Geophysical Research Abstracts, Vol. 9, 05070, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05070

Snow cover modelling under Climate Change conditions (present and future) for alpine plants dynamics (Austria)

J.P Dedieu (1), S. Dullinger (2), C. Randin (3), A. Guisan (3), M. Zappa (4) and T. Jonas (4).

(1) Laboratoire EDYTEM-UMR 5204 CNRS,73376, Chambéry, France, (2) Dept for Conservation Biology, Vegetation and Landscape Ecology, University of Vienna, Austria , (3) Dept of Ecology and Evolution, University of Lausanne, CH 1015, Switzerland, (4) WSL-SLF, Birmensdorf, CH 8903 and Davos CH-7260, Switzerland. jean-pierre.dedieu@univ-savoie.fr / Fax +33-4 76 79 75 77 stefan.dullinger@univie.ac.at / Fax: +43-1 4277 9542

Snow cover is an important parameter for the natural environment (hydrology, vegetation) in alpine regions. Earlier snow melt and an elongation and/or shift of the snow-free period - correlated to increasing summer temperatures observed since the 90's – can impact on various facets of alpine ecology.

The objective is here to use an existing hydrological model, *PREVAH* from Gurtz and Zappa (WSL, Switzerland) to generate various snow parameters (statistics, cover maps) that will then be tested as variables in predictive models of alpine species' distribution. In the following, the focus is mainly given to the first step, i.e. on issues pertaining to the development of the snow cover model.

The study area is located in the North-eastern Calcareous Alps (NCA) of Austria (47˚30' to 47˚50 N and 15˚ to 16˚ E) comprising four different mountain ranges (Mt. Hochschwab, Mt. Rax,, Mt. Schneealpe, Mt. Schneeberg) with an overall area of 150 km^2.

Inputs: meteorological data from the Austrian Meteorological Service (ZAMG) since 1980 and from the Technical University of Vienna since 1993 are used, providing daily means values : temperature, precipitation, humidity, wind speed, sun duration. Complementary data during the snow-free season are also available: land cover and soils classification. Then, a fine digital elevation model (DEM) at 20m grid spatialise

these data.

Calibration: a set of snowpits in high elevation sites and runoff gauges at the bottom of mountains are used to adjust the snow calculation from the hydrological model.

Outputs: the issue is to expand the Swiss model to predict mean annual snow cover duration, mean Julian day of snowmelt and frost risk in a spatially explicit way. The results should serve as a basis for analysing and predicting the consequences of current and potentially changing future snow cover patterns on the dynamics of plant species confined to habitats characterised by long-lasting snow-cover ("snowbeds"). Validation: a set of snow maps derived from orthorectified SPOT satellite images are used to estimate the accuracy of the snow cover modelling results.

The PREVAH model is used to obtain a physically-based predictor for snow cover duration, information primarily relevant to mountain plant distribution. The different steps to expand this model on snowbeds-related plants dynamics will be (i) to apply the model in a way that takes different climate change scenarios into account: HadCM3 (global) and HIRHAM4 (regional). E.g. temperature increase, precipitation change, different distribution of solar radiation across the year and their impact on evapo-transpiration. The main parameter analysed will be the timing and duration of the snow-free period. This would allow for tracking spatial patterns of snowbed habitats, or analysing if emerging gaps or corridors would prohibit, respectively facilitate adaptive migration of plants. (ii) Secondly, to refine the model in the sense that it delivers the average date of snowmelt per year rather than the cumulative duration of snowmelt over the last 20 years and to see if these two variables are related or not. The methodology and the problems related to topography will be presented; e.g. the necessity to correct temperatures and precipitations from valley stations to higher elevation sites using snow pits measurements. Also for each particular grid cell, how to provide interpolated local snow parameters (depth, duration), given the problems encountered in high mountainous areas.