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Impact of two conceptual precipitation modeling schemes on the mass balance of the Gran Campo Nevado Ice Cap, Patagonia

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A linear model of orographic precipitation (OPM) (Smith & Barstad 2004) including the airflow dynamics, the advection of condensed water, and the downslope evaporation was used to downscale orographic precipitation dynamically for the Gran Campo Nevado Ice Cap (GCN) in southwest Patagonia. The model is driven by using Reanalysis data of the National Centers for Environmental Prediction (NCEP) and the National Center for Atmospheric Research (NCAR) for the time period 2000-2010. The OPM is evaluated by using daily precipitation data from automatic weather stations in the investigated area.

GCN is mostly influenced by orographically induced precipitation, providing a suitable basis for downscaling precipitation by applying a linear orographic precipitation model. The amount and spatial distribution of modeled orographic precipitation are in good agreement with observed precipitation fields.
The application of an orographic precipitation model to downscale precipitation even in complex terrain and to obtain a detailed estimate of the spatial distribution of precipitation provides a promising technique for further studies, such as glacier mass balance studies. A long-term application of the OPM for the time period 2000-2010 is implemented in order to improve surface mass balance (SMB) studies at GCN. The SMB is calculated using a degree-day model which is driven by two different downscaled precipitation datasets based on a linear precipitation gradient and daily modeled orographic precipitation. The main intention of this study is the analysis of the sensitivity of GCN to changes in precipitation and the achievement of significantly higher accuracies of the SMB calculations. The variation of the precipitation gradient on the east and west side of the mountain range is assumed to be of crucial importance and should be considered in the calculation of glacier mass balance.