Change Detection of Glacier lake using LISS-3 Satellite Data

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1.Introduction:

Sudden release of water from a glacier lake is referred to as Glacier Lake Outburst Flood (GLOF). This is capable of threatening human lives and triggering environmental damage and utilities. The scientific group is primarily focused on monitoring of potential glacier lakes, finding locations where glacier lakes are likely to develop in the future, and measures to avoid floods or reduce damage.

2.STUDY AREA:

GLOFs are among the most common hazards caused by climate change across the Himalayan state of Himachal Pradesh. Geepang Gath glacial lakes are main glacial lakes in Lahul & Spiti District. It shows an increase in their area, the area of interest has been described as coverage. It is located at a longitude of 77 ° 13 '11.937 "E and 32 ° 31' 38.143" N latitude.

3.MATERIAL AND DATASETS

LISS-3 data of the years 2008, 2013 and 2018 have been used for glacial lake mapping has been downloaded from Bhuvan Website. For Study area boundaries has been downloaded from https://static.fossee.in/mapathon/Mapathon2020_Data Website.

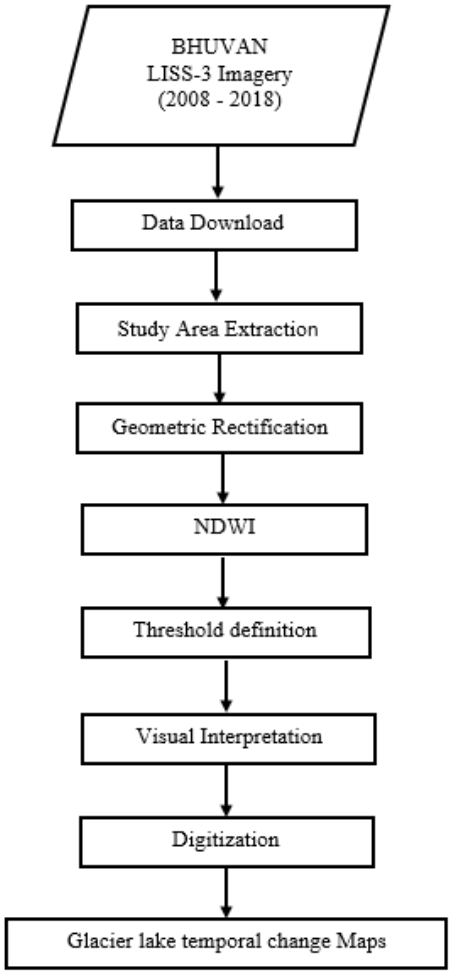
Table 1: Details of dataset

Data/Sensor	**Swath** (km)	**Spectral Resolution (µm)**	**Spatial Resolution (m)**	**Temporal Resolution (days)**	**Radiometric Resolution**
LISS-3	140	Green:0.52-59 Red:0.62-0.68 NIR:0.77-0.86 SWIR:1.55-1.75	23.5 23.5 23.5 23.5	24	10 bit

Table 2: Details of selected imageries

Data/Sensor	**Toposheet Number**	**Date of acquisition**	**Source**	**Bands Comb. (NDWI)**
LISS-3	I43X02	18-Oct-2008	Bhuvan	Green & NIR
LISS-3	I43X02	02-Mar-2013	Bhuvan	Green & NIR
LISS-3	I43X02	12-Mar-2018	Bhuvan	Green & NIR

4.METHODOLOGY



The study of temporal variation in the lake region has been carried out using the satellite images. Landsat images have been used classification and change detection using NDWI (Normalized Difference Water Index). The NDWI (McFeeters, 1996) were calculated as

$$\text{NDWI} = \frac{GREEN-NIR}{GREEN+NIR}$$

The highest reflectance is used by NDWI, green with the NIR bands for the extracting bodies of water. The resulting images has visually examined and associated with google earth imagery. The NDWI values differ from −1 to +1. Much of the characteristics of water are found near the value of +1. McFeeters (1996) defined zero as for water bodies, the threshold value. Values towards −1 indicate the characteristics of vegetation and bare soil or ground. After using the Normalised Difference Water Index (NDWI), digitalization of the result can be extracted.

5.RESULTS AND DISCUSSION

Year	Area (in ha)	Area (in sq km)
2008	57.791	0.578
2013	76.081	0.761
2018	95.686	0.957

Table 3: Temporal variations in the area extent of Geepang gath glacial lake

In this study, glacial lakes have been mapped using Geographic Information System (GIS) and Remote Sensing (RS) techniques. The lake area has increased from 0.578 to 0.957 km^2 for Geepang Gath glacier lake during 2008 – 2018. The present result suggests that from the year 2008 to 2018, the lake area is continuously increasing (as shown in Table 3).

The use of GIS and Remote sensing technology has allowed lakes developed at higher altitudes to be mapped, which would not have been possible through field investigations. Information provided by systematic study of satellite images give an idea about the formation of these lakes. In order to understand the change in their location, the monitoring of glacial lakes, Geepang gath was carried out in depth. Over the years, the monitoring showed a gradual increase in their size, which is further justified by primary survey results. It is therefore important to research such lakes in detail using satellite data in order to evaluate the hazards of such lakes. The results of the research will assist in the development of risk management plans, spatial planning and better preparedness for future potential hazards of GLOFs.