Response to reviewers

Reviewer: 2 (Reply on RC2)

Reviewer comments in 'black', author's responses to each comment in 'blue'.

General comments:

This is an interesting submission using altimetry data to characterise changing lake levels across High Mountain Asia. It is well-structured and the methods appear to follow a well-established workflow. The findings are broadly consistent with previous regional studies, offering some new insights into spatial variability in lake-level trends. There are several aspects that I think could (should) be addressed before the manuscript is accepted; in particular the uncertainty quantification seems optimistic and the attribution of observed changes to climatic drivers rather simplistic (which needs acknowledging/discussing), and the framing of the work around 'glacial lakes' is somewhat misleading since they are not included in any of the analysis.

Author's response: We thank the reviewer for taking the time to review our manuscript and for providing thorough and constructive comments. The suggestions have been very helpful in improving the clarity and scientific presentation of the manuscript. We appreciate the positive comments regarding the overall structure of the manuscript and the methodological framework. Following the comments and suggestions we have substantially revised the manuscript to address the concerns. Specifically, we expanded the discussion of uncertainties by clarifying the distinction between statistical and systematic uncertainties, providing additional discussion of residual inter-mission differences, and including new analyses of CryoSat-2 and ICESat-2 consistency during the overlap period. We moderated the interpretation of lake water level changes and climate analysis together with the limitations of the ERA5-Land climate data. We revised the framing of the manuscript to focus consistently on large lakes (>20 km^2) across High Mountain Asia and removed the discussion of glacial lake expansion and GLOF hazards from the Introduction and Discussion, revised the terminology throughout the manuscript. We also addressed all technical comments, corrected inconsistencies in the supplementary material, revised figures and captions. We hope these revisions have improved the manuscript. The detailed responses to each comment are provided below.

Specific comments

1. The uncertainties calculated for each dataset look optimistic to me - there is some brief consideration, or acknowledgement, that the correlation errors are not accounted for, but how about accounting for things like the bias correction, given that a substantial number of the lakes show a different offset? How does this propagate into the presented trends? While the sign agreement of the trends derived by the two sensors is high, the rates of change (0.15 m/a-1 vs 0.052 m/a-1) are substantially different. How can this inconsistency be accounted for (and can some of that discussion/acknowledgement of the additional uncertainties that go beyond random noise - sensor mismatches for example) be included in the manuscript?

Author's response: Thank you for highlighting weaknesses in the uncertainty propagation. We agree that the statistical uncertainty estimates presented in the original manuscript did not explicitly distinguish between measurement uncertainty and additional systematic sources of uncertainty associated with mission intercomparison trends. We revised both the Methods and Discussion sections to clarify the scope of the reported uncertainty estimates and to discuss the limitations associated with residual inter-mission differences.

The uncertainty estimates reported in this study represent the statistical uncertainties associated with the annual lake level estimates and linear trend fitting. We now clarify that these uncertainties do not include systematic sources of error, such as residual inter-mission bias, geoid differences, retracking differences, or spatially correlated measurement errors. During the overlap period (2018-2023), intercomparison shows a mean vertical offset of +2.74 m between CryoSat-2 and ICESat-2. This offset is statistically significant for 79% of lakes, indicating generally consistent inter-mission differences across the majority of lakes (183 of 232). We therefore applied a -2.74 m correction to ICESat-2 timeseries for the mission intercomparison. Because this correction represents a constant vertical offset, it is not expected to influence linear trend estimates unless the inter-mission bias varies with time. Nevertheless, we now acknowledge that residual lake-specific offsets and other systematic inter-mission differences may contribute additional uncertainty to the combined 2010 to 2024 trend estimates and are not propagated within the reported statistical uncertainties.

Regarding the difference in trend magnitudes derived from CryoSat-2 and ICESat-2. We have expanded the Discussion to emphasize that these differences should not be interpreted solely as sensor inconsistencies because the two missions sample different periods. The revised manuscript now includes an analysis comparing lake level trends before and after 2018, about (33.2%) changed the direction of their trends between the two periods. This temporal evolution indicates that differences between CryoSat-2 and ICESat-2 derived trend magnitudes cannot be attributed solely to inter-mission measurement differences, as the two missions also sample different phases of lake level evolution. We also expanded the Discussion of systematic uncertainties and the mission intercomparison (Fig. S1 and Fig. S6) to more explicitly acknowledge these limitations.

2. The climate attribution is currently quite limited and probably overstated. The correlation between precipitation and lake levels is modest and only some of the subsets show significant relationships. As stated early in the manuscript these lakes integrate fluctuations in the contribution of meltwater, precipitation, permafrost thaw and groundwater so it's a complex picture, and probably doesn't conform to a linear relationship anyway. Even more so if you include storage effects and lags in meltwater routing for example. There should be a more extensive part to the discussion that acknowledges the different components of the water balance more directly and the fact that the analysis is limited by the resolution of the climate data and the absence of a lagged/multivariate/non-linear analysis.

