



## **Estimating surface area changes of Gran Campo Nevado Ice Cap until 2100 using calibrated volume-area scaling**

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Gran Campo Nevado Ice Cap (GCN) is located in southernmost Chilean Patagonia. It features a surface area of 199.5 km<sup>2</sup> (1998) and covers an altitude range between sea level and 1600 m a.s.l. The aim of this study is to estimate probable future area changes of GCN in response to oncoming climate change.

The future glacier area evolution was calculated employing the output of a modified surface mass balance model. Based on the degree-day method, this model was extended to incorporate changing glacier surface extents by using volume-area scaling. A newly developed method was used to calibrate the employed volume-area relation without knowledge of ice volume. The model was run between two known glacier surface extents (1986 and 1998) iteratively performing changes of the volume-area relation until modeled surface area at the end of the calibration period matched observations.

For estimation of the 21<sup>st</sup> century area evolution of GCN the extended model was forced by statistically downscaled monthly air temperature and precipitation NCEP/NCAR reanalysis and HadCM3 general circulation model data. The used model runs represent the scenarios B1 and A2 of the IPCC Forth Assessment Report and thus best and worst case climate forcing. The presented model results can be regarded as a minimum-maximum range of the possible future glacier change.

Modeling results yield area reductions of 24% (B1) or 27% (A2) until the end of the

21<sup>st</sup> century. The extent of the glacier surface of GCN would be reduced to between 154 km<sup>2</sup> (B1) and 147 km<sup>2</sup> (A2) by the end of 2099. The results reveal a recession of the glaciated areas to altitudes above 521 m a.s.l. (B1) or 557 m a.s.l. (A2).