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# A regionally explicit, global SWI calibration based on ISMN observations

*By*:

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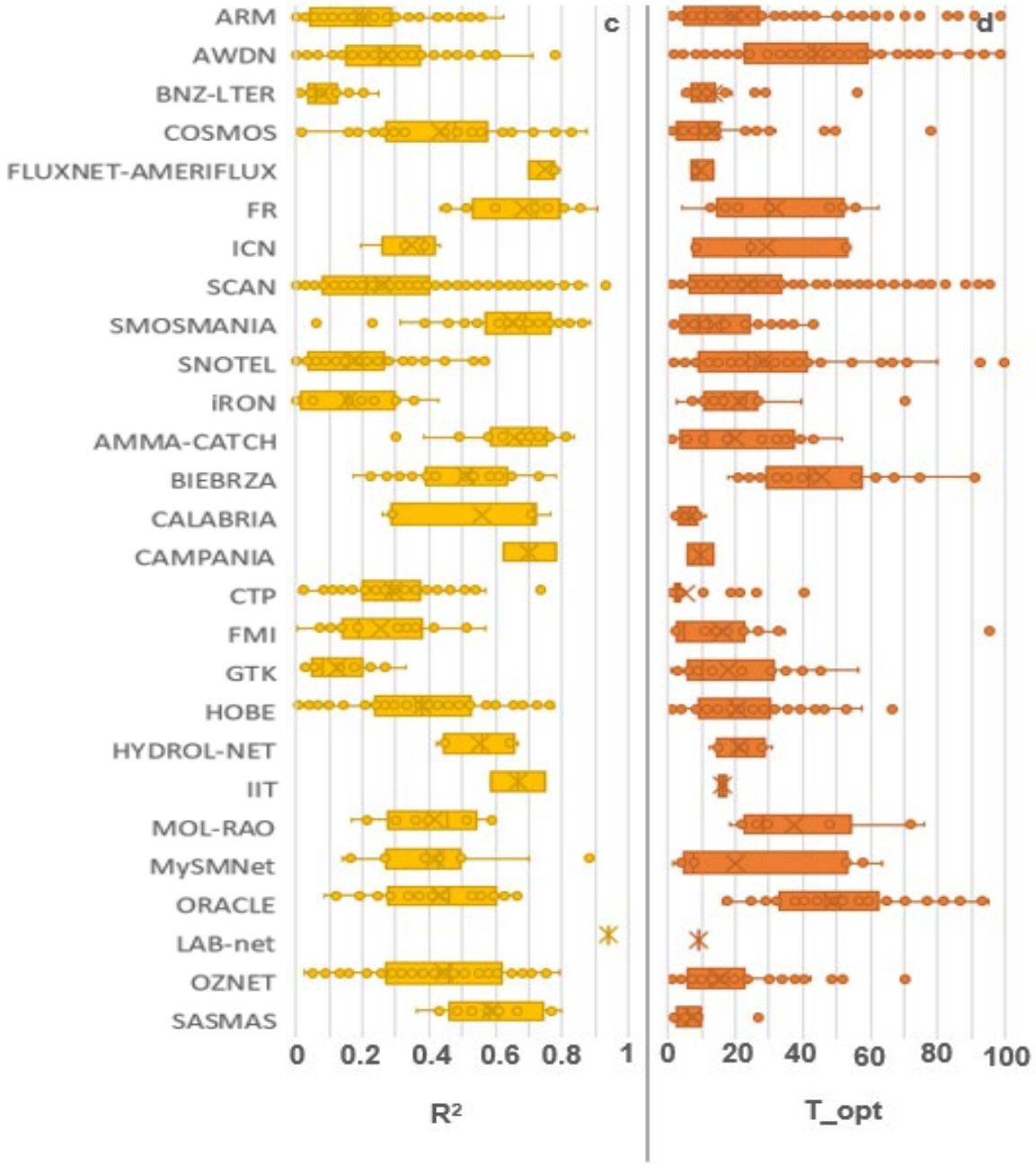
- The European Space Agency's (ESA), Climate Change Initiative (CCI) soil moisture data (ESA CCI SM) comprises one of the most complete remotely sensed soil moisture datasets available.
- One limitation of the ESA CCI soil moisture is the limited soil depth at which the moisture content is represented (2-5 cm).
- To overcome this gap, the Soil Water Index (SWI) is calibrated using ESA CCI soil moisture, against in-situ observations from the International Soil Moisture Network,
- then, machine learning is used to utilize physical soil, climate, and vegetation descriptors at a global scale to regionalize this calibration.
- The calibration is used to estimate the root zone soil moisture for the period 2001 – 2018 and compared to the European Centre for Medium-Range Weather Forecasts, ERA5 Land reanalysis soil moisture.