Author's response: We thank the reviewer for this constructive comment. We agree that lake level variability reflects the combined influence of multiple components of the lake water balance and ERA5-Land correlation analysis cannot alone provide direct attribution of their relative contributions. We revised the manuscript to moderate the mechanistic interpretation. Statements implying direct climatic control have been replaced with more cautious interpretations based on statistical associations. We clarified the distinguish between results supported by our study and process-based attributions based on previous studies. Specifically, highlighting the precipitation as the climate variable most consistently associated with de-seasoned lake level trends. This statistical relationship does not by itself quantify the relative contributions of precipitation to lake level change. For lakes in glaciated catchments, we revised the interpretation to emphasize that weak correlations with contemporaneous temperature, precipitation, and evaporation indicate that lake water level variability cannot be directly explained by the climate variables and may instead reflect hydrological processes with delayed or nonlinear responses.

We added the following statement to clearly define the scope of our climate analysis: Lake level change represents the integrated response of catchment runoff from precipitation, evaporation, snow and ice melt, groundwater exchange, and catchment storage processes. Consequently, the correlations presented here should be interpreted as first-order statistical associations rather than direct attribution of individual water-balance components.

The limitations associated with the ERA5-Land climate data are discussed in greater detail. While ERA5-Land provides consistent spatiotemporal coverage, its performance in high elevations with complex topography remains uncertain due to coarse resolution, sparse ground observations and systematic biases in precipitation representation (Orsolini et al., 2019; Tazi et al., 2024). Comparison with 28 meteorological stations in the Qilian Mountains during 1980-2018 showed that ERA5-Land captured the spatial patterns and temporal trends of monthly precipitation and temperature, while the amount of precipitation exhibited systematic overestimation (Li et al., 2022). Over the eastern Tibetan Plateau, ERA5-Land captured the broad spatiotemporal evolution of regional rainfall events, with spatial correlations >0.8, but exhibited biases in rainfall characteristics (Hu and Yuan, 2021). Evaluations over the Tibetan Plateau indicate that ERA5-Land can reproduce broad spatial and temporal patterns of precipitation and temperature, although systematic biases remain, particularly for precipitation on Tibetan Plateau (Wu et al., 2023b). Consequently, absolute magnitudes of precipitation and evaporation trends should be interpreted cautiously, though relative variability is generally reliable.

3. There are quite a number of citations within the manuscript that are not within the reference list - which on the face of it might seem to be a minor oversight but it makes it difficult for reviewers to properly evaluate how robust the argument being presented is (and therefore ultimately undermines the strength of this argument).

Author's response: We thank the reviewer for identifying this oversight. Number of citations were omitted from the reference list because of a technical issue during manuscript preparation. We have carefully reviewed and included all citations in the reference list in the revised manuscript. The missing references included:

Introduction: (Pekel et al., 2016), (Woolway et al., 2020), (Miles et al., 2021), (Zhang et al., 2023), (Zheng et al., 2021), (Brun et al., 2020), (Zhou et al., 2015).

Method: (Villadsen et al., 2015), (Pavlis et al., 2012), (Sheng et al., 2016), (Mann, 1945), (Kendall, 1975).

4. Given that the study focuses solely on lakes of surface area > 20km^2, all of the text about glacial lakes expanding (and becoming hazardous - with reference to GLOF events) seems somewhat redundant. I suggest those sentences in the introduction and the discussion should be removed.

Author's response: We removed the discussion of glacial lake expansion and associated GLOF hazards from Introduction and Discussion sections. The Introduction now focuses on the role of large high-altitude lakes as indicators of regional hydrological change, the spatial heterogeneity of lake level variability across High Mountain Asia, and the motivation for establishing a consistent multi-mission satellite altimetry record. The Discussion section has also been revised to focus on the interpretation of the observed lake level changes, comparison with previous studies, and the scientific contributions of our study, rather than hazards associated with glacial lakes.

Technical corrections (numbers refer to lines within the manuscript)

Is the title totally representative of what is presented, given that the abstract acknowledges heterogeneity across the TP and there is a decline in lake levels for the Himalaya?

Author's response: We agree that, given the regional heterogeneity in lake level changes and the persistent declines observed in the Himalaya, the original title was not fully representative of the study. Following the suggestion, we revised the title to "Lake Level Changes Across High Mountain Asia from CryoSat-2 and ICESat-2" to better reflect the scope and findings of the study.

21: declines should be presented as a negative number?

Author's response: Decline values are now presented with negative number in the revised manuscript, "whereas Himalayan lakes experienced persistent decline (-0.04 ± 0.001 m yr^{-1}) while western HMA displayed more heterogeneous behavior."

24: deriver = driver?, 25: 'glacierised' here and throughout if you mean that the catchment currently has ice cover?

Author's response: The sentence has been rephrased as "Catchment-scale climate analysis indicates that precipitation is the climate variable most consistently associated with lake-level variability, whereas lakes in glacierised catchments exhibit weak correlations with contemporaneous climate variables despite significant regional warming, suggesting that cryosphere processes may modulate hydrological responses."

