Response to Supplement:

Due to the addition of Fig. 3 to the manuscript, the numbering of the subsequent figures has been consequently shifted.

(Anonymous Referee #1) p1, L11: Injection wells in operation usually do not work under constant pressure. They operate at specified injection rates. The authors should clarify about the operational mechanism that the constant-pressure injection is feasible. If there is not enough operational insights about this condition, the authors should limit this constant-pressure condition to producing wells.

(Authors) You are right, in most cases operational injection wells work under constant flow rate. However, our investigation aims at contributing to a better understanding of the evaluation and interpretation of transient flow rate curves and pressure diffusion in fractured reservoirs for both producing wells and well tests. Some well tests are performed under a constant pressure condition, they have the advantage of minimizing changes in the wellbore storage coefficient (Earlougher Jr., 1977). Accordingly, the first sentence of the abstract was modified to “This work studies intensively the flow in fractures with finite hydraulic conductivity intersected by a well injecting/producing at constant pressure, either during an injection/production well test or the operation of a production well.”.

(Anonymous Referee #1) p1, L17: ~~of.~~

(Authors) Sentence corrected.

(Anonymous Referee #1) p1, L18: Fracture conductivity should be considered compared to the formation conductivity for flow regime transition. This comparison can be expressed in terms of the dimensionless number F_CD=k_f*w_f/(k_m*x_f), where k_f is the fracture permeability, w_f is the fracture aperture, k_m is the matrix permeability, and x_f is the fracture half length. So, I suggest you replace "fracture conductivity" to "dimensionless fracture conductivity" throughout the manuscript, if suited.

(Authors) We took your suggestion. Throughout the manuscript, “fracture conductivity” was replaced by “dimensionless fracture conductivity”.

(Anonymous Referee #1) p1, L18: Radial?.

(Authors) As you raise the question, it may be expected to be radial flow but it may be elliptical or pseudo-radial as well. In our investigation we did not go deeper to prove it, thus we cannot confirm it.

(Anonymous Referee #1) p1, L28 and L29: ,

(Authors) Corrected.

(Anonymous Referee #1) p2, L42: Production wells are almost always under constant pressure or predefined pressure conditions.

(Authors) You have a point here. To be more precise, the sentence “in some cases” was replaced by “in most cases”.

(Anonymous Referee #1) p2, L63: at constant-pressure boundary condition? Please be clear about what conditions lead to no analytical solution for the pressure diffusion equation.

(Authors) There is no analytical solution for the pressure diffusion equation when considering the case of injecting/producing water to/from a vertical fracture embedded in a matrix by means of a well. Accordingly, in the manuscript the sentence was modified to "Conceivably, one of the main reasons why constant pressure tests is not a more common technique in reservoir engineering arises from the fact that no analytical solutions are available for the pressure diffusion equation when considering injection/production at constant pressure in fractured geologic media (Kutasov and Eppelbaum, 2005)."

(Anonymous Referee #1) p3, L74: ~~has.~~

(authors) Sentence modified.

(Anonymous Referee #1) p3, L89: ~~it.~~

(authors) Sentence modified.

(Anonymous Referee #1) p3, L91: Laplace-transform~~ed.~~

(authors) Word modified.

(Anonymous Referee #1) p3, L92: For injecti~~ng.~~

(authors) Word modified.

(Anonymous Referee #1) p3, L96: ~~Formation.~~

(authors) Word corrected.

(Anonymous Referee #1) p3, L97: Why does the time of termination of bilinear flow matter from industry point of view? Although you may have alluded into that in the following sections, a reader expects to know the main reason behind this analysis ahead of time.

(authors) To make it clearer along the manuscript why the termination of bilinear flow is important from industry's viewpoint, the following sentence was added "From the industry point of view, accurately estimating the termination time of the bilinear flow is relevant since it can be used to assess a minimum value of fracture length when the dimensionless fracture conductivity $T_D \geq 3$ (Cinco-Ley and Samaniego-V., 1981). To underpin the latter, Ortiz R. et al. (2013) demonstrated that for T_D approximately higher than 10 the fracture half-length can be estimated as $x_F = C(D_b t_{ebl})^{1/4}$, where C is a constant, D_b is the bilinear hydraulic diffusivity, and t_{ebl} the termination time of the bilinear flow. Moreover, for lower values of T_D the termination time of the bilinear flow can be used to restrict the minimum fracture length. This information is important to characterize and model a fractured reservoir. Having reliable data on fracture dimensions is critically important for production optimization strategies.".

