

This paper deals with an extensive dataset of stable isotope composition of water (precipitation, thermokarst ponds, ground ice, stream) in samples collected on a permafrost dominated area.

The raw data is available at <https://doi.org/10.5281/zenodo.10684110> in five Excel files organised in a logical way.

The concept of the study is good and ambitious, the applied sampling and analytical methods are adequate, although the description of the stable isotope measurements is not totally clear for me. How was the drift corrected and how were the raw data normalized to the SMOW-SLAP scale? Were all the five laboratory standards used in every measurement sequence? Please, make this part of the manuscript clear.

Answer: Dear reviewer, thanks for your valuable comments.

1. According to your suggestions, I have interpreted the drift treatments. If the measured precision and drift values were not passed the guaranteed values, the comprehensive inspection of the analyzer was conducted, i.e., the instrument analyzing system, the vaporizer module, as well as the quality of dry nitrogen. After completing all checking processes, we repeated the analysis of 14 distilled/tap water samples and calculated the drift values until they passed the guaranteed values. The results were normalized to the V-SMOW-SLAP scale by analyzing internal standards before and after each set of ten samples. Five laboratory standards (provided by LICA United Technology Limited, Beijing, China) for each group of 10 samples were used for instrument calibration. (see the red words in page 16 line 282-289)

The terms related to ground ice are not widely known, e.g. pore ice, pure ice layer, segregated ice, excess ice. Please, define these terms.

Answer: Thanks, I have defined these terms. (see the contents in page 2)

The dataset is very important and the manuscript is well written, therefore I recommend its publication after minor revision (see above and below).

Answer: Thanks for your appreciation and valuable comments, which helps us better improve our manuscript.

### **Detailed comments**

In the title I recommend to use Qinghai–Tibetan Plateau, because in the English literature it is much more known?

Answer: Thanks, I have changed the “Qinghai–Xizang Plateau” to “Qinghai–Tibet Plateau” in the whole manuscript.

### **Page 3**

Lines 49–50: You use the phrases “permafrost degradation” and “ground ice melting” side by side as two different ideas, but for me they are not so different. What is the difference between them?

Answer: Actually, there are some differences between them. The ground ice melting is caused by permafrost degradation. However, the permafrost degradation contains rise of ground temperature, the increase in the active layer thickness, and sometimes the melting of ground ice which is not an inevitable outcome of permafrost degradation.

Line 58: "Immerzeel et al., 2010" is missing from the list of references.

Answer: I have added this reference in the list.

Line 68: "Liu et al., 2022)" – In the References there is Liu et al., 2022a and Liu et al., 2022b. Please, specify which one is intended here.

Answer: Thanks, it is Liu et al., 2022a, I have revised it.

## Page 5

Line 106: "between 2017 to 2020" – I recommend to write "between 2017 and 2020".

Answer: Thanks, I have revised it.

Lines 107-108: "393.71 mm", "555.99 mm". – There is no reason to give decimals here. Write 394 mm and 556 mm.

Answer: Thanks, I have revised it.

Line 111: "Lin et al., 2010" – In the list of references I could find Lin et al., 2020! Probably wrong year.

Answer: Thanks, this references is wrongly cited. I have deleted it.

Line 116: "melting water from permafrost and ground ice" – For me "melt water from permafrost" or "melt water from ground ice" are the same. Am I wrong? If I am wrong then please, make the difference clear in the manuscript!

Answer: Yes, you are right. I have revised it according to your suggestions.

## Page 7

Line 134: "to collected daily rain" – please, replace with "to collect daily rain"

Answer: I have revised it.

Line 135: "we select a typical" – better would be "we selected a typical"

Answer: I have revised it, thanks.

Line 144: "one drinking spring (CSQ)" – CSQ is not indicated on Figure 1. I think it is the "Sub-permafrost water" on the second map of Figure 1, but it is not indicated. If my supposition is true, then the legend should be modified as "Sub-permafrost water (CSQ)". Anyway, I have never met with the phrase "drinking spring". Why drinking? I think that in this case the word "drinking" should be omitted.

Answer: Thanks, you are right. I have revised it to "a perennial spring (CSQ; Fig. 1) for domestic water supply", and the figure 1 is also improved.

## Page 11

Line 195: "QXH" – What it stands for?

