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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Multiscale soil moisture estimates using static and roving cosmic-ray soil moisture sensors" *by* David McJannet et al.

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Anonymous Referee #2

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The authors present a nice and straight forward multiscale soil moisture experiment in Australia using the relatively new cosmic-ray neutron rover. While the experiment has been performed in Hawaii, Arizona, Oklahoma, and Nebraska, the study does break some new and interesting ground related to the technology and its application. The authors find an excellent relationship between clay percent and lattice water, which is a critical second order effect on the conversion of neutron counts to soil moisture. In addition, the authors nicely illustrate the challenges and solutions to designing a multi-

scale soil moisture experiment. The rover counts and survey speed should be tailored to the scale of soil moisture heterogeneity present and desired scale results of the experiment. Given the need for more and better soil moisture validation datasets for satellite estimates of soil moisture this is an important methodology paper illustrating the utility of the rover to meet these needs. Lastly the authors present an interesting scaling approach for obtaining point to area averages. This is critical for making soil moisture observations more useful for land management applications which often involve complex areas and are poorly represented by both point sensors and satellite products. The paper is well organized, straight forward, and appropriate for HESS.

Attached are a few key points to address.

1. The authors point to area regressions are based on 3 rover surveys only. While I understand the challenge of collecting multi-date information the authors should mention this limitation. In particular future work should perform a leave one out cross validation study in order to properly identify the error of the point to area methodology and temporal stability of soil moisture patterns. I think a description of this need for future work should be discussed more clearly as a limitation of the study. However, I am confident that the cross validation error would be fairly small and not affect the overall conclusions of the paper.

RESPONSE: This limitation is now clearly identified and, as suggested by the reviewer a recommendation for replication and further testing has been added to the discussion. We agree that the cross validation will likely show only small errors but this discussion is included anyway.

2. Page 2 L 43. The authors should see Andreasen 2016 and 2017 for a better description of the moderated detector energy bins.

Andreasen, M., K. H. Jensen, M. Zreda, D. Desilets, H. Bogena, and M. C. Looms (2016), Modeling cosmic ray neutron field measurements, Water Resources Research, 52(8), 6451-6471. doi:10.1002/2015wr018236.

Andreasen, M., K. H. Jensen, D. Desilets, T. E. Franz, M. Zreda, H. Bogena, and M. C. Looms (In press 2017), Status and perspectives of the cosmic-ray neutron method for soil moisture estimation and other environmental science applications Vadose Zone Journal.

RESPONSE: A better description of the energy bins detected by the CRNS has now been included and the relevant references have been included as suggested

3. Page 8 L 273. The high RËĘ2 values are due to the few number of surveys performed. A cross validation experiment would be better suited to address error in future rover work. Authors should mention number of sample points here and in the discussion.

RESPONSE: New text highlighting the limitations of three data points has now been added to the results and discussion section to make this clear to the reader.

4. Figure 9. The authors should use the same scale as Fig. 7. Odd visual that wetter spots are more red instead

RESPONSE: Figure 9 has been revised and now uses the same colour scale as Fig 7 for consistency. The wet blue colour from fig 7 scale does not appear as the soils are too dry.

A REVISED VERSION OF THE DOCUMENT WILL BE UPLOADED ONCE RESPONSES TO REVIEWER 1 ARE COMPLETE

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