The authors present a new method for automatic mapping and classification of high-mountain/glacial lakes applied to the Third Pole region. The manuscript is generally well composed and the method presented represents a valuable addition to the approaches applied so far. The contribution is of high relevance since knowledge on lake distribution, especially in climate-change affected mountains, is essential for hazard management and mitigation.

While the method and results are well presented and the discussion and conclusion are largely convincing, the manuscript suffers severely from a poor application of the terminology and definition of glacial and non-glacial lakes. This has little effect on the lake detection itself but huge implication on the lake classification and the results and comparison in general. With respect to the potential relevance of the produced dataset for hazard management, this issue needs to be resolved. Otherwise, despite its technological performance, the dataset will be of little use.

To conclude, I think this manuscript requires a revision with respect to the application of the right terms for the objects in focus. In addition, more attention should be paid to the introduction of the comparative database to improve clarity. These revisions require moderate effort, will not affect the geometry of the lakes dataset but surely will change the classification and the discussion. This will improve the quality of the study and ensure comparability and a wider application of the dataset in the intended way.

Response: We would like to express our sincere gratitude to you for the positive assessment of our technical framework and for emphasizing the importance of our work in the context of hazard management. We particularly appreciate the critical feedback regarding the terminology and definition of "glacial" and "non-glacial" lakes. We fully agree that while the deep learning model performs well technologically, the scientific utility of the resulting dataset depends on a rigorous and geomorphologically sound classification scheme. To address these concerns, we will perform a thorough revision of the terminology throughout the manuscript.

Detailed point-by-point responses to your specific comments are provided below.

Terminology: The authors need to reconsider the definition of glacial and non-glacial lakes. In the manuscript a variety of terms are applied starting with the term periglacial lakes in the title and introduction (and not more afterwards) than glacier lakes, montane lakes and non-glacier lakes. The authors mention to follow the classification by Yao et al. (2018) but a detailed definition of the terminology is absolutely required. This will influence the results and interpretation. For additional clarification I suggest fundamental review papers on the terminology for example by Carrivick and Tweed (2013) [DOI: 10.1016/j.quascirev.2013.07.028]

Furthermore, the title is confusing. Despite the use of the term “periglacial lake”, I also don’t know what “global attention” is signifying in this context. Please reconsider a more appropriate title.

L39ff - You should provide a better definition of non-glacial lakes. The reference to “thermodynamic processes" is not enough from a geomorphological perspective since this is a too broad term from physics. The term periglacial lakes is not commonly used, since the formation is not linked to periglacial processes (involving ground ice and freeze-thaw). Using periglacial lakes with respect to the location of the lake should be avoided due to the misleading connotation of the term periglacial here.

Response: We sincerely appreciate the reviewer's guidance on terminology. We have carefully studied the suggested literature by Carrivick and Tweed (2013) and acknowledge that our initial use of "periglacial lakes" as a single category was not sufficiently rigorous.

In the revised manuscript, we will clarify that our study focuses on "lakes in periglacial environments." Within this environment, we will implement a binary classification:

Glacial Lakes: We will adopt the definition by Yao et al. (2018): "natural water bodies mainly supplied by modern glacial meltwater or formed in depressions of glacial moraines." The primary reason for selecting this definition is that our manual interpretation and data labeling were strictly conducted according to these established criteria. To ensure absolute consistency between our methodology and our scientific definitions, we believe this approach is the most appropriate and robust.

Non-glacial Lakes: All other water bodies located within the periglacial study area that do not meet the above criteria will be categorized as non-glacial lakes.

Furthermore, we agree that "Global Attention" could be misinterpreted as "global interest" from the public. To clarify that our study focuses on the comprehensive spatial information (long-range dependencies) captured by the Transformer model, we will replace this term with "Global Context" throughout the text.

In addition, acknowledging the feedback from another reviewer that "Empowers" might be overly strong, we have opted for the more precise term "Enhancing." Consequently, we have synthesized all suggestions and will revise the title to:

"Enhancing Lake Identification in Periglacial Environments by Leveraging the Global Context of Transformers"

To illustrate this, one must investigate chapter 3.3: In the STPG region most of the non-glacial lakes identified and depicted in Fig. 4 are indeed glacial lakes, according to most

classification schemes, because they have been formed by glacial erosion. Many are found in cirques that have been sculpted by glaciers (e.g. in the area around 29°,11.441’ N/95°33,340’E). The only difference is that they are located in catchments without current glaciers, thus they have been formed by glacier action in the past. Your terminology should therefore not only include a geomorphological and topographic definition, but also a temporal one (see for example Buckel et al. (2018)). Non-glacial, from my perspective would be restricted to lakes formed by landslides/debris flow dams or of volcanic origin. Lakes purely formed by excessive precipitation are vary rare in mountainous regions from my perspective.

