Unconventional Resources Research

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PENNSTATE

Shale Gas Innovation Workshop

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Some Key Questions/Objectives

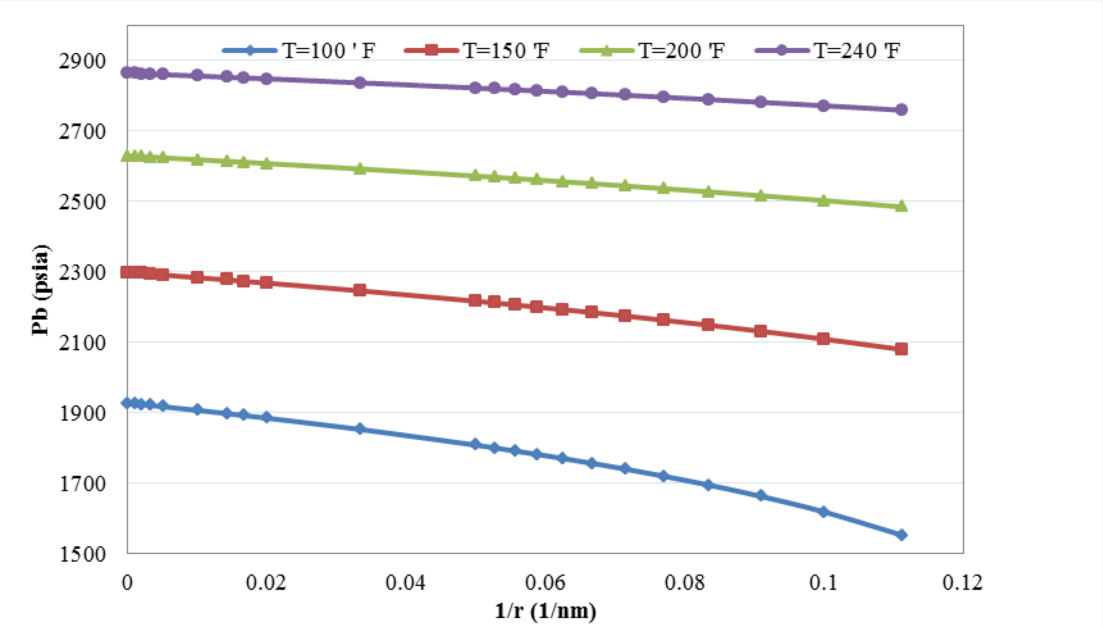
- What is the state of the fluid in nano-sized pores and how does it flow?
- Can we accurately incorporate hydraulic and natural fractures in simulation of tight rocks so that better estimates of flow rates can be made?
- What is the accuracy of decline curve analysis for tight rocks?

New Research Consortium

- We have initiated a new JIP on unconventional gas resources (Chevron and Hess are members)
- Focus is on gas and oil shales, and other tight rocks
- Dr. Luis Ayala and I are co-directors

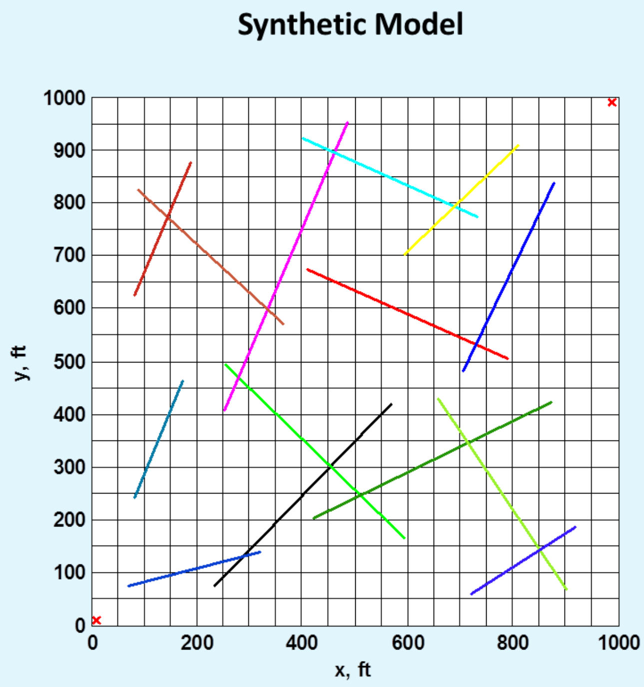
Example: Effect of Nanopores on Phase Behavior