(Anonymous Referee #1) p4, L114: numerical modeling of fluid flow through porous media.

(Authors) Sentence modified.

(Anonymous Referee #1) p4, L115: Software program.

(Authors) Sentenced modified.

(Anonymous Referee #1) p4, L115: The.

(Authors) Sentence modified.

(Anonymous Referee #1) p4, L116: ~~Fractured,~~ matrix.

(Authors) Corrected.

(Anonymous Referee #1) p5, L135: T_D is the same as F_CD. Please indicate in the definition of this parameter that it is the same as F_CD (Recent Advances in Hydraulic Fracturing, SPE Monograph, Vol 12).

(Authors) As you say, they are the same. Therefore, the following sentence was added "Note that T_D is the same as $\left(k_f b_f\right)_D$ used in Cinco-Ley and Samaniego-V. (1981) or F_{CD} used in Gidley et al. (1990).".

(Anonymous Referee #1) p5, L136: k_F is not defined previously and is not defined in this line.

(Authors) That is right. The definition is now included in the corresponding line.

(Anonymous Referee #1) p5, L144: S.

(Authors) Word corrected.

(Anonymous Referee #1) p5, L149: semi-analytical.

(Authors) Word modified.

(Anonymous Referee #1) p5, L152: Gamma (3/4) is not defined.

(Authors) $\Gamma(3/4)$ represents the gamma function evaluated in $3/4$. This was added in the line after Eq. (10).

(Anonymous Referee #1) p6, L159: Set up.

(Authors) Word modified.

(Anonymous Referee #1) p6, L163: 1 MPa.

(Authors) Ok. It was corrected in the whole manuscript.

(Anonymous Referee #1) p6, L164: 100 kPa.

(Authors) Ok. It was corrected in the whole manuscript.

(Anonymous Referee #1) p6, L169: Replace with multiplication (cross) sign, here and afterwards.

(Authors) Ok. A cross was used in the whole manuscript.

(Anonymous Referee #1) p6, L173: 12000.

(Authors) Number corrected.

(Anonymous Referee #1) p6, L173: ,

(Authors) Corrected.

(Anonymous Referee #1) p6, L176: ~~Comparatively.~~

(Authors) Word changed.

(Anonymous Referee #1) p6, L179: 12929.

(Authors) Number modified.

(Anonymous Referee #1) p6, L181: 1358697.

(Authors) Number modified.

(Anonymous Referee #1) p6, L181: It is not clear at the end of this section that what numerical method has been used for solving the governing equations. Did the authors use finite-element method? Adding the discretized forms of the governing equations here is suggested. Also, to demonstrate the quality and transition of the results through various flow regimes, the authors should show a sample result of pressure contours through domain (e.g., in a 2D cross section) for a specific dimensionless fracture conductivity at various times (e.g., at three different times)

(Authors) In section 2.1 "Governing equations and parameters" (page 4 and line 115 in the manuscript version you read), we had mentioned that the software used is COMSOL Multiphysics®. However, we found that this location was not the most appropriate one. Therefore, we removed it from there and this information was relocated to section 2.4 "Description of the model setup". As mentioned previously in the response letter, in relation to a more detailed description of the numerical model, additional information has been incorporated at the beginning of section 2.4 "Description of the model setup". This information includes the following "We ran the numerical simulations in the Subsurface Flow Module of COMSOL Multiphysics® software program. The space- and time-dependent balance equations, described in section 2.1, together with their initial and boundary conditions are numerically solved in the entire modeling domain employing the finite-element method (FEM) in a weak formulation. The discretization of the partial differential equations (PDEs) results in a large system of sparse linear algebraic equations, which are solved using the linear system solver MUMPS (MUltifrontal Massively Parallel Sparse direct Solver), implemented in the finite element simulation software COMSOL Multiphysics®. Utilizing the Galerkin approach, Lagrange quadratic shape functions have been selected to solve the discretized diffusion equations for the pressure process variable. For the time discretization, a Backward Differentiation Formula (BDF, *implicit method*) of variable order has been chosen.". We also incorporated two important remarks concerning studies of mesh- and boundary condition-independency of the solution in the modeling domain we are most interested in. The first one "That way, boundary condition-independency of the solution has been guaranteed for in the computational subdomain of most interest" (included in the manuscript in the corresponding place), and the second one at the end of section 2.4 "We performed mesh convergence studies refining the mesh, particularly, in the computational subdomain that contains steep hydraulic gradients, until the solution became mesh-independent.".

