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Supplementary Material

THE INFLUENCE OF DENSITY DRIVEN MIXING MECHANISMS ON UREOLYSIS INDUCED CARBONATE PRECIPITATION

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Appendix A

Workflow of image processing and analysis:

The workflow for image processing and analysis is presented in **Figure A1** on the next page. Note that the absolute value of the global auto threshold evolves with the sample but the same point relative to the material interface (See **Fig. A1** inset graph, yellow line) does not. The yellow line in this case signifies the boundary that was used between the pore space and solid phases (quartz sand and $CaCO_3$).

The workflow for preparation and running of the fluid mixing model in OpenFOAM is presented in **Figure A2** with model parameters and settings presented in **Table A1**.

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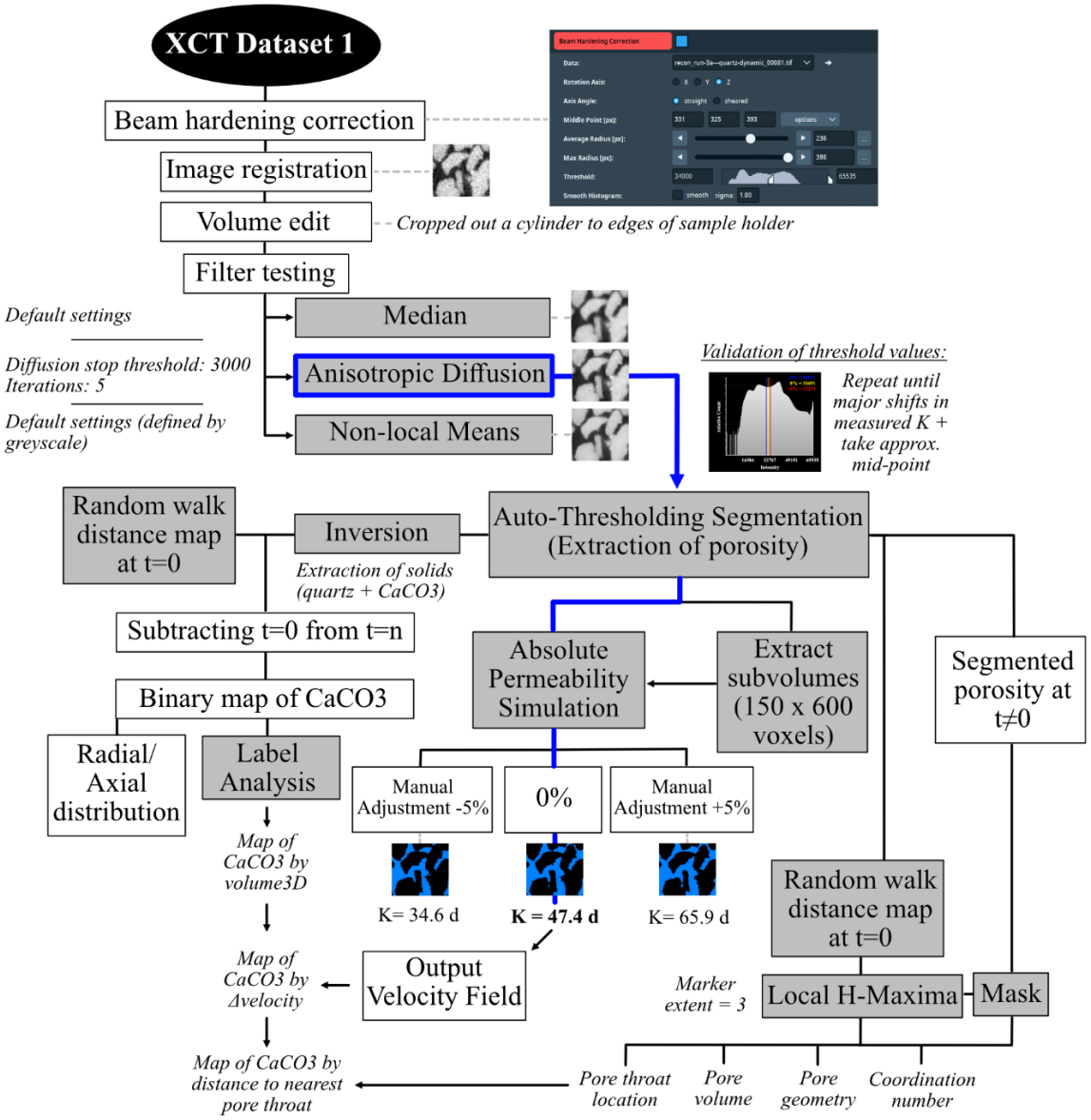

Figure A1: Image processing and analysis workflow.

