



## **Predicting discharge of a small glaciated catchment in southernmost Patagonia using artificial neural networks**

T. Sauter (1), **C. Schneider** (2)

(1) Dep. of Physical Geography, University of Freiburg (tobias\_sauter@web.de), (2) De. of Geography, Tech. University of Aachen (christoph.schneider@geo.rwth-aachen.de)

A model of ice melt rainfall-runoff relationships based in an artificial neural network (ANN) was applied in a small remote partly glaciated catchment area in Patagonia, Chile. The investigation area is located at 53°S in southernmost South America east of the main divide of the mountain range of the Andes at 72.5°W and covers an area of about 15 km<sup>2</sup>. The Río Lengua is draining the outlet glacier “Glaciar Lengua”, which is part of the Gran Campo Nevado Ice Cap. The climate in the area is characterised by whole-year round cool and super-humid conditions with a mean annual air temperature of +5,6°C at sea level and an annual precipitation sum of approximately 6,500 mm.

The ANN model was developed to forecast the river flow of the Río Lengua. The designed multi-layer feed-forward back-propagation network is capable of approximating any function with a finite number of discontinuities. Instead of using the standard training algorithm the Levenberg-Marquardt algorithm was applied to increase the speed of computation (convergence). Using climate data recorded at an automatic weather station nearby and water level records obtained from two digital water depth sensors during 2002-2004, the ANN model was trained and verified using independent training and validation data sets. Observed daily precipitation, temperature and runoff data were used as parameters for modelling. The number of parameters corresponding to different lags were determined by statistical methods such as cross-, auto-, and partial-auto-correlation. The outcome of the analysis suggested a significant correlation up to a 3 days lag in runoff and rainfall data as well as a 5 days lag in temperature data. To obtain an indication of the strength between observed and pre-

dicted flow, root-mean-square-error (RMSE), model efficiency and volume error were estimated. The correlation between observed and estimated discharge (validation) has a significant correlation coefficient of 0.97 and a RMSE of 0.68, respectively. The results confirm that ANN-modelling is a promising technique for the prediction of the run-off for catchments in super-humid and glaciated regions.