My suggestion would be to either add a temporal aspect to your definition (Holocene, historic glacial lake) or to only to focus on ice-contact or near-glacier lakes (which would involve a distance-based definition).

This terminological uncertainty should be resolved and then considered in the discussion of the distance-based method. Your comment may of course be valid for some applications esp. natural hazards assessment (e.g. GLOF), but some of the argumentation is lost when the terminology is better defined and applied. In this respect authors need to consider that the distance-based method is justified here, assuring that there is a glacier upslope of the lake.

Response: We appreciate the reviewer's insightful comment regarding the geomorphological origin of these lakes. We acknowledge that many lakes in cirques were historically sculpted by glacial action. However, as our study follows the classification framework of Yao et al. (2018), our distinction between "glacial" and "non-glacial" is primarily based on modern hydrological processes and contemporary glacial influence rather than long-term geomorphological evolution.

To address the reviewer's concern, we will explicitly state that our "glacial lakes" are those influenced by modern glaciers (current meltwater or moraine proximity). Lakes in relict glacial landforms (like old cirques) without current glacier coverage are classified as "non-glacial" in this study to maintain consistency with our interpretation criteria. This definition is particularly valid for practical applications like GLOF hazard assessment, which focuses on lakes with active glacier-lake interactions.

We clarify that the 10 km buffer distance is not arbitrary; it is a widely adopted threshold in glacial lake studies for classification (e.g., [References 1, 2, 3]). We used this established simple approach as a baseline to demonstrate the necessity and superior accuracy of our proposed classification method. In the revised manuscript, we will incorporate these justifications and references in the revised Section 4.2.

[1] Wang X, Guo X, Yang C, Liu Q, Wei J, Zhang Y, et al. Glacial lake inventory of high-mountain Asia in 1990 and 2018 derived from Landsat images. Earth Syst Sci Data 2020;12:2169–82.

[2] Zhang M, Chen F, Guo H, Yi L, Zeng J, Li B. Glacial lake area changes in High Mountain Asia during 1990–2020 using satellite remote sensing. Research 2022;2022:2022/9821275. https://doi.org/10.34133/2022/9821275.

[3] Ma D, Li J, Jiang L. Efficient glacial lake mapping by leveraging deep transfer learning and a new annotated glacial lake dataset. Journal of Hydrology 2025:133072.

Some minor comments:

L36– exchange the term “montane” with “alpine/high-alpine” – montane refers a biogeographic altitudinal zone usually at intermediate altitudes. (throughout the manuscript!!)

Response: Thank you for the correction. We agree that "alpine/high-alpine" is more accurate for the high-altitude context of our study. We will replace "montane" with "alpine" throughout the manuscript and in the revised title.

L58ff – same issue as above…

Response: We agree with the reviewer's concern regarding the terminology and the vague definition of "non-glacial lakes." In the revised manuscript, we will remove the term "periglacial lakes".

Following the classification criteria of Yao et al. (2018), we will provide a clear, binary definition: Glacial lakes are explicitly defined as "natural water mainly supplied by modern glacial meltwater or formed in glacier moraine's depression." Consequently, non-glacial lakes are defined as any lakes that do not meet these specific criteria (i.e., lacking modern glacial influence). These clarifications will be implemented throughout the paper to ensure geomorphological and terminological rigor.

L251ff – You compare the result to other approaches (CNN, UNet, DeepLapv3+), but you don’t mention that you applied these methods as well. How was this comparison done? Did you use existing data from other studies? This need to be mentioned in the methods section (e.g. 2.5) and reference in Table 1.

L282 – Ch 3.2 – Similar to the comment above – You compare your classification results with two other CNN approaches (EfficientNet, ResNet). How was this done? Again no mentioning in the methods before.

Response: We clarify that the results of the other approaches (CNN, UNet, and DeepLabv3+) were not obtained from previous studies; instead, we implemented and trained these models

ourselves using the same dataset and basic parameters to ensure a fair and direct comparison. Following your suggestion, we will add a detailed description in the Methods section explaining the implementation, training environment, and parameter settings for these comparative models.

L269 – Table 2 (and same for table 3): The tables hold the category “all”. What does this mean? Are these the mapped lakes? I suggest renaming this class for better clarity.

Response: We agree that the category "All" is ambiguous. In the revised manuscript, we will rename this class to "Ground Truth" in both Table 2 and Table 3 to clearly indicate that these represent the reference data used for verification.

L291 – Add explanation for TP, FP, TN, FN in the table caption.

Response: We will address these as suggested in the revised manuscript.

L329 – Exchange “The proposed framework” with a more precise description excluding the CNN/alternative methods. Like: ViT-based methods…

Response: We will replace "The proposed framework" with a more precise description, such as "the ViT-based identification method," as suggested.

L395ff – Chap 4.2 – please add the a, b to the Zhang references throughout the chapter to better differentiate between the publications.

Response: We will address these as suggested in the revised manuscript.