We used the term "glacierised catchments" throughout the revised manuscript to refer to catchments with present-day glacier cover.

28: is growth the correct word here (and throughout)? This implies a lateral expansion to me, which your data do not assess. I suggest being consistent and using 'water level rise' instead.

Author's response: We agree that the term "growth" may imply lateral lake expansion rather than changes in lake water level. The rephrased the sentence as "We find systematic relationships between lake characteristics (area, elevation) and increasing water levels, with larger lakes generally showing higher rates of water-level rise."

40-45: this is an awkward sentence with too many parts to it. Can it be broken down a little bit? And checked for grammar too (lines 40-41 in particular)?

Author's response: We rephrased the sentence as "The HMA, often referred to as the "Third Pole" has undergone rapid warming in recent decades, particularly over the Tibetan Plateau, where warming rates of 0.50-0.67°C/decade have been reported (Kuang and Jiao, 2016; Niu et al., 2021; Wu et al., 2023a). These warming rates exceed the global average (Duan and Xiao, 2015) have contributed to accelerating glacier mass loss (Hugonnet et al., 2021; Zemp et al., 2025) and reduced snow persistence (Muhammad, 2024), along with precipitation changes (Na et al., 2024; Ouyang et al., 2020)."

46: 'so understanding their...'

Author's response: We rephrased the sentence as "Lakes within the region integrate these interacting processes, and understanding their long-term behavior is essential for quantifying the hydrological response to climate change."

47: what is 'this' here - the antecedent is unclear

Author's response: The sentence has been removed from the revised manuscript.

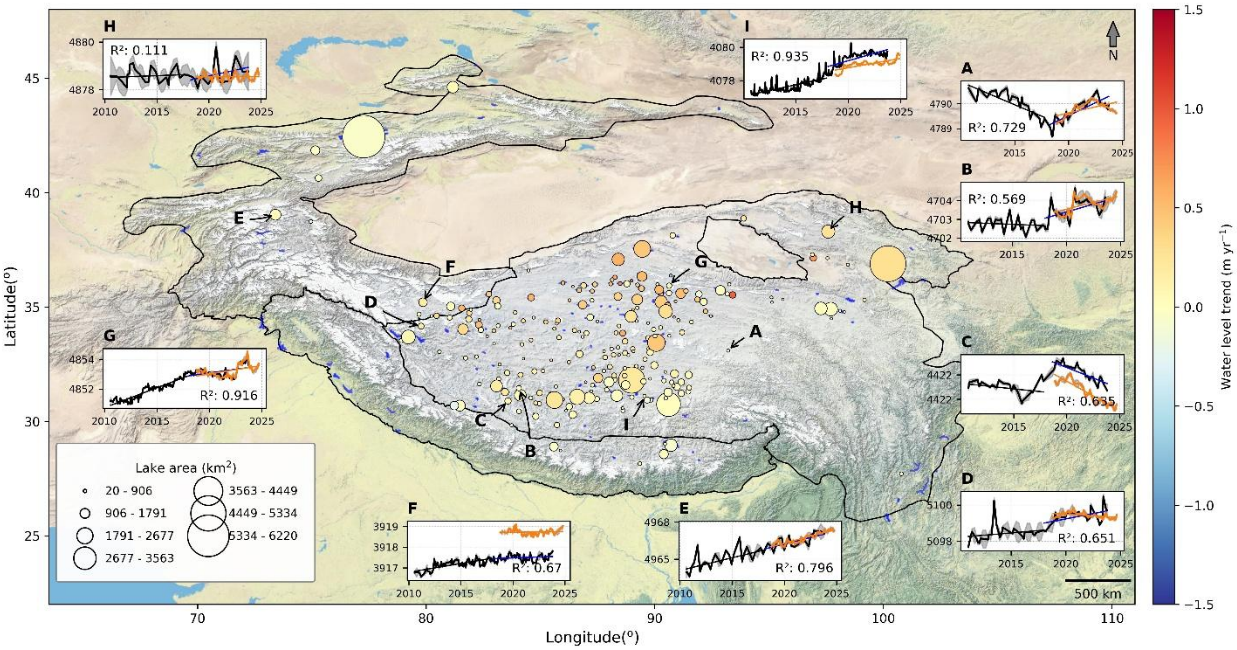
52: 'In the meantime' refers here to the previous studies of the previous sentence I think, but then it's specified as 'since 1990'. Maybe just delete the first three words to avoid any confusion/conflict.

