

July 2021

USCRN Soil Moisture Layer Averages Now Include New Acclima Instrument

ACTION OPTION: You may wish at your convenience to reacquire the Hourly02 and Daily01 and other datasets you use that contain soil moisture from 2017 to July 2021, if soil moisture layer averages are relevant to you. These have now changed to include the Acclima soil probe measurements.

After a substantial evaluation effort both in test beds and in the field at a variety of USCRN sites, the Acclima Time Domain Reflectometry 315 (TDR-315L) soil moisture probe measurements have been incorporated into USCRN soil moisture layer averages. Acclima probes have been installed as replacements at 42 sites so far, and this transition will continue in the future as the legacy Stevens Hydra Probes are gradually replaced. Results from these investigations revealed that the Acclima sensor's soil moisture observations were generally in good agreement with the Hydra's with an exception for stations located in areas with high clay content soils, where the Acclima provides a more realistic measurement.

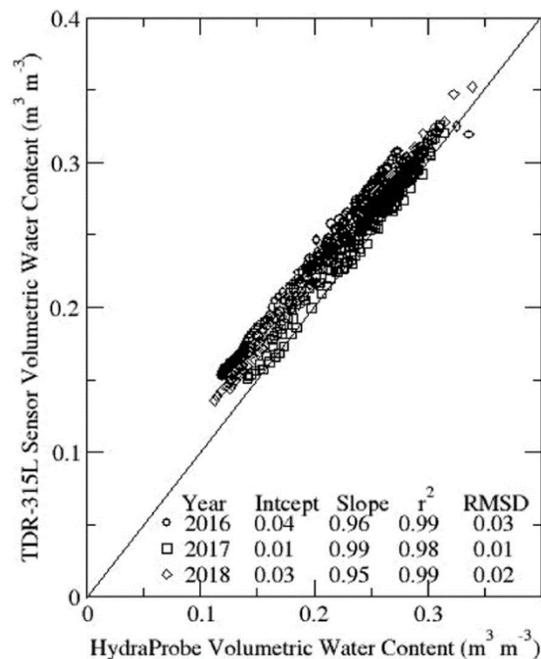


Figure 1. Mean daily volumetric water content comparison between Acclima and HydraProbe measurements in a loam testbed at 10 cm depth (Wilson et al. 2020; Figure 1).

The high correlation and slope near one in the test bed provided an excellent starting point for the analysis, but further investigation was warranted in real operational conditions. The impact of adding the Acclima to a 3-plot average is not always transparent, especially in clay soils, but is within error tolerance for incorporating them in layer averages without making a homogeneity adjustment. The relationship between layer averages with and without Acclima probes added (Figure 2) shows a distinct drying at high moisture levels, levels that are too high to be realistic in some cases. This indicates the positive influence of the Acclima's technology, which works better in moist, clay soils. However, in most locations, these differences were not large, also making the Acclima a good general replacement. The overall difference in terms of root mean square error is quite small (Figure 3).

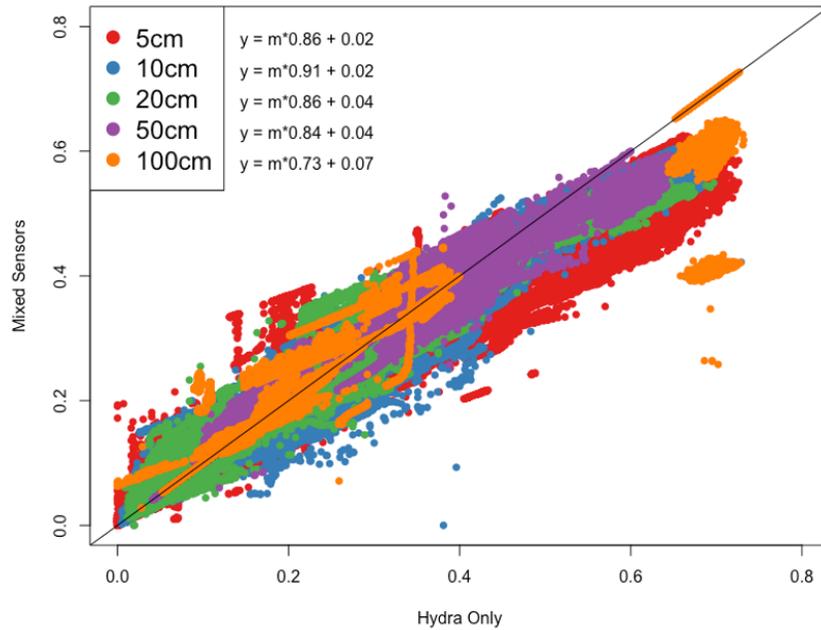


Figure 2. Comparison of layer averages with and without Acclima probes included. Acclima has the desired effect of reducing the average at unrealistically high soil water volumetric content levels as indicated by HydraProbe alone (insufficient 100 cm results for equation calculation).

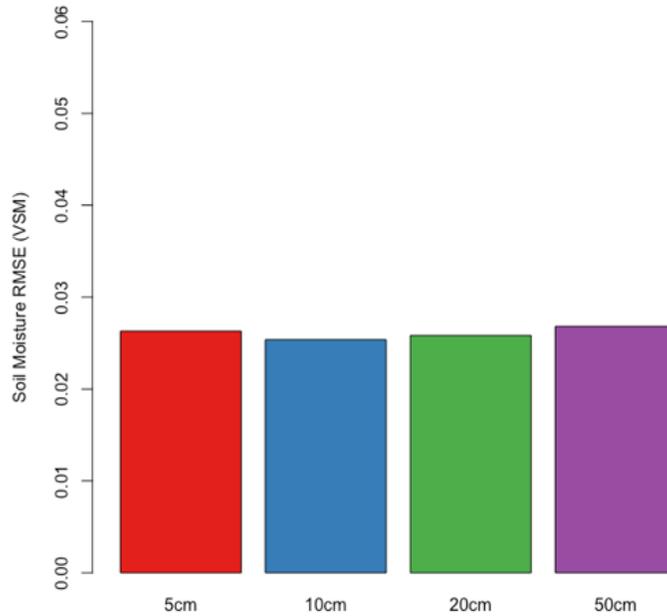


Figure 3. The root mean square error between layers calculated with and without Acclima probes is quite small and very consistent from 5 to 50 cm depth (insufficient 100 cm comparisons for calculation).

Wilson TB, Diamond HJ, Kochendorfer J, et al., 2020. Evaluating time domain reflectometry and coaxial impedance sensors for soil observations by the U.S. Climate Reference Network. *Vadose Zone J.* 2020; 19:e20013. <https://doi.org/10.1002/vzj2.20013>