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Discussions
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Interactive comment on "Depth scaling of soil moisture content from surface to profile: multistation testing of observation operators" *by* Xiaodong Gao et al.

Anonymous Referee #1

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It's my pleasure to review hess-2017-292 "Depth scaling of soil moisture content from surface to profile: multi-station testing of observation operators" by Gao et al. The authors try to use Cumulative Distribution Frequency (CDF) matching method to build the observation operators and adopt this method to predict profile soil moisture from surface measurements. This is a re-submitted manuscript with previous ID "hess-2016-617". The authors do not provide a response to previous reviewer's comments to indicate what has been changed in comparison to previous version, and I find that the results presented in the two versions are significantly different while the data and method are identical. In addition, I'm curious about the transferability of the proposed method, for example, how can the authors apply their method to satellite products? According

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to these, I suggest to reject this paper. My concerns are as follows.

Major Concern

1. The results presented in current version are significantly different from the previous version while the adopted data and method are identical, for example, Table 2 vs. Table 2 in hess-2016-617, Figure 3 vs. Figure 5 in hess-2016-617, why?

2. It's suggested to provide a response to previous reviewer's comments to indicate what has been changed.

3. A fifth-order polynomial fit is adopted, but I do not see any fit parameters for the selected stations. In addition, I'm wonder the transferability of these fit parameters, for example, can these fit parameters applicable for the similar climate condition without further calibration?

4. The authors mention the prediction of profile soil moisture from satellite based surface measurements in the Introduction part, I'm thus curious about how can the authors apply their method to satellite products?

5. In the Introduction part, the authors also argue that "continuous and accurate measurement of profile soil moisture, however, is difficult because of expensive field measurements", but they also indicate in the Abstract that "the findings here have the potential to be applied in profile soil moisture prediction from surface measurements at a range of environments if the target site has long enough (two years) soil moisture observations even with coarse temporal resolutions", then I'm wonder how their methods address the drawback of in situ profile soil moisture measurements, since the methods depend on the calibration that also needs the profile soil moisture measurements.

6. The Title of the manuscript is confusing, for example, what do you mean by "depth scaling", and what's the meaning of "observation operators".

Minor Concern

1. Page 2, Line 4, can the cosmic-ray probes measure surface soil moisture directly?

2. Page 3, Line 29, “A total of 12 stations were chosen for analyses according to the objectives of this study”. This sentence is not clear. I still do not understand why the authors only select 12 stations out of the more than 200 SCAN stations. In the previous version, the authors mentioned that 31 stations were selected, why the numbers are changed?

3. Page 4, equation (1), I do not understand why the authors use this equation to calculate profile soil moisture, please provide corresponding reference.

4. Page 6, Line 6, “Specifically, soil moisture from the years of 2010, 2011, 2014, and 2015 was used to establish the observation operators for data lengths DL1, DL2 and DL3 (calibration), and data from 2012 and 2013 were used for validation”, what is the reason for such a division, for example, why don’t you use 2014 and 2015 for validation, and other years for calibration? What can be the impact?

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