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Interactive comment on "Bench scale laboratory tests to analyze non-linear flow in fractured media" *by* C. Cherubini et al.

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This paper is an experimental study of turbulent flow in fractured media. Despite a few minor issues, I find the paper well written and the results innovative and suitable to publication. The experimental methodology is particularly relevant to analyze systems whose complexity is hardly measurable and difficult to model. Flow in natural fractures belongs to this category, which makes these experiments a valuable trade-off between simplistic numerical simulations and field complexity.

The authors' conclusion about a potential control of the permeability parameters by the flow tortuosity is a very interesting result and a starting point for further studies. I raise below several issues concerning the methodology that deserve being commented in

the text.

1. The main point that deserves clarification is the experimental boundary conditions. Drilling holes is an easy way to inject or collect water; but it makes the experiment interpretation not straightforward because of the planar geometry of fractures. The authors use numerical simulations to manage this issue, and derive the intrinsic fracture parameters. Although critical to interpret experiment results, these simulations are only shortly described, and several points deserve to be clarified:

- The first issue is about the uncertainty of the flow simulations, which can be due either to the 3D reconstruction, or to the flow variability within each fracture. I suspect the latter to prevail, and to produce quite large uncertainty (or variability) in the af and bf coefficients. Can the authors comment this?

- The second issue is about the inverse procedure and its parameter space. Are the transmissivity parameters constant everywhere, in each fracture, or in each mesh? Is each experiment analyzed independently of the others? Is there a consistency analysis for the whole set of experiments (i.e. same mesh parameters for all the experiments)?

With the description provided in the manuscript, it is difficult to criticize the result given in Table 4.

2. The introduction could be better organized. For instance, the Forchheimer equation is given two pages after being cited first. The authors could also acknowledge gravity effects to cause non-Darcian flow (see for instance, Tenchine and Gouze, AWR 2005.

3. It is not clear in the text if the broken limestone block have been split into pieces in order to measure fracture apertures, or if the measurements have been carried out from the block faces.

Fractures are not supposed to be self-affine rather than pure fractals (Table 2).

4. There are a lot of references about tortuosity in fractures that deserve to be cited (see (Wang, WRR 1984) for instance).

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5. There are a few typos in the manuscript...

In conclusion, I recommend the manuscript for publication with minor revisions.

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