PICUS v1.6 - enhancing the water cycle within a hybrid ecosystem model to assess the provision of drinking water in a changing climate

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The PICUS model is a hybrid ecosystem model which is based on a 3D patch model and a physiological stand level production model. The model includes, among others, a submodel of bark beetle disturbances in Norway spruce and a management module allowing any silvicultural treatment to be mimicked realistically. It has been tested intensively for its ability to realistically reproduce tree growth and stand dynamics in complex structured mixed and mono-species temperate forest ecosystems. In several applications the models capacity to generate relevant forest related attributes which were subsequently fed into indicator systems to assess sustainable forest management under current and future climatic conditions has been proven. However, the relatively coarse monthly temporal resolution of the driving climate data as well as the process resolution of the major water relations within the simulated ecosystem hampered the inclusion of more detailed physiologically based assessments of drought conditions and water provisioning ecosystem services. In this contribution we present the improved model version PICUS v1.6 focusing on the newly implemented logic for the water cycle calculations. Transpiration, evaporation from leave surfaces and the forest floor, snow cover and snow melt as well as soil water dynamics in several soil horizons are covered. In enhancing the model overarching goal was to retain the large-scale applicability by keeping the input requirements to a minimum while improving the physiological foundation of water related ecosystem processes. The new model version is tested against empirical time series data. Future model applications are outlined.