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# *Interactive comment on* "Development of a numerical workflow based on $\mu$-CT-imaging for the determination of capillary pressure-saturation-specific interfacial area relationship in two-phase flow pore-scale porous media systems: A case study on Heletz sandstone" *by* Aaron Peche et al.

**Anonymous Referee #2**

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Manuscript "Development of a numerical workflow based on $\mu$-CT-imaging for the determination of capillary pressure-saturation-specific interfacial area relationship in two-phase flow pore-scale porous media systems: A case study on Heletz sandstone" by Peche et al. presents a FEM-based methodology for quantification of interfacial area between two immiscible fluids in complex $\mu$-CT obtained geometries in a transient saturation-dependent regime, and implemented for a case of Heletz sandstone.



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Discussion paper

Conducted modeling of incompressible Navier-Stokes equations in the laminar regime in a pore-scale has been successfully verified. Complexity of the domains used for the modeling gradually increased from idealized single pore geometry to the complex $\mu$-CT-based pore network, defined from a porosity-based REV analysis. Manuscript is clearly written and well organized. Based on presented and discussed modern imaging and computational achievements, proposed methodology has a potential to significantly improve our understanding of the dynamics of a coupled two-phase fluid system with a sharp interface at a micro-scale, followed by a proper upscaling to a macro-scale. Presented methodology would attract an interest of the scientific and industrial communities. The following minor corrections are suggested:

General comments:

I suggest to avoid the multiple abbreviations (PPF, PSD, etc.) explained in the list of abbreviations in the end of manuscript and to leave only the commonly-accepted ones (REV, FEM, etc.)

p.4 bottom: pls change a reference to Comsol (2014) manual to the reference to some handbook or to some other theoretical source.

p6, Model validation: I suggest specifying in the first paragraph that three kinds of the model validations were conducted. Then to specify that first validation addresses single-phase Poiseuille flow, why two others deal with two-phase flow.

p.6, Fig.2: Colorbar addressing the depicted modeled velocities is missing.

p.9 & p.11: Pls insert a sentence with more detailed explanation of REV.

p.15: I suggest changing the title of subsection 6.5 to "Final model setup"

Miscellaneous:

p.5, line 10 "equation is implemented according to equations 3 and 4 " : pls change the wording

p.12, line 14: Pls consider the following substitution: "Model domains are called ->PRESENT? an idealized pore, idealized pore network, $\mu$-CT-based pore and $\mu$-CT-based pore network.", following the increasing level of complexity.

p.15, line 6: a_wn is specified for the first time in this section, so that I suggest calling it by its name.

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