what is the estimated isotope values for this dry member?

Re: the isotope values were described in the supporting information. It is now also described in the main text: "*at q = 0.5 g/kg, $\delta^{18}O$ = -60.3‰, and $\delta^{2}H$ = -418.0‰ (Fig. S2).*"

L186 5 locations: why 5 sites?

Re: As the metrological data are gridded data, 5 locations were selected to reduce the uncertainty associated with the interpolation of the gridded data.

L203 gives: "is" or "can serve as"?

Re: we have replaced it as "*is*"

L204: "this variable" refer to "moisture contribution from upstream air masses"? I didn't get this sentence and not sure what you mean.

Re: Yes, "this variable" refers to "moisture contribution from upstream air masses". We have rephrased the sentence as follows: "*We calculated weighted-mean values for key variables by using the moisture contribution of the air parcel along trajectories as the weight.*"

L210: General characteristics of what? Please be specific.

Re: it now reads as "*General characteristics of vapor $\delta^{18}O$, d-excess, and local meteorological variables*"

L214: add "much" before "lower values"

Re: we have removed "to lower values".

L214-215: rephrase “Without a sharp rebound to values before the summer monsoon”

Re: the sentence now reads as “*Conversely, from the end of the summer monsoon season to spring and early summer, $\delta^{18}O$ shows a gradual increase trend.*”

L215: remove “value”, and “the” can also be removed!

Re: removed.

L216: toward → and reaches

Re: the sentence has been rewritten and please refer to the reply above.

L218: add “a” before “cessation”

Re: the sentence has been rephrased as follows: “*For instance, while local precipitation ceases clearly after the summer monsoon (Fig. 1e), $\delta^{18}O$ remains at relatively low levels.*”

L218-219: not sure what you mean and please rephrase it

Re: Please refer to the reply above.

L222: remove “the”

Re: removed.

L226: which is → ,

Re: modified.

L229 The general temporal variability: “Time series of” is better.

Re: we have now used “*Time series of*”

L233 data points: redundant

Re: removed.

L233: their locations → location of the linear line defined by them

Re: it has been rephrased as “*The linear relationship between paired $\delta^{18}O$ and $\delta^{2}H$ values, along with their position relative to the global meteoric water line…*”

L234: You should compare your vapor lines in different seasons with local water line. If rain evaporation is weak, the slopes of vapor and precipitation should be similar. Strong evaporation decrease the slope of precipitation but will increase that of vapor. Vapor and rain response to evaporation is different. I believe that you should have lots of precipitation isotope data in your study area.

Re: Unfortunately, precipitation isotope data are not available to us. Precipitation $\delta^{18}O$ data from 2007-2014 were publicly available at this station. However, precipitation $\delta^{2}H$ data were not shared.

L234: remove "generally"

Re: removed.

L238 LMWL: should be local vapor line not local water line

Re: Following your suggestion, we have now described it as local vapor line (LVL) throughout the manuscript.

L242 vapor LMWL: should be local vapor line

Re: modified.

L244 LMWL: vapor line

Re: modified.

L252-255: Include this information in the figure caption

Re: included.

L255: add "particularly in winter," after "season,"

Re: added.

L256: of → representing

Re: it now reads as "*…that represents…*".

L257: remove "especially for the winter months"

Re: removed.

L261: remove "that has almost totally dehydrated through condensation"

Re: removed.

L262: remove “of surface evaporation or moisture that has been partially dehydrated through Rayleigh distillation”

Re: removed.

L263: add “that” after “suggests”

Re: it now reads as “*…suggests a moist end member with an* $\delta^{18}O$ *of…*”.

L265: this → our

Re: modified.

L266: can you explain how you get this number? The same way as you estimated for non-monsoon season above? If so, you should rephrase this sentence to indicate this information.

Re: Yes, it is the same way as we estimated for non-monsoon season. This sentence now reads as “*However, during the monsoon season, the overall estimation of* $\delta^{18}O$ *for the moist end member through the linear regression between* $\delta \times q$ *and* q *is significantly lower at -30.9‰ ± 1.8‰, pointing to an additional moisture source from rain evaporation that is more depleted in heavy isotopes.*”

L268: and is → ,

Re: The sentence has been rewritten and now reads as “*These results align with the distribution of* $\delta^{18}O$*-q data below the Rayleigh line during the summer monsoon season (Fig. 3a)*”.

L270: suggest → reflect

Re: modified.

L274: relationships → findings?

Re: modified.

L274: by q than → using q compared to

Re: modified.

L274: for → under

Re: modified.