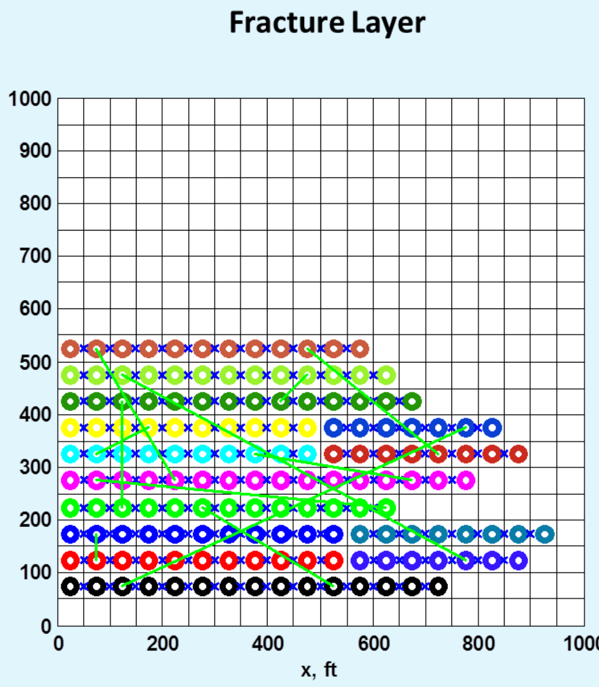
- Capillary pressure is large when pore sizes are small
- Interfacial tension changes the Gibbs free energy and therefore the phase behavior



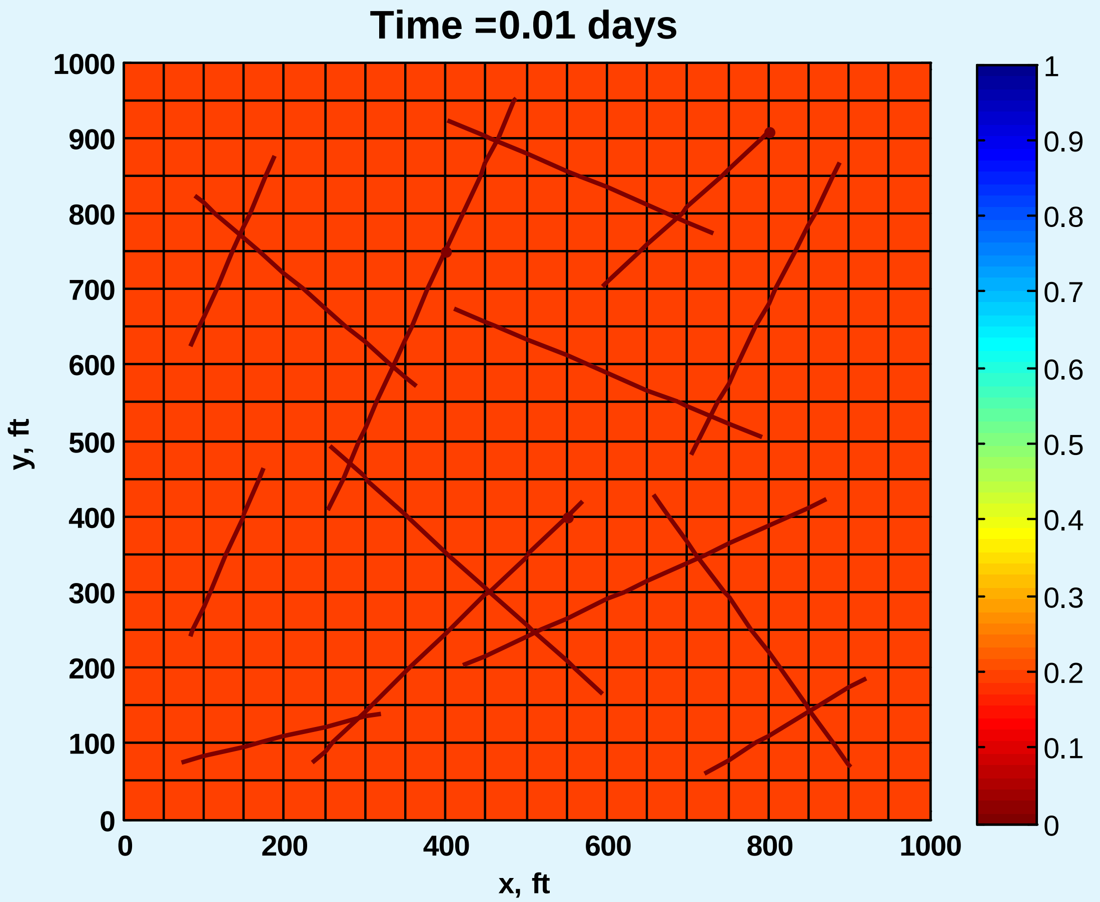
Example: Inclusion of Fractures in Simulation

- Fractures provide fast connections for production
- Fractures and matrix equations are decoupled, increasing accuracy and computational speed



