Global mapping of volumetric water content at 10, 33 and 1500 kPa using the WoSIS global database

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Soil water content is a key property for modelling the water balance in hydrological, eco-hydrological and agro-hydrological models. Currently available global maps of soil water retention are mostly based on pedotransfer functions applied to maps of other basic soil properties. We developed global maps of the volumetric water content at 10, 33 and 1500 kPa by direct mapping based on soil water content data derived from the WoSIS Soil Profile Database and covariates describing vegetation, terrain morphology, climate, geology and hydrology using the SoilGrids workflow. The preparation of the input soil data consisted of the verification of available volumetric water content data and conversion of gravimetric to volumetric data using measured and estimated bulk density. In total we had 9609, 41082 and 49224 soil water content observations at 10, 33 and 1500 kPa, respectively, and prepared around 200 covariates as candidate predictors. After covariates selection, model tuning and cross-validation and final model fitting for 3D spatial prediction, results were presented for the globe with uncertainty estimation. The results were also compared to other available global maps of water retention to evaluate differences between direct mapping against other types of approaches. Directly developing global maps of soil water content, with associated uncertainty, is a novel approach for this type of properties, and contributes to improving global soil data availability and quality.