Comment on gmd-2022-93

Anonymous Referee #2

Referee comment on "URANOS v1.0 – the Ultra Rapid Adaptable Neutron-Only Simulation for Environmental Research" by Markus Köhli et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-93-RC2, 2022

This is a well developed manuscript, demonstrating the applicability of a novel though well-tested code. The manuscript is well readable, inspirational and easy to access for environmental scientists although containting dense information on physical processes and modelling. I recommend publication in GMD with minor revisions urging the authors to expand on a few minor points (see below) and add a new section on limitations and outlook. This section will benefit the readers and inspire the next generation of researchers to build on this code, increase the user space and the capabilities of CRNS to deliver accurate environmental observations.

Please adress following questions (in the new section):

What is the run time on a standard architecture (e.g. interl Core i5, 8GB RAM, Windows or Unix)?
Is the code parallelized for HPC applications?
What are the most expensive calculations and how to they scale from 2D to 3D for a "simple" geometric set up?
Can the atmosphere and cosmic ray interactions be modelled using URANOS code?
What is needed and what is the uncertainty to expand the code to include uncertainty from the cosmic ray energy spectrum at the top of the atmosphere and further particles?
Given URANOS is applied to simulate each CRNS locations, what are the remaining major uncertainties constraining the accuracy of cosmic ray neutron sensor derived hydrogen content in the CRNS footprint?

Line 132: It is unclear for the reader, how TRandom3 is programmed, language, and what a "modern architecture" is. Are the authors referring to HPC systems, GPU based HPCs or

Laptops build in 2019? Please specify what you refer to as modern architecture ideally in the flops as measure for computational performance.

Line 133: Please also mention possible other random number generators and are they available? If those are not relevant questions, then it seems the technical details are not needed and I recommend to simply state that "the TRandom3 random number generator is used" and remove the technical details on random number generation from the manuscript in this paragraph 2.2.

Line 208: Please clarify what "MT numbers" are. Random "Mersenne Twister" numbers would not define reaction types, I assume.

Line 215: What is ensemble statistics?

Line 219: Please state which relevant and non-relevant interactions you are referring and what are the "two different types"?

Line 222: Please clarify, how is it possible that myons are not contributing while myons are the major cosmic rays entering the atmosphere, and neutrons are only a product of myon inter-action?

Line 325: Please state recommended default setting for the source.

Line 332: Please state recommended default starting angle.