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Solid Earth Discussions

Interactive comment on "Quantitative experimental monitoring of molecular diffusion in clay with positron emission tomography" *by* Johannes Kulenkampff et al.

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We should state more precisely - and will do so in a revised version of the paper - what we mean with "molecular diffusion". We thank the reviewer for this hint.

The authors greatly appreciate and are aware of the work of the Norwegian group that published PET observations of [C-11]CO2-propagation in tight rock (Ferno et al, GRL 2015) shortly after we finished the literature review for our paper. We use "molecular diffusion" in a stricter sense, when the only driving force for tracer propagation is a concentration gradient, in contrast to Ferno et al, among others, who use the term in the sense of spreading of a source distribution due to a variety of processes, including molecular diffusion in this strict sense, together with mixing and dispersion caused by

other processes, especially by fluid flow in a pressure gradient. Molecular diffusion in our sense is a much slower process than hydrodynamic dispersion, putting different demands on measurement and quantification with PET. Both notions are common use and correct. The particular meaning should be explicitly specified in our paper.

However, in this short paper the main focus is a due processing method of PET-data in order to yield quantitative results, and thus to derive credible diffusion coefficients. In particular, the processing should include a comprehensible scatter correction method, because scatter causes blurring which is indiscernible from a diffusion (or dispersion) profile. We show the impact of this effect and of its correction (Fig. 4). This was not done before, and should evoke awareness on earlier results from ourselves and others.

The mere experimental method was published earlier in "Clay Minerals" (which certainly is not "internal" or "unpublished"), which allows us to limit the "Measurements" section here. We also refrain from an in-depth description of our Monte-Carlo experiments that have been published earlier in Computers & Geosciences. A third (short) conference paper, which describes the parameter derivation, will be prospectively replaced by a recently submitted journal paper, depending on the review process.

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