Answer: QXH denotes the Qinghai-Xizang Highway. I have defined it. Here according to your suggestions, I use Qinghai-Tibet rather than Qinghai-Xizang to make it clear and understandable.

### Page 13

Lines 213-214: "All the treated raw frozen soil samples were immediately preserved in HDPE bottles." – How could you put the frozen soil samples into the bottles?

Answer: Thanks, during sampling work, the wide-mouth HDPE bottles were used with the diameter of 20cm. The raw frozen soil samples were cut in half and then put into the bottles.

Lines 226-227: "The analyzing accuracy was less than 0.02 ‰ for the  $\delta^{18}\text{O}$  value measurements and 0.05 ‰ for the  $\delta\text{D}$  value measurements" – I recommend to provide one standard deviation instead of accuracy, and please describe how you calculated the standard deviation.

Answer: You are right. Actually, the analyzing accuracy is not correct. I have revised it. The guaranteed instrument precision was 0.025 ‰ for the  $\delta^{18}\text{O}$  value measurements and 0.1 ‰ for the  $\delta\text{D}$  value measurements. (The red words in page 15 line 253). During the precision estimation, we have calculated the standard deviation. (red words in page 16 line 274-276). We calculated the standard deviation via the a function in the excel, and the standard deviation is 0.07‰ and 0.18‰ for  $\delta^{18}\text{O}$  and  $\delta\text{D}$ , respectively.

Lines 228-229: "IAEA standard Vienna Standard Ocean Water (VSMOW) standard" – The first "standard" should be deleted.

Answer: I have deleted it.

Line 230: " $\delta=(R_{sa}/R_{st}-VSMOW-1) \times 1000 \text{ ‰}$ " – I recommend to write " $\delta=(R_{sa}/R_{st}-1) \times 1000 \text{ ‰}$ ".

Answer: I have revised it.

### Page 14

Line 234: "events were occurred" – correctly "events occurred".

Answer: Thanks, I have revised it.

Line 236: "were mixed". – In which ratio? In amount-weighted ratio?

Answer: Thanks, because the precipitation amount of every single event was different. We collected event samples and mixed them in amount.

Line 255: "Five laboratory standards for each group of 10 samples". – Do you mean 10 unknown samples, or the 10 samples included the five lab-standards?

Answer: Thanks, five laboratory standards with given isotopic values were inserted before 10 samples, which were used for instrument calibration. (red words in page 17 line 289-293)

### Page 15

Line 277: "lakes/ponds more positive" – correctly "lakes/ponds are more positive".

Answer: I have revised it.

### Page 16

Line 284: "the isotopic contents of lakes/ponds are lower in" – The phrase "isotopic content"

has no meaning. I recommend the following: “the heavy isotope contents of lakes/ponds are lower in”.

Answer: Thanks for your suggestions. I have revised it. ( see red words in page 18 line 321)

Lines 287-288: “isotopes of lakes/ponds are positive in May, June, July, and October (Fig. 4; Fig. S3) due to evaporation and isotopic-positive precipitation”. – Bad wording. The isotopes of lakes cannot be positive, only the delta values can be positive. And there is no “isotopic-positive precipitation”. But even the delta values of lakes are not always positive in May, June, July and October! Please, describe clearly what you mean.

Answer: I have revised it. In comparison, majority of isotope values of lakes/ponds are positive in May, June, July, and October (Fig. 4; Fig. S3) due to evaporation and recharge of isotopic-positive precipitation. (red words in page 18 line 324-326)

Line 291: “The mean values are equivalent to the average levels of precipitation”. – I recommend to change the word “levels” for “values”.

Answer: I have revised it.

Line 311: “isotopic-negative water” – I recommend to use “isotopically light water”.

Answer: I have revised it.

## Page 17

Figure 4. The legend and the figure caption do not explain every symbols used on the figure. E.g.  $\delta^{18}\text{O}$ precipitation diagram: I think that the grey dots denote event values, while the red dots denote the monthly average values, but this is not stated. It is interesting that the number of red dots of one year varies between 7 and 10. Wintertime there are months without red dots, but zooming into the precipitation amount diagram (PP at the bottom of the figure), we can see very low bars indicating small amount of precipitation (I think that event precipitation), but there is no data (grey dot) on the  $\delta^{18}\text{O}$  diagram. Why? Was the amount insufficient for performing analysis?

