Geophysical Research Abstracts, Vol. 7, 02633, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02633

Dynamic modelling of talus-derived rockglacier occurrence with cellular automata: a prototype model

R. Frauenfelder (1), B. Schneider (2), A. Kääb (1)

(1) Department of Geography, University of Zürich, Winterthurerstr. 190, 8057 Zürich, Switzerland, (2) Department of Earth Sciences, University of Basel, Bernoullistrasse 32, 4056 Basel, Switzerland

The present contribution reports about the exploration of a cellular automata approach to assess regional rockglacier distribution patterns. The designed prototype model allows the numerical simulation of the spatial and temporal occurrence of talus-derived rockglaciers. Its main goal is to help evaluate and increase knowledge about dynamics and distribution patterns of rockglaciers by detailed comparison of the model outcome with the actual occurrence of rockglaciers. The area considered is the Upper Engadine, eastern Swiss Alps; the represented time-scale is the Holocene (i.e. ˜10,000 y BP to today).

The dynamic model considers processes in the spatial and temporal domain and accounts for both external and internal processes, implemented by means of six modules (A to G). The external processes are: (A) rock-debris accumulation, (B) hydrology, (C) climate, (D) glacier extent. The internal processes are: (E) creep initiation, (F) advance rate, (G) creep termination.

Comparison between field evidence and modelling results yields the following main results: (1) Most active and inactive talus-derived rockglaciers are reproduced accurately by the model, and the extents they exhibit in nature are also shown, approximately, although deviations can be found. (2) Certain active rockglaciers are not reproduced by the modelling. Careful consultation of the inventory data reveals that (at least) some of these rockglaciers are moraine-derived forms, and thus cannot be reproduced by a model that is based entirely on the processes involved in the development of talus-derived rockglaciers. (3) In a model run for 10,000 years, the modelled rockglacier fronts do not advance into regions where relict rockglaciers are found in the

inventory. Based on temperature reconstructions and (partly empirical) relative age dating on selected rockglaciers, it can be assumed that relict rockglaciers in the area evolved as early as the Alpine Lateglacial. These findings seem to be supported by the model results with ‘virtual rockglaciers’ not exceeding the extents of active (and some inactive) rockglaciers.

Generally, it can be said that dynamic modelling enables the simulation of spatio-temporal creep processes but proves to be highly dependent on the accurate modelling of the relevant (input) parameters. These deficiencies have been recognized and analyzed, future research activities will address these problems.