



## Glaciers in the Rupal Valley (Nanga Parbat)

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The widely discussed controversy about Himalayan glacier changes instigated a current boom in studies on a regional scale. In contrast to often simplified assumptions of general and mostly rapid glacier retreat, recent studies show a more complex pattern with stable, advancing and retreating glaciers. Furthermore, changes of debris covered glaciers are discussed controversial. Due to the great vertical span and steep relief, large ice streams in the Himalaya and Karakoram are often primarily fed by avalanches. Their impact on glacier mass balances is often unconsidered in present studies. However, Hewitt (2014) highlighted the crucial role of snow and ice re-distribution by avalanches for Karakoram glaciers. He used a concept of glacier typology based on different nourishment processes introduced at the beginning of the 20th century. By using this concept, Hewitt classified large glaciers in order to identify the effect of avalanches on the mass balance, because many Karakoram glaciers show low down-wasting or even thickening processes described as the “Karakoram anomaly” (Hewitt 2005).

Also in the Nanga Parbat region, the western corner of the High Himalaya, the topography is characterized by steep rock walls with vertical distances up to 4700 m. The debris covered glaciers reach down to 2920 m a.s.l. and are regularly fed by small and large avalanches. Our field based investigations show that the glaciers are characterized by small retreating rates since 1857, when Adolph Schlagintweit has mapped them for the first time; others such as the Raikot Glacier are fluctuating since 1934. Furthermore, the extent of down-wasting varies between different glaciers. By using multi-temporal satellite data, topographical maps, sketches and terrestrial photographs changes of glacier lengths were measured. In order to calculate the down-wasting rates, a digital elevation model (DEM) with a spatial resolution of 30x30 m<sup>2</sup> was derived from the digitized contour lines of the topographic map of 1934 and compared to the SRTM-DEM. Furthermore, based on topographical parameters derived from the SRTM-DEM, the glaciers were classified, using Hewitt’s concept. The area of steep rock walls and the ratio between accumulation and ablation zones were calculated for each glacier basin.

### References:

- Hewitt, K. 2005: The Karakoram anomaly? Glacier expansion and the ‘elevation effect’, *Karakoram Himalaya. Mountain Research and Development* 25 (4), S. 332-340  
Hewitt, K. 2014: *Glaciers of the Karakoram Himalaya: Glacial Environments, Processes, Hazards and Resources*. Springer. Dordrecht.