EVALUATION OF NATURAL HAZARDS OF LAKE IMJA, NEPAL

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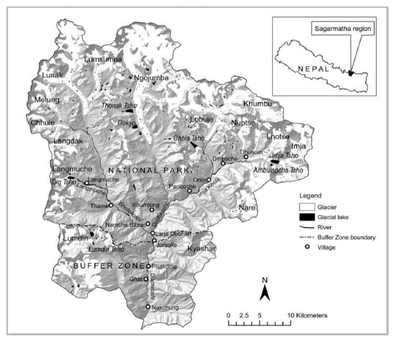
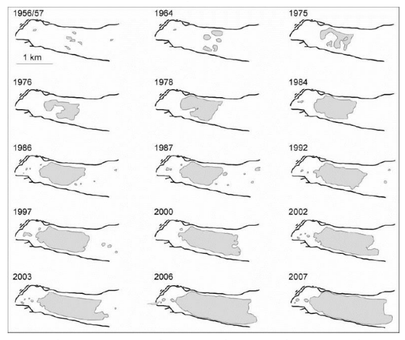
1 Lake Imja

Observed Lake Imja is located cca 5 000 m a.s.l. in Khumbu Himal in eastern Nepal near to Mt. Everest. It is fed by glacial meltwater from Imja and Lhotse glaciers. GLOF (glacial lake outburst flood) could be very dangerous for inhabitants and infrastructure located down the valley while the volume of water is 88 x 106 m^3 and area of lake is 1,35 km^2 (Lala et al., 2018).So main possible triggers of GLOF from this lake were analyzed in this work.



(Bajracharya et al., 2007)



(Somos-Valenzuela et al., 2015)

Lake Imja

2 Data and methodology

- **three main factors for evaluation**
  - a) slope movement into the lake
    - impulse wave creation
    - 3 scenarios (different sizes of rockfalls)
    - remote sensing, field survey, RocFall SW
  - b) dead ice melting
    - morphology, stability of moraine, thermokarst ponds
    - remote sensing and field survey
  - c) lake expansion, temperature analysis
    - remote sensing, GHCN-CAMS reanalysis

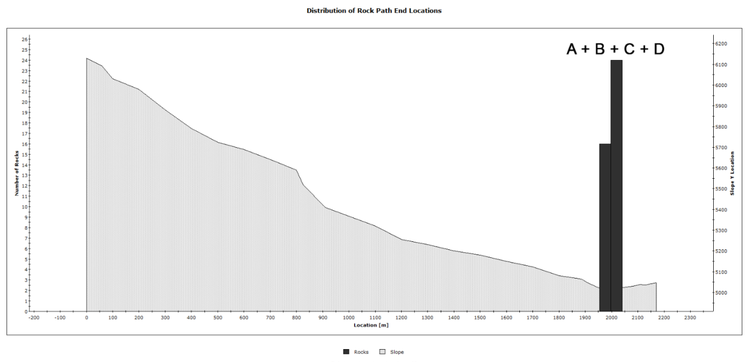
field survey

Analyzed slope with rupture in lateral moraine in the bottom

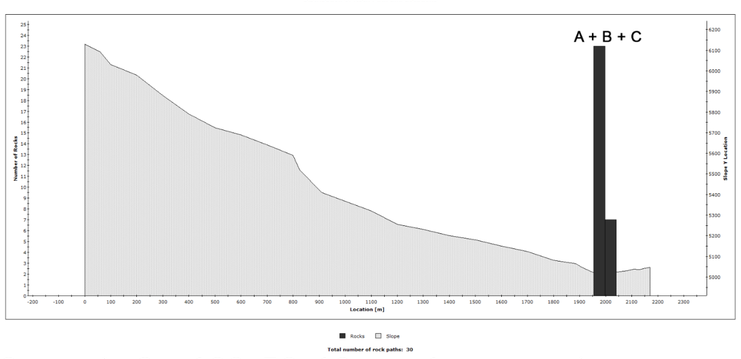
3 Results

3.1 Rockfall/rockslide analysis

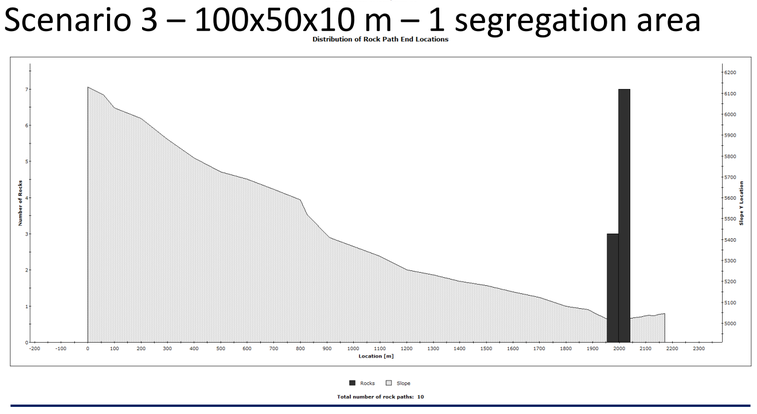
- Scenario 1 – 3x3x1 m – 4 segregation areas



