

Interactive comment on “Decapitation of high-altitude glaciers on the Tibetan Plateau revealed by ice core tritium and mercury records” by S. C. Kang et al.

Anonymous Referee #2

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Glacier volume loss through high-elevation thinning is a major research conclusion, and the strength of this paper lies in expanding the already documented Himalayan glacier thinning to other locations in the Tibetan Plateau. The revision of the paper should concentrate more on this point, which may require significantly shortening the paper. The research adds valuable additional locations demonstrating high-altitude glacier thinning and therefore contributes to our scientific understanding of current freshwater volume stored in Tibetan Plateau glaciers

I am not convinced by the chronology of the Geladaindong ice core, as Figure 4 demonstrates what is likely a melt layer immediately deeper than the AD 1963 radioactivity peak. This likely melt then influences the comparison of Hg records in Figure 5. Do

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modern studies demonstrate a seasonal deposition of Ca²⁺ on these ice fields? Is there any evidence for melt above AD 1963? If the top of this glacier is thinning due to melt, it is likely that the melt influenced the upper strata of the glacier ice. Such melt may explain the offset in Hg records, where the Geladaindong Hg spike appears to occur 5-10 years earlier than the NamCo Hg spike (the geographically closest Hg record with which to compare the results). While comparing Hg records is an interesting approach, the errors associated with this approach (Figures 4 and 5) need to be expressly addressed throughout the paper.

Major points:

P. 423 and Figure 2: You mention that some samples at 31 m were contaminated with tritium during sampling. How were the samples contaminated? Please define. This contamination needs to be explained because otherwise these elevated tritium concentrations at 31 m significantly affect the findings and conclusions.

P. 423 and Figure 2: In the figure caption, you note that the peak in Northern Hemisphere tritium is mid-1963. However, on page 423, you mention that this peak is “during the thermonuclear bomb testing era” which also includes the 1950s. It is essential to be more explicit of the actual years in the paragraph on page 423, as all resulting chronologies are dependent upon this assumption. Also, Figure 2 could be greatly improved if you visually separated the three records.

Figures 4 and 5: The annual layer counting in this figure is completely based on the Ca²⁺ peaks. While the d¹⁸O, Cl⁻ and Fe variations can help support this information, it is not correct to say that they form the annual layer counting. What do the dust records show at the peak at 6 m depth? Is there any evidence of melt and refreezing that causes this large increase in Ca²⁺, Cl⁻ and Fe? If so, the dating below 1963 AD may be incorrect. If this dating below 1963 AD is incorrect, then the comparison in Hg records in figure 5 may also be flawed.

Minor points:

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Figure 1: The map in the upper panel needs to show much more detail: (ie topographic lines, country borders, cities, etc.) that help the reader place the ice core sites into context. Such details are especially important since the meteorological stations are approximately 2000 meters lower than the ice core sites, as well as the fact that the authors extrapolate in to regional applications in the conclusions section.

P. 421 Line 1: This sentence contains two separate ideas that are not linked (as they currently are in the paper). Yes, the Tibetan Plateau influences the intensity of the monsoon. The monsoon itself is a reversal of weather patterns, but this reversal happens regardless of the intensity of the monsoon. Perhaps you would like to stay that the increasing the spatial extension of the monsoon may change weather patterns in regions (ie to the north) that are currently not influenced by the monsoon?

P. 424 Lines 5-10 and Figure 2: All of these assumptions are based on the fact that mercury has an atmospheric lifetime of months. This long lifetime needs to be explicitly stated, so that the reader knows that these assumptions are valid.

P. 425 Lines 25-26: Are these mass losses total mass losses for all glaciers? Or mass loss over a region? Or for a specific glacier?

427 Lines 6 to 10. This sentence is confusing. In the previous paragraphs you suggest that ice and snow have different surface energy-balance characteristics both from each other and from surrounding non-glaciated terrain, which are both true. However, you need to expressly then mention these aspects if you move into the “possibly larger lapse rate in the glacier regions” argument. Or is the possibly larger lapse rate mentioned in the cited publication?

