

Interactive comment on “Pore-scale permeability prediction for Newtonian and non-Newtonian fluids” by Philipp Eichheimer et al.

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We thank Stéphane Beaussier for his review. His useful comments helped us to improve our manuscript.

Please find below a point by point response to the comments (comments of the reviewer in black and our response in blue) and the revised version of the manuscript in the supplement.

Sincerely, on behalf of the authors Philipp Eichheimer

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1. I could not find any link to this manuscript version of the LaMEM code in the text. If I am correct it is an open source code and therefore it would be necessary to provide the code as an online supplementary or at least a link to the repository in the manuscript.

We added a link to the open-source repository as well as the revision number, which has been used to reproduce the results of this work. (Page 18, line 4; Page 6, line 1-6)

2. The only issue I have with this manuscript is that I find the information provided on the stencil rescaling a little limited. Given the importance it takes in the manuscript, I would expect a more extended explanation of the method and its implementation in the code. In particular, I believe better discussion on the stability and accuracy of the FD stencil rescaling with references would improve the quality of the manuscript.

Thank you for your comment. In order to provide more information about stencil rescaling we explained the technique in more detail (Page 6, line 12-25) and modified Figure 1+2 for better understanding. Additionally we also provide more information on stencil rescaling as it has been used in earlier works with application to porous media. We added those as references. These studies performed similar benchmarks e.g. flow between two parallel plates to demonstrate the accuracy of their method. To our knowledge, none of these studies explicitly compared the accuracy of the rescaled stencil approach with the standard staggered grid discretization. As we solve a steady-state problem, we do not have to discretize a time derivative and thus consider the stability of the rescaled stencil method.

3. In page 12 line 2 is written: “using power law exponents ranging from 0.5 to 2.” Yet, in figure 6 you only show two values that are tested rather than a range. I would suggest changing the phrasing to “when using 0.5 and 2 as values for the

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power law exponents”.

We rephrased the sentence as suggested. (Page 13, line 3)

4. In Fig. 3, 4 and 5 black lines with a numerical value are shown but not explained in the caption. It took me quite some time to understand it was the curve local slope. Therefore, I suggest adding a sentence in the caption to explicitly tell what these black lines are, or remove them as the figures are already self-explanatory without giving an numerical value for the local slope. In figure 4 you most likely flipped P3 and P4 in the top left corner schematic as according to line 22-23 page 8 P4 is the largest tube and not P3.

For clarity we added a short sentence in the figure captions. Furthermore as shown in figure 4 tube P3 is the largest tube now referring to the correct value at page 9 line 16-17.

5. In figure 5 the box displaying streamlines around the sphere show significant variations of flow velocity perpendicular to the direction of flow (3 orders of magnitude!!). This is very puzzling as I would expect the flow to be relatively homogenous laterally. Is this a rendering mistake or a consequence of boundary conditions? It should either be corrected or explained in the text.

We changed the figure as the rendered streamlines were not representative and thus the figure was perhaps confusing. Figure 5 now shows computed streamlines of the velocity around the spheres. This should make it easier to understand and highlight the flow structure. (Figure 5)

6. In figure A1: rtoI should be added below the x-axis of subfigure a) and b).

We added labels to each x-axis of the corresponding subfigure. (Figure A1)

7. In the authors contribution there is a spelling mistake in the authors initials. OK is written instead of MOK for M. O. Kottwitz.

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Sorry, we changed the authors initials. (Page 21, line 3)

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