Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC2
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General response

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Author comment on "SMAUG v1.0 – a user-friendly muon simulator for the imaging of geological objects in 3-D" by Alessandro Lechmann et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-342-AC2, 2022

We thank Dr. Nolwenn Lesparre for the detailed feedback that helped us to improve the manuscript for our target audience.

First, the term "tomography" in this work is used as a general term to describe the process of determining the subsurface structure. This is accomplished either by finding the density distribution or by exploring a set of interfaces in the underground. This can be done either in 1D, 2D, or 3D. It is a current problem in the community that there is no clear nomenclature, as words such as "tomography", "radiography", or even "muography" are used. In our understanding the term "radiography" is equivalent to an X-ray image, i.e. a transmission "photograph" that can be obtained at various angles. "Tomography" is then the process of combining these radiographs into a coherent 3D model, as in a CT-scan. We, however, see that in the latter only 2D slices are being made, thus the comment of the reviewer is justified. In order to resolve this issue we adapt the suggestion of the reviewer by using the notion of "imaging" when we specifically address the type of reconstruction. However, we left the term "muon tomography" as it stands, because it is a well-known term in the community and we have used it throughout multiple works to refer to that technology.

Regarding the comment about the abundant variables, we gladly adapt the proposition of the reviewer. First, we think it a good idea to introduce the parameters in a separate list. However, due to the vast number of parameters, we have put a list of new variables at the beginning of each section and grouped them into sections of their first occurrence. We agree that we have not made clear which parameters we are looking for in the study. So we will expand on this in the introduction as well as in the list of variables.

Concerning the usage of Fig. 3 earlier in the text, we think that the directed acyclic graph is a representation of the interaction of the parameters that is too abstract to follow. Furthermore, we use it as a tool to construct the joint probability distribution and as such it is at the right place. However, we think we can address the issue a) by modifying Fig. 1 such that the actual target parameters are clearly indicated, and b) by providing an overhauled Fig. 2 where the function and interactions of the modules in the code are shown in more detail. There we can also show the origin of the different information used in the paper.

Another request of the reviewer was to modify Fig. 2 to better show the interactions of the modules. As described earlier, we think that with a sketch of how the inversion is set up

and how the modules act as “gears” within this machinery, we may provide the reader with useful conceptual information on how the code works. We can also highlight where pieces of external (i.e. laboratory or from GIS) information enter the inversion. Concerning the numbering of the modules, we think that this would confuse the reader as we describe in the text the logical flow from the measurement backwards. This approach allows us to start with the measurement and add one physical model at the time, which provides a better understanding in our view. The actual calculation, as indicated by the arrows in Fig. 2, is however the other way around. Therefore, we omit a numbering but keep the titles of the modules in place, such that we can address them by name.

A full compilation of our line-by-line responses and entailing changes in the manuscript are provided in the supplement to this author comment.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2021-342/gmd-2021-342-AC2-supplement.pdf