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A regionally explicit, global SWI calibration based on ISMN observations

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Remote sensing has proven to be an irreplaceable tool for monitoring soil moisture. The European Space Agency (ESA), through the Climate Change Initiative (CCI), has provided one of the most substantial contributions in the soil water monitoring, with almost 4 decades of global satellite derived and homogenized soil moisture data for the uppermost soil layer. Yet, due to the inherent limitations of many of the remote sensors, only a limited soil depth can be monitored. To enable the assessment of the deeper soil layer moisture from surface remotely sensed products, the Soil Water Index (SWI) has been established as a convolutive transformation of the surface soil moisture estimation, under the assumption of uniform hydraulic conductivity and the absence of transpiration. The SWI uses a single calibration parameter, the T-value, to modify its response over time.

Here the Soil Water Index (SWI) is calibrated using ESA CCI soil moisture against in situ observations from the International Soil Moisture Network and then use Artificial Neural Networks (ANNs) to find the best physical soil, climate, and vegetation descriptors at a global scale to regionalize the calibration of the T-value. The calibration is then used to assess a root zone related soil moisture for the period 2001 – 2018.

The results are compared against the European Centre for Medium-Range Weather Forecasts, ERA5 Land reanalysis soil moisture dataset, showing a good agreement, mainly over mid-latitudes. The results indicate that there is added value to the results of the machine learning calibration, comparing to the uniform T-value. This work contributes to the exploitation of ESA CCI soil moisture data, while the produced data can support large scale soil moisture related studies.