



Dynamics and current state of Glacier Batysh Sook, Kyrgyzstan

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Batysh Sook Glacier ($41^{\circ} 46.668'N$, $77^{\circ} 45.071'E$) is located within the Zhetimbel range ($41^{\circ} 46.668'N$, $77^{\circ} 45.071'E$), Inner Tien Shan. The Zhetimbel range consists of 44 glaciers with a total area of 30.9 km² and a volume of 1.2 km³, as estimated in 2007 [1].

The Glacier spans an altitudinal range of 3950 to 4450 m a.s.l and in 2016 covers an area of around 0.97 km². Mass balance measurements and length change observations have been performed from 2010 to 2016. Annual length changes for the years 2011 to 2016 were measured with a handheld GPS (Garmin, e-trex). The ablation stake network includes 16 stakes and each year between 2 to 4 snow-pits are dug to measure density and snow depth in the accumulation area. Snow depth probing's are additionally carried out to improve the spatial coverage of measurements in the accumulation zone. Field surveys are usually conducted once a year, preferably at the end of summer. However, due to logistic reasons this was not always possible and some surveys were carried out in late July or early August. Mass balance is thus measured in the floating date system.

The mean annual temperature measured at the Tien Shan Kumtor automatic weather station, (AWS) situated in the Akshyirak massive at an elevation of 3660 m a.s.l, is $-5.8^{\circ}C$ (2003-2014). The warmest month is July with an average temperature of $4.4^{\circ}C$ (2003-2014,) and the lowest temperatures are measured in January, with a long-term mean value of $-21.6^{\circ}C$ (1930-1996, Kutuzov and Shahgedanova, 2009). Mean annual precipitation is 360 mm (2003–2014), and on a long-term perspective (1930-1996) up to 76% of the annual precipitation was recorded during the summer months (May–September) [2].

The new AWS is situated at a distance of 32 km from Batysh Sook and records data every hour. Daily precipitation totals and daily mean temperatures are calculated for the use as model input.

Here we investigated length and mass balance change of Glacier Batysh Sook, the length and area change we calculated for the periods 1975-2016 based on Landsat TM/ETM+ data analysis. The total area of 1.04 km² in 1975 calculated for Batysh Sook Glacier is somewhat less area than the result found by E.K. Bakov, he estimated a total area 1.6 km² for Batysh Sook glacier; by 2016 it was reduced to a total area of 0.97 km².

Average length change from 1975 to 2016 for the each year is 8m. The total length change from during 41 years is $-321, 66$ m.

To analyze the glaciological mass balance the study was based on annual glaciological measurements between 2010/11 and 2015/16. The mass balances for 2003/04 to 2009/10 were reconstructed by the application of the calibrated mass balance model. Batysh Sook Glacier had a mean annual mass balance of -0.39 ± 26 m w.e. a-1, from 2003/04 to 2015/16. For the measurement period from 2010/11 to 2015/16, mean annual mass balance was -0.48 ± 0.16 m w.e. a-1.