Author's response: We removed the line 52 with 'In the meantime, ...' and revised the paragraph to improve clarity and the logical flow of the Introduction as, "Lake water levels across HMA exhibit substantial spatial and temporal heterogeneity. On the Tibetan Plateau, lake levels and storage decreased from 1970s to 1990s and increased thereafter, with rising trends in the northern and central Tibetan Plateau contrasting with declines reported in parts of the southern Tibetan Plateau (Song and Sheng, 2016; Zhang et al., 2017b; Zhang et al., 2023). These contrasting patterns have been associated with regional differences in lake water balance components such as precipitation, evaporation, glacier and snow melt, permafrost dynamics (Lei et al., 2014; G Zhang et al., 2017b). The relative contributions of these processes vary across HMA because of strong regional gradients in climate, topography, glacier cover, and hydrological regimes, resulting in diverse lake-catchment environments (Wang et al., 2025; Zhang et al., 2020). Previous studies have shown that precipitation is a dominant contributor to lake water level variability across the Tibetan Plateau, whereas snow and ice melt make a comparatively limited contribution to recent lake volume change (Brun et al., 2020). At shorter timescales, extreme precipitation anomalies previously lead to abrupt lake level changes on Tibetan Plateau (Lei et al., 2019; Song and Sheng, 2016), underscoring the sensitivity of lake water storage to both persistent climate forcing and episodic hydroclimatic variability. Consequently, understanding changes in lake water levels at the regional scale requires observations that can resolve spatial differences in lake responses while providing sufficient temporal coverage to characterize their evolution."

Figure 1: I can't see lake I. Also where the labels are overlayed directly onto the lake circle they are difficult to make out. Also the caption states A-J, not A-I. Figure 1: The placement of a (largely) results figure here in the introduction is a bit odd?

Author's response: We revised Figure 1 to improve clarity and consistency. The time series subplots have been rearranged from panel A to I. Positions have also been adjusted to avoid overlapping between labels and the lake trend circles. The missing label 'I' has been placed, and the figure caption has been corrected. Lake boundaries are now also displayed on the basemap to better illustrate the study locations.

The aim of placing Figure 1 at the end of the Introduction was also to introduce the study area, regional division of High Mountain Asia, and spatial distribution of the analysed lakes, while also providing an overview of the observed lake water-level changes. To clarify this dual purpose, we revised the figure caption.



Revised Figure 1 Overview of the study area and spatial distribution of analysed lake across High Mountain Asia (HMA). The regional boundaries of the Tibetan Plateau, Himalaya, and western HMA follow Bolch et al. (2019) are shown with black outlines. Each circle represents an individual lake, circle color shows CryoSat-2 derived lake water level trend from 2010 to 2023, corresponding to the colorbar. The circle size is scaled by area of each lake. (A to J) Water level timeseries of selected lakes showing CryoSat-2 observations (black; 2010–2023) and ICESat-2 observation (brown; 2018–2024). The y-axis in each subplot represents lake water level in meters (EGS2008).

Section 2: how were multiple datapoints over each lake handled? Mean? Median? And which ERA-5 cell was selected for the climate analyses? (sorry if I missed these)

Author's response: Instead of using mean/median of multiple along-track observations within each lake, we apply the mixture distribution approach described in Nielsen et al. (2015), which assumes observations follow a mixture of Gaussian and Cauchy distributions. We revised the Materials and Methods section to clarify how multiple altimetry observations over each lake were combined.

“The water level time series is reconstructed via the method presented in Nielsen et al. (2015). All valid altimetry observations falling within the lake boundary are combined through the state-space model to estimate a single monthly lake water level together with its associated uncertainty. In summary, the model includes a random walk as the process part to account for the temporal correlation, and the observations are assumed to follow a mixture between the Normal and Cauchy distributions to ensure robustness of the water level estimates. The Cauchy distribution is characterized by heavier tails compared to the Normal distribution. In contrast to assuming that the observations only follow a normal distribution, the mixture distribution reduces the influence of extreme observations on the estimated mean.”

We revised the Climate data analysis section to clarify the ERA5-Land data analysis over lake catchment. “For each lake, climate variables are extracted as the spatial average over the corresponding lake catchment using all ERA5-Land grid cells intersecting the catchment.”

134-135: how were regulated lakes identified/derived?

Author’s response: We thank the reviewer for highlighting the missing statement to identify lake where water levels are regulated. Regulated lakes were identified through lake names in the lake database used in this study, where reservoirs and impounded water bodies (e.g. Maharana Pratap Reservoir and Ramganga Reservoir) are provided and visual inspection of high-resolution satellite imagery in the Interactive Map, where dam structures were clearly visible (e.g. Ranjit Sagar Lake, Toktogul Skoye, Erher Hai, and Cheng Hai). We included clarification in the revised manuscript “Regulated lakes are identified from reservoir classifications in the lake database (Sheng et al., 2016) and by visual inspection of high-resolution satellite imagery, where dam structures were clearly visible.”

138: correct the (R)

Author’s response: Thank for pointing out the mistake ® is now corrected (R).

159: why is this 238 lakes?

Author’s response: Thank you for pointing out this error. The value 238 was a typographical error. The correct number of analysed lakes is 232 and has been corrected in the manuscript.

160: is this systematic bias an average value? give the range if so? and why does it only apply to 77% of lakes?? What is the case for the other 23%!?