L277: compositions → (d18O)

Re: it now reads as "*Relationships between vapor isotopes ($\delta^{18}O$ and d-excess) and specific humidity (q) from 2015-2017.*"

L281: This doesn't sound like a subtitle, and how about this: "Seasonal variability in moisture sources and transport pathways"

Re: Agree, we have used the suggested version.

L282: remove "reflected in vapor isotope compositions"

Re: removed.

L284-285: Do you mean local origin? If so, you need to rephrase it.

Re: We wanted to emphasize the moisture contribution from what is already in the air masses compared to the moisture contribution from surface evaporation. To avoid confusion, we have removed "instead of moisture uptake from the Earth surface."

L288-290: Please explain what is the difference between air parcels and air masses? West two clusters are air masses and the south one are considered air parcels?

Re: Air parcel is an imaginary volume of air that is large enough to contain a very great number of molecules, but small enough so that it has uniform properties. Air mass may be defined as a large body of air with near uniform physical properties. Therefore, when describing a single trajectory, air parcel is preferred, and air mass is preferred when describing a great number of trajectories. However, we sometimes used the two terms interchangeably. We have checked throughout the manuscript, and revised the term to make the descriptions as precise as possible.

L293: results → pathways

Re: the sentence has been rewritten and now reads as "*The pathways observed in May share similarities with those of the non-monsoon season, but with notable differences.*"

L295 AS: Please define the AS. Please also mark AS and BOB in the figures for the convenience of readers.

Re: It was been defined in the Introduction. Following your suggestion, we have marked the approximate location of AS and BOB in Figure 4 using both their full name and acronyms.

L295 pattern: I think that you mean transport direction not pattern. Air masses origin from south in general.

Re: we have now replaced "pattern" using "*direction*"

L298-299: rewrite as "the dominant contribution from proximal terrestrial regions"

Re: modified.

L299: remove "regions"

Re: removed.

L299-300: redundant and can be combined with the first sentence.

Re: it has now been removed.

L303: add "," after "limited"

Re: the sentence now reads as "*This indicates that surface evaporation from oceanic regions such as the BOB and AS contributes minimally.*"

L316: The way you presented makes this part difficult to follow.

Re: We think the reason for it being difficult to follow is probably partly because that Figs. S6 and S7 were in the supporting information. We have combined Fig. S6 and S7 into one single figure, and have put it in the main text (the new Fig. 6). The title of this subsection has also been rephrased as "*Role of ocean surface evaporation conditions at seasonal and intraseasonal time scales*". In addition, we have made substantial revision on the writing of this subsection to make it clearer.

L317: of → , such as or including

Re: we have replaced it with "*, such as*"

L322: please indicate the range

Re: the range *"(from -0.3‰ $\%^{-1}$ to -0.6‰ $\%^{-1}$)"* has now been included in the sentence.

L325-328: I am totally lost in this sentence. The lower right of what? The upper left part of the space refers to what space?

Re: This sentence was describing the distribution of data in Figs. S6 and S7. The sentence has been rephrased as follows: "*However, upon closer inspection of the d-excess- RH_{SST} plots (Fig. 6), it becomes evident that data points clustered according to different seasons, implying that the apparent negative correlations might primarily stem from opposing seasonal trends.*"

L334: remove “and do not hold realistic causal relationships”

Re: removed.

L337-338: Why the correlation of the whole year is higher than individual seasons including both monsoon and non-monsoon?

Re: The Figs. S6 and S7 were important to understand this, and we have therefore moved them into the main text and combined them into the one figure as the new Fig. 6. Variations of these variables generally follow a seasonal pattern, such as lower RH_{SST} in winter and higher RH_{SST} in summer. Therefore, similarities in the seasonal variations (either in the same way or the opposite) will cause correlations between these variables.

L339 ending stages: what stages? Be specific!

Re: the sentence now reads as “*In contrast, significant correlations present during the non-monsoon season (Fig. 5c), potentially due to intraseasonal variations where d-excess peaks in winter and decreases at the beginning and ending of the non-monsoon season (Fig. 1b), possibly accompanied by opposing* RH_{SST} *trends.*”

L341: How did you estimate this? You should provide explanation or citation.

Re: This is based on the coefficient of determination (R^2). We have added the explanation in the revised Data and methods section.

L362: In Method section, you should briefly introduce how you did composite analysis.

Re: We have added the following description in the revised Data and methods section to introduce the composite analysis:
“In addition, we also used composite analysis to reveal relationships between variables. For example, to identify general patterns in backward trajectories associated with d-excess exceeding 30‰, all the days with such high d-excess were compiled into a collection. A composite map of trajectories from this collection was then constructed to reveal typical pathways under these conditions.”