# The SWI calibration on ISMN locations

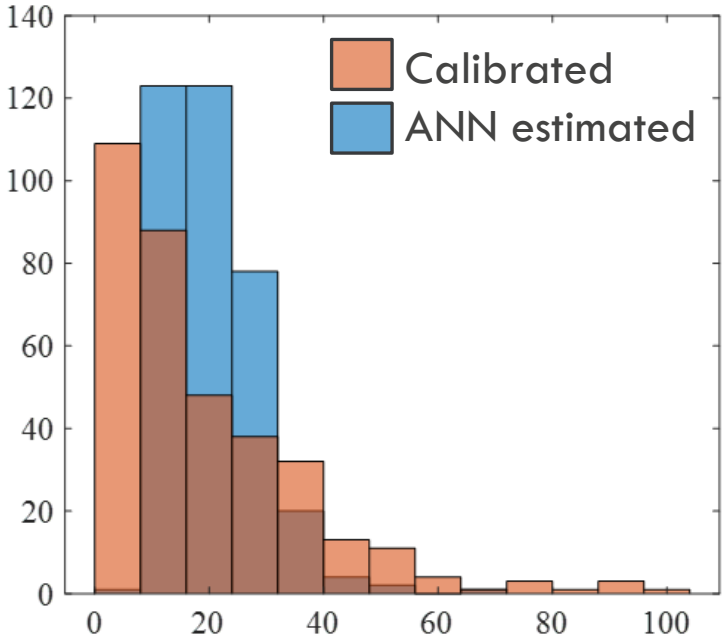
- The calibrations that resulted to *T_opt* between 1 and 100, that correspond to a total number of 1,629 timeseries are shown here.
- Among them, the $R^2$ ranged between near zero and 0.94. The average $R^2$ was 0.31 with a standard deviation of 0.27.
- From them, only the measurement points that gained an $R^2>0.5$ were retained to train the ANNs, i.e. 353 ISMN measuring points.



# Artificial Neural Network Results

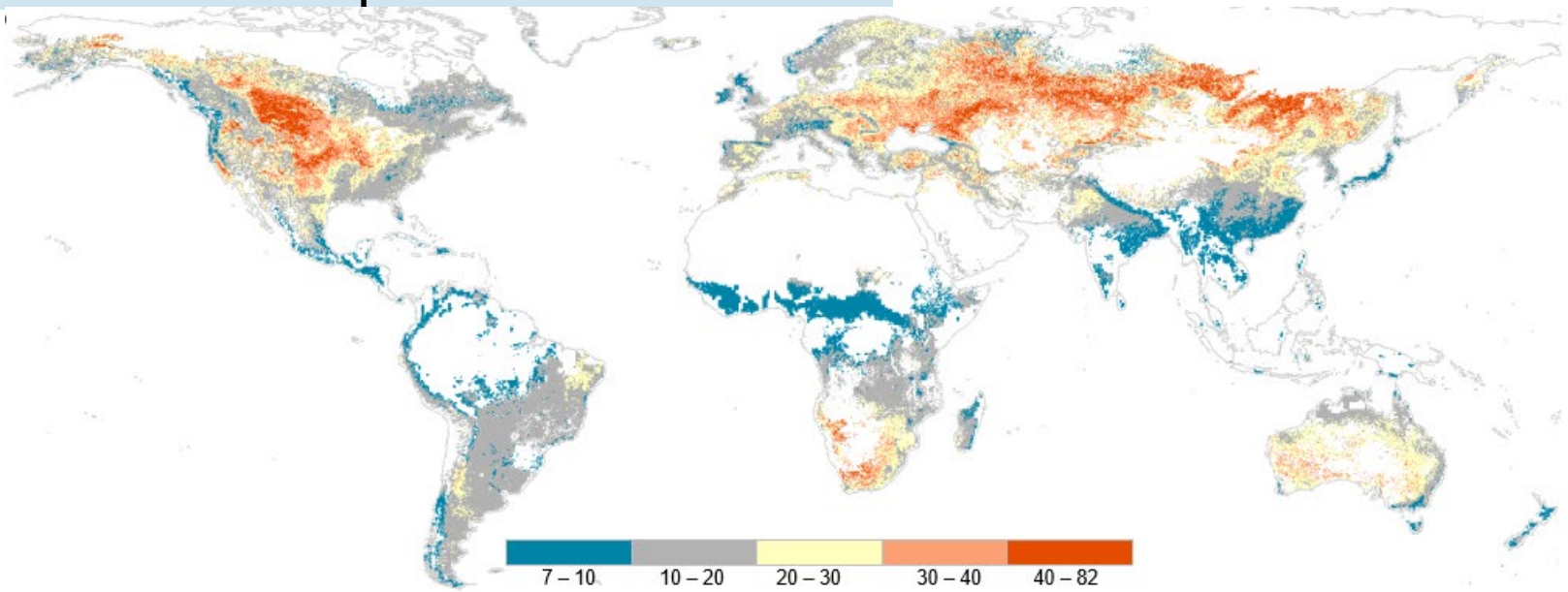
Properties of the Soil Grids 250m dataset for each one of the 353 ISMN, as well as climate and vegetation properties were used to train the ANN. (Available soil water potential, Saturated and wilting point water content , Bulk density and coarse fragments, Sand, silt, clay content Soil organic carbon content in fine earth fraction, Absolute depth to bedrock, Average annual precipitation and mean annual temperature and Leaf Area Index).

