

Impact of Geomorphological Factors on Glacier Melting and associated The Imja Glacial Lake Expansion

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Introduction

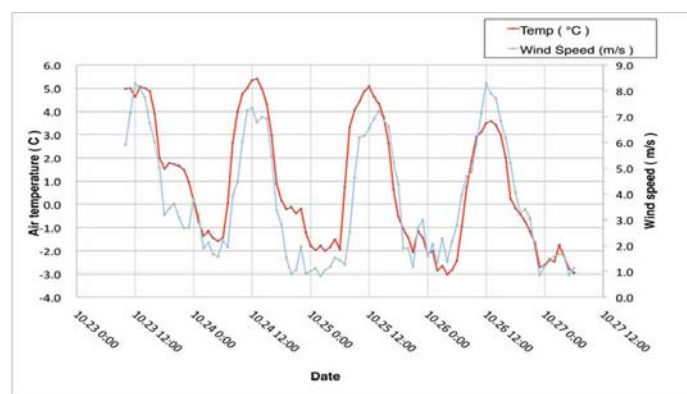
The Imja glacial lake is well recognized as one of the most dangerous of glacial lakes outburst floods. The Imja lake is located at 5100masl in the Khumbu region of Nepal. The Imja lake long axis lies approximately at the east-west direction. In this investigation, I found many crack on the glacier faced to the lake, and pieces of calved glaciers on the lake surface. The investigation was carried out during 23th to 30th October 2009 at the around of Imja lake. This study aims to predict glacial lake expansion speed and to prevent glacial lake outburst flood, this paper is first step toward achieving these aims.

Observation

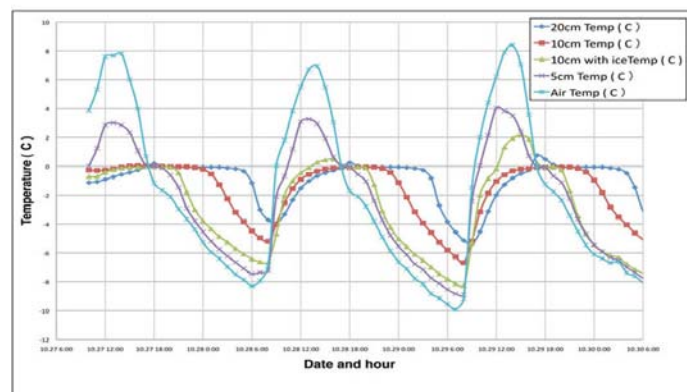
Automatic Weather Station (AWS) and temperature loggers were used in this investigation. The AWS observed air temperature, wind speed, wind direction, gust wind, humidity, albedo and solar radiation. In this paper we focused on relationship between temperature and wind speed. The AWS was installed at the Imja glacier upstream of the Imja lake during 23th to 27th October 2009. After the observation at the Imja glacier, the AWS was installed at the moraine downstream of Imja glacial lake during 27th to 30th October 2009. The temperature loggers observed underground temperature between debris layer and debris covered glacier. The temperature loggers put on the glacier and covered again with different thickness of debris layer. The thickness of debris layers were employed such as 5cm, 10cm, and 20cm. Temperature loggers were installed under the different thickness of debris layer at the upstream of the Imja lake during 27th to 30th October 2009.

Result

The result indicates strong relationship between air temperature and wind speed. Strong wind blew up the valley outlet which was located approximately 3 km westward of the observed point



Relationship between Air temperature and wind speed



Relationship between underground temperature and thickness of debris layer

at the Imja glacier. The main wind direction was eastward at 10 AM to 4 PM, and the wind direction distributed in a random way at morning and night time.

The northern half of exposed glacier faced to the lake was more melting than the southern half of exposed glacier faced to the lake. This northeast part is located on the line between the valley outlet and observation point.

We assume that strong solar heated ground surface and blew upslope wind from down part of mountain. Upslope wind through the valley outlet and reach to the Imja lake. Then the wind weathered glacier which faced to the glacial lake, and made cracked glacier.

Underground temperature was observed between the debris layer and glacier with different conditions of thickness of debris layers at the Imja glacier. The result indicates strong relationship between debris thickness and underground temperature. For example, thickness of 5cm debris layer covered on the temperature logger recorded higher temperature than thickness of 20cm debris covered on the temperature logger. Fluctuation of thickness of 20 cm debris layer temperature was small than thickness of 5 cm debris layer temperature. In addition, the natural thickness of debris layer at the one point of glacier area was 40 cm. These results might indicate that the Imja glacier melting was not caused by temperature increasing.

Remarkable

This investigation collected meteorological data and underground temperature around the Imja lake. These results might indicated that cause of the Imja glacial lake rapid expansion was strong wind blew and whether the glacier. If cause of Imja lake expansion was temperature increasing, the glaciers around the study area also formed glacial lake as the Imja glacial lake. However natural debris layer thickness was 40cm at the study area, and satellite image of this area also showed that the Imja glacier lake expansion speed was too rapidly than other glacier near the Imja lake. This study concludes the Imja lake expansion was caused by strong wind and geomorphological factors.

Keywords: Himalaya, Glacier, Imja glacial lake, glacial lake expansion