Interactive comment on “COSMOS: The COsmic-ray Soil Moisture Observing System” by M. Zreda et al.

Anonymous Referee #3

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Reviewers’ comments are in black.
Our responses are in red.

General comments:

The paper "COSMOS: The COsmic-ray Soil Moisture Observing System" describes a new methodology to estimate area-averaged soil moisture and, thus, fill the gap between point and satellite mesurements. The cosmic-ray probes, methodology of measurements and calibration, and the processing to estimate soil moisture from neutron counts are presented. Some example data are also provided.

Response: None needed.

Useful information on the physics behind the process and how to interpret the measurements is given in the paper, which also reviews some undergoing studies in this research field. However, it is more a review than a scientific paper, with some redundancies in different sections, maybe because they try to be self-contained. Apart from that, some paragraphs are written in a language more appropriate of an advertisement than of a scientific paper.

Response: The redundancies have been pointed out by the other two reviewers; they have been eliminated as far as possible. Please refer to our response to reviewer 1 (Heye Bogena) for details. Advertisements, also pointed out by another reviewer, have been eliminated.

(i) The terminology "neutronavka" is introduced to name the cosmic-ray probes (CRP). This is not the standard nomenclature for this kind of instruments, and can lead to confusion to some readers. Plus the instruments are referred as neutronavka, CPR or COSMOS probe within the text, which leads to confusion. I strongly suggest to remove neutronavka from the manuscript and use CRP instead.

Response: “Neutronavka” has been removed from the manuscript; it has been replaced by “cosmic-ray probe” (meaning the instrument) or “COSMOS probe” (meaning the cosmic-ray probe as part of the COSMOS network).

(ii) References to papers in preparation should not be used.

Response: References to abstracts and papers in preparation have been removed; where possible, they have been replaced by published papers.

Specific comments:

- Section 2 could be shortened by deleting redundancies.

Response: Section 2 has been reorganized: part of text in 2.2 was moved to 2.1. Section headings have been changed to be more precise.

- Sect. 2.5.4. Results from other probes in the network should be looked at before making this statement.

Response: Assessment of the goodness of calibration with time is possible at one other site, Santa Rita, where we have five calibrations; they agree well with neutron-derived values. Other sites lack extensive independent soil moisture data to allow for stability assessment, but we see no reason for the instrument to drift. However, there may be problems related to variations of the soil moisture field in time, which might lead to instability of calibration. We do not have field data to assess this, and we are just now starting modeling experiments to see what happens if the statistical properties of soils change with, for example, average soil moisture. This needs further research.

- Fig. 5 does not add any additional information to the text and could be deleted. Same with Fig. 11 (if it is kept, what does A stand for in this figure?)

Response: We agree about Figure 5; it has been deleted. Figure 11 is a schematic of the network, so we prefer to keep it. In similar papers authors have block diagrams or flow charts of their systems to show how the entire system works; we have a schematic to accomplish the same. “A” stands for Arizona [it is indicated in the figure caption].

- Fig. 2: meters -> m, sec -> s

Response: Changed as suggested by the reviewer.

- Fig. 3: Resolution should be improved. The image is blurred and symbols can not be distinguished clearly.

Response: A higher-resolution figure has been produced. It was also edited for clarity.

- P4525: Which were the selection criteria to chosse the location of each of the sites in the COSMOS network?

Response: Mostly the presence of other instruments (such as eddy covariance towers) or availability of ancillary data (such as meteorological data). This is stated at the beginning of section 3.2.

- P4530 L13: Appendix A1 should be Appendix A

Response: It is Appendix A in the published HESSD.

- P4531: There is no real conclusion in the "Concluding remarks" but, again, a short advertisement. Last paragraph of this section should be moved to the "Intro" (if not removed).

Response: This section has been deleted.