Geophysical Research Abstracts
Vol. 16, EGU2014-13872, 2014
EGU General Assembly 2014

The influence of future glacier extents on hydrological flow regimes in the Ötztal Alps

Moritz Zimmermann (1,2), Matthias Huttenlau (1), Katrin Schneider (1), Johann Stötter (1,2)
(1) alpS, Innsbruck, Austria (zimmermann@alps-gmbh.com), (2) Institute of Geography, University of Innsbruck, Austria

The ongoing retreat of glaciers since 1850 and especially within the last 20 years already impacts the natural environment. Rising temperatures as projected by the IPCC Fifth Assessment Report (AR5) will affect future glacier extents with the inherent consequences e.g. on runoff.
This contribution presents a relative simple approach to analyze mostly temperature but also precipitation driven potential changes on the extent of glacierized areas and the resulting impact on runoff within the catchment of the Ötztaler Ache (Ötztal, Austria) until 2050. Changes of mean summer temperatures are derived from simulation results realized with three different regional climate models (ALADIN, REMO and REGCM3). The realizations are driven with the SRES A1B emission scenario of the Fourth Assessment Report (AR4). Potential future glacier extents are calculated according to the approach of Paul et al. (2007). Thereby, the steady-state equilibrium line of altitude (ELA) is calculated and then shifted depending on temperature change. Future glacier extents are calculated under consideration of the 2:1 steady state accumulation area ratio (AARo) based on the Austrian Glacier Inventory 2006 and a digital elevation model (DEM). Impacts of potential future glacier extents but also of changes in temperature and precipitation are analyzed with the semi-distributed hydrological model HQsim.
According to Paul et al. (2007), the ELA in the Swiss Alps rises with approx. 140 m per degree Celsius warming. The evaluation of the available regional climate change realizations for the study area shows a potential increase of the mean summer temperature of approx. 2.7 °C by 2050. Based on the considered approach ELA will increase by 370 m. The retreat of glacierized areas will be calculated incrementally by a temperature increase with 0.5 °C steps.
The glacierized area (Austrian Glacier Inventory 2006) of glaciers > 500,000 m^2 in 2006 will be reduced by 82 % from 68 km^2 to 3.8 km^2 in 2050. Glaciers with an area smaller than 500,000 m^2 are not considered.
Potential future runoffs based on changes in the cryosphere but also in temperature and precipitation indicates a change in future flow regimes. As the study area is of high priority for the further expansion of hydropower generation in the Alps such or more sophisticated studies are of strategic relevance.
The introduced approach only considers the shift of the ELA with a constant 2:1 accumulation-ablation ratio. Further factors like volume, lateral melting, glacier-specific response times or a change of the AARo are neglected.