

## ***Interactive comment on “A universal calibration function for determination of soil moisture with cosmic-ray neutrons” by T. E. Franz et al.***

### **Anonymous Referee #2**

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First of all, I would like to congratulate the authors for this great work, very interesting and new within this field. I have seen in this paper one of the best analysis with respect to soil moisture in-situ measurements, and I am sure with some improvements already on-going, the results obtained with this new technique will be cited and used a lot of times in other future papers.

Nevertheless, I would like to add my comments regarding to the science quality behind this analysis and of course the validation of this technique for mosaic regions.

The soil bulk density, as mentioned in Section 3, Page 10311, plays a very important role to determine accurately soil moisture, but in all the regions with forest where there is a litter layer or a thick layer of leaves, this technique nowadays does not improve

the soil moisture measurements with disaggregating the effect of this litter layer with respect to other already existent ones, and also with stony soils as also mentioned in Abstract section is not possible to get good results. Here take place multiple interactions between diverse variables involved and it is necessary to find the better choice of some of them to reach better results, more reliable and significant to provide a universal calibration function which could be used for every soil type.

Sincerely, one of the best advances of this technique was to be capable to determine soil moisture averaged over wide and extensive areas and I think is in this averaging where it is being taken a variety or mosaic of vegetation and soil types, which show at the end an averaged result of all and consequently it does not reproduce the real conditions.

Another of the most difficult issues and very challenging may be to improve the sensitivity to the hydrogen molecules amount just above and also just below the surface, which affects directly to the neutron counts and consequently to the effective depth of the measurement. With a varying effective depth depending on soil moisture content, the accuracy to determine properly the Volumetric Water Content (VWC) in these zones around the soil surface is not easy to be solved.

I recognize the difficulty to address this important issue and therefore the work showed in this paper is on the right track to find a function capable to describe the most soil types as possible.

And to finish just mention that the uncertainty issue, which is just the final result of the processing carried out previously, will be of course minimized if the treatment of the vegetation and organic matter (biomass) present in the soil surface layer is carried out with a better accuracy.

Thanks for offering this great work to the science community. Congratulations again!

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