

Slowing down the retreat of the Morteratsch glacier, Switzerland, by artificially produced summer snow

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Many large valley glaciers in the world are retreating at historically unprecedented rates. Also in the Alps, where warming over the past decades has been more than twice as large as the global mean, all major glaciers have retreated over distances of several kilometers over the past hundred years.

The Morteratsch Glacier, Pontresina, Switzerland, is a major touristic attraction. Due to strong retreat the lowest part of the glacier is getting out of sight from the gravel road that provided direct access to the glacier front. The Community of Pontresina has commissioned a preparatory study to find out if it is possible to slow down the retreat of the Morteratsch Glacier in an environmentally friendly way. In this article we report on the outcome of such a study, based on a modelling approach. Our analysis is based on a 20- year weather station record from the lower part of the glacier, combined with calculations with an ice flow model. This model has been carefully calibrated against the historical glacier length record, to ensure an optimal initial state for projections into the future.

We arrive at the conclusion that producing summer snow in the ablation zone over a larger area (typically 0.5 to 1 km²) is the best option, and may have a significant effect on the rate of retreat on a timescale of decades. We consider three scenarios of climate change: (i) no change, (ii) a rise of the Equilibrium Line Altitude (ELA) by 1 m/yr, and (iii) a rise of the ELA by 2 m/yr. Projections of glacier length are done until the year 2100.

It takes about 10 years before snow deposition in the higher ablation zone starts to affect the position of the glacier snout. The difference in glacier length between the snow and no-snow experiments becomes 400 to 500 m within two decades.