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Vegetation root zone storage and rooting depth, derived from local calibration of a global hydrological model

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The storage and dynamics of water in the root zone control many important hydrological processes such as saturation excess overland flow, interflow, recharge, capillary rise, soil evaporation and transpiration. These processes are parameterized in hydrological models or land-surface schemes and the effect on runoff prediction can be large. For root zone parameters in global hydrological models are very uncertain as they cannot be measured directly at the scale on which these models operate. In this paper we calibrate the global hydrological model PCR-GLOBWB using a state-of-the-art ensemble of evaporation fields derived by solving the energy balance for satellite observations. We focus our calibration on the root zone parameters of PCR-GLOBWB and derive spatial patterns of maximum root zone storage. We find these patterns to correspond well with previous research. The parameterization of our model allows for the conversion of maximum root zone storage to root zone depth and we find that these correspond quite well to the point observations where available. We conclude that climate and soil type should be taken into account when regionalizing measured root depth for a certain vegetation type. We equally find that using evaporation rather than discharge better allows for local adjustment of root zone parameters within a basin and thus provides orthogonal data to diagnose and optimize hydrological models and land surface schemes.