

Dear Referee #1,

Thank you very much for your time and the detailed review of our manuscript "X-Ray CT analyses, models and numerical simulations – a comparison with common analytical methods of an experimental CO₂ study". Your review will strongly improve this contribution and the quality of the Special Issue "Pore-scale tomography & imaging - applications, techniques and recommended practice", at all.

The topic and content of our manuscript was already presented and discussed in detail during the preliminary special issue organization meeting within the 4th Geo-CT/-I workshop in Mainz. The outcome of these discussions was that this contribution for the Special Issue will be a practical example of CT-applications which should be presented as a study report. Therefore, the intention was to give an introduction for the potential applications and the comparability of μ -CT data with the results from different (petrophysical) standard methods.

Following your suggestions, we will reorganize and optimize the structure of the manuscript to describe the sample material and used methods in more detail. We will also point out more clearly the new generated data from adopted data of previous publications of the authors.

The reorganization of the manuscript will be conducted according to your notes, outlined in points 1-3 in your general remarks.

- 1) Here a more comprehensible documentation of identical sample material used for the different methods will be given, e.g. within a table in the material/method chapter and identical colors/symbols in the figures. This will also been done for the corresponding fluid samples and consequent cross references will be included.

Regarding the exact sample locations we will more clearly refer to the former publications from the authors and resign a detailed annotation in this manuscript. Some data from former studies have also been used in this study; this will be shown more pronounced in the material chapter (table).

Also the exact sample dimension (μ -CT cube, plugs, crushed rock fragments) will be outlined in the material chapter with a table, to give a more comprehensible overview.

Yes, you are right, figures 7 and 8 are in that way not both necessary and we will rearrange this and distinguish a more detailed aspect in fi. 8.

- 2) Thank you for outlining the benefits of a more detailed discussion of the results from surface area determinations by the μ -CT data calculations and the BET measurements.

To the knowledge of the authors, at present, gently crushing sandstone samples for the BET measurements is the gentlest preparation method. Since the topic of this contribution is a comparison of pre- and post-autoclave experiment BET (surface area) data sets, this method is assumed to be the best one.

On some representative separated pieces of the crushed material also FE-SEM analyses were conducted. With this high resolution (nm-scale) imaging technique no cracks on the sample surfaces were detected.

Please be aware, that even careful sawing of the μ -CT cubes from the borehole material is also a rather destructive method, but by the conducted μ -CT scans no cracks were observed for the processed material.

Maybe an alternative way is to scan the crushed samples before BET measurements e.g. with a ROI, to evaluate any micro crack presence. We will keep this in mind for further work.

- 3) Yes, you are right maybe the conclusions regarding the fact of the very good accordance for coarse and medium grained sandstones respectively the comparison of μ -CT data with He-porosity and N₂-permeability outcomes has to be discussed in more detail. We will do this by referring to the sample table and add some appropriate publications/citations for this discussion. We will also include considerations on the influence of grading processes during deposition and of recent cementations on the kind of fluid migration pathways and their potential impact on porosity and permeability determinations. This also includes lithotype variations of the whole sample set which will be more highlighted in the revised version.

This modifications will improve the quality of the discussion and conclusion sections, following your and referee #2 suggestions.

Some further statements on your detail remarks:

- abstract, line 25: please rephrase "even regarding only CT-single scan of the rock samples". What exactly is meant by this phrase?
The meaning is that with just one single CT-scan (one method) a whole range of sample material characteristics can be obtained. - A great advantage of the method.
- Page 2, line 2: provide a translation or rather an explanation of the term "Energiewende"
The target of the intended so-called German "Energiewende" is a change in energy production which is recently based on fossil fuels and nuclear power to renewable energy sources (e.g. wind, solar).
- Page 5, line 8, caption Fig. 3: there are no arrows present in Fig. 3C.
We will add the arrows; it was a bug during formatting.
- Page 5, line 10 + line 12: Fig 5 is referred to earlier in the text as Fig. 4. Please rearrange order of figures or text.
We will do this.
- Page 7, line 23/25: which sense does a mean permeability value have
You are right, we discussed this but by the given overall sample number of < 30, there is no sense at all. We will keep it with the permeability ranges of the different samples.
- Page 8, Fig 5: please significantly increase the text size of units and descriptions of the axes /
Page 10, Fig 6: please significantly increase the text size of units and descriptions of the axes

We will improve this.

- Page 9, lines 17/18: It is unclear, why cm^2 is presented as a unit for surface measure: (1) If it is also specific surface area, the cm^2/g is missing in the unit. In this case the authors should specify, how rock density was calculated or estimated to provide the relation to mass; (2) if it is just a surface value, the authors should at least state the corresponding sample volume and provide a clue, on what basis these values are compared to the specific surface area values yielded by the BET method

This will be discussed in more detail in the chapter methods.

Once again, thank you for your very helpful and professional ideas, comments and suggestions which will strongly improve this contribution.