Author’s response: Intercomparison during the overlapping period (2018-2023) shows a mean vertical offset of +2.74 m between ICESat-2 and CryoSat-2 measurements. This offset is statistical significance ($p < 0.05$) for 79% of the lakes (183 of 232), indicating generally consistent inter-mission differences across the majority of lakes. We therefore applied a constant -2.74 m correction to ICESat-2 timeseries for the mission intercomparison. For the remaining lakes (49), the estimated offsets are not statistically significant. Since the majority of lakes exhibited a consistent inter-mission bias, we applied the mean offset as a constant vertical correction for the mission intercomparison. We include further description for further clarification in the revised manuscript.

"Intercomparison during the overlapping period (2018-2023) shows a mean vertical offset of +2.74 m between ICESat-2 and CryoSat-2 measurements. This offset is statistical significance ($p < 0.05$) for 79% of the lakes (183 of 232), indicating generally consistent inter-mission differences across the majority of lakes. We therefore applied a -2.74 m correction to ICESat-2 timeseries for the mission intercomparison. Because this correction is applied as a constant vertical offset, it is not expected to influence linear trend estimates unless the inter-mission bias varies with time. Residual lake-specific offsets and other systematic inter-mission differences may nevertheless contribute additional uncertainty to individual lake trend estimates and are not represented in the statistical uncertainties reported here. The reported uncertainties therefore represent uncertainties associated with the annual lake level estimates and linear trend fitting, and do not include systematic sources of error such as residual inter-mission bias, geoid differences, retracking differences, or spatially correlated measurement errors, which are discussed further in Section 4."

164: full-stop (not comma)

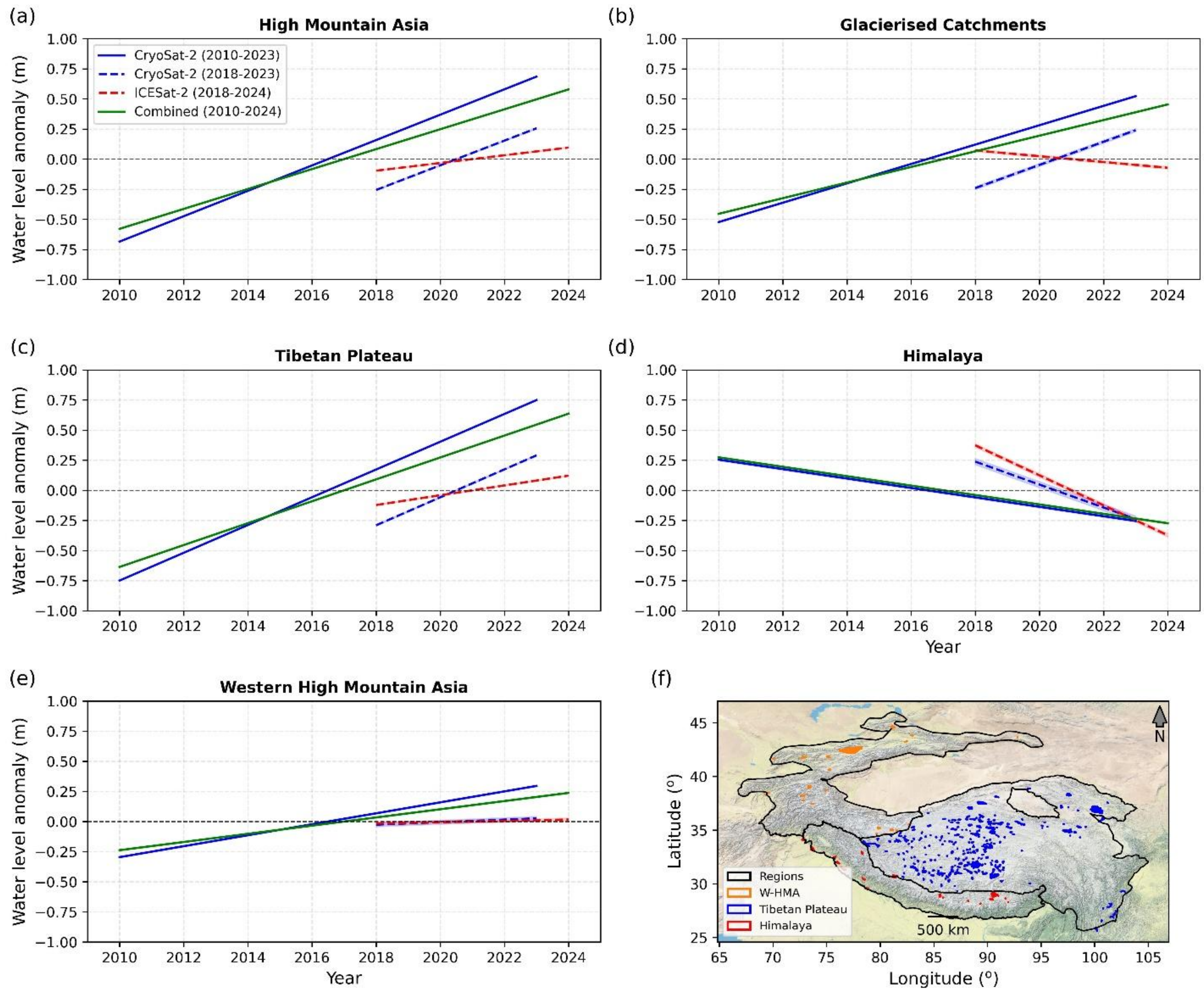
Author's response: Replaced comma with full-stop.

