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## Soil Moisture Patterns in an artificial water catchment – A machine learning approach from geophysical measurements

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The Chicken Creek catchment (Brandenburg, Germany) was built 2005 in a post-mining landscape in Eastern Germany and was left for an unmanaged primary ecosystem succession. During the following years this artificially created system was subject to a series of fast changes with regard to morphology, hydrology or vegetation cover. Soil water content plays a major role since it mediates the water and energy exchange between the surface and atmosphere. In this respect, time-lapse electrical resistivity tomography measurements were carried out along a transect in the Chicken Creek catchment.

Electrical and electromagnetic geophysical techniques have been widely used to estimate soil electrical conductivity ( $\sigma$ ) and soil moisture ( $\theta$ ). However, obtaining the relationship is not straightforward due to the non-linearity and also dependency on many different soil and environmental properties. To ensure proper retrieval of the  $\sigma$  and  $\theta$ , reference values were measured near the beginning of the transect via an excavated pit using 5TE capacitance sensors installed at different depths.

The purpose of this contribution is to determine if artificial neural network is an appropriate machine learning technique for relating electrical conductivity to soil water content. We explored robustness and pertinence of the artificial neural network approach in comparison with Rhoades model (as a commonly used petrophysical relationship) to convert the inversely estimated  $\sigma$  from electrical resistivity tomography to the  $\theta$ . The proposed approach was successfully validated and benchmarked by comparing the estimated values with the reference data. This study showed the superiority of the artificial neural network approach to the Rhoades model to obtain relationship. In particular, artificial neural network allowed for more accurate estimation of the temporal wetting front than the petrophysical model. The proposed methodology thus offers a great promise for deriving spatiotemporal soil moisture patterns from geophysical data and obtaining the in situ relationship, taking into account the non-linear variations of the soil moisture.