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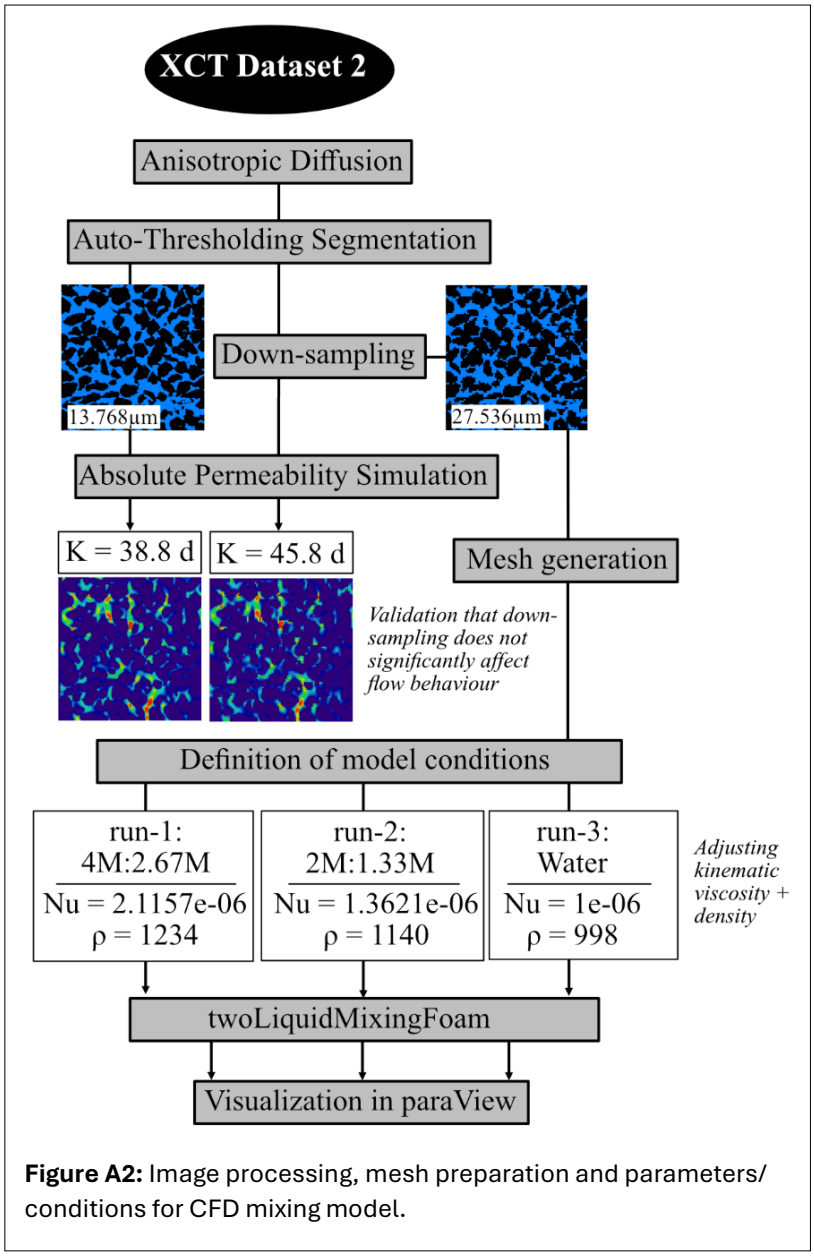

Figure A2: Image processing, mesh preparation and parameters/ conditions for CFD mixing model.

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Table A1: OpenFOAM Mixing Model Parameters and Settings

Parameter	Description	Value
Solver	Name of the solver used	twoLiquidMixingFoam
Time discretization	Temporal scheme for time-stepping	Euler
Gradient scheme	Scheme for gradient calculations	Gauss linear
Divergence scheme	- div(rhoPhi,U)	Gauss linear
	- div(phi,alpha)	Gauss vanLeer
	- div(phi,k)	Gauss limitedLinear 1
	- div(((rho*nuEff)*dev2(T(grad(U)))))	Gauss linear
Laplacian scheme	Scheme for laplacian calculations	Gauss linear corrected
Interpolation scheme	Scheme for interpolating values	linear
Surface-normal gradient scheme	Surface-normal gradient calculation method	corrected
Solver algorithm	Algorithm used for solving equations	PIMPLE
Convergence criterion	Residual tolerance for p_rgh (pressure)	Tolerance: 1e-7, relTol: 0.01
	Residual tolerance for U (velocity)	Tolerance: 1e-7, relTol: 0.1
Solver for pressure (p_rgh)	Solver type for pressure equations	GAMG
Solver for velocity (U)	Solver type for velocity equations	smoothSolver
Smoother	Type of smoother used	GaussSeidel
Number of correctors	Number of PIMPLE correctors	2
Number of outer correctors	Number of outer correctors for coupled solvers	1
Simulation start time	Starting time of the simulation	0
Simulation end time	Ending time of the simulation	5*
Time step (deltaT)	Time step size for the simulation	0.0001
Write interval	Frequency of data output	0.1
Maximum Courant number	Maximum allowed Courant number	1
Maximum Alpha Courant number	Maximum allowed Courant number for alpha phase	0.5
Viscosity of enzyme solution (Pa·s)	Dynamic viscosity of the fluid	1.00E-06
Density of enzyme solution (kg/m^3)	Fluid density	998
Viscosity of cementing solution (Pa·s)	Run 1 - 4M urea, 2.67M $CaCl_2$	2.12E-06
	Run 2 - 2M urea, 1.33M $CaCl_2$	1.36E-06
	Run 3 - water	1.00E-06
Density of cementing solution (kg/m^3)	Run 1 - 4M urea, 2.67M $CaCl_2$	1234
	Run 2 - 2M urea, 1.33M $CaCl_2$	1140
	Run 3 - water	998
Turbulence model	Turbulence model used	laminar
Gravitational acceleration (m/s^2)	Magnitude and direction of gravity	-9.81
***Due to limitation on max job size by the supercomputer cluster - the simulation was run in 5 second interval batches.**		

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