

## Measurement of mass balance with high altitude, and thermal property of debris-covered area at the Trambau Glacier, Nepal

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Shrinkage of Himalayan glaciers is unabated and thus contributes to sea level rise. In this region, in-situ measurements of mass balance of large glaciers have been conducted at few glaciers due to the difficult accessibility to their accumulation area. Moreover, many large glacier tongues are covered with debris, which makes the ablation process complicate. Thus, it is required to carry out in-situ measurement at debris-covered glaciers with accessible accumulation area.

We carried out in-situ measurements at Trambau glacier in the Nepal Himalaya pre- and post-monsoon seasons in 2016. We installed stakes network from ablation to accumulation area, and obtained direct mass balance data. An automatic weather station was set beside the glacier to obtain basic meteorological data during observation period. In order to establish a model for ablation at debris-covered ice, we also measured thermal conductivity and water content in debris layer, and set temperature sensors at different depth in the debris layer. Observed mass balance ranges from -2.62 m to +0.12 m w.e. a<sup>-1</sup> during the period. The maximum ablation is found at 5280 m a.s.l., which is the lower bound of debris-free area, and a liner relationship is found between mass balance and elevation ( $r = 0.94$ ,  $p < 0.01$ ). In contrast, no significant correlation is found between mass balance and elevation in debris-covered area whereas a coefficient correlation between mass balance and thermal resistance, which is a proxy of debris thickness, is 0.71 ( $p < 0.05$ ).

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