L379 The relationship between vapor d-excess and: redundant

Re: removed.

L379-380: air masses from any direction have upstream regions. How this can test the intrusion of cold and dry air?

Re: We were not referring to any upstream location or region. Instead, the term “upstream …” has a very specific meaning. It represents weighted-mean values along the 10-day backward trajectory

weighted by the moisture contribution at each time step. To avoid confusion, we have replaced "upstream …" using "*weighted-mean upstream …*"

L391 SETP: redundant

Re: removed. In addition, we have condensed this whole paragraph into three sentences.

L429: "Distribution" is not a clear description and very confusing!

Re: The sentence now reads as "*During the summer monsoon season, $\delta^{18}O$-q plots below the Rayleigh curve, indicating that the vapor has undergone a degree of rain-vapor interaction due to evaporation (Fig. 3a).*"

L448: local?

Re: The sentence now reads as "*These findings lead us to infer that vapor isotopes during the summer monsoon season at SETP are influenced not only by local rain-vapor interactions but also by the history of rain-vapor interactions that occurred before the vapor reached the region.*"

L452: Please indicate correlation coefficient r and p for both lines

Re: The r values were indicated in the figure. The p values are below 0.01. The following sentence has been added at the end of the figure caption: "*The r values for both lines are indicated in (a) and both of them are significant at the 0.01 level.*"

L466: technically, d excess is not considered as isotope compositions and it is a secondary parameter.

Re: Following your suggestions, we have avoided such description, and it now reads as "*vapor isotopes ($\delta^{18}O$ and d-excess)*"

L478-479: rephrase as "also involves rain-vapor interactions, which significantly influence isotope compositions in the lower troposphere"

Re: agree and we have rephrased it as "*also involves rain-vapor interactions, which significantly influence vapor isotopes in the lower troposphere.*"

L495: the → their?

Re: the sentence now reads as "*Furthermore, the direct contribution of oceanic vapor to humidity at SETP is very limited (Fig. 4), implying an even smaller contribution over the TP since SETP is at the forefront of moisture transport toward TP (Fig. S1).*"

L498-500: Rephrase this sentence, as there are several grammar problems. What do you mean "the degree of continental recycling"

Re: The sentence now reads as the follows: "*Terrestrial processes such as transpiration and evaporation introduce isotopically enriched moisture and high d-excess signatures, respectively.*"

L507: what do you mean by "moisture sources at the Earth surface"? I think you mentioned this earlier. Does this mean that there are moisture sources below the Earth surface? Please explain this.

Re: We wanted to emphasize the moisture contribution from what is already in the air masses compared to the moisture contribution from surface evaporation. We have rephrased it as "*Our alternative perspective explains high d-excess induced by westerlies as dry and cold air intrusions rather than surface evaporation or evapotranspiration.*"

L511-512: Do you mean the studies have gradually shifted the focus from precipitation and river to ice cores? If so, please rephrase this sentence. In general, I did not understand the first sentence (the whole sentence), and not sure what you are trying to say in this sentence. I am lost!

Re: We are sorry for the confusion. The sentence was a recap of the question described in the Introduction. We have rephrased it as the follows: "*The proposed alternative interpretation could also help explain the abnormally high d-excess in high-altitude ice cores mentioned in the Introduction.*"

L517: remove "has been"

Re: removed.

L525-526: another source for → a possible source of

Re: modified.

L533: remove "data for"

Re: removed.

L533-534: rephrase as "these correlations weaken or disappear when analyzed within individual seasons."

Re: agree and it now reads as "*these correlations weaken or even disappear when analyzed within individual seasons.*"

L536: remove "both"

Re: removed.

L536: the → both

Re: modified.

L552-554: rephrase as “The study reveals distinct moisture sources and dynamics between non-monsoon and monsoon seasons over the southeastern Tibetan Plateau (TP). These findings will aid in interpreting $\delta^{18}O$ and d-excess records from TP glaciers, offering refined insights into past hydroclimatic conditions and challenging assumptions linking ice core isotopes to oceanic evaporation alone.”

