



Is the impact of future climate change on hydro-climatic conditions significant? - A climate change study for an Eastern European catchment area.

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The future change of climatic conditions is, among others, closely linked to future hydrological changes. One important aspect of these issues is the question of future availability of water resources. A changed climatic water balance, as indicator for potential water availability, has far-reaching consequences for the water cycle, hydrological conditions, ecology, water management, the energy business, agriculture and forestry, and for anthropogenic use of the river.

We generated regional climate projections via dynamic downscaling for the catchment area of the Western Bug river in the border area of Poland, Belarus, and Ukraine. The hydro-climatic conditions of the past and their projected future changes in the catchment were analyzed based on 2m-temperature, precipitation, potential evaporation and climatic water balance.

Up to the end of the century, the used IPCC scenarios B1 and A2 lead to warming for each month in the long-term mean, with highest warming rates in winter. Instead, precipitation does not change in the long-term yearly mean. However, the intra-annual distribution of monthly precipitation sums shifts with an increase in winter and a strong decrease in summer. Combined, this leads to a changed climatic water balance with a stronger deficit in summer and a higher gain in winter. Particular in the south-eastern part of the catchment, the summer deficit cannot be compensated within the annual cycle.

It raised the question: are these changes statistically significant and thus robust for use in further impact studies? Using a significance analysis, we found, that climatic changes in temperature, precipitation and potential evaporation and thus the climatic water balance change is most significant for scenario A2 from 2071 to 2100. The temperature changes are significant throughout the year. For the other variables changes are most significant in the late summer months (July, August, and September) and the winter months (December, January, and February). In contrast, projected changes are hardly significant in the first period from 2021 to 2050. Only temperatures show most statistically significant changes. Weaker change signals in temperature, precipitation and potential evaporation lead also to weak climatic water balance changes in the first period. However, the projected changes in the first period are already indications of impending climatic changes in the catchment.