



Glacier length fluctuations in southern Norway back to the 17th century based on historical data: opposite behaviour compared to the Alps?

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The understanding of past and present glacier variations is a key task for evaluating current climate change. Historical and proxy-records have documented a partly asynchronous evolution in temperature, precipitation and glacial variations between European regions during the Little Ice Age (LIA), with the causes of these temporal anomalies yet being poorly understood. The comparison between the Alps and Scandinavia allows an assessment of the spatial distribution of glacier fluctuations in the studied areas during the last few centuries.

Here we present temporally high-resolved glacier reconstructions for southern Norway covering the period back to the 17th century, based on newly discovered historical material. Length changes were determined by the interpretation of high-quality historical documents such as drawings, paintings, prints, photographs, maps and written sources that are abundant for selected glaciers in the area (Folgefonna, Jostedalsbreen). Historical material is only available in adequate quantity for those glaciers which drew the attention of travellers, scientists and artists through their reputation and scenic attraction, reflecting also the glacier perception at that time. A critical quality check of the documentary data was necessary in order to get reliable information on past glacier extents. The glacier extents obtained were finally compared with existing moraine findings in the glacier forefield.

Results from outlet glaciers from Folgefonna (Bondhusbreen, Buerbreen) and Jostedalsbreen (Briksdalsbreen, Bøyabreen, Suphellebreen, Bergsetbreen, Nigardsbreen, Lodalsbreen) indicate a highly different glacier evolution compared to the Alps. According to the historical record, the maximum glacier extent occurred at Folgefonna at around 1890, and at Jostedalsbreen at around 1750, respectively. In the Alps, existing glacier length records (e.g. for Unterer Grindelwaldgletscher, Switzerland, or Mer de Glace, France) show glacier advances around 1600, 1640, 1780, 1820 and 1850.

The cause for the different glacier behaviour and timing of LIA glacier maxima in western Scandinavia and in the Alps may be related to differences in temperature and precipitation distribution which themselves are determined by changes in the large-scale atmospheric circulation over the northern North Atlantic/European and western Russian area, and possibly also by SST changes at low frequency timescales.