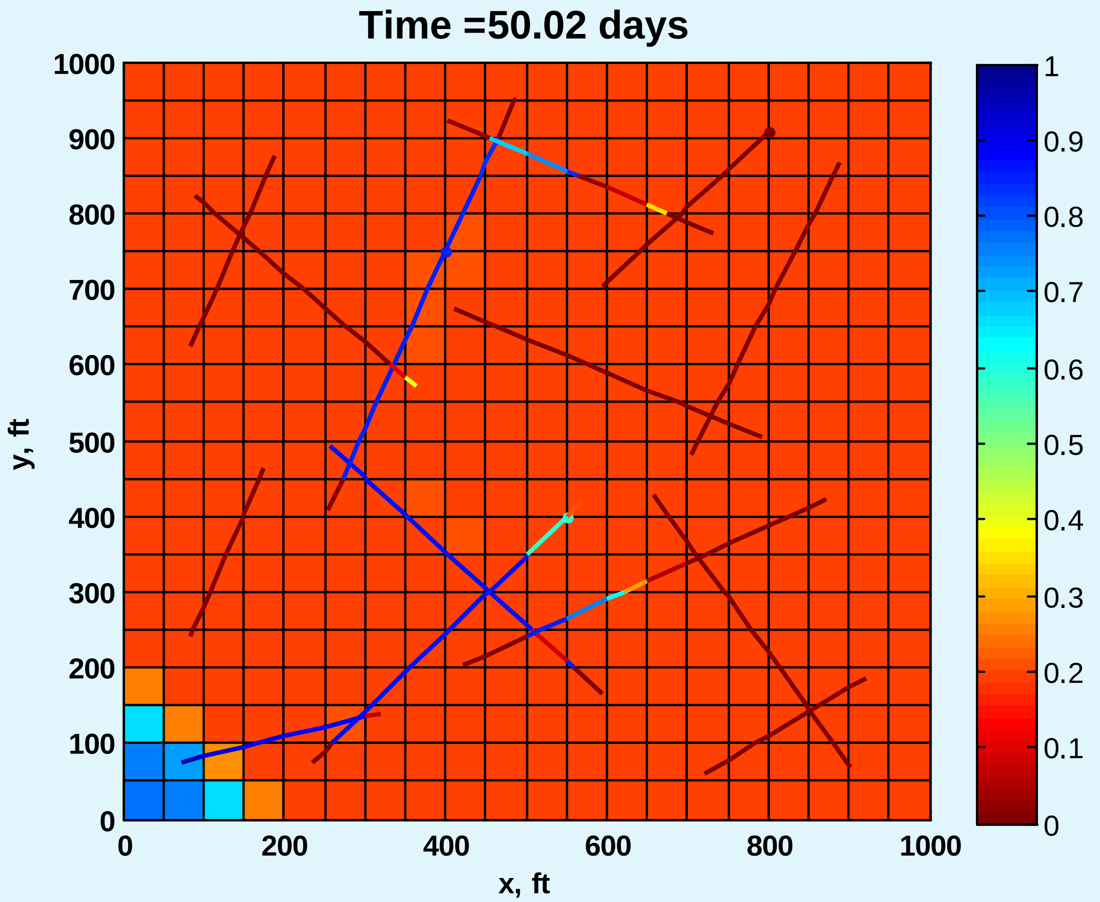


2D MODEL / WATER-FLOOD



Water saturation

2D MODEL / WATER-FLOOD



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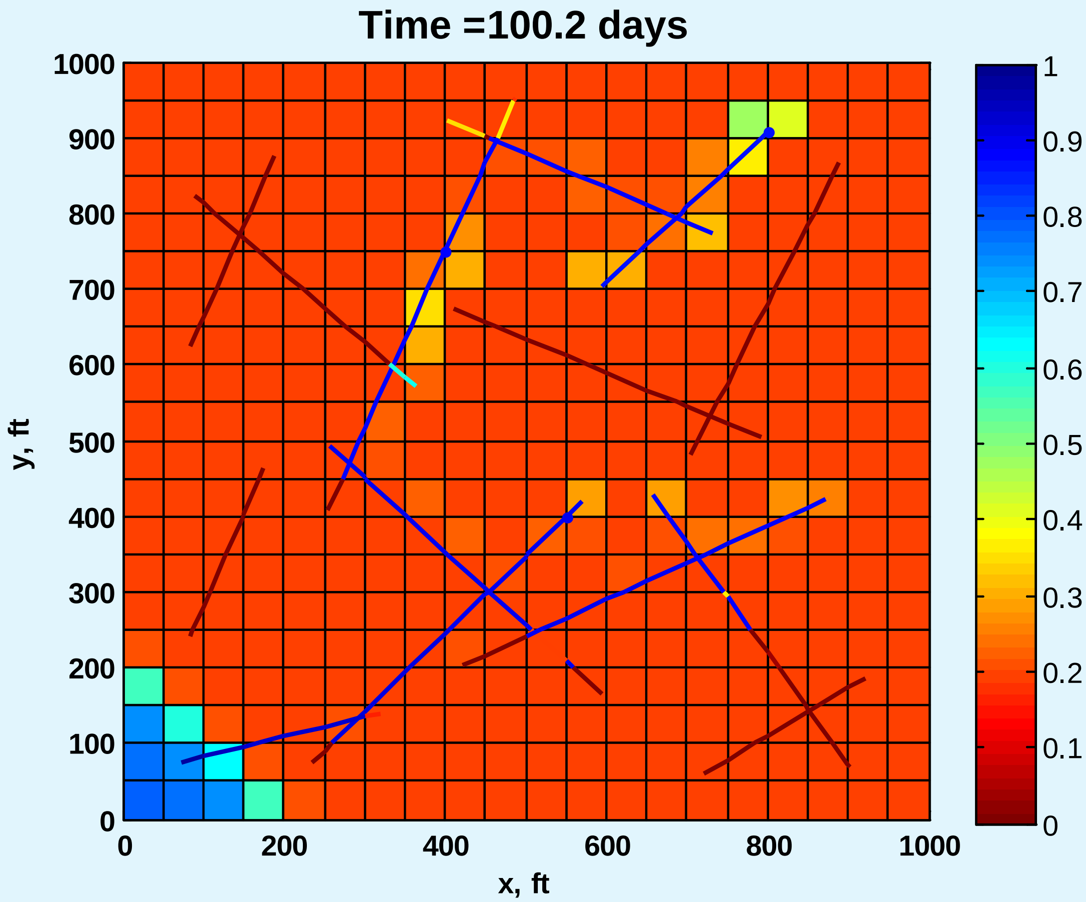

