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Global root zone storage capacity from satellite-based evaporation data

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We present an "earth observation-based" method for estimating root zone storage capacity – a critical, yet uncertain parameter in hydrological and land surface modelling. By assuming that vegetation optimises its root zone storage capacity to bridge critical dry periods, we were able to use state-of-the-art satellite-based evaporation data computed with independent energy balance equations to derive gridded root zone storage capacity at global scale. This approach does not require soil or vegetation information, is model independent, and is in principle scale-independent. In contrast to traditional look-up table approaches, our method captures the variability in root zone storage capacity within land cover type, including in rainforests where direct measurements of root depth otherwise are scarce. Implementing the estimated root zone storage capacity in the global hydrological model STEAM improved evaporation simulation overall, and in particular during the least evaporating months in sub-humid to humid regions with moderate to high seasonality. We find that evergreen forests are able to create a large storage to buffer for extreme droughts (with a return period of up to 60 years), in contrast to short vegetation and crops (which seem to adapt to a drought return period of about 2 years). The presented method to estimate root zone storage capacity eliminates the need for soils and rooting depth information, which could be a game-changer in global land surface modelling.