Earth Syst. Sci. Data Discuss.,
https://doi.org/10.5194/essd-2019-75-AC2, 2019

Interactive comment on "Soil moisture and matric potential – An open field comparison ofsensor systems" *by* Conrad Jackisch et al.

Conrad Jackisch et al.

c.jackisch@tu-braunschweig.de

Received and published: 12 September 2019

We thank the reviewer for his/her work on our manuscript and the constructive comments.

L39: Since the geographical location of the test site is given and since there is no gradient in topography, soil type or any other feature, we chose to limit the description of the setup to the given fig. 1 and 2. We will add the locations of the samples and the relative setting in the field to fig. 2.

Tab.1: Thank you for highlighting the error.

Fig.2: The shading is explained in the center of the figure. We will let the legend stand out more clearly. The distances are the same in both dimensions (L46).

L60: We regret that the first set of samples where only analysed for soil water retention properties. This is due to an organisation error during the sample treatment.

L71(1): Yes, there is an uncertainty range (or variability) in the soil water retention properties. Especially and not surprisingly, the large pores and total porosity varies most. However, there is no discrimination of different locations or times of sampling possible from the data. As such, this can be considered as local variability. The soil state rarely dropped below values of pF 2 (or approx. -98 hPa and well above field capacity). Hence the variance in the spectrum of large pores might affect non-uniform infiltration during events but the overall soil water retention should have a quite narrow variance at our test site. Since we aggregate 3 to 4 sensors of one system in fig. 4 and report the local variances as shaded bands, also the effect of local variability of soil properties is included. However, these bands are rather narrow and do not affect the main findings of the study. We will detail on this in the revised manuscript.

L71(2): For an analysis of the infiltration processes, the wetting curve would be of interest. For the data set at hand, we expect the drying curves to be a sufficiently detailed retention reference, because most of the times the soils operate on this branch of the retention curve.

L74ff.: Since we report the bulk density, this calculation can be done with an estimated mineral particle density for the loamy soil.

Fig.4: It is correct that the soil sensor temperature records have a (narrow) range. In the top panel data of the official meteorological station is reported, which we might state more clearly in the figure caption.

Fig.4 (caption): The "heterogeneity issue" cannot be fully discriminated from the overall variance of records of one sensor system. However, we refer to fig. 6 to address this issue. Especially for the earlier phase of the monitoring we claim that the generally narrow bands of both sensor classes (theta and psi) corroborate our assumption of very low soil heterogeneity.

Fig.5 (caption): Yes and no. Generally, the laboratory reference is very much in line with the findings from the field monitoring with the 10HS recording highest values, the Pico32 lower values and the 5TM lowest values. Moreover, the differences between the sensors of one system are moderately small als found in the field. This finding nourishes our initial attempt to generate an a posteriori calibration to generate a true reference time series for all sensors. However, any attempt to re-calibrate the three sensor systems failed to produce any consistent result. Furthermore, the event reaction cannot be studied in the laboratory reference.

L105ff.: Actually this effect is an odd artefact of the all-metal enclosure of the reference monolith. We do not consider this a feature to study in more detail but to be aware of, when using the data set. Under field conditions, it will be far less likely to create a similar situation (except for metal lysimeters) where the configuration of the capacitor (soil) is altered. Given the measuring principle of the sensors (inferring soil moisture based on the bulk relative permittivity through its capacitance), the setup could charge differently with and without the metal lid, electrically connecting the soil enclosure. We will rephrase this sentence to clarify this.

L111: Thank you for highlighting this awkward formulation. We will seek a more appropriate formulation in the revisions.

L119: Most sensors do not allow for a direct record of the sensed relative permittivity. If the standard parameters of the internally applied polynomial equation (based on the Topp approach with an order of 3 or 4) are reported by the manufacturer, the permittivity can be approximated by an inversion. We will seek to include these details in a revised table 1 following reviewer 2 where possible.

L120: Obviously, we failed in conveying one of the central points in setting up this experiment. The test site was prepared to be as least heterogeneous as one can imagine under field conditions. We agree that we cannot completely exclude heterogeneity effects on the comparison. As we explicitly highlight in this subsection 3.4, the records

of the employed tensiometers (as most direct means of state observation) suggest that heterogeneity develops within relatively short time as imprint of emerging redistribution structures. However, these records also corroborate our homogeneity assumption in the first weeks of the experiment. Hence it is very unlikely that 10 tensiometers distributed over the whole central section of the plot report less heterogeneity than 3-4 soil moisture sensors in the same or smaller spatial extent. As stated earlier, the generally narrow bands of variance of all sensors of one system would be much broader and more dynamic if soil heterogeneity would be their primary cause. However, we cannot fully exclude such effects. We will revise the manuscript accordingly.

L125: In the same lines, we will add more discussion about the limitations of the data.

Thank you again for your valuable comments and suggestions to improve our manuscript. We hope to have grasped your general concerns about the manuscript correctly and we will add more details along your comments in the revision.

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