

Interactive Discussion: Author Response to Referee #3

The Potsdam Soil Moisture Observatory: High-coverage reference observations at kilometer scale

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RC: Reviewer Comment, AR: Author Response, ☐ Manuscript text

Dear Madam or Sir,

thank you very much for your detailed and constructive referee report, and for the time and effort you dedicated to reviewing our manuscript. We highly appreciate your comments, which helped us identify aspects that required clearer explanation and methodological refinement.

Please find below our point-by-point responses. We plan to address all your comments in the revised version of the manuscript.

Thank you again for your valuable feedback and your support of this process.

Kind regards,

Peter Martin Grosse (on behalf of the author team)

RC: *The color scheme of Fig. 2 could be updated to improve the contrast among vegetation types. It is very difficult to tell them apart in the map.*

AR: The color scheme of Fig. 2 will be revised. Similar vegetation classes will be merged, and color contrasts will be adjusted to enhance readability and improve visual differentiation among the vegetation types.

RC: *Fig. 4 - please note the interpolation method.*

AR: In response to the reviewers' feedback, the manuscript will be restructured. Figure 4 will be moved to the Results section. We will add a short sentence on how the image was created (i.e. spatial smoothing of the data for overlapping or between footprints footprints). However, as the CRNS sensors provide soil moisture for a large horizontal footprint, partially overlapping for the PoSMO, they are an actual measurement and not an interpolated soil moisture from a point measurement. We will make this more clear.

RC: *A key limitation of cosmic ray neutron sensors is that their penetration depth is approximate, but this site has the advantage of multi-depth conventional soil moisture sensors. Could a comparison graph between CRNS and conventional sensor be made - perhaps similar to Fig. 3, but showing the difference between the CRNS measurements, and the conventionally measured values interpolated to the same nominal depths? This will be very useful in giving the readers an understanding of the measurement uncertainty.*

AR: We agree, that an estimate of the penetration depth in combination with CRNS soil could be helpful to interpret CRNS soil moisture data, in respect of its depth representativeness. We will provide in Figure 3 the estimated penetration depth calculated using point-scale soil moisture. We will also add some discussion on the uncertainty of estimating the penetration depth on sparse point-scale data.

However, we disagree, that a direct comparison of CRNS and point-scale data will help readers to understand the "uncertainty" of the measurement. Such a comparison might mislead readers to account for the point-scale measurements as the "ground-truth". We do not understand your suggestion for a comparison by using "[...] conventionally measured values interpolated to the same nominal depths". Maybe an approach like the exponential filter "aggregated over the corresponding CRNS depths"?

We would rather include in the manuscript a part where to discuss a appropriate comparison between CRNS and sparse point-scale data could be done. This requires in our opinion a more comprehensive assessment, beyond the scope of a data paper.

Following another reviewers' suggestion, we will provide an additional graph showing a time series of CRNS and point-scale soil moisture side-by-side, however, without the aim to show the uncertainty of CRNS, but rather to give space to discuss the need and approaches how to achieve a meaningful comparison between CRNS and sparse point-scale data. This requires in our opinion a more comprehensive assessment, beyond the scope of a data paper.