183: 179+54=233...?

Author's response: Thank you for identifying this typo-error. The number of lakes with declining water levels is incorrectly reported as 54. The correct value is 53. This has been corrected in the revised manuscript.

Figure 2: I don't see any shading, as described in the caption. Figure 2: Is it possible to add the data points (in light grey for example) from which the relationships are derived? Figure 2: The Himalaya combined line doesn't seem to be altered from the Cryosat one - is that real?

Author's response: Thank you for these helpful suggestions. The uncertainty associated with the regional uncertainty-weighted mean trends is small therefore the shaded are largely not clear with the trend lines. We considered adding individual data points to Figure 2, however, because the figure is intended to illustrate regional temporal trajectories, plotting individual lake trend estimates substantially reduced the clarity of the figure. We revised the Figure to add regional trends derived from the CryoSat-2 for the overlap period (2018–2023), visual comparison with the ICESat-2 trends (2018–2024). We have now added a new supplementary Figure S6 comparing lake-level trends from CryoSat-2 and ICESat-2 for all 232 lakes during the overlap period. The caption of Figure 2 has been revised to clarify the uncertainty representation.



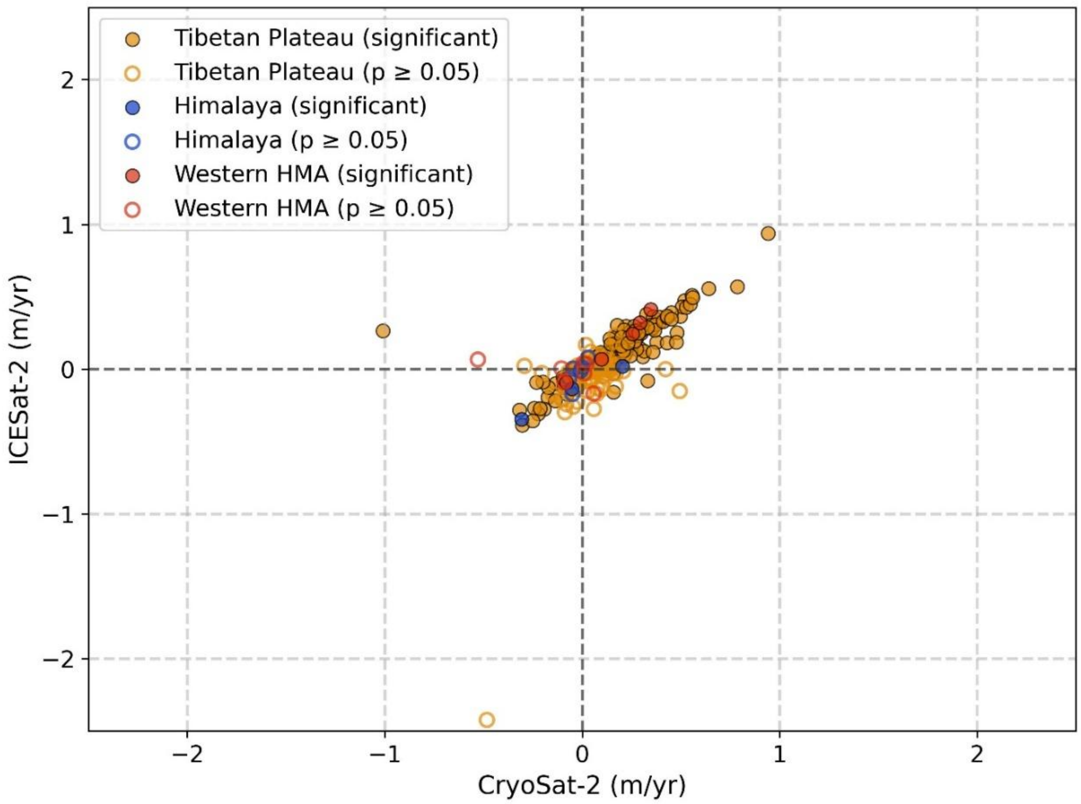
Revised Figure 2 Regional lake water-level trends across HMA derived from (a) CryoSat-2 (blue, 2010–2023), CryoSat-2 overlap period (blue dash, 2018–2023), ICESat-2 (red, 2018–2024), and the combined record after bias correction (green, 2010–2024); (b) lakes within glacierized catchments; (c) the Tibetan Plateau; (d) the Himalaya; and (e) western High Mountain Asia. The shaded uncertainty band represents the standard error (1 σ) of the regional uncertainty-weighted mean trend. (f) Spatial distribution of lakes, with the different regions outlined in black.