As already mentioned in the response letter, to show the evolution of isobars we incorporated to the manuscript Figure 3, which displays simulation results of pressure contours through the computational domain in a 2D cross section for the dimensionless fracture conductivities $T_D = 0.3$ and $T_D = 6.3$ for three different times. We chose these values of T_D because they represent two interesting and illustrative scenarios. Furthermore, we introduced the following text in section 3.1 "Propagation of isobars along the fracture and the matrix", just after the definition of P_N, "The isobars behave differently depending on the value of T_D. For cases with low T_D, it is distinguishable that after the termination of bilinear flow, the isobars reveal a tendency of progressing toward an elliptical or pseudo-radial flow while still propagating along the fracture (see, for example, $T_D =$

0.3 in Fig. 3 a, b, c). The lower the value of T_D, the more pronounced this tendency becomes. On the other hand, for high T_D the behavior of the isobars is similar to the formation linear flow beyond the fracture (see $T_D = 6.3$ in Fig. 3 d, e, f). Although the behavior of isobars after the termination of bilinear flow is also highly interesting, this aspect is not addressed in further detail in this work. It remains pending to be studied in a follow-up investigation.".

(Anonymous Referee #1) p7, L183: ~~Computed.~~

(Authors) Word removed.

(Anonymous Referee #1) p7, L183: ,

(Authors) Corrected.

(Anonymous Referee #1) p7, L188: Is equal to.

(Authors) Corrected.

(Anonymous Referee #1) p7, L204: Of.

(Authors) Word added.

(Anonymous Referee #1) p8, L214: Respectively.

(Authors) Word removed.

(Anonymous Referee #1) p8, L222 and L223: ,

(Authors) Corrected.

(Anonymous Referee #1) p8, L224 and L227: Dimensionless.

(Authors) Corrected in the whole manuscript.

(Anonymous Referee #1) p8, L229: What does "acceleration" mean here? The authors must clarify about its meaning in the manuscript.

(Authors) We have considered the classic definition of acceleration, which is the rate of change of velocity with respect to time. The previous statement was added to the manuscript (in the corresponding place) in order to clarify the meaning of acceleration.

(Anonymous Referee #1) p8, L234: Figure 5 contradicts with the statement that the higher the isobar, the sooner it migrates. For instance, consider a specific time (e.g., 10^-8). Isobar 0.66 reaches to x_iD of 0.02 whereas isobar 0.01 reaches to x_iD of 0.2. This shows that isobar 0.01 is faster than isobar 0.66. Please revise the relevant statements to clarify this contradiction.

(Authors) Considering the case you exposed related to Fig. 5 (now Fig. 6 in the new version of the manuscript), the isobar 0.66 reaches the grey line at $x_{iD} = 0.02$ and at $\tau = 5 \cdot 10^{-10}$, and the isobar 0.01 reaches the grey line at $x_{iD} = 0.2$ and at $\tau = 2 \cdot 10^{-9}$. We can see that the isobar 0.66 (in terms of time) reaches the grey line earlier than the isobar 0.01. This means that the isobar 0.06 starts to behave according to the bilinear flow behavior earlier than the isobar 0.01. That is what we mean in the sentence **"**when discussing qualitatively about the early time we notice that the higher the value of the isobar P_N the sooner it migrates proportional to the fourth root of time (Fig. 6)". We do not state that the higher the value of isobar the faster it is, we state that the higher the isobar the sooner it starts to behave according to bilinear flow, that is propagating along the fracture proportional to the fourth root of time. However, after reading the sentence more carefully we find that we word combination “sooner it migrates” may be misleading. Therefore, to make it clearer, we slightly reformulated the sentence into “when discussing qualitatively about the early time we notice that the higher the value of the isobar P_N the sooner it starts behaving proportional to the fourth root of time (Fig. 6)”. We now hope that it is better understandable what we mean.

