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Solid Earth
Discussions

Interactive comment on "Uncertainty assessment for 3D geologic modeling of fault zones based on geologic inputs and prior knowledge" *by* Ashton Krajnovich et al.

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The authors truly appreciate the detailed constructive comments from the referee. The authors have taken several steps to address the misuse of terminology regarding Markov Chain Monte Carlo (MCMC) algorithms and posterior distributions. As the referee noted, there is and was no intention of a Bayesian model being used in the study. The manuscript has been edited throughout to replace erroneous mentions of terms related to MCMC and Bayesian inference (e.g., MCMC sampling, posterior distributions) to proper terminology for the Monte Carlo sampling that was performed in the study.

As for the description of the statistical parameters of the Monte Carlo model, sections of text that were previously withheld for the sake of brevity have been reintroduced to Sections 4.1-4.4 to describe in detail the parameterization of and rationale behind the distributions explored using Monte Carlo sampling.

Relating to the above point regarding erroneous usage of terms from Bayesian inference, Section 4.5 has been reworked extensively to provide an appropriate description of how the study went about assessing the quality of the exploration of the input uncertainty space from Monte Carlo sampling.

The authors agree that the interpretation of the tailing behavior is a result of the use of an empirically derived distribution (previously referred to as a "deterministic distribution"), and not a result of posterior analysis. The wording has been adjusted to clearly state this. However, the authors chose to retain the interpretation of tailing behavior in the vertical termination depth. The authors believe it highlights the possibility of unexpected uncertainty envelope shapes when using empirically derived probability distributions.

The authors have also updated the README file included with the code published on Github to provide a clearer and more comprehensive snapshot of the dependencies required for use of the input uncertainty quantification script.

The authors agree with the referee's well thought out recommendation regarding the extraneous use of abbreviations when referring to the concept of probabilistic geomodeling through exploration of the geologic model input uncertainty space using Monte Carlo sampling. Changes have been made throughout the paper to refer to

the method as 'probabilistic geomodeling', following a proper introduction of what the term means in the context of the study. This includes changing the term "MCUP formulation" to "probabilistic model".

The authors acknowledge that the description of the automated workflow implemented in Leapfrog with custom support is sparse, and have supplemented additional text to detail the process of automated model updating. The authors believe that the automated model updating that was implemented for this study is in fact rather straightforward, in the sense that it follows the same series of modeling steps that a user in Leapfrog would follow if they wished to create n realizations of their own fault zone model. The authors believe that the updated text clearly illustrates this concept to the reader.

The method implemented in Leapfrog is available to other researchers on the basis that they contact the developers of Leapfrog (Seequent) independently to acquire access to the unique functionality (which is built on top of a default Leapfrog installation). The product is not currently commercially available and was designed with the supervision of the authors to accomplish the specific goals of the current study. The authors of this study are not developers of Leapfrog, and are therefore not privy to the specific code written in the Leapfrog development environment to accomplish the automated model updating. Rather, the authors worked in collaboration with the developers of Leapfrog to guide them in implementing our own requirements for automated model updating. Communication between the authors and the developers of Leapfrog provided a sufficient level of transparency in how the code was developed, although the specific code cannot be released to the public as it is built directly within the Leapfrog engine.

Please refer to the attached supplement (.pdf) for the full, detailed replies to all

comments of RC2 (general and specific) and the proposed changes to the manuscript.

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2020-21/se-2020-21-AC2-supplement.pdf

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2020-21, 2020.