

Review of: Cosmic-Ray neutron Sensor PYthon tool (crspy): An open-source tool for the processing of cosmic-ray neutron and soil moisture data

Authors: Power et al 2021

GENERAL COMMENTS

I found this paper to be very interesting and generally well written. I think the subject matter will be increasing importance to the global CRNS community as we strive to make our datasets available and useful to the global research community. Your approach should prompt networks (existing and evolving) to think about the types of data and metadata that they would need to contribute to help harmonization.

I really like the ideas and concept presented. Those who run CRNS networks will acknowledge that their processing is not up to date but will also point out that changing a database can be a big undertaking. I think it may be worth mentioning this as a discussion point and stating that a central approach to processing might be quite valuable. It's not hard to imagine a system where networks might collect the raw data and metadata but then use crspy (or similar) as an internal processing tool to deliver the final product through their website. This is taking the product further than the intention of this paper, but it will get readers thinking. If new corrections or procedures are developed, then all that changes is a new crspy procedure calculation.

The approach of bringing in other data sets like ERA-5 and soils data to help with corrections is a great approach. Many countries are improving the spatial and temporal data sets of climate and soil properties so being able to choose a specific dataset set could be a further development for the future – again it would be good to have some brief discussion around this. This type of thing would not necessarily be for the authors to handle but a network may choose to contribute code to achieve this. This does get away from the harmonization idea, but it does open up the options further.

Related to the previous point, In terms of processing, I think you could propose two potential paths, 1) crns researcher level - the user steps through and chose the correction/datasets to apply at each step which keeps it flexible, 2) CRNS output user -global best practice which can be used for global or standardised comparisons

You say crspy can process using the most current methods – I think the issue may become keeping track of what is the “most current” method. If there is a globally accepted best approach that is going to require some discussion and agreement between network representatives. The CRNS community stands to benefit from this type of approach but some consensus on when and how to implement ‘best practice’ will be needed. The continued update of crspy will also need to be supported. This is an important point to make.

It would be good to see some discussion on what the future potential/ direction might be. Crspy requires a lot of user setup, package installation and folder structuring that might be beyond data users (i.e. not CRNS researchers). I had a quick go at getting crspy to run in Python a couple of months ago and ran into a couple of hurdles that stopped me proceeding through lack of time. I have limited exposure to Python having trained in R so I think most of the issues come back to my experience. That being said there could be room for some discussion around the potential for lowering the bar to entry by utilising a webpage interface. I have seen some nice Python Dash or R Shiny applications which really make these types of things a breeze.

In summary a nice piece of work. I have some specific comments below.

SPECIFIC COMMENTS

L46 – use either “Cosmic-Ray Neutron Sensors (CRNS) are a relatively new...” or “Cosmic-Ray Neutron Sensing (CRNS) is a relatively new...”

L49/50 – this sentence makes no sense

EQ1 - May be worth noting that modification to this key equation have been very recently published (Kohli et al 2021 <https://doi.org/10.3389/frwa.2020.544847>) but not widely used. This is also highlights how your package could be useful as knowledge improves and processing evolves.

L59 – misspelling “corrections”

L71 – delete “in” before Australia

L78 – “As a consequence...”

L80 – “across” or “between” rather than “among”?

L89 – change ref style to name out side bracket - Dirmeyer et al. (2016)

L99 – This bit is a bit clunky. How about something like “Schrön et al., (2017) provided an improved approach to CRNS calibration demonstrating that their revised approach improves accuracy of soil moisture estimates. Using UK sites as an example, Schrön et al., (2017) found that ...”

L102 – “...however this revised approach has not yet been deployed/applied across networks.”

L121-122 – sense need rewording to make sense

L126 – this doesn’t actually apply here in the text but when I looked at Table A1 to see the labelling the time zone was not specified. IF this is to be global then UTC probably needs to be specified. Or at very least have a metadata entry for time zone

Eq2 - This already highlights an issue of needed an agreed best practice. The equation noted has be widely used but I can think of alternatives already in the CRNS literature. Eq. Franz et al. 2016 Eq 2

Franz TE et al. (2016) Using Cosmic-Ray Neutron Probes to Monitor Landscape Scale Soil Water Content in Mixed Land Use Agricultural Systems. Applied and Environmental Soil Science 2016:11 doi:10.1155/2016/4323742

L169 – some success with clay content and lattice water in Australia (McJAnnet et al 2017) and limited in US (Avery et al 2016). With a global data base (which has been discussed) this could evolve – again requires cooperation between networks)

McJannet D, Hawdon A, Baker B, Renzullo L, Searle R (2017) Multiscale soil moisture estimates using static and roving cosmic-ray soil moisture sensors. Hydrol Earth Syst Sci 21:6049-6067 doi:10.5194/hess-21-6049-2017

Avery WA et al. (2016) Incorporation of globally available datasets into the roving cosmic-ray neutron probe method for estimating field-scale soil water content. Hydrol Earth Syst Sci 20:3859-3872 doi:10.5194/hess-20-3859-2016

L198 "...potential of a..." ?

L282 word missing between static and estimated?

L310 considers not considered

L353 – are these country codes from some international standard list e.g. ISO 3166 – would be useful. Is so please say which list or ISO

L472 – "...due to the fact..."

L480 – I think it should be "affect conclusions".

Fig 4 – I assume this box plots are counts of sites? This could be made clearer on the plot or the caption

L546 – last sentence is clunky and should be reworded. I assume you mean something along the lines of "Crspy has been developed to show the potential for easily and efficiently processing CRNS data in a consistent manner. The aim is to promote the usefulness of free and open access data and engage the CR"NS and research communities in the continued improvement of this product in the coming years