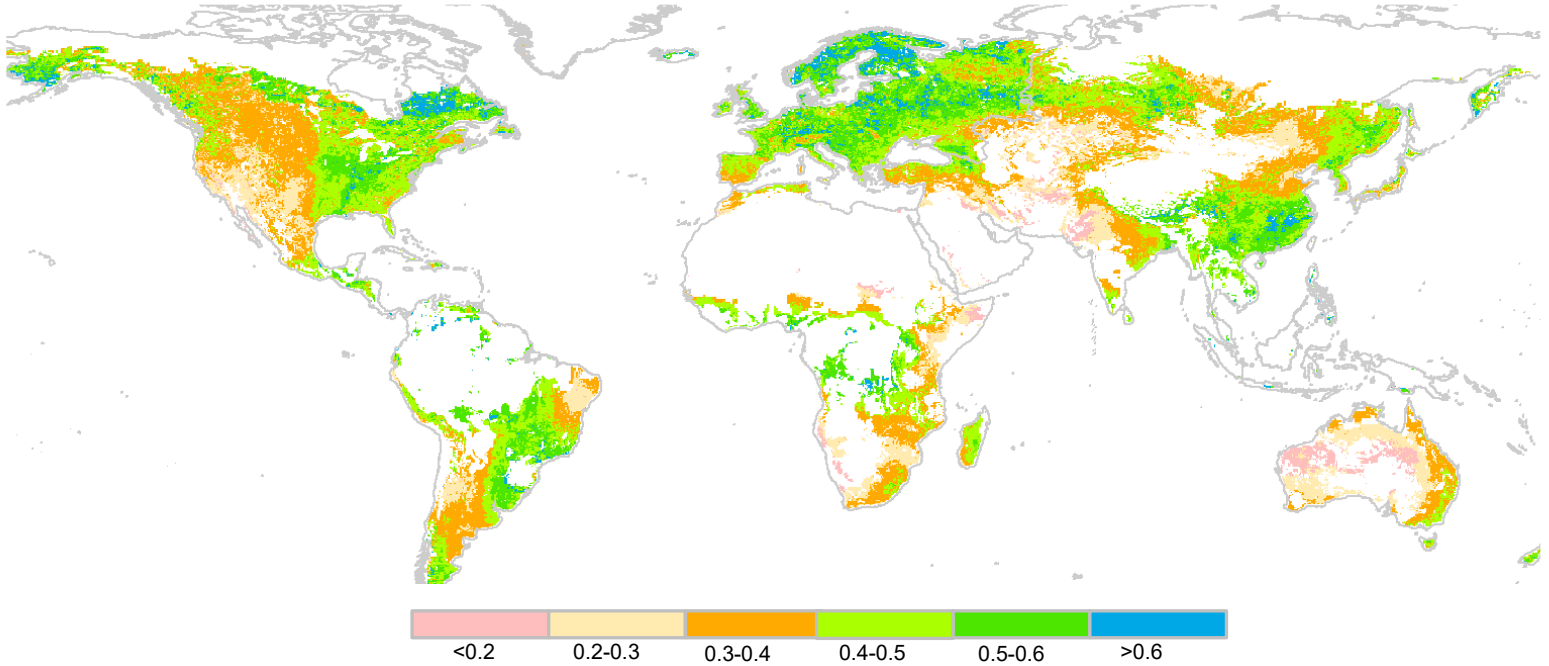
The trained ANN was found to have a decent performance in estimating the T value for SWI.

