

Interactive comment on “Quantifying the impact of the structural uncertainty on the gross rock volume in the Lubina and Montanazo oil fields (Western Mediterranean)” by Carla Patricia Bárbara et al.

Alexander Schaaf (Referee)

a.schaaf@abdn.ac.uk

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General comments

The paper presents an interesting case study of the impact of structural uncertainties on structural geomodels. The authors compare two different approaches of uncertainty parametrization of structural geomodels from seismic data and their impact on gross rock volume estimations. The manuscript is well structured, and both title and abstract are adequate for the content.

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The manuscript gives a good introduction to the uncertainties involved in seismic interpretation and subsequent structural geomodeling and clearly states the motivation for and relevance of their work in the context of economic geology.

The methodology section and clarity of the paper would be significantly improved if the authors would elaborate more on the details of how they parametrized the stochastic geomodel. It is not very clear what kind of statistical distributions were used for the Monte Carlo simulation, which is important to interpret the results. More detail on this can be found in the specific comments below.

The results are clearly presented, and the authors give a good visual overview of the effects of uncertainty on the structural geomodel and GRV estimates.

The discussion is overall good but could use some minor improvements outlined in the specific comments below. It could also use a more detailed integration of the results in context of related work. The figures presented are overall good, but the use of a perceptually uniform colormap is recommended (see technical comments below).

Overall, I believe this manuscript to be a good submission for the special issue on uncertainty in the geosciences. The scientific quality of the manuscript is good but should be further improved regarding the stochastic parametrization.

Specific comments

P6L25 – The sentence is not clear to me: what exactly is meant by geophysical data? This should be more specific for the reader.

P6L25-26 – The sentence is unclear. As I interpret it, the authors use the base case model and modify it using samples from perturbation distributions for faults and horizons to create new structural geomodels. I recommend specifying this.

P7L10-12 – What does “constant envelope” mean in context of the stochastic simulation? A Uniform distribution with the stated bounds? I recommend the authors expand this a bit to clearly state the stochastic parametrization of their uncertainty model.



P7L12-13 – How exactly was the envelope adjusted to the seismic quality and what exactly does seismic quality refer to in this context?

SED

P8L10 – This sentence needs to be corrected. A stochastic simulation can only create equi-probable realizations if only Uniform distributions were used. The authors used Gaussian Random Fields and Gaussian distributions in their simulation (Fig. 7), and therefore the samples/realizations are not equi-probable. It is also unclear to me what “spans the uncertainty” means. A Monte Carlo simulation (or any stochastic simulation methods) will only ever reproduce the exact uncertainty in limit to infinite samples.

Interactive comment

P8L24 – Why 200 realizations? Stochastic simulations need to balance computational cost with representative sampling, and the number of samples is critical for an accurate representation of the uncertainty within the results. I recommend the authors elaborate why they chose this number.

P11L7-9 – I recommend comparing Inner Quartile Ranges instead of minimum and maximum values to describe and compare the uncertainty. Minimum and maximum values are not necessarily representative.

P11L15 – Parametrization relies on assumptions, thus the word “accurate” can be misleading here. There is ample room for human bias and error in interpreting uncertainty from seismic data.

P11L25 – It is unclear to me what exactly is compared here. The mean GRV values of the different simulations?

P12L24 – Why are trend uncertainty values typically up to 10% of the depth of the horizon? Is this a rule of thumb, is there actual data on this? The source of this information should be clarified.

P12L13 – Why should the variogram range for the residual uncertainty “in general not be more than the half of the reservoir size”? It is unclear if this is a rule of thumb or based on actual studies. This should be clarified.

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P13L3-5 – Manual interpretation of seismic data is prone to human error and bias. This should be discussed in this paragraph.

SED

Technical corrections

Figure 13d – It's really hard to see any differences in this plot due to the small size and scale of the y-axis and use of arrow heads.

Interactive comment

Figures 6, 8, 9, 12 – All figures make use of rainbow color schemes, which is perceptually not uniform. This makes it more difficult for readers to correctly perceive the underlying data. I highly recommend use of a perceptually uniform colormaps which are also more robust to color blindness.

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-64>, 2019.

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