

Outburst of Glacial Lake due to Moraine Dam Failure by Seepage Flow and Overtopping with Impact of Climate Change

○Badri Bhakta SHRESTHA, Hajime NAKAGAWA, Kenji KAWAIKE,
Yasuyuki BABA, Hao ZHANG, Ripendra AWAL

1. Introduction

Due to impact of climate change, flood and sediment disasters caused by Glacial Lake Outburst Flood (GLOF) are frequently occurred in the Himalaya of South Asia or glacier regions of the world. GLOF typically occurs by seepage and lake water overtopping and eroding the moraine dam. In this study, outburst of glacial lake due to moraine dam failure is investigated.

2. Impact of climate change on glacial lake

Glacial lakes form due to glacial melt or retreat caused by global climate change. Global warming has accelerated glacial retreat, which results the formation or expansion of glacial lakes and constitutes a major hazards in the Himalaya. The warming in the Himalayas in last three decades has been between 0.15°C-0.6°C per decade. **Fig.1** shows the trend of expansion of lake area of Tsho Rolpa, Imja Lake and Dig Tsho Lake (outburst in 1985) of Nepal and rapid expansion of lake area may cause the outburst of lake.

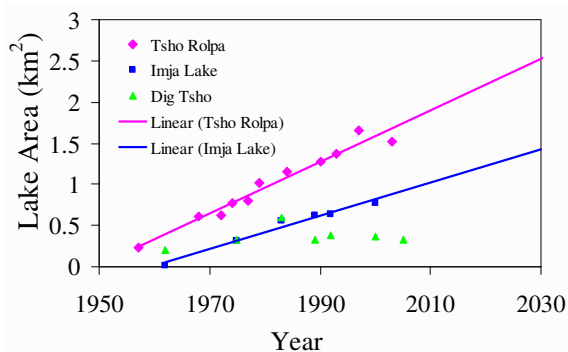
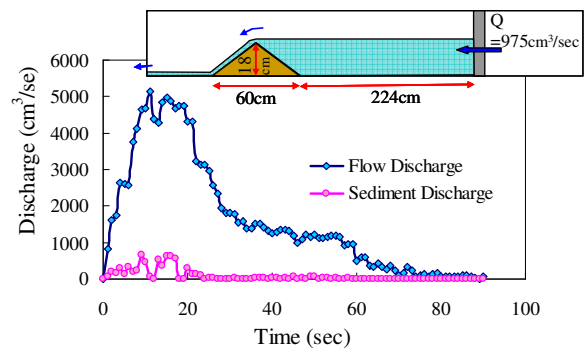


Fig.1 Trend of lake area expansion by climate change

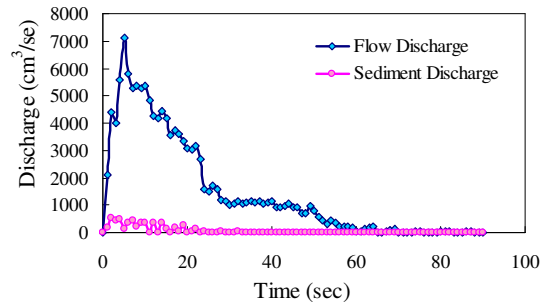
3. Moraine dam failure and outburst floods

The failure mechanism of moraine dam by overtopping due to water level rising and seepage

flow is investigated through the flume experiments. A 5m long, 30cm wide and 45cm deep flume is used for the experiments. A dam body is made by silica sand.



(a) Initial moisture content of dam= 0.13% case



(b) Initial moisture content of dam= 6.65% case

Fig.2 Outburst discharge at end of flume

Fig.2 shows the outburst discharge due to moraine dam failure by overtopping in the experiments. By comparing the results it is shown that the peak discharge is higher in the case of 6.65% initial moisture content of dam, which may be due to higher rate of breaching or erosion of dam with increase in moisture content. Lake water overtopping onto the moraine dam can rapidly erode the dam and cause the failure of dam. The result of the moraine dam failure is catastrophic downstream flooding. The analysis of GLOF problem in the mountainous regions of the world due to global climate change is very urgent.