200-205: Couldn't this be a test for difference on a per-lake basis?

Author's response: we assessed the agreement between CryoSat-2 and ICESat-2 using multiple complementary metrics for each lake during the overlap period (2018–2023), including the mean bias and standard deviation of the differences, correlation of the lake level time series also shown in the Figure S1 with representative examples of lake level agreement, and agreement in the direction of the estimated trends (80% sign agreement). These metrics indicate generally consistent behaviour between the two missions across the majority of lakes. We therefore consider these analyses to provide a robust assessment of inter-mission consistency.

203-204: Might the reader see some numbers on how well the rates of change compare - in a scatterplot for example? Could all of the lake values be shown for the overlap period?

Author's response: Following the suggestion, we added a new supplementary Figure S6 comparing lake level trends derived independently from CryoSat-2 and ICESat-2 for all 232 lakes during the overlapping period (2018–2023). The comparison demonstrates strong agreement between the two missions ($r = 0.92$, $p < 0.001$), with an RMSE of 0.20 m/yr, a mean bias of −0.06 m/yr, and 80% agreement in the direction of change.



New Figure S6. Comparison of lake level trends derived from CryoSat-2 and ICESat-2 during the overlapping period (2018 – 2023). Each analysed lake is represented by a point, with colors indicating geographic regions. Solid circles show trends that are statistically significant in both missions ($p < 0.05$), while hollow circles show trends that are not significant in one or both missions.

216-219: The total number of lakes here is significantly short of 232. why is that?

Author's response: Thank you for pointing this out. The numbers in this paragraph refer only to the Tibetan Plateau subset rather than to the complete dataset of 232 lakes. We agree the existing text was not sufficiently clear and may have caused confusion. The text has been revised to explicitly state the number of lakes within the Tibetan Plateau before presenting the regional statistics. "Among the 2011 lakes on the Tibetan Plateau, CryoSat-2 (2010 to 2023) based results show increasing lake levels at a rate of 0.18 m/yr, with 113 lakes (54%) showing consistent increasing trends (>0.1 m/yr), only 14 showed stable water levels (-0.01 to 0.01 m/yr) and the number of lakes with a strong decreasing trends (<-0.1 m/yr) is relatively low (7 lakes)."

Figure 3: The splitting of the Cryosat data into two periods confused me for a bit here - is this introduced earlier in the manuscript or does an explanation need adding?

Author's response: The CryoSat-2 trend is divided into the pre-overlap (2010-2017) and overlap (2018-2023) periods visual comparison with the ICESat-2 trend. We revised the figure caption in the manuscript to clarify.

Figure 3. Water-level and climate variability for representative lakes on the Tibetan Plateau. (a) Location of Qinghai Hu Lake (blue), lake catchment boundary shown in black. (b) Monthly lake water-level time series derived from CryoSat-2 (2010–2023) and ICESat-2 (2018–2024). Point colours indicate the season of observation (correspond to the color bar), and standard deviation of lake levels is shown in grey. (c) Linear trends in lake water level derived from CryoSat-2 (blue) and ICESat-2 (yellow). For visual comparison with the ICESat-2 observations, the CryoSat-2 trend is shown separately for the pre-overlap (2010–2017) and overlap (2018–2023) periods. (d) Monthly anomalies in air temperature (T, °C), precipitation (P, mm), and evaporation (E, mm) derived from ERA5-Land. The same layout is shown for Hala Har Hu Lake, Gozha Lake, Dogai Coring Lake, Taro Co Lake, and Dogaicoring Qangco Lake.

247: the start to this sentence is missing. 'The lakes in western HMA showed a consistent pattern, with 7 out of 12 experiencing...'?

Author's response: The sentence has been revised for clarity as follow "Among the 12 lakes studied in western HMA, 7 lakes experienced increasing water level during 2010 to 2023 based on CryoSat-2, with a mean rate of 0.13 m yr-1. ICESat-2 results show the slowdown in water levels rise during 2018 to 2024, with the mean trend decreasing to near zero (Fig. 2e)."

266: On 'the' Tibetan Plateau...

Author's response: The sentence has been revised " On the Tibetan Plateau, where most lakes are located, correlations with all three climate variables are weak and statistically not significant ($r = 0.09$)."

Figure 4: These data look like they still have a seasonal signal to me...?

Author's response: The time series shown in panel b and c of Figure 4 represent the monthly lake water level estimates from CryoSat-2 and ICESat-2. De-seasonalization was applied for the trend analysis.

294: Lake catchments in 'the' Himalaya experience...?

Author's response: The sentence has been revised "Lake catchments in the Himalayan experience an increase in temperature during summer (+0.06 ± 0.01℃/yr) and autumns (+0.08 ± 0.04℃/yr) which is statistically significant. Winter precipitation shows a significant decline (-0.07 ± 0.03 mm/yr), while other seasons exhibit weaker, non-significant trends."

