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Evaluation of a new root water uptake model in the Community Land Model with lysimeter data

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The Community Land Model (CLM4.0) was extended to account for an alternative root water uptake model, which is based on the root hydraulic architecture and allows for compensatory root water uptake in case of local water stress. In this study, the new approach was compared with the standard root water uptake model of CLM by checking the simulated evapotranspiration rates against measured data from a grassland lysimeter (Rollesbroich, Germany). On-site measured data on air temperature, air pressure, humidity, precipitation, wind speed, and incident radiation were used as atmospheric forcing input, and data on plant height, leaf area index and soil texture for the land surface data set. Some adjustments of the default CLM plant and soil parameters (as stomatal resistance and near-infrared reflectance) were necessary to avoid underestimation of transpiration rates and surface albedos as well as overestimated surface runoff. Hourly data of evapotranspiration and the radiation components obtained by measurements at the lysimeter station Rollesbroich were used to evaluate the model outputs. Under the usually sufficient water conditions of the test site, both models produced equal results. Significantly different rates of root water uptake and transpiration were obtained when water limitations were induced by eliminating the precipitation in warm periods. These findings will be validated with data from the European drought and heat wave in 2018.