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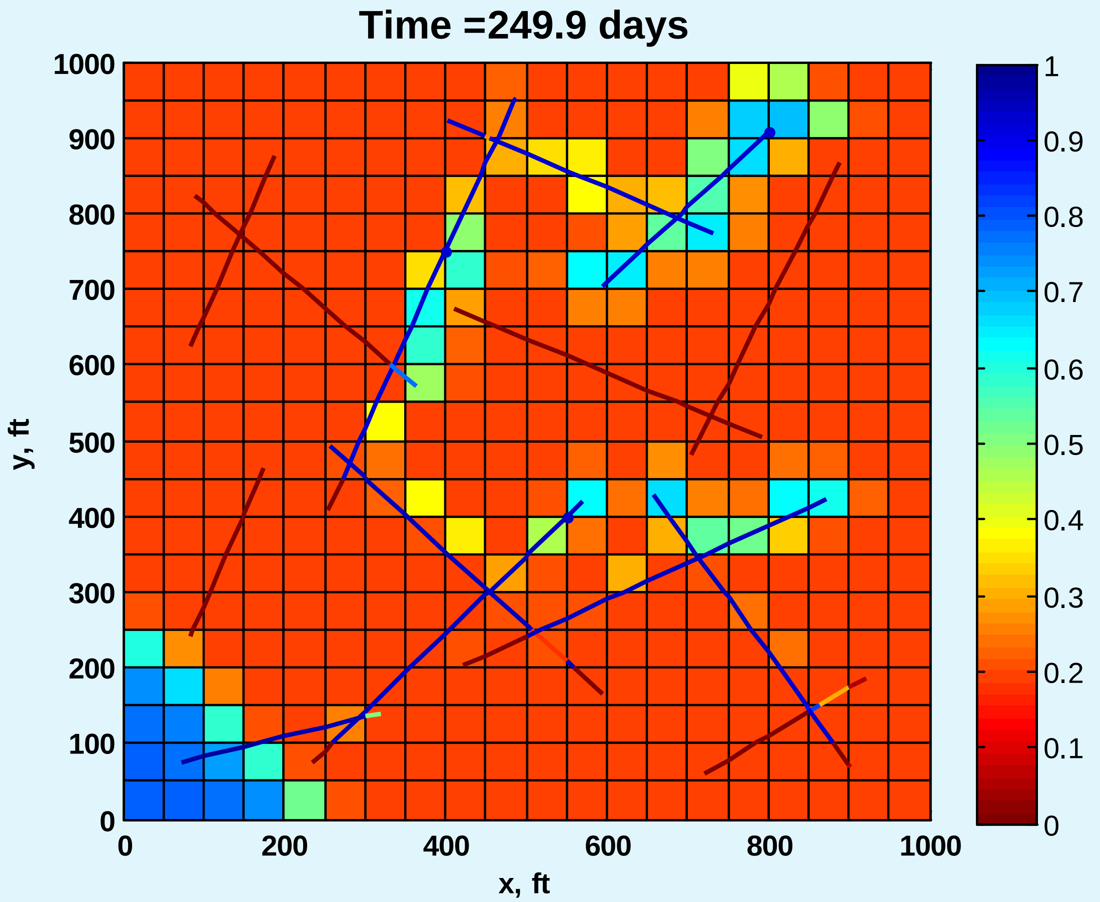