Table 1 probably needs moving up as it includes important information about how many lakes are analysed per sensor per period (which accounts for some of my comments above)

Author's response: The table has been moved to section 3.1. in the Results section, before the presentation of regional lake-level changes.

lines 375-376: odd capital letters here

Author's response: Thank you for highlighting the mistake. We revised the sentence. "Lake expansion on Tibetan Plateau in recent decades have been attributed to precipitation, evaporation (Biskop et al., 2016; Yang et al., 2017), snow and ice melt (Zhang et al., 2017b) ground Water (Lei et al., 2022). The increasing precipitation trend observed at meteorological station on Tibetan Plateau during 1978 to 2013, except in parts of the southeast (Zhang et al., 2017a), is broadly consistent with the spatial pattern of lake water level changes (Fig. 2)."

400: 'the' lake water budget. (full stop)

Author's response: The sentence has been rephrased. "At the lake-catchment scale, Zhang et al. (2024) attributed 62.5% of the increase in Dogai Coring lake storage during 2014-2020 to glacier mass loss and 19.3% to permafrost degradation, while ground ice melt contributed an estimated 12% of Selin Co lake volume expansion during 2017-2020 (Wang et al., 2022)."

426: 'aligning'

Author's response: The sentence has been revised as suggested. "This pattern is particularly evident on the Tibetan Plateau aligning with the finding of Zhang et al. (2019), though weak (r = 0.09) statistical correlations, indicating that other catchment properties modulate this relationship such as precipitation."

425: I agree, but that's why they're large in the first place, so it doesn't account for why the relative rate of change is higher.

Author's response: We agree that the original statement overinterpreted the observed relationship. The discussion has been revised to avoid inferring a mechanistic explanation from the observed association. We revised text: "The systematic relationship between lake area and water-level change rates across most regions, with the largest lakes (>1000 km^2) showing the most rapid increases, suggests that lake size is associated with the magnitude of observed water level change. This pattern is particularly evident on the Tibetan Plateau aligning with the finding of Zhang et al. (2019), though weak (r = 0.09) statistical correlations, indicating that other catchment properties modulate lake level variability."

444-446: this study says nothing about glacial lakes and even less about GLOF hazards so I think this sentence can be removed.

Author's response: We agree that this paragraph should reflect the main scientific contributions of the study and avoid overemphasizing hazards that are beyond the scope of our analysis. We revised the paragraph. "The heterogeneous lake responses documented in this study highlight the strong spatial variability of hydrological change across HMA. Continued water-level rise across much of the Tibetan Plateau contrasts with persistent declines in the Himalaya, indicating that lake responses vary substantially among different hydroclimatic and cryosphere settings. Lakes within glaciated catchments exhibit weak contemporaneous relationships with precipitation, temperature, and evaporation, indicating that lake level variability represents the integrated response of multiple hydrological processes rather than direct climatic forcing alone. By combining CryoSat-2 (2010–2023) and ICESat-2 (2018–2024), this study provides regionally consistent multi-mission assessment of lake water-level variability across 232 large lakes in HMA, enabling direct comparison of temporal trajectories among contrasting hydrological settings. These observations establish an important reference for evaluating future changes in alpine water storage, improving understanding of regional hydrological responses to climate change, and supporting the development and evaluation of hydrological models for HMA."

473: citations should come after 'runoff' not 'presents'

Author's response: Thank you for the suggestion. We now moved the citations before 'presents' as suggested. "The climate-change exposure represented by 250 million people dependent on HMA runoff (Immerzeel et al., 2020; Pritchard, 2019) presents a strong impetus to improve our understanding of the lake water level variability across HMA."

Table S1: why are there 238 lakes here (232 referred to in the caption)?

Author's response: Thank you for identifying this inconsistency. The Supplementary Material by mistake contained an incorrect version of Table S1. Table S1 has been replaced with the correct version, which is fully consistent with the analyses presented in the manuscript.

Revised Table S1 Group statistics of median lake level change rates by their magnitudes for all 232 lakes across HMA.

Group	Num. (%) of lakes	Median rate (m/yr)	Num. (%) of lakes ($p < 0.05$)	Median rate (m/yr) ($p < 0.05$)
<−0.2	4 (2)	-0.35 ± 0.03	4 (2)	-0.35 ± 0.03
[−0.2, 0]	49 (21)	-0.06 ± 0.01	39 (16)	-0.07 ± 0.01
[0, 0.15]	79 (34)	0.06 ± 0.01	68 (29)	0.07 ± 0.01
[0.15, 0.3]	42 (18)	0.22 ± 0.02	42 (18)	0.22 ± 0.02
[0.3, 0.5]	38 (16)	0.39 ± 0.02	38 (16)	0.39 ± 0.02
>0.5	20 (9)	0.39 ± 0.03	20 (9)	0.63 ± 0.03
>0	179 (77)	0.23 ± 0.02	168 (72)	0.24 ± 0.02
<0	53 (23)	-0.08 ± 0.02	42 (18)	-0.09 ± 0.01
All	**232 (100)**	**0.16 ± 0.02**	**210 (91)**	**0.18 ± 0.02**

References:

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