The application of a non-linear back-propagation neural network to study the mass balance of Grosse Aletschgletscher, Switzerland

Daniel Steiner - *Institute of Geography, University of Bern, CH-3012 Bern, Switzerland*
steiner@giub.unibe.ch
A. Walter,- *Deutscher Wetterdienst, Postfach 100465, D-63004 Offenbach, Germany*
H.J. Zumbuhl - *Institute of Geography, University of Bern, CH-3012 Bern, Switzerland*

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Abstract

Glacier mass changes are considered to represent key variables related to climate variability. We have reconstructed a proxy for annual mass-balance changes in Grosse Aletschgletscher, Swiss Alps, back to AD 1500 using a non-linear back-propagation neural network (BPN). The model skill of the BPN performs better than reconstructions using conventional stepwise multiple linear regression. The BPN, driven by monthly instrumental series of local temperature and precipitation, provides a proxy for 20th-century mass balance. The long-term mass-balance reconstruction back to 1500 is based on a multi-proxy approach of seasonally resolved temperature and precipitation reconstructions (mean over a specific area) as input variables. The relation between the driving factors (temperature, precipitation) used and the reconstructed mass-balance series is discussed. Mass changes in Grosse Aletschgletscher are shown to be mainly influenced by summer (June–August) temperatures, but winter (December– February) precipitation also seems to contribute. Furthermore, we found a significant non-linear part within the climate–mass-balance relation of Grosse Aletschgletscher.