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# Potential climate change impacts on water availability and cooling water demand in the Lusatian Lignite Mining Region, Central Europe

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In the catchments of the rivers Schwarze Elster, Spree and Lusatian Neisse, hydrologic and socioeconomic systems are coupled via a complex water management system in which water users, reservoirs and water transfers are included. Lignite mining and electricity production are major water users in the region: To allow for open pit lignite mining, ground water is depleted and released into the river system while cooling water is used in the thermal power plants.
In order to assess potential climate change impacts on water availability in the catchments as well as on the water demand of the thermal power plants, a climate change impact assessment was performed using the hydrological model SWIM and the long term water management model WBalMo. The potential impacts of climate change were considered by using three regional climate change scenarios of the statistical regional climate model STAR assuming a further temperature increase of 0, 2 or 3 K by the year 2050 in the region respectively. Furthermore, scenarios assuming decreasing mining activities in terms of a decreasing groundwater depression cone, lower mining water discharges, and reduced cooling water demand of the thermal power plants are considered. In the standard version of the WBalMo model cooling water demand is considered as static with regard to climate variables. However, changes in the future cooling water demand over time according to the plans of the local mining and power plant operator are considered. In order to account for climate change impacts on the cooling water demand of the thermal power plants, a dynamical approach for calculating water demand was implemented in WBalMo. As this approach is based on air temperature and air humidity, the projected air temperature and air humidity of the climate scenarios at the locations of the power plants are included in the calculation.
Due to increasing temperature and decreasing precipitation declining natural and managed discharges, and hence a lower water availability in the region, were simulated by SWIM and WBalMo respectively. Next to changing climate conditions, also the different mining scenarios have considerable impacts on natural and managed discharges. Using the dynamic approach for cooling water demand, the simulated water demands are lower in winter, but higher in summer compared to the static approach. As a consequence of changes in the seasonal pattern of the cooling water demand of the power plants, lower summer discharges downstream of the thermal power plants are simulated using the dynamical approach. Due to the complex water management system in the region included in the water management model WBalMo, also the simulation of reservoir releases and volumes is impacted by the choice of either the static or the dynamic approach for calculating the cooling water demand of the thermal power plants.