Answer to reviewer Zihong Zhang

The fracture network in this study is very simple (only including two flow paths), so the authors should discuss the implication of their results for an in-situ fracture network (e.g. including hundreds of fractures).

In the conclusion a long part has been added in which the issue of the scale is discussed, as far as the validity and reliability of continuum and discrete models in relation to the study scale.

1. ***The authors should rewrite this part in an order of background, scientific gap and aim, and in particular with emphasis on the poor understanding of transport behavior in fracture network under non-Darcian flow conditions. In addition, the authors should summarize and discuss the previous works in a compact way, rather than pasting their abstract here.***

   The Introduction has been totally restructured

   It has been arranged in the following way:

   First part: evidence of non-linearity of flow in fractured aquifers and experiments related

   Second part: modeling tracer test and non fickian behavior in fractured aquifers. ADE and MIM and relative performances. Experiments related

   Third part: introducing the problem of poor understanding of transport behavior in fracture networks under non-Darcian flow. Few studies present up to now. Study of Qian et al (2011) about a single fracture

   Fourth part: as requested, summary of the previous studies of Cherubini et al (2012, 2013) about the influence of non Darcian flow on solute transport in a fracture network

   Fifth part: introducing the new study about analyzing the performances and reliabilities of MIM and ENM.

2. ***Page 14923 line 2: The sentence of 'a delay of solute transport for high flow rates' is confusing to this reviewer. A decreasing of travel time with the increasing injection flow rate means that high flow rates speed up the solute travel***

'In particular a change of slope is evident in correspondence of the injection flow rate equal to 4×10-6 m3s-1 (Cherubini et al., 2013a), which evidences a delay of solute transport for high flow rates.'

The reviewer is right. The above sentence is not clearly expressed. It has been reformulated into: 'In particular a change of slope is evident in correspondence of the injection flow rate equal to 4×10^{-6} m^3s^{-1} (Cherubini et al., 2013a), which means the setting up of a transitional flow regime; the diagram of velocity profile is flattened because of inertial forces prevailing on viscous one, as already showed by Cherubini et al (2013a). The presence of a transitional flow regime leads to a delay on solute transport with respect to the values that can be obtained under the assumption of a linear flow field.'

3. ***Page 14925: The mobile water fraction β varies between 0.41 and 0.95, and there is not obvious relationship between β and the injection flow rate. Even though MIM model can satisfactorily fit the experiments with different injection flow rates, the physical meaning of the best-fit values of β is not clear to this reviewer. The authors should explain why β could randomly change with increasing injection flow rates in the same fracture network, from a physical point of view.***

   Two graph have been added where the two MIM parameters β and α have been shown as a function of velocity.
   A different behaviour of these two coefficients to varying the injection flow rate is observed. At Darcian-like flow conditions the mass exchange coefficient remains constant, whereas the ratio of mobile and immobile area decreases as velocity increases. When nonlinear flow starts to become dominant a different behaviour is observed: α increases in a potential way, whereas β assumes a weakly growing trend as velocity increases with a mean value equal to 0.56 meaning that the 0,56% of the fracture network is involved in advective transport.
   An outlier is evidenced for v/L=0,028 s^{-1}
   In order to better explain this behaviour, the transport time (reciprocal of normalized velocity) and the exchange time (reciprocal of the exchange term) varying the flow rate for the MIM model are showed in Figure 8. In analogous way in Figure 9 is showed the comparison between the mean travel time for the main path and the secondary path varying the injection flow rate for the ENM4 model.

4. ***Page 14926 lines 8-13: More explanation is need for Figures 7 and 8, because I still do not understand why PQ is different between the flow model and ENM models.***

   P*Q* evaluated by the flow test corresponds to the square brackets of Equation (29). For the ENM model three assumptions for the configuration parameters have been made. The configurations are distinguished on the basis of the number of fitting parameters and assumptions made on P_c and P_Q parameters. The first configuration named ENM2 has only two fitting parameters ω_{eq} and αL. In this configuration P_c is imposed equal to P_Q and is derived as the square brackets term in Equation (29).
   The second configuration named ENM3 has three fitting parameters ω_{eq}, α_L and P_c (P_Q). P_c is still equal to P_Q but they are not evaluated by the equation (29) but through the interpretation of BTC curves.
   In the third configuration named ENM4 all four parameters (ω_{eq}, α_L, P_Q, P_C) ($Pc \neq Pq$) are determined through the fitting of BTCs.
   In figure 10 and Figure 11 it is evidenced that P_Q evaluated by transport tests by means of breakthrough curves decreases more rapidly than P_Q evaluated by flow tests (Equation 29), that means that the interpretation by means of BTC curves evidences a more enhanced nonlinear flow behavior than flow tests.

5. ***Page 14926 lines 16-24: Is the secondary path (3-4-5) included in the immobile zone of MIM model? Actually the secondary path (3-4-5) becomes quite active under high injection flow rate, and in my opinion they should be mobile zone.***

The secondary path is indeed in the mobile zone, just for very low flow rates it can be considered almost immobile.

6. ***Page 14927 lines 1-5: In order to better show the nonlinear flow regime, why not plot the relation between flow velocity and water pressure?***
   Another figure has been added that shows water pressure as a function of velocity. A change of slope is evident for v=1,5 x10^{-3} m/s.

7. ***Page 14927 lines 6-18: Why the dispersions obtained from MIM and EMM4 models are so different?***
   The result is coherent with the results found by Qian et al (2011) and Gao et al (2009).
   This may be attributable to the fact that the MIM separates solute spreading into dispersion in mobile region and mobile-immobile mass transfer. The dispersive effect is therefore partially taken into account by the mass transfer between the mobile zone and the immobile zone.

8. ***Figure 6: The observation curves are not necessary and the authors can just leave the measured data points.***
   The figure has been reedited. For the observed data the measured data points have been left, as requested.

Technical corrections:

1. ***Page 14922 line 2: Eq. (24) should be Eq. (23)? Eq. (31) should be Eq. (30)?***
   The reviewer is right. The sentence has been corrected : 'Figure 3 shows the fitting of observed resistance to flow determined by the inverse of Equation (23) and the theoretical resistance to flow (Equation 30).'
2. ***Page 14923 line 13: Eq. (16) should be Eq. (15)?***
   The reviewer is right. *'Equation (16)'* has been corrected into *'Equation (15)'*
3. ***Page 14925 line 18: What does 'soil' mean?***
   'Soil' has been corrected into '*fracture network'* as we are not dealing with a porous medium but a fractured medium
4. ***Page 14926 line 5: why do you refer to 'soil volume'?***
   '*Soil volume'* has been corrected into: '*fracture volume'*
5. ***There may be other mistakes, so the authors should have a carful check during revision***
   The paper has been carefully further revised after the corrections