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Assessment of climate change impacts on hydrological processes and patterns in the Spree River catchment

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Nowadays, a successful river catchment planning and management should consider climate change impacts on hydrological processes and patterns. This is of particular interest for stakeholders in the Spree River catchment, which is significantly affected by long term lignite mining activities. Furthermore, the consideration of climate change impacts is essential for the development of climate change adaptation strategies, e.g. land use change. Therefore, the Innovation Network of Climate Change Adaptation Brandenburg Berlin (INKA BB), funded by the Federal Ministry of Education and Research (BMBF), was launched to reveal among others the impact of climate change on the hydrology at the regional scale. To achieve this, simulations with help of the process-based, spatially distributed Water Balance Simulation Model (WaSiM-ETH) were conducted. In a first step, a model for the Spree River catchment (up to gauge Leibsch, 4500 km^2) was set up, calibrated (from 1998 to 2002), and validated (from 2002 to 2006) on measured discharge for a headwater sub-catchment (135 km^2) which discharge is only minor affected by water management. To consider climate change impacts, results of the STAtistical Regional climate model STAR were used as meteorological input for hydrological modeling in a second step. From 100 available STAR-realizations, three were chosen which are closest to the median, the 10%-, and 90%-percentile of the entire number of realizations and hereafter called as moderate, dry, and wet scenario. The model period of the three scenarios spans over 10 years (from 2045 to 2054) and was compared to a 30 year period in the past (from 1961 to 1990) where measurements were used as climate input parameters (reference period). The model results show reduced precipitation (except the wet scenario), increased evapotranspiration and consequently reduced runoff in the scenarios compared to the reference period. Hence, the climate water budget decreases and hydrological patterns e.g. runoff building, soil moisture, and groundwater recharge are also affected. It must be considered that uncertainties are inherent for model predictions. Hence, the results presented are not certain but rather representative for the probable future development of the hydrology in the Spree River catchment concerning climate change impacts.