

## **Spatio-temporal glacier area change analysis in the Himalayan: A comparison between northerly and southerly flowing glaciers**

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Global mean temperature has increased  $0.3^{\circ}$ - $0.6^{\circ}\text{C}$  (IPCC) during the last 100 years due to industrialization and fossil fuel combustion; as a result glaciers are recessed in a faster rate in the Himalaya. Himalayan glaciers have lots of variability with region wise, therefore various workers monitor parameter like; glacier mass balance, area change, frontal change, lake area change, and debris content. These are very important, but significant gaps remain, till yet very less work has been done on glacier area change in the whole Himalaya. Hence regular monitoring of those glaciers should be done. Present study describes the spatial pattern in glacier area change in the Himalaya based on Landsat and ASTER GDEM. A total numbers of 14141 glaciers were taken into analysis for time span of 25 years from 1990 to 2015. Total loss was estimated around  $2801.73\text{ km}^2$  with overall recession rate of  $-0.65\%/\text{yr}$ . TRMM precipitation data showed that in the western Himalaya precipitation trend decreases till 2000 after that it starts increasing till present; whereas in eastern Himalaya precipitation decreases year wise till present. Mean surface temperature data showed that temperature was more in eastern part than western part of the Himalaya. This recession happened due to this change in precipitation and temperature pattern. Due to complexity in rainfall and temperature pattern, we divided whole Himalaya into five regions (Region I, II, III, IV, and V) from west to east. Consequently, we got that except region I (Jammu & Kashmir), all were retreating throughout the studied period, whereas region I undergo retreat till 2010 after that it started increasing. Here we attempted to explain retreat rate with controlling factors like slope, debris content, glacier size, precipitation and temperature. Glaciers flowing towards N have a high recession rate  $-0.88\%/\text{yr}$  than the glaciers flowing toward S i.e.  $-0.54\%/\text{yr}$ . The observation show Southern flowing glaciers retreat in a lower rate than northern flowing glaciers. The factors behind this can be attributed as bigger glacier size, higher debris content, higher precipitation, less slope, higher temperature and less temperature change for southern flowing glaciers, which helps glaciers to retreat less.