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Geoscientific Model Development Discussions

Interactive comment on "GemPy 1.0: open-source stochastic geological modeling and inversion" *by* Miguel de la Varga et al.

Anonymous Referee #2

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Review of Manuscript gmd-2018-61 entitled "GemPy 1.0: open-source stochastic geological modeling and inversion" by Miguel da la Varga, Alexander Schaaf, and Florian Wellmann

Dear Editor and Authors,

This manuscript presents an open source implicit geomodelling method implemented in python that is capable of generating 3D geological models with complex lithostratigraphic structures, fault networks, and unconformities. Currently, there are no open source solutions that exist with all of these comprehensive features. In addition, gempy provides all the necessary tools to perform complex 3D modelling, visualization, and analysis out of the box and provides a much needed ecosystem for scientific research permitting enhancement of existing methodologies as well as potential addition of new

methods, techniques, and tools benefitting a suite of various geoscience applications. The fact that their method can be integrated into machine learning and Bayesian inference frameworks for stochastic modelling and inversion is indeed exciting and opens up numerous possibilities. I have many suggestions to improve the paper's descriptions and clarity. I recommend this manuscript for publication after the authors have addressed the issues noted in the review.

Specific Comments

My detailed comments and edits can be found with the attached pdf. Some general comments are given below.

The sections regarding Bayesian inference/Probabilistic modelling is weak, in my opinion. Although, it should be noted that the reviewer's expertise does not lie within this domain but within mathematical approximation and the implicit approach. The general formulation of Bayesian inference and how it is integrated with the variables of the interpolants/estimators from the implicit approach should be presented. The Appendix E needs to be expanded and described in more detail. In addition, there is a lot of Bayesian/probability nomenclature not properly defined in section 2.3. The manuscript would benefit from clearly stated definitions.

It's unclear, to me at least, how fault drift functions are chosen or designed and how the form of that function affects the modelled results. Is it a trial and error process – finding the result that maximizes the sharpness on the transitions around the discontinuities? Perhaps an appendix section would be useful for this. In addition, I find all python code samples involving faults confusing (e.g. Listing 3). For example, there is no input data describing the fault (location and orientation points) how can a fault's scalar field be produced without this information? Only the order of the formations involving the fault is given.

The work entailed in the manuscript has a high potential for establishing a research community for developing next-generation geological modelling algorithms. There can

be many improvements made to the current code base but what has been completed is impressive.

Please also note the supplement to this comment:
https://www.geosci-model-dev-discuss.net/gmd-2018-61/gmd-2018-61-RC2-supplement.pdf

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