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Impact of climate change on water balance of forest sites in Rhineland-Palatinate, Germany

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It is expected that global climate change will also influence the water balance in Rhineland-Palatinate (SW-Germany) due to modified temperature and precipitation distribution. Consequently, the change of water balance affects economic and natural sectors. For example, forestry is endangered because biomass productivity of forest stands is closely correlated to the soil water regime. Hence, for regional forest management planners it is necessary to know how the biomass productivity of different tree species will be affected by climate change. Therefore, it is required to determine the existing link between climate parameters and biomass productivity. Until now the regional forest agency in Rhineland-Palatinate uses precipitation as primary climate parameter to detect the water balance degree of a site, which is related to biomass productivity. It is assumed, that the existing correlation between climate parameters and water balance should be revised in order to assess the impact of climate change. Because appropriate measured data is not available, a model based approach is developed in cooperation with forestry specialists, which allows to integrate the impact of climate change on water balance degree and quasi on biomass productivity in forest management planning.
The aim of this study is to develop plausible methodical components for a concept, which finally allows detecting the correlation between climate, terrain and soil parameters with biomass productivity. At first the WaSiM-ETH 8.2 model was parameterised to simulate various forest sites. Furthermore different drought stress indices were applied to the simulated water balance time series. The impact of variations of climate, topography and soil characteristics on water balance was plausibly simulated. All drought stress indices detected years, which were dominated by dry conditions, however, the indices relating to soil water content were more selective than those relating to evapotranspiration. Drought stress indices for one future projection have shown increasing number of years with drought stress. Thus the steps before are capable components to detect the link between water balance with climate, terrain and soil parameters.