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# Scientific visualization of glacier changes for public communication: the example of Findelengletscher, Switzerland

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The melting of glaciers and ice caps has been recognized as one of the best natural indicators for global climate change. In Switzerland, the early onset of both glacier research and detailed mapping of the country resulted in a wealth of historical material documenting glacier changes over the past 160 years.

Fife years ago, the Universities of Zurich and Fribourg, along with the Swiss energy utility Axpo, launched the Glacier Laserscanning Experiment Obervallis (GLAXPO). In this project three laserscanning flights were performed on Findelengletscher in order to create high resolution Digital Elevation Models (DEM). These DEM provide a precise mapping of the glacier surface topography and serve as reference surface for the co-registration of past DEMs computed from digitized historical maps. In addition to that distributed numerical glacier models were run with ensembles of climate change scenarios in order to calculate glacier changes over the 21st century.

The present work makes use of this great data pool for a scientifically correct visualization of 3-dimensional changes of Findelengletscher from AD 1850 to 2100 for public communication. We therefore collected ten different historical maps with the earliest dating from 1862 (plane survey sheet of the Dufour map). The pre-processing included georeferencing and digitalization of contour lines for the creation of different historical DEMs. Afterwards all historical DEMs were co-registered to one of the latest high resolution laserscanning DEM (from 2005). In between years with available DEMs, surface changes were interpolated linearly to create a sequence for the computer animation. For future developments, modeled glacier elevation changes where added/subtracted from the latest DEM (from 2010). Finally, two animations, showing glacier changes from 1850-2010 and 2010-2100, were composed and rendered in the animation program Visual Nature Studio 3.

In cooperation with professional booth and model builders, these animations were set up as a glacier exhibit including an interactive touchscreen, a large panoramic view of the Findelen Valley, and an additional interactive monitor providing related background information in French and German. Beginning of 2013, the glacier exhibit was launched as permanent part of the Axporama visitor center and ready for more than 10,000 public visitors a year.