

## **Snow and Glacier Studies in Sikkim Himalaya Using Remote Sensing and GIS Techniques**

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Snow, ice and glacier considered as an indispensable component of the extreme milieu is the largest source of fresh water outside the Polar Regions. Himalayan glaciers accounting for 10% of the fresh water sources regulates and sustains the major hydel projects and human civilization in the downstream. Thus, research on the Himalayan snow, ice and glacier is a necessity and is an important aspect in the development of the country in general and the cryogenic regions of the Himalayas in particular. The potential impact of climate change and its variability is felt over the globe as well as in Sikkim Himalaya. The retreat, advance and mass balance fluctuations of the valley glaciers is a major concern for the climatologist, Earth scientist and the geomorphologist and it is attracting them for the study of Himalayan glacier behavior.

Temperature fluctuation and change in precipitation pattern is a major cause of glacier shrinkage and sea level rise, but anthropogenic factor and the change in composition of atmospheric constituents also have a significant role to play. The monitoring of snow and glacier and glacier behavior using remote sensing and GIS tools along with field expedition of the valley glaciers in the past furnished the sensitive detection of natural and anthropogenic climate variability which may pose an enormous pressure on water sustainability and river regimes in the downstream.

Sikkim Himalaya is blessed with 84 valley glaciers and permanent snow fields and ice aprons distributed in the various sub-basins of Tista in Sikkim. An attempt has been made for the mapping of 84 valley glaciers using remotely sensing data, due to unavailability of cloud free scenes only 57 valley glaciers could be mapped to develop spatial and attribute information on them. The major valley glaciers in Sikkim Himalaya are Tista Khangse, Tasha, Changme Khanpu, Khanpuk Khangse, Lhonak, Jonshang, Zemu, Talung, Onglakthang, and East Rathong. The largest among them in Sikkim Himalaya is Zemu occupying an area of 95.86 sq.km in Zema sub-basin of Tista. In the present paper the area vacated by different glacier in Tista river valley have been calculated. The analysis of the results shows that area of some of the glaciers has decreased significantly. The total glaciated area occupied by 57 glaciers reduced 11.18 sq.km in 7 years (1997-2004).

Key words: Snow, Glacier, Sikkim Himalaya

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