

## General comments

The paper is globally well written and interesting. However, the title and introduction are too general, which is misleading as the reader could expect a methodological framework rather than a specific application of 3D MPS with a conditioning sensitivity analysis. The motivations, novelty and specificity of this work should be better stated in the introduction. As this paper investigates soft conditioning, it seems strange not to perform multiple MPS realizations (until the appendix) and not to compute probability maps to compare to the soft data. The authors should justify strongly and properly the use of a single realization to assess the quality of soft data conditioning in the main part of the paper.

I do not understand why the 100 generated realizations are only used in the appendix, and why the authors do not state in the text that they produced 100 realizations per strategy (it is only written in the caption of figure 22). In addition, it reduces the validity of the performed analysis to display the histogram of the sand body size, eccentricity and jaggedness for 3 specific realizations rather than showing the mean plus minus 1 or 2 variance(s) of the histograms, to account for the 100 available realizations. These results should be incorporated in the paper, and the discussion could eventually be enriched by a comparison of quality assessment using 1 realization versus 100.

## Details

Introduction : the motivations and objectives need to be clarified. For instance, page 2 line 28-29, you could as described in [Pilot \(2017\)](#) give a few examples of ways to produce 3D training images (by object-based or process-based algorithm), or by enhanced tools ([Comunian, 2012](#) ; [Rezae, 2015](#)).

Page 2 line 30, it should be indicated that it is applied to a specific dataset.

Page 3 regarding the main objectives, it seems important to precise that the iterative development is performed by an expert user, and that it is applied to a specific dataset. The actual formulation might lead the reader to think that you propose a general framework to develop 3D TIs, which is not really the case. The TI is adapted iteratively such that the resulting prior (MPS realizations influenced by algorithm parameters) fits qualitatively your expectations (a quantitative criteria would be an argument to claim a new methodology). For the second objective, it also seems to be an application of a recent strategy proposed by Hansen et al. (submitted).

Introduction/Study area : would it be a good place to define your voxel dimensions (grid resolution) and justify it ? It could also be the right place to explain why you are not interested by multiple realizations and justify your choice, which comes too late in the current version of the manuscript.

Page 5 line 31 : the bottom surface has a grater dip than the top one, as the thickness increases from east to west.

Page 6 line 12 : please justify the high reliability of the seismic data interpretations.

Page 7 line 12: as the paper by Hansen et al. (submitted) is not yet published, it is necessary to explain in more details what is meant by 'ignore such localized soft data'.

Page 8 line 16: it would be could to recall the definition of your indicators displayed in Figures 11 to 13, and explain why they are significant when computed on a single realization, and why they are not rather computed on the TIs. Are these indicators useful as they are not considered in a quantitative criteria to select the TI? If they are not used, they might be removed, as well as the corresponding figures.

Page 9 line 5: 'which further supports our final choice for the TI2'. Is this really a good argument? As you display horizontal slices and as the TIs mainly differ by the layer thickness, I am not sure sections in realizations generated with TI1 would have been less good.

Page 9 line 20: can you give some reasons for this (linked to the algorithm? ...)

Page 9 line 22 / Figure 15c&d: how do you justify the quality of your realization when using soft conditioning if you can not compute probability maps with a single realization?

Page 10 line 12 / Figure 18: why is the cross correlation shaped like a pyramid? Is it due to voxel indexing? Which voxel indexes correspond to borehole information? Should you recall the definition of the cross-correlation to explain that shape?

Page 10 line 30: do you mean 'geo time ad  $yz$ -axis'?

Page 14 line 9: could you precise 'This study investigates **conditioning** strategies' ?

Page 19 line 2: can you reformulate the beginning of your sentence?

Figure 4 : could you super-impose the graben structure like in Fig 1b, it would facilitate the interpretation.

Figure 5 : missing legend for the colored lines

Figures 11,12,13 : legend on the figure should state realization (TI#) and not only TI# to be coherent with the caption.

Figure 15 : missing color legend for the boreholes. It is not straightforward to localize the mismatch. Would a white line around the boreholes + same colors as on the simulation when it matches and yellow or black when it does not match and outside the simulation grid help ?

Figure 22: what is 'e-type map' ? The presented results are not clear. The caption should describe clearly what is displayed