(Anonymous Referee #1) p8, L244: ,

(Authors) Corrected.

(Anonymous Referee #1) p9, L267: data -> not clear

(Authors) By adding the following sentence to the manuscript we hope to explain better what we mean “The transition and reflection criteria take into account measurements of flow rate in the well and the arrival criterion considers measurements of the migration of isobars P_N along the fracture.”.

(Anonymous Referee #1) p9, L268: ~~the fracture criterion~~

(Authors) Corrected.

(Anonymous Referee #1) p9, L269: ~~we can say that~~

(Authors) Corrected.

(Anonymous Referee #1) p9, L270: ~~transient~~

(Authors) Corrected.

(Anonymous Referee #1) p9, L270: Fracture time needs to be defined here as well.

(Authors) The sentence at hand was changed to “In this work, a fracture criterion is presented for the first time. This criterion quantifies the separation between the migration-type-curves and the migration-fit-curves (see Fig. 4). The time at which this separation occurs is defined as the fracture time.”. We hope that this new sentence clarifies what fracture time is.

(Anonymous Referee #1) p9, L274: of T_D 1.1 down to 0.1.

(Authors) Sentence modified.

(Anonymous Referee #1) p10, L275a: According to Fig. 2, the terms 1/q_wDt and 2.60tau^1/4 should be replaced with log(1/q_wDt) and log(2.60tau^1/4) because Fig. 2 is in log-log plot

(Authors) We followed your recommendation and corrected the equation accordingly. This was also carried out for all concerned cases.

(Anonymous Referee #1) p10, L275b: It is important to note that 1/q_wD versus tau is associated with equation 2.60tau^1/4 in a log-log plot.

(Authors) To clarify that, the following sentence was added “note that $1/q_{wD}$ vs. τ is associated with equation $2.60\tau^{1/4}$ in a log-log plot (bilinear-fit-curve)”.

(Anonymous Referee #1) p10, L276: Not defined in the paper. The term in Fig. 2 is q_wD not q_wDt.

(Authors) As you say, Fig. 2 is a graph showing $1/q_{wD}$ vs. τ for different dimensionless fracture conductivities. The curves describing the behavior of the reciprocal of dimensionless flow rate over time for different dimensionless fracture conductivities, from $T_D = 0.1$ up to $T_D = 100$, are referred to as type-curves (black lines in Fig. 2). We invoke the behavior of q_{wD} for the different type-curves as q_{wDt}. The latter is the term we compare to the master curve (in the case of reflection criterion) or the bilinear-fit-curve (in the case of transition criterion) through the definition of the criteria. To clarify this, the following sentence has been now added to the manuscript "where q_{wDt} represents the dimensionless flow rate q_{wD} of the specific type-curve under study (Fig. 2)".

(Anonymous Referee #1) p10, L280: ~~It~~

(Authors) Sentence corrected.

(Anonymous Referee #1) p10, L280: The mechanism of isobar reflection at the fracture tip should be explained here although authors have cited a reference for that. It is not clear at all how an isobar is assumed reflecting from the fracture tip upon arrival of the isobar to the fracture tip.

(Authors) As we exposed in the response letter, When lower isobars than the isobar under study have already reached the fracture tip, these isobars are partly reflected from the fracture tip toward the well, due to the hydraulic conductivity contrast experienced at the interphase between the fracture tip and the matrix. This hydraulic conductivity structure causes the isobar reflection at the fracture tip back toward the well and the isobar transmission further into the matrix. Thus, the propagation velocity of all isobars decelerates when they leave the fracture tip and start to propagate through the matrix. The previous text was added at the beginning of the section 3.2.2 "Reflection criterion", in order to clarify the explanation of the criterion.