Miscellaneous:

P. 419 Line 13: Please define the altitude(s) of the summit regions

P. 419 Line 14: Define “this” at the beginning of the sentence. E.g. “This mass loss”

P. 419 Line 17: Please omit the abbreviation “TP” for “Tibetan Plateau” throughout the

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paper. You are not limited for space. It is easier and more clear to read sentences without acronyms.

P. 419 Line 22: Replace “retreating” with “retreat”.

P. 419 Line 24: Define “several percent”. 2%? 20%?

P. 419 Line 24: Include “Tibetan Plateau” after “central”.

P. 419 Line 26: Include “the” before “last”

P. 420 Line 13: Add “thinning” after “this”.

P. 420 Line 16: This is not “Ice accumulation chronology”. The major point is that the ice is not accumulating over timescales of more than the seasonal surface snow. A better phrase could be “timing of ablation”.

P. 420 Line 18: Omit these acronyms from the entire paper. These acronyms only serve to confuse the reader. Your goal is to be as clear as possible, and the acronyms work against you.

P. 420 Lines 24 and 25: Replace “Climatically the southern and central TP is influenced primarily” with “The southern and central Tibetan Plateau is climatically influenced by”

P. 420 Line 27: Omit “respectively”

P. 421 Line 5: Change to: “by drilling to the bedrock depth of 124 m”.

P. 421 Line 17: Change “frozen” to “in a frozen state”

P. 421 Line 21: Describe how much of the ice core was scraped away during the decontamination process.

P. 421 Line 21: Replace “parts” with “sections”

P. 421 Line 24: Place “the” before “outer”

P. 421 Line 26: Place “of” before “the samples”

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P. 422 Line 12: Replace “showed good agreement of differences within 15%” to “agreed within 15% of each other”

P. 422 Line 25: Place “bomb” after “thermonuclear”

P. 423 Line 7: Place “the” before “central”

P. 424 Lines 5-10: All of these assumptions are based on the fact that mercury has an atmospheric lifetime of months. This long lifetime needs to be explicitly stated, so that the reader knows that these assumptions are valid.

P. 424 Line11: Replace “emissions” with “concentrations”.

P. 424 Line 27: Please replace “experiencing shrinkage” with “retreating”.

P. 425 Line 3: Please omit “where ice cores were retrieved for reconstructing paleoclimate”.

P. 425 Line 6: Omit “hoever”.

P. 425 Lines 9-10. Replace “Suggest that the annual mass losses from upper glacier areas are at least on the order of several hundred millimeter water equivalent (mm w.e.) with “This data suggests that the glaciers have a net loss of at least several hundred millimeters water equivalent (mm w.e.) each year.

P. 425 Line 24: Please replace “they” with “these authors”

P. 425 Line 26: The total mass loss?

P. 426 Line 4: Please replace “to” with “with”.

P. 426 Line 8: Replace “DDM” with “DDMs”.

P. 426 Line 10: Place “as” before “the”

P. 426 Line 16: Replace “station” with “stations”

P. 426 Line 25: Replace “the previous works” with “the previous work”

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P. 426 Line 27: Please replace “ shows a dramatic increasing trend in positive accumulated temperature” with “shows a dramatic positive trend in increasing temperatures”

P. 427 Line 3: Replace “glacier mass losing” with “glacier mass loss”

P. 427 Line 15: Replace “glacier” with “glaciers”

P. 427 Line 16: Replace “northwestern of the TP” with “northwestern section of the Tibetan Plateau”

P. 428 Line 1: What do you mean by “inland” ? Do you mean the southern section of the Tibetan Plateau?

P. 428 Line 5: Replace “outburst” with “outbursts”

Interactive comment on The Cryosphere Discuss., 9, 417, 2015.

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