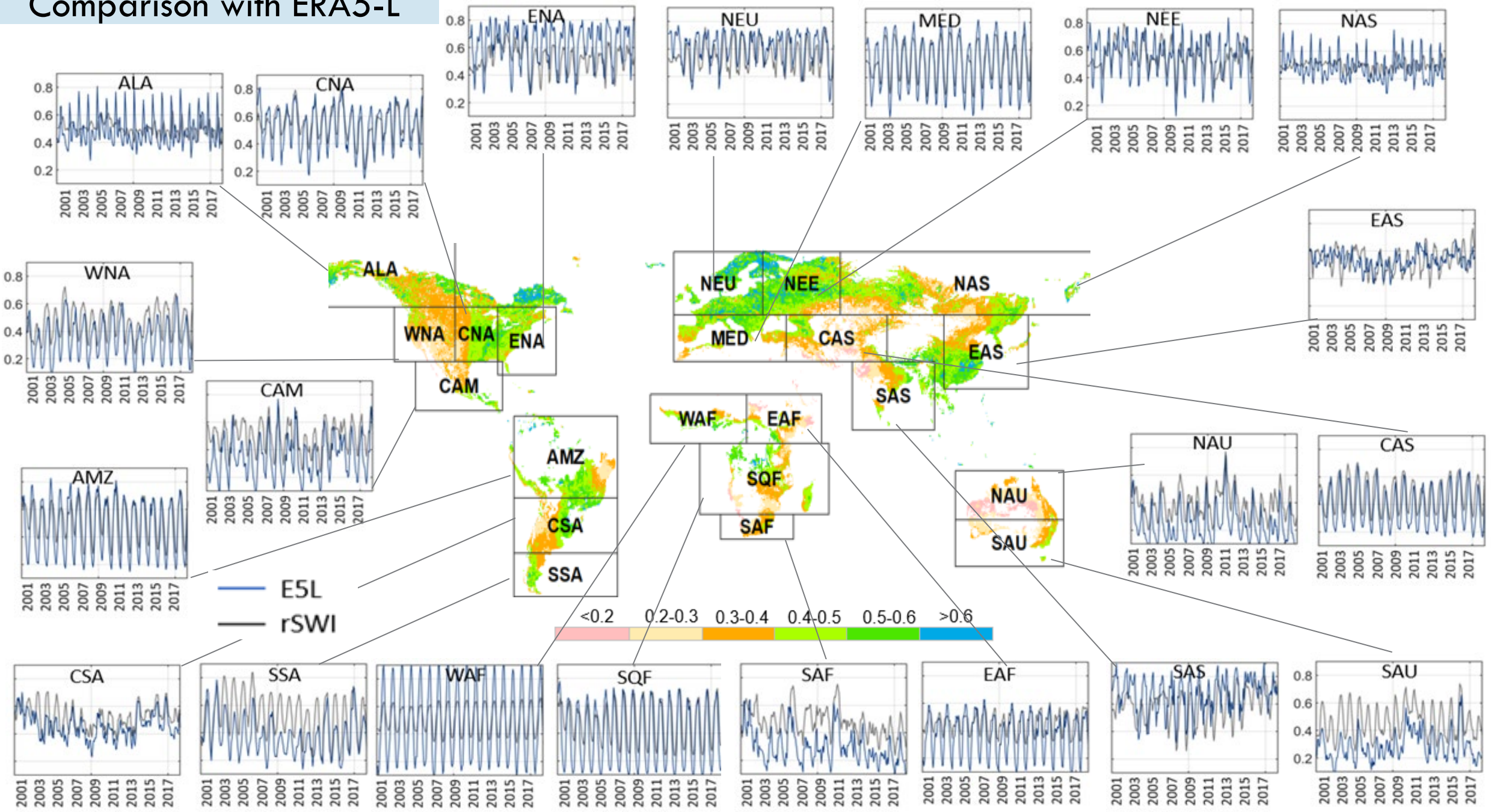
# Global estimation of SWI using ANN and comparison with ERA5-L

- The calibrated ANN was then used to estimate the T value. The result of the ANN application is a global estimation of the T value at 1 km spatial resolution.
- The calibrated T was finally used to produce the SWI.
- The produced SWI was compared to the ERA5 Land normalized soil moisture.



# Comparison with ERA5-L



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