(Anonymous Referee #1) p10, L282: 1/q_wD.inf and 1/q_wDt should be replaced with log(1/q_wD.inf) and log(1/q_wDt) for the same reason explained before.

(Authors) As we explained earlier in the reply to comment (Anonymous Referee #1) p10, L275a, we followed your recommendation and corrected the equation accordingly. This was also carried out for all concerned cases.

(Anonymous Referee #1) p10, L283: at infinity? What is infinity here?

(Authors) When we referred to "infinity", we meant by that "an infinitely long fracture". We reformulated the concerned sentence to "where $q_{wD\infty}$ denotes the dimensionless flow rate of the master curve (Fig. 2), which describes the behavior for the case of an infinitely long fracture.". We hope now that this way the doubt has been removed.

(Anonymous Referee #1) p10, L284: This must be tau_t not tau_r, and different from the parameter in the following parentheses.

(Authors) τ_t represents the *termination time* of the bilinear flow regime when the transition criterion is used to identify the time at which bilinear flow ends. Analogously, τ_r represents the *termination time* when the reflection criterion is utilized to determine the time at which the bilinear flow regime culminates. Consequently, since we are presenting the reflection criterion, we must use τ_r within the parentheses. Please see also the next answer to the next comment.

(Anonymous Referee #1) p10, L284: According to Fig. 7, the high T_D, the shorter the reflection time (tau_r; box symbols) not termination time (tau_t; circle symbols). tau_t is almost constant with change of T_D.

(Authors) The terminology *termination time* is generally involved in every criterion that aims at identifying the end of the bilinear flow regime. This terminology (*termination time*) is a general way to refer to the time at which bilinear flow ceases and it is not attributed to any specific criterion. For instance, the transition time τ_t and reflection time τ_r represent the *termination time* of bilinear flow, but for different ranges of T_D. To avoid confusion to the reader, we changed *termination time* to "transition time" in section 3.2.1, *termination time* to "reflection time" in section 3.2.2, *termination time* to "arrival time" in section 3.2.3, and *termination time* to "fracture time" in section 3.2.4. Additionally, we added the following sentence in the introductory part of section 3.2 "It is noteworthy that the termination time is referred to differently, according to the criterion used to identify the time at which the bilinear flow regime ceases (e.g. transition time τ_t, reflection time τ_r, arrival time τ_a, and fracture time τ_F, introduced in the subsections 3.2.1, 3.2.2, 3.2.3, and 3.2.4, respectively).".

(Anonymous Referee #1) p10, L286: ~~it~~

(Authors) Corrected.

(Anonymous Referee #1) p10, L287: arrival?

(Authors) As we already wrote in the previous answer (p10, L284), we changed here *termination time* to "arrival time".

(Anonymous Referee #1) p10, L288: A criterion is a conditional statement which determines a condition upon satisfaction of the equality in a criterion. Because of that, Eq. 22 in this section must be an inequality such as epsilon>0. Provided that epsilon>0, bilinear flow switches to radial flow. Right?
Please clarify all above criteria (reflection criterion, transition criterion) following this comment.

(Authors) We followed your advice of substituting "=" by "<" in the epsilon definitions in the respective criteria. The following explanation was also added at the end of the introductory part of section 3.2 "Further, criteria generally aim at defining the deviation of curves obtained by numerical simulations from analytical fit curves that correspond to bilinear flow. The deviation is quantified by introducing the quantity ε (see subsections 3.2.1, 3.2.2, and 3.2.4). That is, the numerical results differ from the analytical bilinear fit curves by a value of ε due to the transition to another flow regime. Throughout the manuscript we use, for instance, $\varepsilon = 0.01$ or $\varepsilon = 0.05$ corresponding to 1% and 5% deviation, respectively. This employed notation is intended to express that when a separation between numerical results and fit curves is greater than 1% or 5%, the termination of bilinear flow is evidenced.". We hope now that this contributes to a better understanding of the epsilon definitions in the criteria and the use of epsilon values throughout the manuscript.

