# Answer to Referee 2

We are very grateful to Reviewer 2 for the in-depth reading and for the relevant review we received. We present below our detailed answer to the discussed points. The reviewers' comments appear in orange and our responses appear in black.

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| This manuscript proposes the use of vapor pressure over frozen lake surfaces to estimate cold-season snowfall, offering a practical approach to address the challenges posed by limited and difficult in-situ snowfall observations over lake areas. While the study presents certain merits and has reference value for related hydrometeorological research, several key issues must be addressed before it can be considered for publication. |
| We thank the reviewer for their positive appreciation of our work. This is likely due to a lack of precision in our manuscript, but we feel that there is a slight misunderstanding in the reviewer interpretation of our work: we measure the *lake water pressure* as a proxy of snow overburden, and not *vapor pressure* over frozen lake. We clarified this point in the text to avoid confusion: l21: "*To overcome these issues, recent studies suggested that solid precipitation could be also estimated from frozen lake <u>water</u> pressure changes (Pritchard et al., 2021)*". L69: "*Three Hobo U20 <u>water</u> pressure transducers (PT) were immersed in Golojang Co*". L75: "*It has been demonstrated that such <u>water</u> pressure time series can be interpreted as direct measurements of the precipitation falling onto the lake during winter-like conditions (Pritchard et al., 2021)*" |

1.

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| The authors repeatedly highlight the use of "new observations." However, both the methodological framework and the ground-based measurements employed are not novel in the field. The authors should clearly articulate what is truly innovative about their observational strategy or data application, and avoid overstating the originality. |
| As referee 2 stated, both the methodological framework and the type of ground-based measurements employed are indeed not novel in the field. The novelty here lies in the observations themselves, as mentioned on l 25*: "In this study, we report new observations of lake level changes during the cold season"*. These original lake pressure observations are then used to derive snowfall measurements. To avoid confusion, we modified l 227: "*In this communication, we studied the hydro-meteorology of the northern Langtang National Park in Nepal and the Southern Paiku Co basin in Tibet using in-situ and modeled data from conventional and ~~new~~ recent methods*." The two previous mentions of novelty were the only ones present in the manuscript. |

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| The concept of "winter precipitation transition" is central to the manuscript, yet it lacks a clearly defined temporal scale. It remains unclear whether this refers to intra-annual seasonal transitions (e.g., winter to pre-monsoon) or to interannual variability in winter precipitation. This ambiguity persists in the title, abstract, and main text. The authors must explicitly clarify the temporal framework throughout the manuscript. Additionally, the pronounced increase in precipitation from winter to pre-monsoon is a well-recognized climatological feature in many regions, |

particularly across the southern Tibetan Plateau. Prior studies have documented a spring precipitation peak in this region. Therefore, the transition described in Golojiang is not a unique phenomenon and should be contextualized within broader regional precipitation dynamics.

We apologize for the lack of precision in our manuscript. Our study tackles only spatial gradients of simultaneous precipitation measurements, and does not investigate temporal variability. The methodological constraints imply that the lake and catchment have to be frozen and hence can only be applied during the coldest months of the year (DJFMAM), but we do not investigate the precipitation increase during pre-monsoon that is indeed a well-documented phenomenon in the region. We implemented the following changes for the sake of clarification:

- title: " Brief communication: Sharp precipitation gradient on the southern edge of the Tibetan Plateau during cold season"
- abstract: "We show that precipitation totals can vary by one order of magnitude over a short distance of 10 km in a rather smooth terrain during cold season."
- text: we replaced "transition" by "gradient" (L161)

3.

The manuscript emphasizes that using lake surface vapor pressure can help identify snowfall events that may be missed by conventional precipitation measurements. However, the authors should also assess whether this method can reliably capture larger-scale precipitation events typically recorded by standard instruments. A more comprehensive evaluation of the method's strengths and limitations is necessary to support the reliability and generalizability of the results.

As mention earlier, we are sorry for the visible misunderstanding due to the lack of clarity of this manuscript. As clarified previously in this response letter, our manuscript does not discuss the use of the lake vapor pressure. However, we use a recent but published method developed by Pritchards et. al 2021 (https://doi.org/10.1175/JHM-D-20-0206.1), allowing to use the water pressure of the lake as an efficient way for recording the precipitation during cold seasons. Here, we apply, as users, this method and discuss its apparent limitations for the present case.

We agree that the magnitude of the events that can be detected by a novel method is an important question. The method seems reliable to detect large snowfall events and overall season total snowfall with a relatively low errors (l135 : "*The total precipitation have been estimated to 420 ± 46 mm for the period 01 December 2019 to 31 May 2020, 307 ± 27 mm for the period 01 December 2020 to 31 May 2021, and 211 ± 9 mm for the period 01 December 2021 to 14 April 2022 (Fig. 3 - a, b and c)"),* but is more questionable for small events (see response to referee #1's 5$^{th}$ comment: "*Although we use Golojang PT estimates as references here, they are likely underestimated, as the pressure time series primarily captured wet spells averaging 73 hours, while shorter snowfalls may have been masked by noise"*).

4.

The manuscript presents an interesting approach, but substantial revisions are required to clarify its novelty, conceptual framework, and methodological reliability. I encourage the authors to address the concerns raised above to enhance the scientific clarity and impact of the study.

We are very grateful for the referee's comments and believe that our detailed responses address their concerns.

References:

Pritchard, H. D., D. Farinotti, and S. Colwell, 2021: Measuring Changes in Snowpack SWE Continuously on a Landscape Scale Using Lake Water Pressure. J. Hydrometeor., 22, 795–811, https://doi.org/10.1175/JHM-D-20-0206.1.