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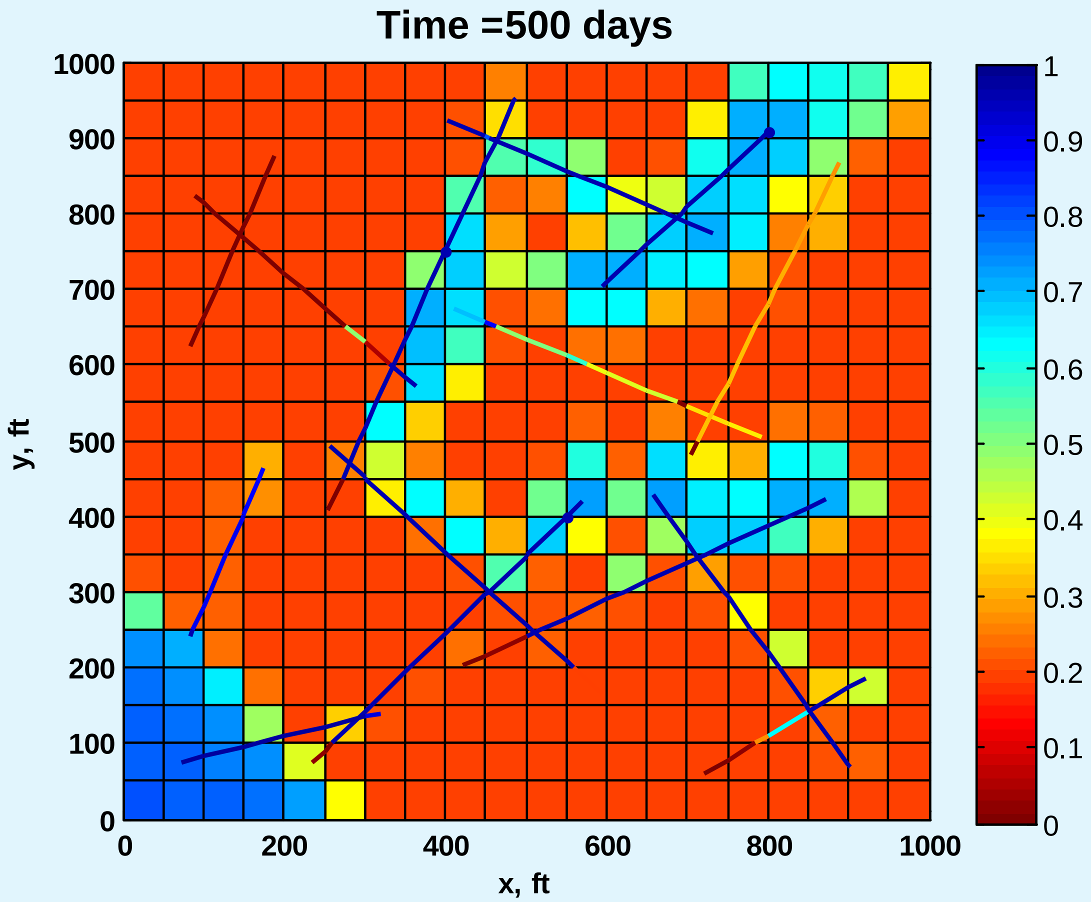

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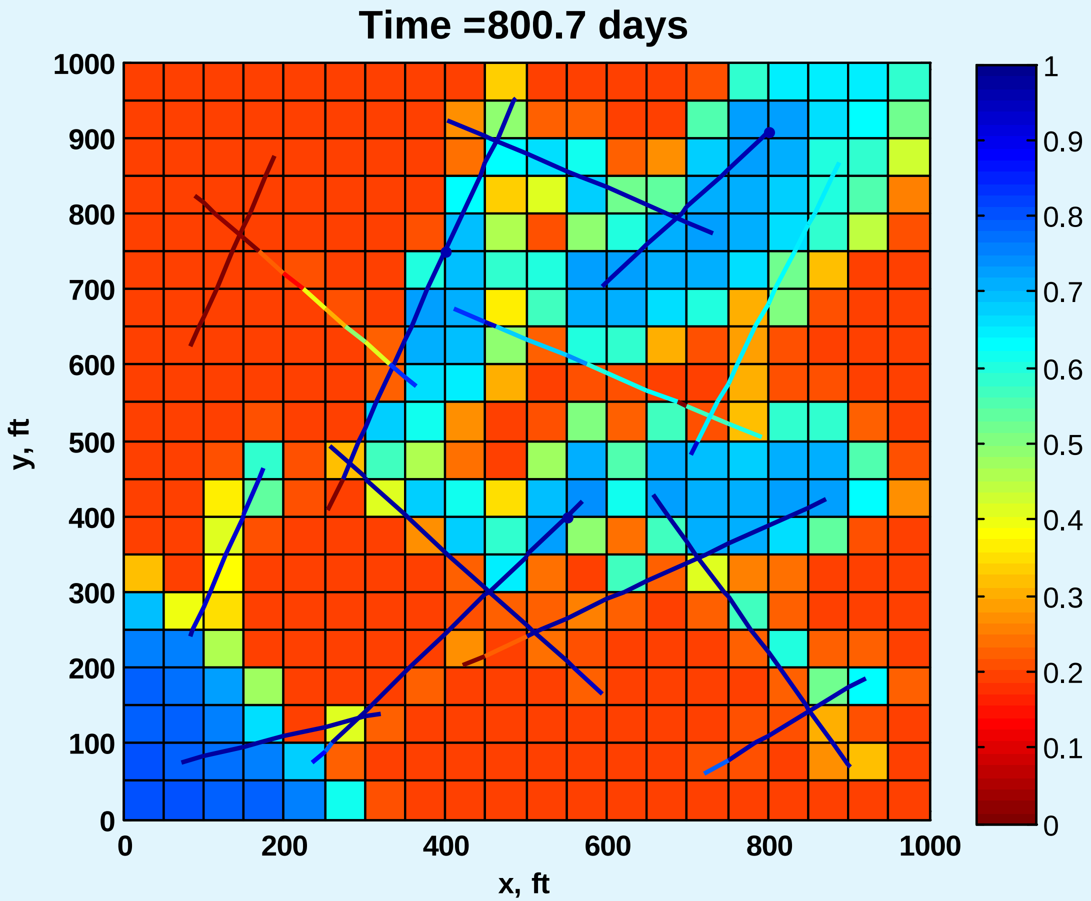

