



## Comment on se-2021-1

Anonymous Referee #1

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Referee comment on "An Analytical Framework for Stress Shadow Analysis During Hydraulic Fracturing – Applied to the Bakken Formation, Saskatchewan, Canada" by Mostafa Gorjian et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-1-RC1>, 2021

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The Authors are encouraged to consider the following comments.

- Introduction line 55: What is the specific objective of the study? The author mentioned “a better understanding of the combined effects of mechanical, thermos and poroelastic stress shadows during the process of hydraulic fracturing.” But from the literature review, it is not clear what is the problem or gap in this area that this work is attempting to address. The paper’s objective is not the same with the discussion and conclusion. The abstract needs to reflect clearly the objective(s) of the study.
- The equations presented to the end of page 17 are all from the literature and well known. There is no need to present them all in the main body of the manuscript, as it distracts the reader to focus on the main objective of this work. If necessary they should be moved to the Appendix.
- It is not clear at all, what a is the new development in this work. Is it the algorithm which combines the use of the analytical methods and numerical simulations using Gohfer?
- What is the shortcoming or limitation of the cumulative stress shadow calculation method? For example. 1. The author assumed the  $i+1$  stage stress shadow has no impact on the  $I$  stage stress shadow. 2. The author assumed the average value of fracture length and width.
- 1 Workflow: Clear discussions need to be given regarding the GOHFER software and how it accommodates stress shadow distribution (magnitudes and direction). Simple example to clarify how it works and validation of results should be given before presenting a complex 30 stage fracturing example.
- 2 Mechanical stress shadow equation 1-4: There is no explanation of parameters such as  $E$ ,  $E'$ ,  $R$ ,  $r$ , etc. It is not clear if it is proposed to modify the existing equation or solely reproducing the equations.
- 3 Thermo-elastic Stress Shadow:  $\Phi_{ie}$  (effective porosity) is better to be shown as  $\Phi$ .
- Line 310: In the case study part. The author mentioned the results of sensitivity analysis from other research, but there is no citation. These results are not generally known.
- Line 330: Which figures in the Appendix are results of  $\sim 0$  MPa for the thermo-elastic

and 0 for 330 the poro-elastic" are not mentioned.

- Line 350: It will be useful to show the direction of the stresses in Figure 12 using arrows in Figure 1. That will help to understand why the stage 3 fracture orients 11 degree.
- Line 400: figure 18 (a) is not induced shear stress, it is minimum horizontal stress.
- It is important to show the results of GOHFER simulation, I didn't see how GOHFER was used and what are the outcomes. No explanations are given on how GOHFER adopts and utilizes the stress distribution to predict the fracture geometry and orientation.
- There is no explanation on how to obtain the total stress shadow from each stage.
- Figure 21. The orientation of each fracture is not clear. It looks like each fracture is parallel to the other and no stress shadow effect.
- There is a discussion on microseismic events on the early page but no further explanation in the main paper except one-page appendix. How the results of multistage fracturing simulations presented and the stress shadow effect was validated against microseismic data?