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Investigating the impact of scaling methods in soil moisture validation on error metrics

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Soil moisture is an important parameter for the climate system and environment. It is currently measured via remote sensing techniques as well as through in situ observations. The validation of remote sensing products plays a key role in quality control, improvement of retrieval algorithms and in setting benchmarks for future means of observation or new satellite missions.
Retrieval of absolute soil moisture values is difficult and depends on ancillary information from soil porosity maps. Because of this, remotely sensed products often have a systematic bias to in situ soil moisture observations. To alleviate this issue, most published validation studies use one or several scaling techniques to remove these systematic biases.
The aim of this study is to determine the impact of different scaling methods on often used error metrics like Pearson's (R) and Spearman's (rho) correlation coefficient, root mean square difference (RMSD) and bias.
For this study, remotely sensed soil moisture from the ASCAT sensor onboard Metop - A and B will be compared to in situ data from the International Soil Moisture Network (ISMN; http://ismn.geo.tuwien.ac.at/). The four most popular scaling methods found in the literature will be used to remove systematic biases. These are: minimum-maximum scaling, mean-standard deviation scaling, linear regression scaling and CDF matching.
Preliminary results, calculated with two years of data, show that CDF matching, being a non-linear transformation, can have a significant impact on R while leaving rho unchanged. The mean R of the 248 examined time series changed by 0.096. The maximum difference occurred when CDF matching changed R from -0.12 to 0.79, resulting in a difference of 0.91. This indicates that it can be problematic to use Pearson's R in combination with non-linear scaling.