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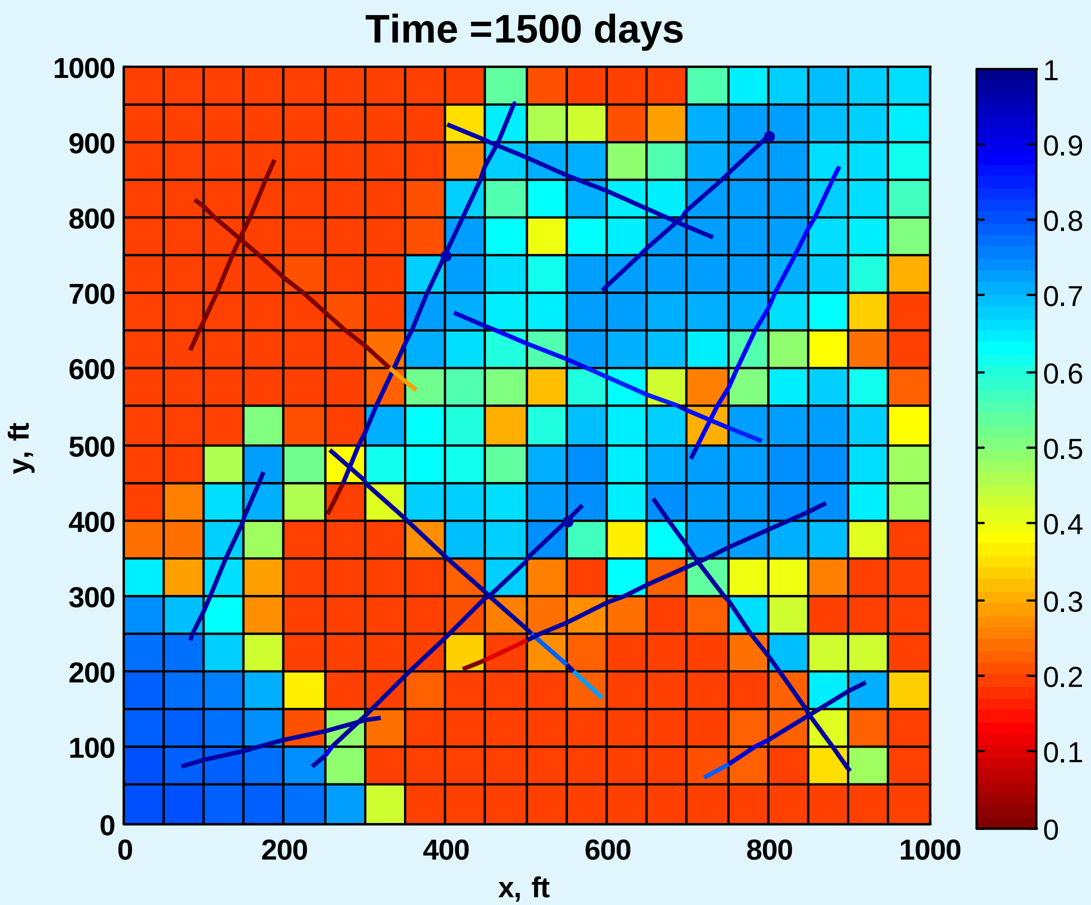