Re: Point taken, and the paragraph now reads as the follows:
“*This study reveals distinct moisture sources and dynamics between non-monsoon and monsoon seasons over the southeastern Tibetan Plateau. These findings will aid in interpreting $\delta^{18}O$ and d-excess records from Tibetan Plateau glaciers, offering refined insights into past hydroclimatic conditions and challenging assumptions linking ice core isotopes to oceanic evaporation alone.*”

Referee #2

This paper studies moisture sources and dynamics over southeastern Tibetan Plateau using water vapor isotopes, especially in non-monsoon season. The findings offer valuable insights into the mechanisms at seasonal scale for this region and could provide an explanation for hydrological information recorded in paleo proxy isotopes. However, there are still many problems preventing the publication in current version. The structure of the paper is not well-organized and lack of logic. Especially, the discussion and results section needs to be carefully revised and organized. The English expression is not good and needs improvement.

Re: We sincerely thank the referee for the overall comments and the comments/suggestions on how to improve our manuscript. In response to your comments and suggestions, we have made significant revisions to enhance the clarity, logical flow, and overall structure of the manuscript. The Introduction section has been streamlined and now maintains a sharper focus on vapor isotopes, aligning more closely with the study's objectives. In addition, we have thoroughly reorganized the discussion and results section to improve the structure and ensure a coherent presentation and discussion of our findings. We have also addressed the issues related to English expression, striving to improve the manuscript's readability. These revisions are informed by your comments as well as those from the other reviewer. Please find below a detailed response to your comments and corresponding changes.

Specific comments:
Abstract: lines 13-15: The study area in this paper is southeastern Tibetan Plateau, not the whole Tibetan Plateau. Please rewrite the abstract.

Re: Following your suggestion, the first part of the Abstract has been rewritten as follows:
"*The southeastern Tibetan Plateau (SETP) has experienced a significant drying trend in recent decades, likely linked to changes in moisture sources. Water vapor isotopes are valuable tracers of the atmospheric water cycle, yet their interpretation is hindered by ambiguities in atmospheric controls.*"

Introduction：This part is too long and distracted. It is hard to get why do you perform vapor isotopes analysis in southeastern Tibetan Plateau. There have been a lot of studies on moisture sources and dynamics in this region. What is your scientific question?

Re: We agree that the Introduction section was overly lengthy and lacked focus, which may have obscured the rationale behind our study. In response, we have thoroughly rewritten the first paragraph to clearly articulate the motivation for conducting vapor isotopes study over the southeastern Tibetan Plateau. In addition, we have streamlined the discussion on precipitation isotopes by consolidating related materials into a single, coherent paragraph. The last paragraph of the Introduction has also been revised to outline our scientific objectives and approaches employed.

Line 60: why do you emphasize non-monsoon season. In fact, I don't think it is a good idea to emphasize the non-monsoon season independently. I suggest the authors to emphasize the scientific

question, and to introduce the important role of the non-monsoon season on resolving the scientific question.

Re: Yes, we agree that isolating the non-monsoon season independently may detract from the study's overarching scientific objectives. Following your suggestion, we have restructured the relevant parts by integrating the discussion of the non-monsoon season and monsoon into a single paragraph. The restructured paragraph on the review of precipitation isotopes highlights the importance of both seasons in addressing the scientific question. The material has been significantly condensed.

Lines 318-325: this part should be results, not discussion.

Re: We agree that these parts are more appropriately situated within the Results section. It has been relocated to a new subsection within the Results section.

Section 4.2, 4.3, 4.4: Most of these sections are results, not discussion. I strongly suggest the authors to reorganize the results and discussion. It is difficult to obtain information in current version.

Re: We agree that the original structure made it difficult to distinguish clearly between results and their interpretation. Following your suggestions, we have reorganized the results and discussion. The Sections 4.1, 4.2, and 4.3 are now moved to the Results section. Currently, only one section was kept as discussion section. The current structure of the results and discussion is as follows: "

3 Results

3.1 General characteristics of vapor $\delta^{18}O$, d-excess, and local meteorological variables

3.2 Seasonal variability in moisture sources and transport pathways

3.3 Role of ocean surface evaporation conditions at seasonal and intraseasonal time scales

3.4 Role of dry and cold air intrusion during the non-monsoon season

3.5 Role of rain-vapor interaction during the summer monsoon season

4 Implications for interpreting TP ice core isotope data

"

Figure Legends: Ensure consistent formatting (e.g., font size, symbols, color schemes) across all figures to improve clarity and visual coherence.

Re: We have checked all figure legends to ensure uniformity across all figures, and we have made changes when it is necessary.

Isotope Notation: Verify that "$\delta^{18}O$" is consistently formatted with proper superscripts (e.g., replace "d18O" or "delta18O" with "$\delta^{18}O$").

Re: We have checked the isotope notation across the manuscript, figures, and supplementary information. To ensure consistency, we replaced all occurrences of "d18O" from those figures in the supporting information with the properly formatted "$\delta^{18}O$".