Dear reviewer

Thank you for your professional comments and advice on our manuscript “Seismic wave modeling of fluid-saturated fractured porous rock Including fluid pressure diffusion effects of discrete distributed large-scale fractures” (ID 675243). Those comments and advice are valuable and helpful for revising and improving our paper. According to your nice suggestions, we have made extensive corrections to our previous manuscript, the detailed corrections are listed below.

Comments from referee 1

1. Section 2.1 The low-frequency limits elastic linear slip model (LFLSM). This model is not valid for single fractures and it should not be used in that context. In the second part of the work, it is used to approximate the effective properties of a set of conjugate fractures but the authors should understand and explain in which scenarios this model makes sense first. The authors should also explain how this model is adapted for the case of conjugate fractures as it has been presented for "a single set of rotationally invariant fractures".
2. Section 2.2 The high-frequency limit elastic linear slip model (HFLSM). Same as in Section 2.1.
3. Section 3 Nakagawa's poroelastic LSM. Please explain why this model is required (i.e., validation only) and the main assumptions of a LSM.
4. Section 5.1 Viscoelastic modeling based on VLSM. The use of the LFLSM and HFLSM models from Sections 2.1 and 2.2, respectively, is incorrect for individual fractures. To assess the importance of FPD effects, the authors could utilize the low and high-frequency limits of the VLSM model by Barbosa et al. (2016), which is valid for a single fracture and provides the desired elastic limits.
5. Comment on Figure 2. Since the traces are recorded sufficiently away from the fracture, the slow wave is not present (it gets completely attenuated close to the fracture). This should be mentioned as Nakagawa's model provides the slow wave solution and Barbosa's does not. Nevertheless, this comparison shows that the effects on P and S waves are properly accounted for.

6. Section 6.1 Single horizontal fracture model. (a) The authors should compute the characteristic frequency of FPD effects or present Zn plots to confirm that FPD effects are indeed important at 35Hz. Based on the values given in Table 1, I got that the maximum FPD effects occur around 45Hz, which is close to the frequency considered by the authors. (b) The model should also be validated for oblique incidence (or inclined fractures) before moving on to multiple fractures.
7. From Section 6.2 onwards, the approach is not suitable for the analyzed cases. The VLSM cannot accurately represent the seismic response of connected fractures as it does not account for pressure relaxation effects between them. The assumption that the VLSM-based modeling is "accurate" for assessing FPD effects is incorrect. Additionally, the authors need to describe how the models LFLSM and HFLSM, presented in Sections 2.1 and 2.2, respectively, apply to cases of conjugate fractures (e.g., how are the dry compliance matrices computed for a set of conjugate fractures). The assumptions underlying this approximation, as they correspond to effective medium models, should also be explained. In Section 6.3, the authors attribute the observed differing results to scattering caused by the presence of fractures, but it is uncertain whether the scattering is accurately modeled.
8. I have also made some minor technical corrections, which are annotated in the attached PDF.

The author's answer:

1. The LFLSM in the previous draft is not appropriate for individual fractures. We have replaced it with the low-frequency limit of Barbosa's VLSM (LVLSM) in section 2.3 to model the elastic properties of individual fractures in which the fluid pressure is in complete equilibrium.
2. The HFLSM in the previous draft is not appropriate for individual fractures. We have replaced it with the high-frequency limit of Barbosa's VLSM (HVLSM) in section 2.3 to model the elastic properties of individual fractures in which the fluid pressure is in nonequilibrium.
3. We explain the reason for using Nakagawa's poroelastic LSM in Section 3.2, lines 266~268, which is marked in green. The main assumptions of PLSM is described

in Section 2.2, lines 115~118, which is marked in green.

4. We replace the LFLSM- and HFLSM-based modeling scheme with LVLSM-based or HVLSM-based modeling scheme to simulate wave scattering of individual fractures in Section 3.2, lines 259~260, which is marked in green.
5. The slow *P*-waves are invisible in the poroelastic modeling. According to reviewer's suggestion, we mention it in Section 4.1, 328~329, which is marked in green.
6. (a) According to reviewer's suggestion, we calculated the characteristic frequency to be 46Hz and plotted Zn and Zx in Section 4.1, lines 317~322, which is marked in green. The central frequency (35Hz) of the Ricker wavelet used for numerical simulation is close to the characteristic frequency (46Hz), which ensures that the impact of the FDP effects on seismic scattering is significant in the seismic frequency band.

   (b) We have showed the numerical simulation results for a single inclined fracture in Section 4.1.
7. We are very sorry for our negligence the critical assumption of Barbosa's VLSM, so we have changed the multiple conjugate fractures with a set of aligned fractures in Section 4.2.
8. We thank the reviewer for all of these nice suggestions, we have made corrections.

We have restructured the manuscript to better address the problems.

Comments from referee 2

1. There are errors in equations (28b) and equations (29b) in section 3.2.
2. The poroelastic finite-difference modeling based on the PLSM in section 3.2 is an effective one, I suggest the authors use the PLSM explicitly in the numerical simulation to capture the FPD effect on scattered waves when validating the VLSM-based modeling.
3. Why the slow P-wave is invisible in the snapshot of poroelastic modeling?
4. The calculation of local effective moduli based on VLSM in section 4 belongs to seismic modeling. It is better to combine the context of section 4 and section 5.1.

The author’s answer:

9. We have corrected all the errors in the equations of the manuscript.
10. We have presented the PLSM explicitly in the numerical poroelastic modeling scheme in Section 3.2 and given the numerical result in Section 4.1.
11. Due to the high diffusion and attenuation of slow P-waves in the background media, them are invisible in the poroelastic modeling result.

Author's changes in manuscript

We thank the reviewers for all of these nice suggestions. We have made extensive corrections to our previous manuscript and restructured the it into five section: 1 Introduction, 2 Review of the LSM, 3 Seismic modeling of fractured porous rock, 4 Numerical examples and 5 Conclusions. The main changes are in section 3 and 4, with minor changes in sections 1, 2 and 5.

Thank you very much for your attention and time. Look forward to hearing from you.

Yours sincerely,

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