Reviewer's comments to the paper:

X-ray CT analysis of pore structure in sand
by Toshifumi Mukunoki et al.

This paper nicely fits the scope of this special issue of Solid Earth. I think that overall it is a welcome addition to the technical literature in the field, and its scientific content is quite good. However, in my opinion the current version of this paper requires some major revision, both in terms of the structure and most importantly in terms of the English, the quality of which is at times so poor that the reader doesn't understand the meaning of what the Authors are writing.

In the reviewer's opinion, the contribution under review cannot be published in its present form. The Authors should be encouraged to revise and resubmit their paper, but this will clearly require substantial modifications to the present version, and a new referee review.

General remarks

- Quality of the English: besides many typos and errors (too many to be listed herein: I'll just mention the word "retentively" often – but not always - used instead of "retention"), some statements are really hard to understand, e.g.,

    - *"This behavior indicates that mean pose size caused a capillary pressure head of 30-40 cm is mainly distributed. This behavior should be caused by sands with a value less than the uniform coefficient"*

    - *"Figure 24 concluded that a reasonable WRC can be obtained from saturation degree and distribution of pore diameter concerned the percolation property"*

    - *"it was possible for the porosity and surface area to evaluate the relative standard deviation less than 1%"*)

    - *"… requires that the water/oil flow in the soil quantitatively understand the pore structure"*

    I strongly suggest to the Authors to ask the help of a native English speaker.

- Figures: they are far too many (24!), and some of them are in fact quite useless – e.g., Fig. 1. Some other figures might be combined in one single figure.

- References: they are often cited in large groups, and it is not clear what is the criterion for citing those references rather than others. It would be better to cite fewer references, while making clear(er) what was studied/presented in each of them.

- Sections and subsections: they are far too many. The structure of the paper might be simpler, with fewer subsections.

More specific remarks

- It is stated in the introduction that "*In this paper, authors distinguish pore from pore structure*" (page 3, line 12). Yet, I haven't been able to find in the paper any clear definition neither of the former nor of the latter.

- At the end of the introduction, the Authors write that "*the evaluation of sand will be treated in this paper because it is natural material and has a uniform grain shape*". This is just not true: Toyoura sand grains have not a "uniform" grain shape – whatever this means.

- Image segmentation (section 3.11): The very first step of image binarization is not discussed at all, which is weird – this is a crucial step in the analysis, because it affects all subsequent steps. They have used the image segmentation method developed by Otsu (1979). Are they aware that there are many other segmentation methods? The Authors simply inform the reader that "… *the Toyoura sand tested showed two distinct peaks in this study*", but they don't show any histogram of greylevel for a typical tomographic image – in my opinion they really should, this is mandatory.

- The explanation of the granulometric method (section 3.1.2, figure 5) is not very clear to me. I must confess I got lost – and yet I know a bit of image analysis…

- Also section 3.2 is rather obscure to me, I find Fig. 6 really not clear. The Authors are encouraged to substantially improve this section (and this figure), because this is an important part of their paper.

- In Fig. 9 (grain size distribution of Toyoura sand), the measured data are only two points. How is it possible?

- When commenting Fig. 23, the Authors state that "*the AIM had an overestimation of between 0.03 and 0.055 mm …*". The figure might in fact also indicate that VPM underestimates pore size in that range…

- Conclusions:
  - conclusion #1 is incorrect: the Authors cannot write that "*The size of a voxel affected the results of image analysis*", simply because they have studied only one voxel size. Of course I see what do they mean, and it is of course true that voxel size affects the results of image analysis. Affects, not affected: here is one of the numerous examples where a bad English can be misleading.
  - in conclusion #3, the statement "*This issue revealed that the pore diameter obtained from AIM was not Poiseuille*" deserves more explanations, I believe.
  - conclusion #4: that "…the VPM was the better image analysis method distribution" should be explained better.

Further general remarks

- On how many experiments is the paper based? Just one?

- The Authors are right when stating – at the very end of the paper – that "in future work, it will be necessary to verify the appropriate dimension (i.e. REV) for several kinds of grains". This is a very crucial issue: to what extent the results obtained in this study can be generalized to other granular materials and other resoultions/images? I believe the Authors should further comment on this.