Reviewer #1 comments:

1. (a) *The authors mentioned several times the variable of 'density of contact areas', but no detailed definitions of this variable is given. Since this is one of the major influencing factors that the authors investigated, so the authors should give a clear definition of this variable.*

   (b) Following the reviewer's suggestion, we have added the following definition of "density of contact areas" in Section 2: "We define the density of the contact areas as the ratio between the area of the fracture walls in contact and the area of the entire fracture"

2. (a) *Page 4, Line 17: the authors state that 'We solve this system of equations in the weak formulation…'. What does 'in the weak formulation' mean? Please explain this in details.*

   (b) As indicated in the text, the weak formulation is derived, shown and explained by Quintal et al. (2011). It is out of the scope of our manuscript to go deeply into details about the numerical method.

3. (a) *Section 3.1: it seems that the authors choose a REV with only one fracture for the numerical simulations of medium with parallel fractures. This may ignore the boundary condition effects (e.g, Milani et al., 2016, Geophysics) and also the possible fracture interactions. Please comment.*

   (b) The reviewer points out that the results of the numerical relaxation test applied to the considered REVs may have ignored effects of boundary condition or fracture interactions. The numerical models we employ consist of a cubical background cut by a horizontal fracture which reaches the background boundaries. In the case of planar fractures, such models are essentially unidimensional and as shown by Milani et al. (2016) no boundaries effects would play a role as a consequence of Eq. 1 of our manuscript. However, as the reviewer pointed out, the distribution of the fracture apertures we considered suggests that boundary effects may affect the results. In order to study such possible effects, in Figure I we plot the normalized vertical stress field in the case of the binarized Model B considered in the manuscript (i) for a single repeating unit cell (RUC) and (ii) for 4 RUCs. As shown by Milani et al. (2016), this comparison illustrates boundary condition effects associated with the numerical relaxation test if any. Fig. I shows that the stress fields and consequently, the real parts of the P-wave moduli for both models are not affected by boundary effects. This analysis supports the consideration of our models as REVs of media containing periodically distributed fractures and the fact that no boundary effects or undesired fractures' interaction are affecting the results of the numerical relaxation tests. Moreover, this represents an extension of the results shown by Milani et al. (2016) for fractures that are not unidimensional. We have clarified this in the text in Section 4.

