

## Review Report

This paper entitle" **Assessing economic impacts of future GLOFs in Nepal's Everest region under different SSP scenarios using three-dimensional simulations**" by Furain and Sauter model the possible future GLOF from existing lakes and possible future glacial lakes in the Nepal's Everest region by using 3D OpenFOAM model and additionally assess the downstream impacts. The paper is suited for NHESS, however, there are several concerns which needs to be addressed and I think it will enhance the quality.

[1] The Everest region is widely studied for glaciers, lakes and GLOF studies. Thus, some of the localized important studies can be considered in the study. For example, glacial lakes in these region among others has undergone highest expansion in the Nepalese Himalaya (Khadka et al., 2018), with numerous GLOF events and notable lakes modeled in this study identified as dangerous (Bajracharya et al., 2020; Khadka et al., 2021). Further, Gouli et al. (2023) has modeled combined GLOF effects of upper and lower Barun lakes in the region. This region has also witnessed number of GLOF events including 2017 from Langmale lake (Byers et al., 2018).

[2] Methods: The methods should be explicitly described as this study used a comparably new model for GLOF simulations. In section 4.2, the authors should briefly illustrate which equations were utilized in the Open foam to simulate the dam break flow and downstream GLOF routing. Lines 220 to 224 – The authors state that the flow in this study involves air and water. It is acknowledged that GLOFs are generally mixture of water and various type of sediments (as mentioned by authors in several places), only considering 2 phase modeling (air and water) will not oversimplify the GLOF rheology? What differences can be found when comparing the results with clear water modeling or others? While this model may offer improvements over traditional clear water flow modeling, it has significant limitations when it comes to accurately simulating the complex processes involved in GLOFs. These events often carry large boulders and debris, as demonstrated by the recent GLOF event from small lake in Thame, Everest, on August 16, 2024. Do GLOF significantly attenuate in those places as shown in Fig 3 or some thresholds were set, please mention? In Fig 3, since lake volumes are large especially for Bhote and Ngojumba Tsho will max inundation depth will be only 20 m, recheck? Author uses a constant manning value, discuss its limitation in discussion.

[3] Impact analysis: Figure 8: There are no roads in Phakding. I feel authors are confused with walking/trekking trails as there are no roads in Everest region. Recently, earthen road was constructed up to Surkhe. This must be corrected throughout the text and impact analysis, otherwise it will exaggerate the economic analysis. Local Impacts: Further, it would add a value to assess impacts to tourism trekking routes and discuss briefly about

the direct-indirect impacts on tourism, local economy and jobs...as these places are touristic hub. Imja on Sagarmatha National Park, Barun Tsho on Makalu Barun National Park, Tsho Rolpa on Gaurishankar Conservation Area. Glacial lakes provide opportunity for adventure trekking and significantly engage locals for economic opportunities (see Khadka et al., 2025) which might be disrupted due to GLOFs leading to huge socio-economic setback.

[4] Discussion: It would also be better to briefly discuss about the uncertainty of formation of potential lakes' dam in Ngozumpa and Bhotekoshi glaciers. Formation of new glacial lakes are not only tied to glacier loss but whether the existing moraine dams the lake or not. Significant drainage of supraglacial lakes (Benn et al., 2001) has breached lateral moraine of Ngozumpa glacier and also future increase in debris cover in the glaciers might inhibit the ongoing melting.

L15 too many uses of between

L25 Also refer (Khadka et al., 2025)

Figure 1: Are the black dots on future lake extent supraglacial lakes? The location of Mt Everest peak is incorrect

L126 More studies have studied GLOF modeling from Lower Barun/Tsho Rolpa

L139 Are Bhotetsho and Ngozumpa glacial lakes susceptible to possible mass movements, do they have enough topographical potential to hit lakes directly? Since modeled lakes are large, the volumes of most glacier avalanche that trigger GLOFs in Himalaya and Tibetan Plateau are about 25–50% of the volume of the lake (Yu et al., 2023).

L168 Since the results are based on depth damage curves, it would be essential to show how it was calculated, authors can use supplementary? Which year rates were used, are they latest?

L185 What is ArcGIS surface reflectance data? Which satellite data you used?

L207 Is there such ArcGIS satellite imagery? Name of images can have referred directly. Further, these maps need to be latest to confirm the latest data. Which date OSM data you used, OSM data are regularly updated

L233 elected or selected? Please use correct word throughout the paper

L235 Which satellite imagery?

L265 Eq. 2 Explain what those coefficient means

5.1 Overview is not results, replace with appropriate title

Figure 3, legend: replace comma with decimal. What does cross section mean? Make the symbol of places hollow or place it bit side so that inundation can be seen.

L515 citations needed. Please confirm whether Imja have EWS or not? I think it does not have

Figure 7/8/9 did authors modify the extent (edges)?

**References:** These references serve as examples from review process without the need to adhere strictly to the authors for citation purposes.

- Bajracharya SR, Shrestha AB, Shrestha F, Wagle N, Maharjan SB, Sherpa TC. Inventory of glacial lakes and identification of potentially dangerous glacial lakes in the Koshi, Gandaki, and Karnali river basins of Nepal, the Tibet autonomous region of China, and India. International Centre for Integrated Mountain Development (ICIMOD); United Nations Development Programme (UNDP), Kathmandu, Nepal, 2020, pp. 54.
- Benn D, Wiseman S, Hands K. Growth and drainage of supraglacial lakes on debris mantled Ngozumpa Glacier, Khumbu Himal, Nepal. *Journal of Glaciology* 2001; 47: 626-638 DOI: <https://doi.org/10.3189/172756501781831729>.
- Byers AC, Rounce DR, Shugar DH, Lala JM, Byers EA, Regmi D. A rockfall-induced glacial lake outburst flood, Upper Barun Valley, Nepal. *Landslides* 2018: 1-17.
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- Khadka N, Liu W, Shrestha M, Watson CS, Acharya S, Chen X, et al. Multidisciplinary perspectives in understanding Himalayan glacial lakes in a climate challenged world. *Information Geography* 2025; 1: 100002 DOI: <https://doi.org/10.1016/j.infgeo.2025.100002>.
- Khadka N, Zhang G, Thakuri S. Glacial lakes in the Nepal Himalaya: Inventory and decadal dynamics (1977–2017). *Remote Sensing* 2018; 10: 1913 DOI: <https://doi.org/10.3390/rs10121913>.
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