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The effect of climate change on the runoff behaviour of glacierised Alpine catchments with regard to reservoir power stations

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Climate changes lead to changes in the runoff regime of glacierized basins. This is an aspect of climate change that is of prime importance for the production of hydro power in alpine reservoirs since both the annual hydrograph and the total amount of runoff are affected. This study calculates the down-wasting and the ensuing change of glacier surface elevation and glacier area available for melt based on ice thickness measurements, observed changes and climate sensitivity derived from independent model runs.

The water balance of three adjacent east alpine basins (strongly glacierized, weakly glacierized and ice free) upstream of a reservoir power station is modelled for the mean of the reference period 1983-2003 using the hydrometeorological model OEZ. Based on this reference, changes in melt and runoff are modelled for a scenario in accordance with IPCC A1B.

Starting with the present distribution of ice thickness on one of the largest east alpine glaciers Gepatschferner (17 km2) and with its measured change from 1997 to 2006, ice melt, ice volume and glacier surface area are calculated for increments of 1°C. Up to a temperature increase of 3°C (which corresponds to the decade 2030-40 in the model assumptions) total ice melt continues to increase. With further warming the reduction of glacier area outweighs the increase of specific melt and reduces glacier runoff. For glaciers smaller than Gepatschferner this turning point occurs already at lower temperature increases.