Answer: Thanks, I have stated all the symbols in this figure. About the data in wintertime, you are right, the very low bars indicate much smaller amount of snow, which were recorded by the instrument. However, the amounts were insufficient for performing analysis.

In few cases the red dots on the  $\delta^{18}\text{O}$  diagram stand without grey dots. E.g. the very first red dot. Why? Was there only one precipitation event in that month?

Answer: Yes, you are right. There only one precipitation event in that month

Lines 319-320: “isotopic points of ground ice are located in the left sides of the mean level of precipitation (Fig. 5), i.e., the ground ice represented more negative isotopes” – Bad wording again. “mean level”: please replace it with “mean value”; and provide this mean value in brackets (-10.94‰). “negative isotope” – an isotope is not negative; it can be light or heavy. I recommend the following wording: “ $\delta^{18}\text{O}$  points of ground ice are located in the left sides of the mean value of precipitation (-10.94‰) on Figure 5, i.e., the ground ice is isotopically lighter than the precipitation”.

Answer: Thanks for your comments. I have revised this expression according to your suggestions. (see the red words in page 20)

### Page 18

Line 328: “past precipitation; et al)” – Please, delete “et al”.

Answer: I have deleted it.

Line 331: “(Fig. 4)” – correctly (Fig. 5).

Answer: It is revised.

Line 334: “more negative isotopes” – isotopically lighter.

Answer: I have revised this expression according to your suggestions. (see the red words in page 20)

“(Fig. 4; Table 4)” – correctly (Fig. 5; Table 4).

Answer: It is revised.

Line 337: “isotopic-positive pore ice” – the delta value can be positive.

Answer: It is revised.

### Page 19

I recommend to give the  $\delta D$  data with one decimal only.

Answer: I have revised it

### Page 20

Figure 5: There is a blue vertical line on every diagram. I suppose it indicates the mean  $\delta^{18}O$  value of precipitation. If this is true, then please, write it down in the figure caption.

Answer: Thanks, I have added it in the figure caption.

It would be interesting to check the relation between the  $\delta^{18}O$  values and the type of ice (segregated ice, pore ice, ...). May be it gives some clue for the interpretation of the wide variation.

Answer: This suggestion is wonderful. Thank you. Actually, the ice formation mechanisms vary among different types of ground ice. As I stated in this manuscript, the near-surface ground ice is closely related to the recent precipitation and active layer hydrology, however, the deep-layer ground ice exhibited complicated formation mechanism, including the various source water (meltwater from glacier, permafrost, and snow; lake water; past precipitation), climate conditions, and freeze histories. The pore ice is usually formed under in-situ quick freezing conditions, the isotopic signals of which reflected the original isotope information of its source water; however, the segregated ice grows under slow freezing, the source water of which suffered isotopic fractionation during water migration and water freeze. Given that the ESSD prefer to publish articles on original research data (sets), the detailed interpretation on original data is will give in the future.

Lines 362-363: "The local meteoric water line (LMWL), determined by ordinary least square regression using the daily isotopic data during six years (2017-2022)," – This is only one way of determining the LMWL and not the most wide-spread one. It is widely accepted that the LMWL is calculated using monthly data. The LMWL based on daily data may differ significantly from that based on monthly data, see e.g. Barešić et al. 2006. Therefore, I recommend to determine the LMWL using monthly data. The most sophisticated way to determine the LMWL is using the amount-weighted multi-monthly mean isotopic values. See, e.g., Kern et al. 2016. I recommend to calculate the LMWL by all three ways.

Answer: Thanks for your suggestions. I have calculated the LMWL by all the ways you mentioned and referred the papers you suggested (Barešić et al. 2006; Kern et al., 2016), and put them on the figure.

The local meteoric water line (LMWL), determined by three different methods, i.e., ordinary least square regression using the daily isotopic data, the arithmetic mean isotopic values, and the amount-weighted multi-monthly mean isotopic values during six years (2017-2022). They are expressed as:  $LMWL_{event}: \delta D = 7.97\delta^{18}O + 15.26$  ( $r^2 = 0.96$ ),  $LMWL_{monthly}: \delta D = 8.06\delta^{18}O + 12.58$  ( $r^2 = 0.93$ ),  $LMWL_{PWA}: \delta D = 7.78\delta^{18}O + 8.78$  ( $r^2 = 0.92$ ). The slope is nearly identical to that of the global meteoric water line (GMWL; Craig, 1961). However, the intercepts are quietly different (Fig. 6) due to the influences of precipitation amounts and the exceptional meteorological conditions (Barešić et al., 2006; Hughes and Crawford, 2012; Kern et al., 2016). (see the red words in page 22 line 379-386)

Barešić, J., Horvatinčić, N., Krajcar Bronić, I., Obelić, B., & Vreča, P. 2006. Stable isotope composition of daily and monthly precipitation in Zagreb. *Isotopes in environmental and health studies*, 42(3), 239-249.

