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Historical analysis and visualization of the retreat of Findelengletscher, Switzerland, 1859-2010

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Abstract

Since the end of the Little Ice Age around 1850 glaciers in Europe have strongly retreated. Thanks to early topographic surveys in Switzerland, accurate maps are available, which enable us to trace glacier changes back in time. The earliest map for all of Switzerland that is usable for a detailed analysis is the Dufour map from around 1850 with subsequent topographic maps on a ~20 year interval. Despite the large public and scientific interest in glacier changes through time, this historic dataset has not yet been fully utilized for topographic change assessment or visualization of historic glacier extents. In this study, we use eleven historical topographic maps and more recent digital datasets for the region of Zermatt to analyze geometric changes (length, area and volume) of Findelengletscher as well as for creating animations of glacier evolution through time for use in public communication. All maps were georeferenced, the contour lines digitized, and digital elevation models (DEMs) created and co-registered. Additional digital data like the SRTM X-band DEM and high resolution laser scanning data were used to extend the analysis until 2010. Moreover, one independent DEM from aerial photogrammetry was used for comparison. During the period