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Nanga Parbat Revisited: Glacier changes between the 1930s and 2010

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In contrast to the relatively well investigated glacier changes in the mountains of Europe and North America, very few investigations using repeat photography have been undertaken in the Himalayas and adjacent high mountain regions. The present study seeks to redress this by investigating glacier changes in the Nanga Parbat region (NW-Himalaya) using matched pairs of photographs. A comprehensive collection of historical landscape photographs, taken by members of the German Himalaya expeditions in 1934 and 1937, forms a valuable baseline data set for the area. Our own fieldwork in the 1990s (1992-1997), 2006, and 2010 made it possible to repeat a large number of these photographs from viewpoints identical to the earlier ones. The multi-temporal data allows for direct comparisons and illustrates glacier changes over a span of seventy years. For the purpose of change detection, we also integrate the topographic map of 1934, as well as multi-temporal and multi-scale satellite data (Corona, ASTER, Landsat and Quickbird). The multi-temporal comparison of images detects a complex pattern of glacier retreat and stability in the six glaciers investigated in the Rupal Valley, to the South of Nanga Parbat. Whereas the termini of some of these glaciers are relatively stable since 1934; others such as the Raikot Glacier on the north face of Nanga Parbat are characterized by great fluctuation and a terminus retreat of about 210 m over the last 70 years. The extent of down-wasting displays a similar variation between the different glaciers under investigation.