

## ***Interactive comment on “Actors, actions and uncertainties: Optimizing decision making based on 3-D structural geological models” by Fabian Antonio Stamm et al.***

### **Anonymous Referee #2**

Received and published: 17 June 2019

This is an interesting and original contribution on simulating uncertainties and their impact on decision making in a structural hydrocarbon trap. Monte Carlo error propagations and Markov Chain Monte Carlo sampling are used to consider the probability of different trap volume models based on stated uncertainties. Loss functions are used to explore potential decision making scenarios for high-risk and low-risk users. The technique has great potential to be used, with addition of more parameters, for hydrocarbon exploration and other geoscience applications.

The main strengths of the paper are that it is tightly focused on a specific and important problem, it builds up the methods and results in logical step-wise sections, and it

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contains useful and clear figures to clarify key inputs/findings. The main weaknesses are that it is written in a fairly inaccessible way, with key elements and some assumptions undefined, and that it does not look beyond the broader applications beyond the specific one used.

There are a few ways that it could be made more accessible to a non-specialist in decision analysis (discussed below) and some general editing would shorten the text and increase its clarity.

General: For reviewing, it would be much better to have continuous line numbers to refer to rather than numbering resetting back to 1 on each page, also every line rather than every 5th line should be numbered.

Lots of instances of unnecessary modifiers e.g. line 10 (P1), line 3-4 (P4), convoluted sentences (e.g. line 2-4, P9) and redundant words (e.g. line 20 P12, line 4, P19) make the text difficult to access. Many of these could be drastically simplified, making the text shorter and more accessible.

The word ‘actor’ is used throughout and in the title. It would be good to define the term in the context used early on. I see that it is commonly used in the decision sciences as a synonym for the more widely-understood term ‘decision maker’ or ‘user’, and seems to represent the human element of the process. However, in line 2 (P9) the phrase ‘the case of an actor or decision maker’ is used, suggesting that the two are different – perhaps actor has a very specific meaning here, which should be made clear. In line 11 (P9), for example, the ‘actor’ would like to know the trap volume. Use of actor in this context seems obscure, and would be better replaced with a common word representing the human element in decision analysis like worker/geologist/company/user. Line 15 (P17) reports observations of the behaviour of the modelled actors – reflecting that actors are a non-human element of the modelling (e.g. Fig. 3). Please clarify.

Several other key concepts, terms and abbreviations are used throughout, but not all are clearly defined. It would be beneficial to place the work in the framework of such

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definitions.

The use of the hydrocarbon sector as an application for geological modelling is sensible. However, no other options are mentioned. What might other sectors be, and what modelling problems could be solved in the same way (perhaps things like nuclear waste disposal, landslide susceptibility)?

Throughout, volumetrics are discussed in the sense of 'trap volume' – which is appropriate and supported by the parameters used. However, there is one instance of the term 'reservoir volume', and there is consideration, in section 2.3, of OOIP. This indicates that actual hydrocarbon reserves are a key outcome of the analysis. But converting from a trap volume to a reserve volume of course involves extra parameters such as porosity, net:gross ratios, water saturation etc. These factors and their uncertainties may be as important or more important than the overall trap volume. While it is reasonable that other factors aren't included in the present modelling, it would be beneficial to mention them, justify their omission, and perhaps consider how they might be integrated in a future iteration of the model. I think they are alluded to in Fig 7 (reservoir and recovery parameters) but these should be made explicit, given the geologic focus of the topic.

Lines 6-8 (P6). Is there actually an independent uncertainty related to fault offset? Since that parameter can only be inferred indirectly via stratigraphic surface picks, I would argue that there is no additional uncertainty on either the hangingwall or footwall beyond what has already been accounted for by the surface uncertainty (which is the sole observational basis for fault offset). It would be useful to see a short descriptive justification for including this additional uncertainty. The significance of this parameter is clear in Fig. 5, where the smaller probabilities of hangingwall seal and reservoir result (I think) from the additional uncertainty applied. If this extra uncertainty is not justified (I think it is not), then it places the subsequent results in doubt.

Line 14 (P6) OOIP/OOIG – presumably this should be OOIP/OGIP instead?

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Line 25 (P6). SSF is not defined. I suspect it may be 'shale smear factor' (used without the abbreviation in line 19 (P18)). Please define accordingly.

Line 18 (P13). 'Low but positive volumes' – is a negative volume possible/meaningful? If not, simply use 'low volumes'.

A few minor typos throughout (e.g. line 24 (P18) should read: an individual's. . ., line 29 (P18) should read: to what extent. . .). Please check and amend generally.

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-57>, 2019.

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