Kern, Z., Harmon, R. S., & Fórizs, I. 2016. Stable isotope signatures of seasonal precipitation on the Pacific coast of central Panama. *Isotopes in Environmental and Health Studies*, 52(1-2), 128-140.

Hughes, C. E., & Crawford, J. 2012. A new precipitation weighted method for determining the meteoric water line for hydrological applications demonstrated using Australian and global GNIP data. *Journal of Hydrology*, 464, 344-351.

## Page 21

Line 384: "Yang et al., 2017a" – Only Yang et al. 2017 exists in the list of references. If "Yang et al., 2017a" is intended to denote another paper than it is missing from the list.

Answer: Yes, it is Yang et al., 2017, I have revised it.

## Page 22

Figure 6: Please, insert to the figure caption what "Wt. avg. AP", "Wt. avg. SP" and "Wt. avg. WP" stand for.

Answer: I have added the detailed information. (see the red words in page 23 line 407-410)

Lines 396-397: "the d-excess values of ground ice are more negative than those of river water and more positive than the amount-weighted average value of annual/summer precipitation" – The mean d-excess values of ground ice are positive numbers except one (BLH-L-6), see Table 4. I recommend the following sentence: "the d-excess values of ground ice are lower than those of river water and the amount-weighted average value of annual/summer

precipitation”.

Answer: Thanks, I have revised it. (in page 24 line 431-433)

### Page 23

Lines 406-407: “All the stable isotope data that support the findings of this study The dataset provided in this paper can be obtained at <https://doi.org/10.5281/zenodo.10684110>” – Please, delete the text “The dataset provided in this paper”.

Answer: Sorry for my mistake. I have revised it.

### Page 24

The cited texts below are characterised by bad wording, see my comments above.

Answer: I have improved the contents.

Lines 420-421: “lower isotopic contents” – isotopically lighter.

Answer: I have revised it.

Line 422: “isotopic-positive precipitation”

Answer: I have revised it.

Lines 423-424: “The slopes of the three LELs are all lower than those of LMWL, indicating strong evaporation.” – The first part of the sentence is evident, otherwise we would not call it “evaporation line”. The meaning of “strong evaporation” is not clear. Actually the slope of the evaporation line is related to the relative air humidity, there is a positive correlation between them. See Figure 2-8 in the Clark & Fritz 1997. So, lower slope means lower relative humidity.

Answer: Thanks for your suggestions. I have revised it. (see the red words in page 23 line 391-393; page 26 line 459)

Line 426: “isotopic-negative water”.

Answer: I have revised it.

### Pages 26-30

The journal names should be written with capital initials, but in many cases it is not so. E.g. in reference [4] “Nature communications is written instead of “Nature Communications”. The same is true for references [25], [34], [52], [56], [59] and [67].

Answer: I have checked all the references and revised the patterns.

What is reference [5]? A book? Who is the publisher? It is an incomplete bibliography.

Answer: I have added the detailed information of this references.

Reference [42] is also incomplete, volume and page numbers are missing.

Answer: I have added the detailed information of this references.

### References

Clark, I., Fritz, P. (1997) Environmental Isotopes in Hydrogeology. Lewis Publishers, Boca Raton – New York

Barešić J, Horvatinčić N., Krajcar Bronić I., Obelić B., Vreča P. (2006) Stable isotope composition of daily and monthly precipitation in Zagreb. *Isotopes in Environmental and Health Studies* 42(3):239-249

Kern Z., R. S. Harmon, I. Fórizs (2016) Stable Isotope Signatures of Seasonal Precipitation on the Pacific Coast of Central Panama. *Isotopes in Environmental and Health Studies* 52(1-2):128-140

Answer: Thanks, I have refereed these papers for interpretation and make the explanation and contents clear.