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Development of maps of drought risk in forest stands based on the modification of evapotranspiration calculation

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Climate change is closely related to the risk of water scarcity in the landscape and subsequently drought. The impact of drought on forest stands tends to be specific, and its development and occurrence in forest areas also differ from agricultural landscapes. Therefore, it is appropriate to adapt the methods of drought monitoring. Since 2015, the Czech Republic has been affected by several drought episodes, which in some areas have had a very negative impact on forest stands, which have been severely damaged. So the task was to verify the possibilities of modifying the calculation of moisture characteristics indicating the occurrence of drought in forest stands. There were used more accurate characteristics measured at several localities in forest stands and the possibility of using modeled outputs was verified. To determine the possible occurrence and severity of drought in forest stands, potential and actual evapotranspiration, potential and actual water balance and available water in soil were used. The agroclimatic model AVISO (CHMI) based on the MORECS model was used for calculation of the characteristics. The analysis of data from measurements of meteorological stations, several stations in forest stands, model outputs and soil moisture measurements in forest stands was analyzed and the links between the resulting model characteristics from localities with different types of vegetation were investigated. For this reason, a various combinations of the coefficients settings characterizing the forest stand such as leaf area index, stomatal resistance of plants, point of reduced availability or rate of decrease in evapotranspiration intensity associated with soil moisture change were used. Mainly the intensity of evapotraspiration and the model reaction to precipitation were observed. The results show that the intensity of water withdrawal from the soil profile can be relatively well simulated but replenishment of soil water during significant precipitation episodes has proven to be more problematic. The calibration of the model calculation with real soil moisture data at the beginning of the growing season was also suitable. The analysis and definition of possible indicators of drought in forest stands and the subsequent development of maps were implemented finally for two general types of forest stands (deciduous and coniferous). The results show that due to the large variability of forest conditions it is suitable to standardize individual forest stands and to divide them into a few groups with fixed characteristics. The values of the water balance in the warm half-year and also the 3-year average ratio of the actual evapotranspiration to potential evapotranspiration were processed in the form of map outputs to spatially indicate drought areas.