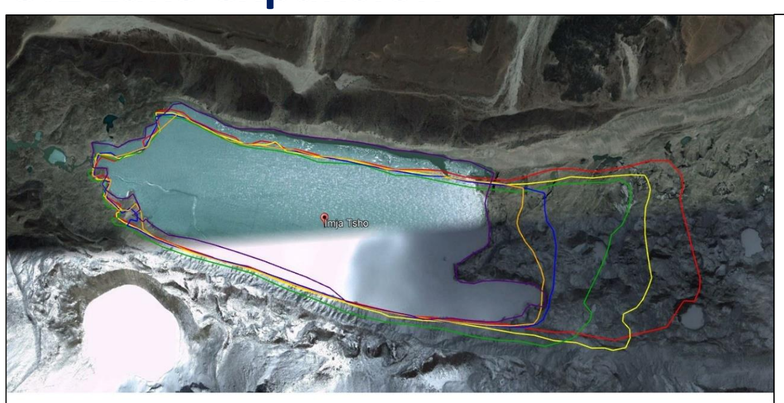
- Scenario 2 – 30x30x3 m – 3 segregation areas

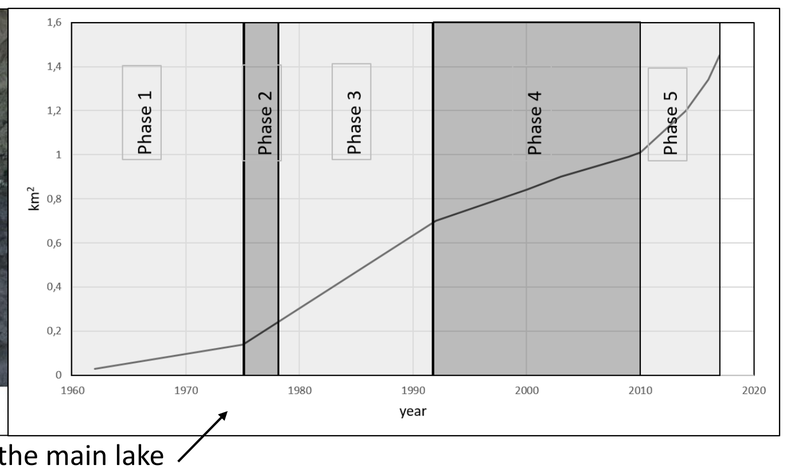


- Scenario 3 – 100x50x10 m – 1 segregation area

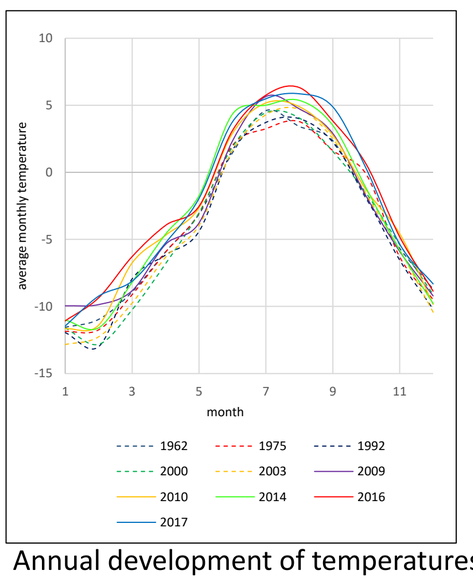


3.2 Lake expansion



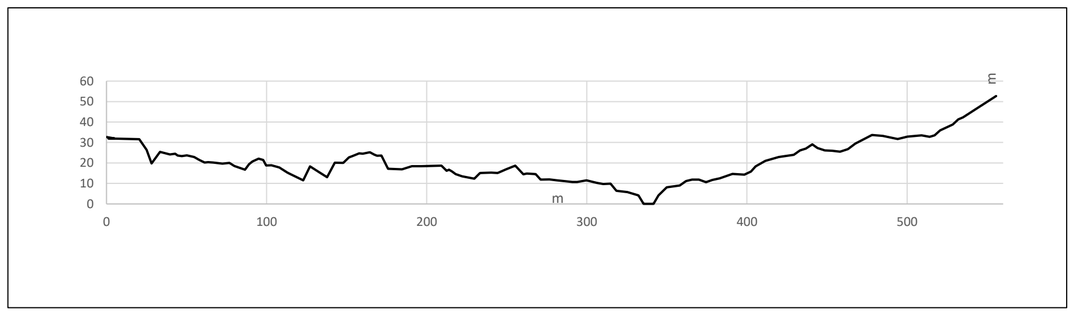


Evolution of the main lake

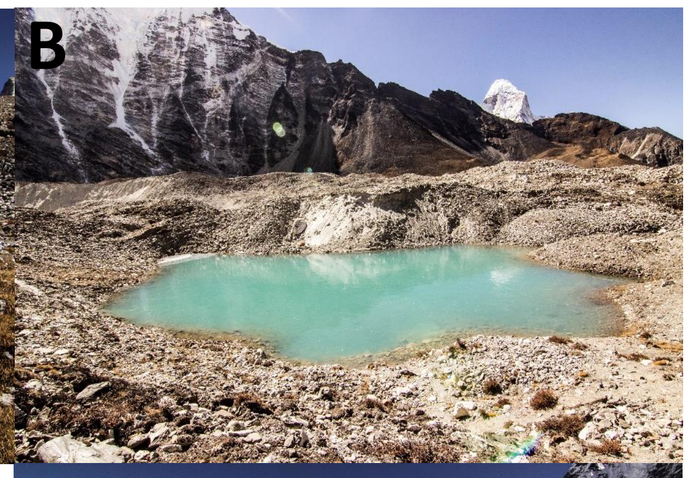


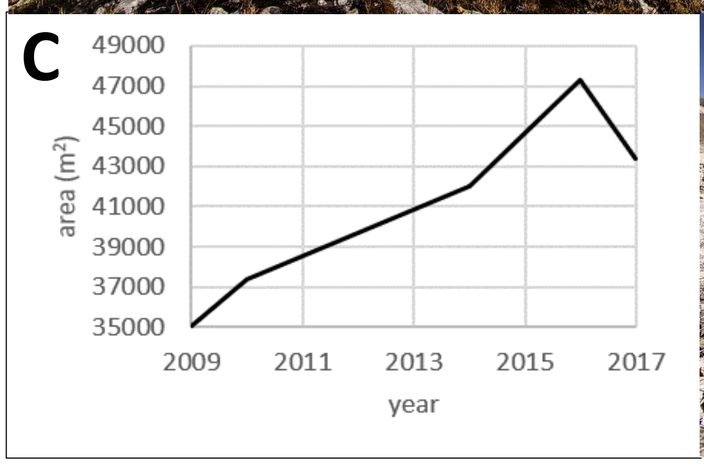
Annual development of temperatures using GHCN-CAMS reanalysis

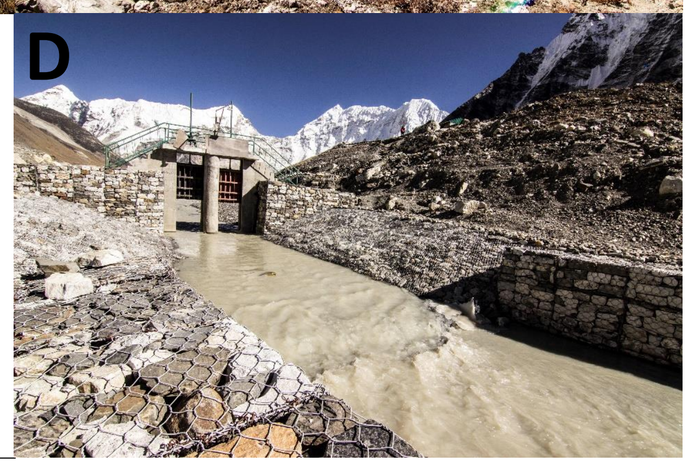
3.3 Terminal moraine changes



Transversal profile of terminal moraine. Sharp and round shapes mark dead-ice in the moraine and also its melting.







A - dead-ice melting/seepage through terminal moraine, **B** – one of thermokarst ponds on the terminal moraine marking dead ice melting, **C** – flow and thermokarst ponds on the terminal moraine area development, **D** – water level lowering/flow control

4 Conclusions

- no hazard of the formation of an impulse wave after the impact of slope movement into the lake
- the expansion of the lake is accelerating to the east – new phase was determined
- „scissors“in the course of the annual temperature cycle are increasing
- slow dead-ice melting is currently the most problematic parameter affecting the stability of the dam
- in the next few years, no GLOF is likely to occur, unless there is an earthquake

See more:
Kroczek T., Vilímek V. (in print, 2021): Rockfall/rockslide hazard, lake expansion and dead-ice melting assessment: Lake Imja, Nepal. In: Vilímek et al. (eds.) Catastrophic Landslides, Causes and Consequences, Springer.

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