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Climate change impact on the water supply of the city of Vienna

T. Senoner and H.P. Nachtnebel

Institute of Water Management, Hydrology and Hydraulic Engineering, University of Natural Resources and Life Sciences, Vienna, Austria (tobias.senoner@boku.ac.at)

Abstract The objective of this paper is to analyse the possible impacts of climate change on water resources, especially on drinking water resources, in an alpine environment. The outputs from two Regional Climate Models (Aladin-Arpege and RegCM-ECHAM5-r3) are used to drive a water balance model under different climate conditions. The main components of the water balance are analysed to assess changes of spring discharge which is the main source for drinking water.

The research area comprises the catchment areas of the water supply of Vienna. It is located in the Eastern Alps, approximately 150 km southwest of Vienna. In 15 locations, karstic spring water is tapped, and a total amount of 400.000 m^3 is diverted to Vienna on an average day. Water balance simulations were carried out with a continuous conceptual hydrological model with a spatial resolution of 1x1 km. Using the downscaled and corrected scenario data, a period from 1971 to 2100 was simulated, in due consideration of climate-related land use changes. The entire period was divided into five periods for which statistical parameters of the water balance were obtained.

The hydrological model was calibrated for the baseline period from 1971 to 1990. Under the assumption that the hydrological parameters remain unchanged over the next decades, the outputs from the RCMs, in our case these refer to time series of daily rainfall and temperature, provide the input to the hydrological model. In comparison to the baseline period, the Aladin-based results show a decrease in runoff for the time after 2050. RegCM3, on the contrary, shows a slight increase. Both models show an increase of temperature for the future, which is more pronounced in the Aladin-model than in the RegCM3 data. Due to higher temperatures evaporation rates rise as well as snowmelt driven runoff occurs at an earlier time in the year, being shifted from May to April. Runoff increases in winter time because of a change from snowfall to rainfall, especially at lower altitudes. For the time after 2050, Aladin clearly shows a decrease in spring discharge. The RegCM3 results show a decrease in spring discharge for the period from 2051 to 2070 and a slight increase after 2070.

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