
Downloaded from: http://e-space.mmu.ac.uk/622278/

Publisher: EGU

Please cite the published version
### Results and discussion

Glacial lake outburst floods (GLOFs) occur where the natural dam of a glacial lake is breached or overtopped. There have been significant population and infrastructure losses in the last decades from such events (Fig 1,2). Given the threat for local communities, many studies seek to estimate GLOF risk. One of the key shortcomings of such studies is that there is no consensus about what criteria should be assessed, in order to determine GLOF risk.

### Multiple Criteria Decision Analysis (MCDA)

MCDA is a method that provides a framework to determine a coherent set of criteria for making risk assessments. Whilst it has been applied in other natural risk/hazard contexts, it has not yet been applied to GLOFs. Fig 3 was created after applying the guidelines shown in the methods section to all GLOF risk criteria stated in literature.

**Aim:** Provide an objective method to remotely assess GLOF risk (Fig 4).

**Methods**

- **MCDA was tested on 12 lakes already evaluated by Worni et al. (2013), Frey et al. (2016), Rounce et al. (2016) as well as on 5 past GLOFs and the results obtained are in agreement.**

- **15 lakes are classified as low risk and are not priorities for further detailed risk assessment.**

- **2 lakes are classified as medium risk and a research focus should be given in the following years.**

- **1 lake (Laguna Arkhata) presents high risk and should be the subject of urgent research into potential GLOF effects (e.g. hydrological modelling of GLOF runout).**

### Introduction

Glacial lake outburst floods (GLOFs) occur where the natural dam of a glacial lake is breached or overtopped. There have been significant population and infrastructure losses in the last decades from such events (Fig 1,2). Given the threat for local communities, many studies seek to estimate GLOF risk. One of the key shortcomings of such studies is that there is no consensus about what criteria should be assessed, in order to determine GLOF risk.

### Methods

- **The guidelines for the creation of a coherent set of criteria presented in Fig 3 are listed below, accompanied by examples:**
  - **Exhaustiveness:** a criterion, such as rockfall/landslide susceptibility, is actually a composite of multiple criteria (e.g. slope steepness, seismic activity, etc.) (Fig. 3).
  - **Non-redundancy:** For example, some assessments examine both glacier snout crevassing, but these two criteria are actually strongly related - steeper slopes will generally lead to faster ice flow and crevassing.
  - **Consistency:** For example, glacier shrinkage can have a two-way effect. For moraine-dammed lakes, glacier shrinkage will increase the risk of calving or avalanches, but for ice-dammed lakes glacier shrinkage will increase the risk of GLOFs. Hence, criteria need to be selected such that their effects operate in the same direction.

### Results and discussion

GLOFs. Hence, criteria need to be selected such that their effects operate in the same direction.

### Results and discussion

- **15 lakes are classified as low risk and are not priorities for further detailed risk assessment.**

- **2 lakes are classified as medium risk and a research focus should be given in the following years.**

- **1 lake (Laguna Arkhata) presents high risk and should be the subject of urgent research into potential GLOF effects (e.g. hydrological modelling of GLOF runout).**

### References: