

TOPOGRAPHIC CHANGE OF FINDELENGLETSCHER, VALAIS, SWITZERLAND, 2005–2010 (1:15,000)

Philip Claudio Joerg, Felix Morsdorf, Michael Zemp

Department of Geography, University of Zurich, Switzerland

In 2004, Findelengletscher (and its former tributary Adlergletscher) in the Canton of Valais, Switzerland, were chosen as a validation site for a research project (Machguth et al. 2006a, 2006b). For this purpose, a network of stakes and snow pits was installed to derive the mass balance with the direct glaciological method for both glaciers. Based on this preparatory work, it was decided to continue the mass balance measurements on Findelengletscher to add an additional glacier to the Swiss Glacier Monitoring Network (Glaciological Reports 1881–2010). Today, the mass balance network is maintained jointly by the Department of Geosciences, University of Fribourg, and the Department of Geography, University of Zurich.

Following the decision to maintain use of the traditional measurements, the need arose for verification and calibration based on a geodetic method. We decided to use data from airborne laser scanning (ALS), as this method has repeatedly demonstrated its ability to provide accurate topographic information on glaciers (e.g., Favey et al. 1999, Geist 2005). The annex map shows the elevation change in the period between October 2005 and September 2010. To enhance the visual information content in the accumulation area and at values close to zero meters change, the color bar changes to a finer scale. The map uses the Swiss grid coordinate system (CH1903) and levelled heights (LN02). Therefore, the map shows a kilometer grid and elevations are meters above sea level. The raster resolution of the map information is 1 by 1 m, the background map shows the shaded relief of 2005 in the same spatial resolution.

In the period covered, Findelengletscher lost c. 2% of its area (to 13.03 km² in 2010) and the corresponding length change at the tongue was about -200 m. The average thickness change was -1.76 m for Adlergletscher and -3.18 m (-0.64 m y⁻¹) for Findelengletscher with maximum ice losses of up to -35 m close to the terminus. Only few regions with increased elevation are present in the map, many caused by the downvalley flow of crevasses, altering the elevation values locally but not increasing the glacier volume.

In Joerg et al. (2012), the accuracy of the ALS method in preparation of the comparison to the direct measurements is assessed: Assuming a density of $850 \pm 60 \text{ kg m}^{-3}$, the observed thickness change results in a geodetic mass balance of $-2.70 \pm 0.19 \text{ m w.e.}$ for the five year period covered. This is more negative than the glaciological balance for the corresponding period (-2.07 m w.e.) and shows the need for a re-analysis of the mass balance series.

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