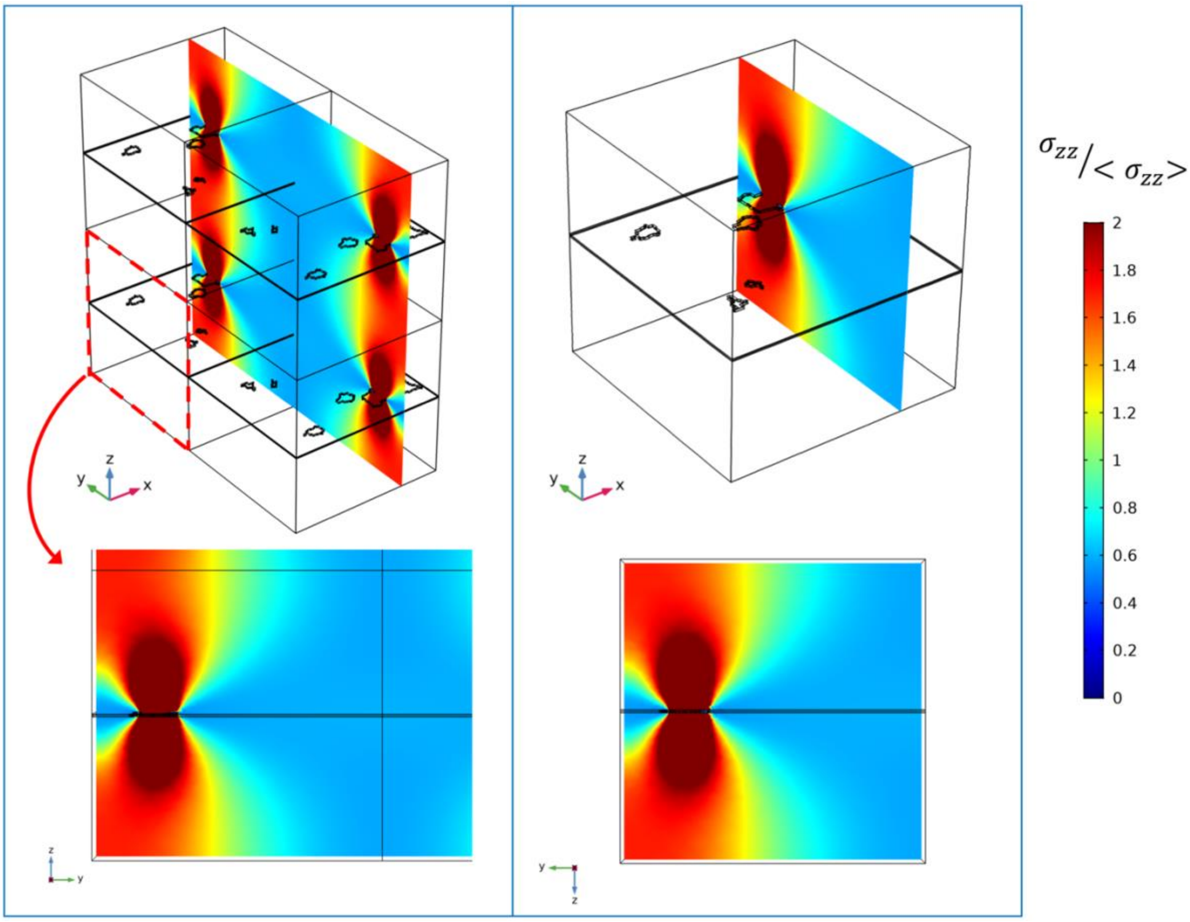

Figure I. Real part of the normalized vertical component of the total stress field for wave propagation normal to the binarized model B of the manuscript under dry condition. For a model consisting of 4 RUCs with a zoom to the left bottom RUC (left) and for a simple RUC (right).

4. (a) *Figure 2: the authors consider the contact area to be rectangular, but the contact area in reality can be circular or some other much complicated shapes. What is the possible effects of the contact area shape on seismic attenuation and dispersion? Please comment.*

(b) In this example, we only use square contact areas, so that the models are as simple as possible to give the basic understanding of the physical processes. Subsequently, we analyze realistic distribution of fracture apertures in Section 3. We were not interested on studying the effects of the shape of contact areas in very simplified models, but rather to study the effect of contact area distribution in more realistic models.

5. (a) *Page 15, Line 16: the authors extended the normal incidence case to the oblique incidence case using the approach of Krzikalla and Müller, but no introduction of this approach is given. For the ease of the readers, please give a brief introduction of this approach.*

(b) The following brief description of the analytical solution from Krizkalla and Müller (2011) has been included in the text: “The analytical solution in based on the relaxed and unrelaxed poroelastic Backus averages of a layered porous medium consisting of a periodic distribution of a stiff background and a soft thin layer. Moreover, they showed that a single relaxation function can be used to link the relaxed and unrelaxed limits of all components of the stiffness matrix. The corresponding frequency dependence is derived from the P-wave modulus predicted by White et al. (1975). We use such soft layer to approximate a fracture of constant thickness having the equivalent properties (μ_{fr}^{eqv}, K_{fr}^{eqv}, $\emptyset_{fr}^{eqv}$ and h_{fr}^{eqv}), obtained as described above."

6. (a) *Some minor errors that need to be corrected, such as:*

Page 2, Line 31: 'have on the fracture stiffness and on the fluid flow trough the fractures', 'trough' should be a typo and should be 'through', please correct.
Page 7, Line 5: 'This occurs because there is not time for fluid pressure', 'not' should be corrected to 'no'.
Figures 5 and 7: 'Correlation lenght' should be corrected to 'Correlation length'.
Figures 6 and 9: Please explain briefly in the figure captions what 'A','B','C', and 'D' in the figures refer to.

(b) All the mentioned minor errors have been corrected.