

Surge event of Alakesayi Glacier, West Kunlun Shan, based on remote sensing data

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Surging glaciers are glaciers that move periodically and rapidly. During a surge event, a glacier advances rapidly in a short time. The velocity is several times larger than usual, and glacier thickening at the terminus may be induced. After a surge, a compensatory glacier retreat may occur. These processes lead to potentially dangerous consequences, especially the outburst flood of a glacial lake. Although surging glaciers in Alaska and Svalbard Islands have been studied in detail, there are few studies on a large number of surging glaciers in the High Mountain Asia (HMA) including Kunlun. A better understanding of the dynamics of glacial surges in this region will help to predict future glacial behavior and assess potential disasters.

Alakesayi Glacier lies in West Kunlun Shan (WKS), northwestern Tibetan Plateau, China. A surge event was observed to have started in 2014. By utilizing more than 50 frames of Sentinel 1 and Landsat satellite images, we estimated the change in surface velocity (seasonal and inter-annual) and terminus morphology. Changes in surface elevation were also obtained using DEMs for different periods. The data analysis shows that, the surface velocity continued to increase during 2014-2015, reaching a maximum of more than 1,000 m/yr. Then the velocity gradually decreased but was still greater than other glaciers in the same region. During the surge, Alakesayi Glacier advanced by 1.3 km. Although the glacier continued to retreat during the 1980s and 1990s, the current terminus is close to that before the retreat because of the surge. Surge events similar to this time may have occurred also in the past. The elevation change of the glacial surface reflects the mass transport process during the surge, i.e., the mass lost in the midstream but increased in the downstream including the terminus. These results from remote sensing data provide an insight into the surge dynamics of Alakesayi Glacier and will be useful for understanding the glacier mass balance in this area.

Keywords: surging glacier, remote sensing, glacier change, surface velocity