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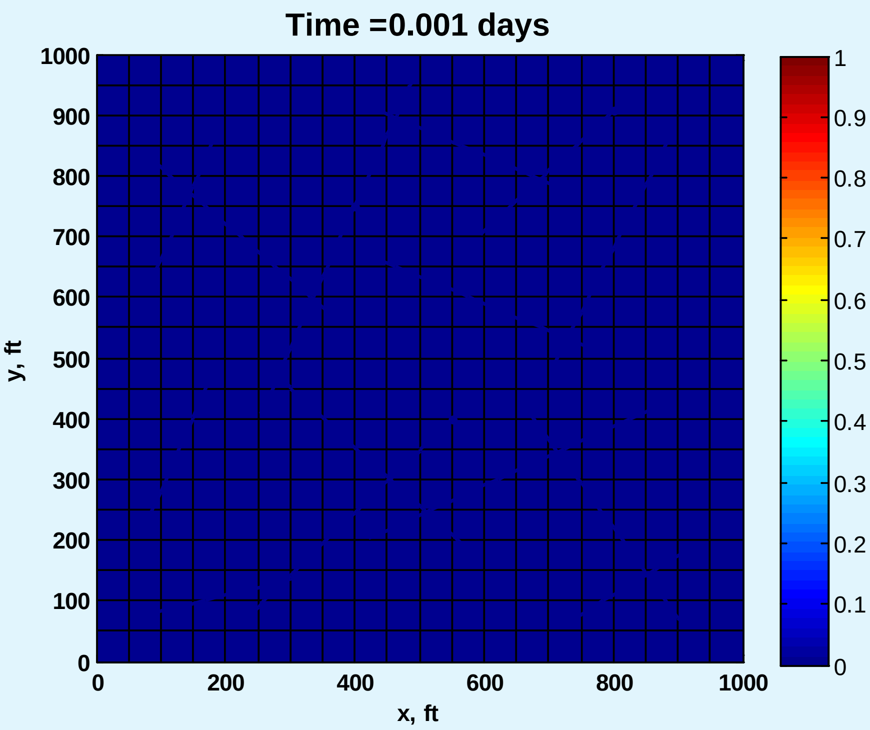
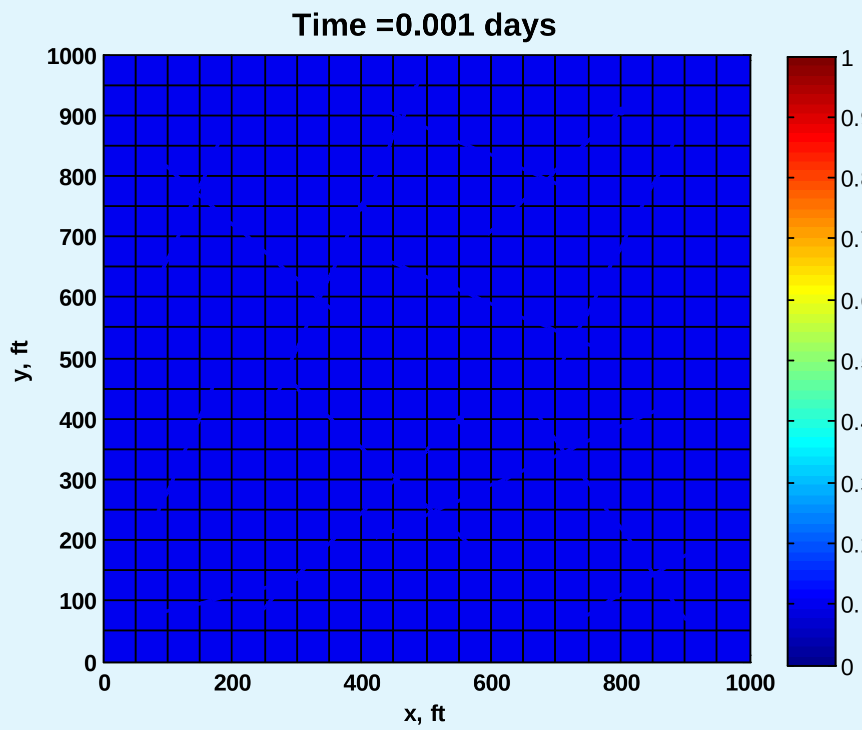


CO2 mole fraction in oil



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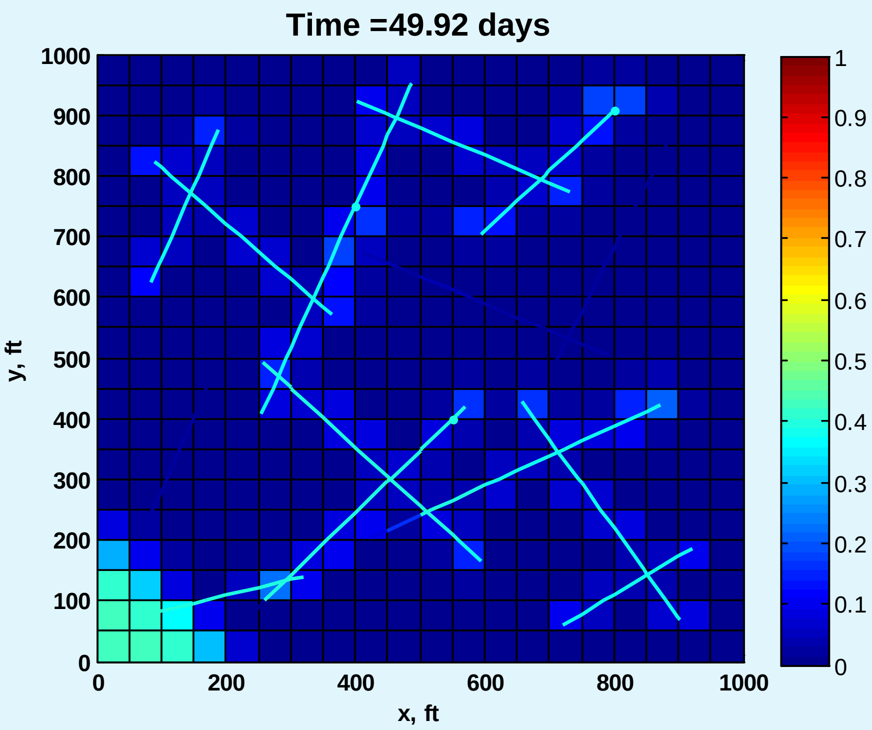

