Improving soil moisture predictions from a land surface model by optimisation of pedotransfer functions.

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Accurate soil moisture predictions from land surface models are important in hydrological, ecological and agricultural applications. Despite increasing availability of wide area soil moisture measurements, few studies have combined soil moisture predictions from models with in-situ observations beyond the point scale. This work uses the LAVENDAR data assimilation framework to markedly improve soil moisture estimates from the JULES land surface model using field scale Cosmic Ray Neutron sensor observations from the UKCEH COSMOS-UK network. Rather than directly updating modelled soil moisture estimates towards measured values, we optimize constants in the underlying pedotransfer functions (PTF) which relate soil texture to soil hydraulics parameters. In this way we generate a single set of newly calibrated PTFs based on field scale observations from a number of UK sites with different soil types. We demonstrate that calibrating PTFs in this way can improve the performance of JULES. Further, we suggest that calibrating PTFs for the soils on which they are to be used and at the scales at which land surface models are applied (rather than on small-scale soil samples) will ultimately improve the performance of land surface models, potentially leading to improvements in flood, drought and climate projections.