

## The seasonal in-situ mass balance, temperature and precipitation of Yala Glacier, Langtang Valley, Nepal, from 2011 to 2015

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In-situ glacier mass balance measurements are still scarce in the Hindu Kush Himalayan (HKH) region and little is known about the seasonal balances. The glaciers in the Nepalese Himalaya have been considered summer accumulation glacier types because of the assumption that the majority of the accumulation occurs in the summer months during the monsoon. The glacier mass balance of Yala Glacier in the Langtang Valley of Nepal has been measured using the glaciological method since autumn 2011. Stakes were measured biannually in pre- and post-monsoon, usually in early May and in November, respectively. The measured mass balance gradient for the summer balance was larger than the winter balance, which is typical for glaciers with distinct ablation and accumulation seasons. On Yala Glacier, the summer balance was negative, and the winter balance was positive in all years with measurements. However, the annual net balance was negative for all four mass balance years from 2011 to 2015. The mass balances were further compared to temperature and precipitation data measured at nearby climate stations during the same time periods. In October 2013 and 2014, the Central Himalayas received large amounts of precipitation brought by the cyclones Phailin and Hudhud. These precipitation events contributed to the summer balance since the measurements were taken after the cyclones passed. In conclusion, on Yala Glacier accumulation processes dominated ablation processes during the winter, and ablation processes dominated during the summer, which could be explained by the low elevation range of Yala Glacier and precipitation from westerlies in the winter. Hence, this should be kept in mind when using the term 'summer accumulation glacier' for Yala Glacier. For future research in the HKH region, seasonal mass balances should be measured, and the processes impacting the mass balance and the role of winter precipitation should be investigated for other glaciers in the HKH region.