Geophysical Research Abstracts, Vol. 8, 06038, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06038

Simulation of glacier runoff in a regional climate model

S. Kotlarski (1), D. Jacob (1), F. Paul (2)

(1) Max Planck Institute for Meteorology, Hamburg, (2) Department of Geography, University of Zurich (kotlarski@dkrz.de)

A main application of regional climate models (RCMs) is the analysis of regional water cycles and the prediction of future changes in the individual water balance terms. A focus is often laid on river discharge and on the occurence of hydrological extremes under future climate conditions. For this purpose, the runoff as produced by an RCM's land surface scheme can be directly used as input to river routing schemes which account for the lateral transport of water on the land surface.

In alpine regions, a large fraction of the total amount of river dicharge might originate from glacier melt. This is especially true during hot and dry summers when the level of further natural reservoirs is at minimum but glacier melt is strongest. In the extraordinary warm and dry summer of 2003 alone, about 10% of the glaciers in the European Alps disappeared (EEA, 2005) with meltwater being released into the river systems and maintaining flow conditions above critical thresholds. The observed trend of enhanced glacier melt is expected to continue far into the 21st century.

Present-day RCMs have so far not been capable of including the influence of glacier melt on runoff conditions. The size of mountain glaciers is usually beyond grid box resolution and only the largest glaciers are accounted for as fixed surface boundary conditions with runoff generation on these surfaces being simplified to a very high degree or even neglected. To overcome these deficiencies and to represent the storage and release of water in mountain glaciers, a subgrid glacier parameterisation has been developed and implemented into the RCM REMO. The new scheme replaces the static glacier mask used so far and includes the explicit simulation of glacier mass and energy balance. The total ice mass within a climate model grid box is represented by a two-layer ice body covering a certain fraction of the total grid box area. Surface fluxes are derived separately for glaciated and non-glaciated parts. The glaciated fraction of an individual grid box is adjusting dynamically depending on accumulation

and ablation conditions following a simple volume-area relationship. Surface runoff and drainage originating from the glacier fraction are added to total grid box runoff thus closing the water balance. In order to assess the effect of changing ice volumes on runoff in glaciated catchments the routing scheme HD (Hydrological Discharge) is coupled to REMO in an offline mode.

Within this contribution, simulations of the regional climate in the European Alps for the period 1958-2002 will be presented. A focus is being laid on runoff conditions in the alpine part of the Rhine Catchment and the effect of glacier meltwater on the simulated discharge.

European Environment Agency (EEA), 2005: The European Environment - State and Outlook 2005. Copenhagen, 570 pp.