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Review
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Adv. Geosci., 21, 3-11, 2009
www.adv-geosci.net/21/3/2009/

Analysis of possible impacts of climate change on the hydrological regimes of different regions in Germany

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Abstract. In this study, the impact of climate change scenarios on the hydrological regimes of five different regions in Germany is investigated. These regions (Northwest Germany, Northeast Germany and East German basins, upper and lower Rhine, pre-Alps) differ with respect to present climate and projected climate change. The physically based SVAT-model SIMULAT is applied to theoretical soil columns based on combinations of land use, soil texture and groundwater depth to quantify climate change effects on the hydrological regime. Observed climate, measured at climate stations of the German Weather Service (1991–2007), is used for comparison with climate projections (2071–2100) generated by the regional scale climate model WETTREG.

While all climate scenarios implicate an increase in precipitation in winter, a decrease in precipitation in summer and an increase in temperature, the simulated impacts on the hydrological regime are regionally different. In the Rhine region and in Northwest Germany, an increase in the annual runoff and groundwater recharge is simulated despite the increase in temperature and potential evapotranspiration. In the Eastern part of Germany and the pre-Alps, annual runoff and groundwater recharge will decrease. Due to dry conditions in summer, the soil moisture deficit will increase (in Northeast Germany and the East German basins in particular) or remain constant (Rhine region). In all regions the seasonal variability in runoff and soil moisture status will increase. Despite regional warming actual evapotranspiration will decrease in most regions except in areas with shallow groundwater tables and the lower Rhine. Although the study is limited by the fact that only one climate model was used to drive one hydrologic model, the study shows that the hydrological regime will be affected by climate change. The direction of the expected changes seems to be obvious as well as the necessity of the adaptation of future water management strategies.

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Citation: Bormann, H.: Analysis of possible impacts of climate change on the hydrological regimes of different regions in Germany, Adv. Geosci., 21, 3-11, 2009. Bibtex EndNote Reference Manager