Solid Earth Discuss.,
doi:10.5194/se-2016-41-RC1, 2016
© Author(s) 2016. CC-BY 3.0 License.

Solid Earth Discussions
Open Access
EGU

Interactive comment on "Simulating stress-dependent fluid flow in a fractured core sample using real-time X-ray CT data" *by* Tobias Kling et al.

Anonymous Referee #1

Received and published: 22 March 2016

Overall the approach, description and methods presented in the manuscript "Simulating stress-dependent fluid flow in a fractured core samples using real-time X-ray CT data" submitted to Solid Earth Discussions is good. I would recommend the following minor changes to enhance the presentation and discussion of this work.

Page 5, Line 9, if you could add the permeability of the rock matrix in mD that would save a reader from having to think about the conversion. This would be nice elsewhere in the document as well.

Page 6, lines 17 and 18 discussing the conversion of the original voxel dimension to the isotropic voxel size. This is unclear to me. If a 0.5 x 0.5 x 1 mmˆ3 voxel is converted to four (4) 0.25 x 0.25 x 0.25 mmˆ3 voxels there is a loss of volume somewhere I think.

I think the authors mean for this to be 16 voxels, but I am unsure on the conversion technique in general and would like for some more discussion on this process to be added to the text so that it is clear.

Page 6, line 27, 'dense' should be 'density' I think.

The use of the missing attenuation approach in general. Since it's stated on page 7, line 32 that N = 1 for the MA calculations then this isn't really a summation of the the HU in the aperture. The authors acknowledge this later on in the text (Page 8, line 10), but then double back in the conclusions and discussion to say that MA is good for identifying the aperture values. That just doesn't sit very well with me and more clarification on this when describing the results would be preferred. Something like "the modified MA using the primary voxel within the fracture showed good results"

I'm not as convinced as the authors are that conversion to a PEEK core holder would improve results of the simulation so much. But I'm willing to let that slide, as it would reduce CT noise and improve results somewhat.

I think the largest issue with the simulations is the constant matrix permeability. The authors discuss this several times and attempt to correct for this by modifying the matrix permeability +/- one standard deviation of the HU (Fig 7b). I think the variability in the matrix would need to be accounted for by modifying the voxel permeability in the matrix to match high HU voxels with very low (zero) permeability and low HU voxels to higher permeability values. But I have no idea if GeoDict could actually handle this level of complexity. If it could, I think it would benefit your analysis and fit to the experimental data.

Overall, I think the manuscript is well written, identifies some issues with this type of analysis that are worth publishing, and is a good stepping stone to improved measurements and simulations of flow in fractures. I recommend publication with the minor issues listed above corrected to the best ability of the authors.

Thank you!

Interactive comment on Solid Earth Discuss., doi:10.5194/se-2016-41, 2016.