(Anonymous Referee #1) p10, L289: ~~it~~

(Authors) Corrected.

(Anonymous Referee #1) p10, L296: ~~it~~

(Authors) corrected.

(Anonymous Referee #1) p10, L298: This is not a criterion.

(Authors) This was explained before in the reply to the comment (Anonymous Referee #1) p10, L288.

(Anonymous Referee #1) p11, L304: transition

(Authors) corrected.

(Anonymous Referee #1) p11, L324: these

(Authors) Modified.

(Anonymous Referee #1) p11, L325: This statement is repetitive. Please avoid repetitive statements.

(Authors) Statement removed.

(Anonymous Referee #1) p11, L329: ,

(Authors) Corrected.

(Anonymous Referee #1) p12, L337: a deceleration? Figs. 3g-j show that the isobars decelerate once they reach the fracture tip.

(Authors) We recognize that the statement used is not clear in English and therefore we reformulated it, hoping that it is now clear what we mean. We rephrased the words concerned and now we write the following "at times shortly before the isobars reach the fracture tip". We went through the manuscript and whenever this previous "confusing phrase" was present we corrected accordingly. In Figs. 3g-j (now Figs. 4g-j in the new version of the manuscript) we refer to the increase of velocity just before the isobars arrives at the fracture tip, what correspond to an acceleration. The latter was demonstrated in the last part of section 3.1 "Propagation of the isobars along the fracture and the matrix".

(Anonymous Referee #1) p12, L338: They do not progress once they arrive at the fracture tip as the x_iD plots versus tau become horizontal at the fracture tip arrival.

(Authors) You have a point here. Once the isobars arrive at the fracture tip, they no longer progress through the matrix over a certain period of time. This was clarified in the manuscript by adding the previous sentence in the concerned line.

(Anonymous Referee #1) p12, L341: This has not been explained well in the manuscript. It is still not clear how isobars reflect from the fracture tip. How about isobar propagation through the porous media surrounding the fracture?

(Authors) The mechanism of isobars reflection was explained in the response letter and in the reply to the comment (Anonymous Referee #1) p10, L280, and it has also been added to the manuscript. Related to isobar propagation through the porous media surrounding the fracture, see Figure 3 added to the manuscript.

(Anonymous Referee #1) p12, L358: ,

(Authors) corrected.

(Anonymous Referee #1) p12, L359: transition

(Authors) corrected.

(Anonymous Referee #1) p12, L362: What epsilon is this one? There are three definitions of epsilon in Eqs. 20-22.

(Authors) When we use the expression ε and $P_N = 0.01$, it means that we are studying the case of the isobar $P_N = 0.01$ and we are considering that for values of ε greater than 0.01, the bilinear flow ends. This has now been clarified throughout the manuscript (for instance at the end of introductory part of section 3.2). In the concerned sentence we are referring to Fig. 7a (now Fig. 8a in the new version of the manuscript), where the four criteria presented in this manuscript play a role. Therefore, this epsilon is related to the relevant criteria exhibiting a value of 0.01 according to their respective definitions (Eq. 20 – 22). It is important to note that only one criterion can be fulfilled at a time. In Fig. 7b (now Fig. 8b in the new version of the manuscript), we consider ε and $P_N = 0.05$, that is we are studying the isobar $P_N = 0.05$ and we are using a value of $\varepsilon = 0.05$ to determine the termination of bilinear flow, for all pertinent criteria. To make it more understandable for the reader, we incorporated the two following clarifications in the introductory part of section 3.2 "It is important to mention that only one criterion can be fulfilled at a time and "It is worth noting that when using the expression ε and $P_N = 0.01$, it means that we are studying the case of the isobar $P_N = 0.01$ and we are considering that for values of ε greater than 0.01, the bilinear flow ends. Note further that when considering ε and $P_N = 0.05$, we are studying the isobar $P_N = 0.05$ and we are using a value of $\varepsilon = 0.05$ to determine the termination of bilinear flow, for all pertinent criteria." .

