In-situ measurement of two years mass balances on a debris-covered Trambau Glacier, Nepal Himalaya

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Shrinkage of Himalayan glaciers is unabated and thus contributes to sea level rise and alters regional water cycle (Gardner et al., 2013). In this region, only few ground-based observation of mass balance on large glaciers has been conducted due to the difficult accessibility to high-elevation accumulation area. Moreover, many large glaciers are covered with debris over the lower reaches, which makes the ablation process complicated. We therefore have conducted in-situ observation on Trambau Glacier in the Rolwaling region, Nepal Himalaya, covering an elevation range of 4550 to 6850 m a.s.l., since the pre-monsoon season of 2016. We installed several stakes from lower debris-covered area (4590 m a.s.l.) to upper debris-free accumulation area (5850 m a.s.l.), in order to obtain mass balance. An automatic weather station and an air temperature sensor were set beside the glacier to obtain meteorological data. Observed mass balance during the 2016 monsoon season and the period 2016–2017 range from −2.62 to +0.12 and −3.83 to −0.12 m w.e., respectively. The most negative mass balance in both observation periods were found at 5280 m a.s.l., which is the lower bound of debris-free area, and a liner relationship was found between mass balance and elevation over the upper debris-free area. Even though the highest stake was set at 5850 m, the mass balance at the point in 2016–2017 showed still negative value (−0.12 m w.e).
We furthermore calculated altitudinal mass balance profile during observation periods using a model, which established by previous study (Fujita and Sakai. 2014), and observed meteorological data. By updating precipitation and temperature lapse rate from previous study using observed meteorological data, calculated altitudinal mass balance profiles performed plausible values compared with observed mass balance data, and then glacier-wide mass balances were estimated as −0.79 and −0.77 m w.e. during 2016 monsoon season and 2016–2017, respectively.

References

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