

Geosci. Instrum. Method. Data Syst. Discuss., referee comment RC1
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Comment on gi-2022-20

Anonymous Referee #1

Referee comment on "Testing a novel sensor design to jointly measure cosmic-ray neutrons, muons and gamma rays for non-invasive soil moisture estimation" by Stefano Gianessi et al., Geosci. Instrum. Method. Data Syst. Discuss., <https://doi.org/10.5194/gi-2022-20-RC1>, 2022

The authors present a novel set of experiments using a new sensor to simultaneously measure neutrons, muons, and gammas. The new sensor is compared to conventional sensors with satisfactory results for longer time periods of integration (i.e. 6 hrs for neutrons). The technology is lighter and potentially a lower cost, which will open up doors for more applications in science and in practical applications. The manuscript is well written and appropriate for the journal. I have a few suggestions that should be addressed prior to publication. Some instances of English grammar and word choice will need to be addressed.

L33: "Runoff generation"

L 40: "More recently, attention"

L 44: "has shown"

Figure 1: Are events outside of the blue and red ovals not included in the analysis?

L165: For the gammas are there any corrections needed for pressure or air temperature/humidity variations?

L247: I would use the SG filter on the neutron/gamma count time series, not the soil moisture time series that have been transformed by the calibration function.

L 302-305: This sentence is confusing and long. Please rewrite.

Figure 7. Will be interesting to compare the Muon detection with the correction factor being proposed by McJannet and Desilets using cutoff rigidity and atmospheric depth with the NMDB historical data. Unfortunately, that work is in the review process still.

Figure 8. So the soil moisture data is from FINAPP and not depth weighted following the Schron method? If you did have gravimetric surveys how would you depth weight them for the gamma sensitivity? From my understanding they would have a similar sensitivity with depth as the neutrons but be a little shallower (10-15cm)?

Table 1. Iwema et al. 2015 recommends 3 calibrations for estimating N0. From the variability here I would do at least 3 to estimate some uncertainty on N0. I agree additional gravimetric studies are needed, particularly for establishing the gamma to soil moisture dependence, especially when used in cropping systems with significant temporal variations in vegetation biomass. Unfortunately, for CRNS and GRS studies all roads don't lead to Rome but to more gravimetric sampling :).

Iwema, J., Rosolem, R., Baatz, R., Wagener, T., & Bogaen, H. (2015). Investigating temporal field sampling strategies for site-specific calibration of three soil moisture–neutron intensity parameterisation methods. *HESS*, 19, 3203–3216. <https://doi.org/10.5194/hess-19-3203-2015>