(Anonymous Referee #1) p12, L363: (Fig. 7)

(Authors) corrected.

(Anonymous Referee #1) p13, L364: Not clear. Explain more with magnifying the area of interest out of Fig. 7 for this statement.

(Authors) In order to clarify this we modified the concerned sentence to "Note that for the case ε and $P_N = 0.01$ and $2 < T_D < 3$ (see Fig. 8a), it is observed that values (non-filled circles) depart from the fit-curve linked to the transition criterion and start converging toward the fit-curve associated with the reflection criterion. A similar behavior is also observed for the case ε and $P_N = 0.05$ and $1.1 < T_D < 2$ (see Fig. 8b). A comprehensive study is required to unravel more precisely what occurs within those ranges of T_D. Based on their work, Ortiz R. et al. (2013) came to the same conclusion.". We now hope that this new statement better explains this striking feature observed in Fig. 7a and Fig. 7b (now Fig. 8a and Fig. 8b in the new version of the manuscript), within the considered ranges. That said, we further hope that magnifying the areas in the graphs, where this feature is exposed, is no longer necessary. We believe that magnifying the area will not give substantial information to the reader.

(Anonymous Referee #1) p13, L364: ~~Deeper~~

(Authors) word changed.

(Anonymous Referee #1) p13, L369: tau_a

(Authors) Added.

(Anonymous Referee #1) p13, L373: his statement must be mentioned at early sections of this manuscript.

(Authors) This statement was relocated in section 3.2.2 "Reflection criterion". Additionally, the previous statement "The transition time τ_t defines the end of bilinear flow when $1/q_w$ is no longer proportional to $t^{1/4}$" was relocated in section 3.2.1 "Transition criterion".

(Anonymous Referee #1) p13, L379: What epsilon is this based on Eqs. 20-22?

(Authors) This was answered before in the reply to the comment (Anonymous Referee #1) p12, L362.

(Anonymous Referee #1) p13, L381: What epsilon is this based on Eqs. 20-22?

(Authors) This was answered before in the reply to the comment (Anonymous Referee #1) p12, L362.

(Anonymous Referee #1) p13, L392: (1 microD)

(Authors) Corrected in the whole manuscript.

(Anonymous Referee #1) p14, L397: of

(Authors) Corrected.

(Anonymous Referee #1) p14, L401: is obtained as

(Authors) Corrected.

(Anonymous Referee #1) p14, L406: these

(Authors) Corrected.

(Anonymous Referee #1) p14, L412: is obtained as

(Authors) Corrected.

(Anonymous Referee #1) p14, L416: ~~documented for the first time…~~

(Authors) Corrected.

(Anonymous Referee #1) p14, L419: is obtained as

(Authors) Corrected.

(Anonymous Referee #1) p15, L424: Not clear verbally.

(Authors) This sentence was modified to "For instance, when calculating explicitly a counterclockwise 5% separation of the synthetic curve (red line) from the bilinear-fit-curve (grey line), an arrival time of 865.5 s and a fracture length of 41.9 m are obtained.". We hope now that the reformulation of the content can express the idea more clearly.

(Anonymous Referee #1) p16, L450: tau_a

(Authors) The dimensional arrival time t_a must be used since it has to be introduced in Eq. (16), which is a dimensional equation.

(Anonymous Referee #1) p16, L453: ~~documented for the first time…~~

(Authors) Corrected.

(Anonymous Referee #1) p17, L483: transition

(Authors) Corrected.

(Anonymous Referee #1) p17, L488: Apparently, they decelerate first for a while and they they start to accelerate. Authors should clarify about this.

(Authors) We recognize that the statement used is not clear in English and may lead to erroneous interpretations. Therefore, we reformulated the statement, hoping that it is now clear what we mean. We now write the following "it is observed that isobars exhibit a peak of acceleration shortly before they arrive at the fracture tip (Figs. 4 and 6)". In this sentence we refer to the peak of acceleration experienced by the isobars shortly before they reach the fracture tip, which is clearly visualized in Fig. 6.

(Anonymous Referee #1) p17, L490 and L491: er

(Authors) Corrected.