Dear Editor,

First, we would like to thank again for prompt consideration of this manuscript and the related material and for an immediate action. We have considered all the comments of the reviewer, which all refer to the abstract.

The following actions have been made:

- *Wormholes* are defined at the beginning of the abstract.
- A sentence has been added stating that fractures *intersect in a rectangular grid*.
- *inserting* has ben used instead of *putting* as suggested.
- in the last sentence *which* is used instead of *what.*
- We have now used "these fracture *discharge*" instead of "*eject"* (line 15) as the wormholes do not attract flow from the surrounding, but emit flow to the surrounding fracture system.

We once more thank to the reviewer for this valuable comments, which have made the abstract a bit more stand-alone.

Below, please find the new abstract with marked changed or new sentences.

Yours Sincerely,

Wolfgang Dreybrodt & Franci Gabrovšek

Abstract. Reactive transport in porous or fractured media often results in an evolution of highly conductive flow channels, often referred to as wormholes. The most spectacular wormholes are caves in fractured limestone terrains. Here, a model of their early evolution is presented. The modelling domain is a two-dimensional square net consisting of one-dimensional fractures intersecting each other in a rectangular grid. Fractures have given width *b* and length *l,* to each fracture a constant aperture width, *a*, (homogeneous net) or an aperture width taken from a lognormal statistical distribution (heterogeneous net) is assigned. The boundary conditions are constant head *h* at the input driving the water downstream to the output at *h* = 0. Linear dissolution kinetics, controlled by surface kinetics and diffusion are active. First we discuss the simple case of a homogeneous net. Two steps in its evolution are observed. In the first, all fractures are widened evenly and a homogeneous even dissolution front progresses slowly into the aquifer. The second step is triggered by an instability when, due to small perturbations, some of the foremost fractures gain length compared to the neighbouring ones. Then, these fractures discharge flow using the parallel resistances of the net. This way they attract more fresh aggressive water and their propagation is enhanced. Several wormholes (caves) are penetrating into the aquifer but only one reaches the output, whereas the others stop growing due to the redistribution of hydraulic heads

caused by the leading wormhole. The mechanisms governing the evolution of a single wormhole are explored by increasing the aperture width of one selected input fracture by $\Delta a << a$. In this case, only one single wormhole is created and inspection of the flow rates along it reveal the mechanism of flow enhancement in detail. If one uses a heterogeneous net, the first step of evolution is suppressed because of the large perturbations and wormholes start to grow immediately. We have also modelled the case of several competing wormholes in a homogeneous net by inserting appropriate seeds. We find that there is a critical distance between the wormholes. Within this distance only one wormhole survives, whereas there is no interaction between them when they are separated by more than the critical distance. We also answer the question, Why do wormholes in a two-dimensional model exhibit breakthrough times at least one order of magnitude smaller than a one-dimensional model representing the aquifer by one single plane parallel fracture of the same dimensions? Finally, we present several scenarios with non-homogeneous distribution of initial aperture widths. In these, uniform dissolution front does not develop and wormholes start to grow immediately, which is more likely expected in nature.