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Discussions

Interactive comment on "The effect of rock composition on muon tomography measurements" *by* A. Lechmann et al.

Anonymous Referee #1

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This paper studies numerically the sensibility of muon tomography to the type of rock being scanned. The authors calculate the ratio of the flux of muons that should be observed after traversing different types of rock, and compare it to what would be observed if the rock was a "standard type", that is, the reference material used to translate a measurement of muon flux into an average density. To do so, they take into account the mineral composition of each rock type and, for each mineral, the distribution of elements involved, and calculate the total energy loss as a volumetrically averaged energy loss involving each element.

The authors claim that the muon flux measured in common applications are significantly sensitive to the rock type composition and therefore the rock composition should be taken into account for modeling purposes.

The paper is well written and the idea is interesting. The work however lacks some fundamental information necessary to draw the conclusions claimed. There is no discussion regarding the error in the physical models and simulations used to calculate the resulting fluxes, nor how these errors translate into the final parameter studied: the ratio of resulting fluxes between rock types and the standard rock.

Before drawing any conclusions, the authors should provide uncertainty estimations to all the simulations, from the simulation of the incoming flux to the energy loss, and propagate these errors to the final flux ratio.

Furthermore, the methodology developed is limited to a volume averaging of element properties. The results presented involve one sensitivity test that is rather straightforward. Therefore, in its present form the paper does not contain sufficient and sound results: the analysis is limited to one figure where the results lack the uncertainty estimation.

This work would be of a significant impact if the authors could provide, besides the uncertainty in their simulations, real muon measurements associated to different rock types from the field.

Additional comments:

As the authors mention, the incoming flux model is precise only to 10% and this is in the best scenario which corresponds to the vertical direction (zenith angle equal to zero). The question that rises then is, even for the vertical direction used in the paper, what is the purpose of trying to recover an average density in the limit of 2.5 % as the authors use as a threshold.

In a best case scenario where we the incoming flux would be known with a 5 % precision and no errors were associated to the energy loss calculation, one could think that a 5% change in the outgoing flux would be detectable. In this case, only basalt and dolomites would have a significant effect right above the error level, and that only if the

amount of this rock type would be larger than 400 and 500 m of rock respectively.

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