

Response to reviewer

The manuscript addresses an important topic related to GLOF risk management in a highly vulnerable region. It employs advanced methodologies to obtain relevant results that could contribute to improving plans and actions aimed at mitigating the impacts of these events. Overall, the methodology is robust, and the data are consistent with the objectives of the study. I recommend publication after minor revisions.

The figure title appears both above the figure and in the figure caption below it. Please consider removing the duplicated title above the figures to avoid redundancy and ensure consistency with the journal's figure-formatting requirements. Additionally, several figures appear to present similar or overlapping results. Please consider whether some of these figures could be combined or removed to improve the clarity and conciseness of the manuscript.

Response: the duplicate titles from all figures are removed. The susceptibility maps look similar but they have minor difference but not exactly the same.

Line 39: The word “triggers” should be corrected.

Response: typo error corrected (tigger to triggers)

Line 85: The legend and information presented in Figure 1 are difficult to read clearly. Consider increasing the font size and/or improving the figure resolution.

Response: figure improved accordingly front size increased for readability.

Line 95: “A minimal area threshold of 0.002 km^2 (about three Landsat pixels) was used to rule out small or transient ponds that are unlikely to cause GLOFs.” Does the threshold of 0.002 km^2 itself provide sufficient evidence that a lake is unlikely to cause a GLOF? I was unable to find information in the cited reference (Xu, 2006) that clearly explains or supports the use of this specific threshold. Please provide further justification or an appropriate reference supporting this criterion.

Response: Thank you for this important observation. We agree that a lake area of 0.002 km^2 alone cannot provide sufficient evidence that a lake is unlikely to generate a GLOF. We have therefore revised the wording to clarify that the 0.002 km^2 threshold was applied as a remote-sensing screening and inventory-quality criterion rather than as a physically based GLOF-hazard threshold. The use of 0.002 km^2 is supported by previous satellite-based lake inventories and glacial-lake studies that have employed this

magnitude of minimum lake area to reduce uncertainty associated with the detection and delineation of very small water bodies. For example, Verpoorter et al. (2014) used approximately 0.002 km² as a minimum size in the GLOWABO lake inventory because smaller water bodies were difficult to reliably verify relative to image noise. Similarly, glacial-lake inventories in the Himalaya have used 0.002 km² as a minimum mapping threshold. We have consequently removed the implication that lakes below this threshold are inherently incapable of causing GLOFs. The revised manuscript now makes clear that the threshold was used for quality control, whereas GLOF susceptibility was evaluated using multiple physical and environmental factors. Referred to line 98 to 102.

Line 100, Table 5, and Figure 3: It is not clear how the Bayesian prior weights and rankings for the key GLOF susceptibility parameters were determined. Provide further details on the methodology used to establish these prior weights and rankings.

Response: Thank you very much for identifying the lack of clarity regarding the prior weights used in our Bayesian framework. In an effort to keep the original description concise, some essential methodological details regarding the derivation and interpretation of the prior weights were inadvertently omitted. We have therefore revised and rearranged this section (Lines 180–200) to provide a clearer explanation of both the parameter-specific prior weights and the class-level prior weights. The revised text now explicitly describes how the parameter rankings were established, how ordinal-ranking-informed normalized Bayesian prior weights rather than conventional ROC weights are formed and used and how these weights differ from the class-level prior probability used in the Bayesian classification. This revision provides a more transparent description of the prior-weighting procedure and clarifies the role of each type of prior information within the Bayesian framework.

Lines 106–113: The criteria used to identify non-GLOF lakes are presented, but the criteria used to identify GLOF-prone lakes are not clearly described. Clarify how the GLOF-prone lakes were identified.

Response : line 120-125 : Lakes that did not satisfy the predefined non-GLOF criteria were not assumed to have experienced a GLOF; instead, they were treated as referenced GLOF-prone samples. A random subset 225 of these samples were subsequently selected to construct the GLOF-prone class used in the Bayesian analysis.

Line 107: It is not clear how the threshold of 0.7 was established for classifying lakes as GLOF-prone or non-GLOF. Please provide the rationale or methodological basis for selecting this threshold.

Response: 0.7 is a conservative Bayesian decision threshold, mathematically corresponding to 70% posterior probability and 2.33:1 posterior odds, and it is broadly consistent with the use of elevated susceptibility cutoffs in HKKH GLOF studies.

Lines 207–208: This sentence appears to describe the methodology rather than the results. Please consider moving it to the appropriate section of the manuscript.

Response: Thank you for the comment. We have retained the sentence within Section 3.1 because it provides the context necessary for interpreting the model-performance results presented in Table 6. However, we revised its wording to integrate the evaluation measures directly with the reported results, rather than presenting it as a separate methodological statement. The subsection now focuses on the performance metrics and their corresponding results.

Line 210: The abbreviation “HNN” has already been defined. It is not necessary to define the abbreviation again.

Response: corrected thanks

Line 234: Hindu Kush–Karakoram–Himalaya (HKKH) has already been defined earlier in the manuscript, it is not necessary to define the abbreviation again.

Response: corrected thanks

Line 241: The abbreviation “GLOF” has already been defined.

Response: corrected thanks

Lines 264–265: “...were used to determine the susceptibility classes; 0.0–0.2 denotes extremely low susceptibility, 0.2–0.4 low, 0.4–0.6 medium, 0.6–0.8 high, and 0.8–1.0 very high.” Please clarify how boundary values between two classes are treated. For example, if the susceptibility value is exactly 0.4, is the lake classified as having low or medium susceptibility? The classification intervals should be defined unambiguously, including the treatment of boundary values.

Response: The posterior-probability threshold of 0.7 was used solely as the decision criterion for distinguishing GLOF-prone from non-GLOF lakes and should not be interpreted as a boundary between the five susceptibility classes. The susceptibility classes were independently defined from the normalized susceptibility index using fixed intervals of 0.2, 0.4, 0.6, and 0.8. Thus, a posterior probability of 0.7 indicates a GLOF-prone classification under the Bayesian decision rule, whereas a normalized susceptibility value of 0.7 corresponds to the High susceptibility class. The normalized susceptibility index was

divided into five predefined classes using equal-width intervals of 0.2. The class boundaries were defined as follows: Very Low ($0.0 \leq S < 0.2$), Low ($0.2 \leq S < 0.4$), Medium ($0.4 \leq S < 0.6$), High ($0.6 \leq S < 0.8$), and Very High ($0.8 \leq S \leq 1.0$). These intervals were adopted as a consistent classification scheme for interpreting the normalized 0–1 susceptibility index. Boundary values were assigned to the higher susceptibility class; therefore, $S = 0.4$ is classified as Medium, $S = 0.6$ as High, and $S = 0.8$ as Very High.