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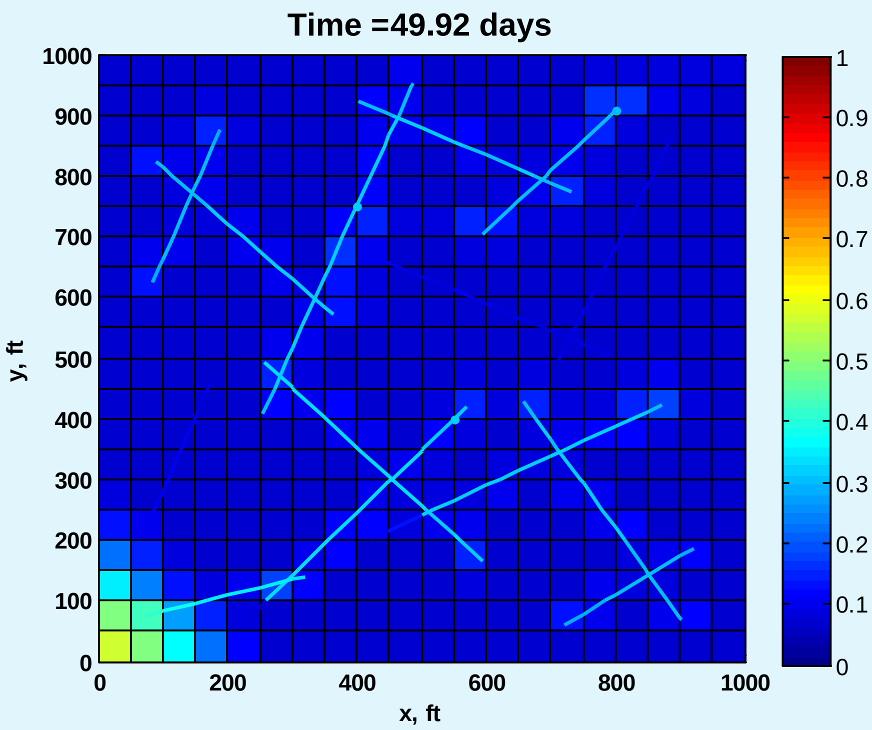

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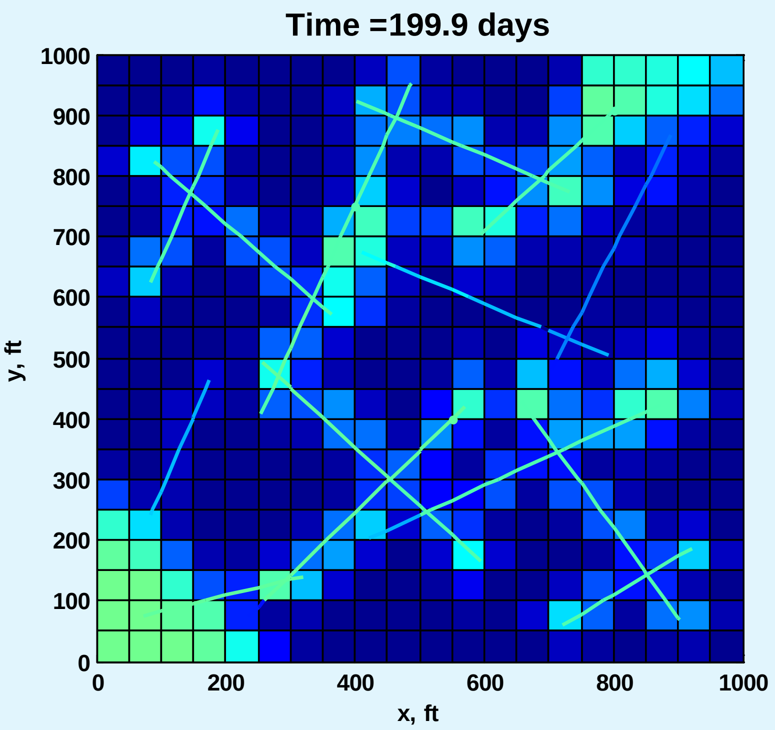

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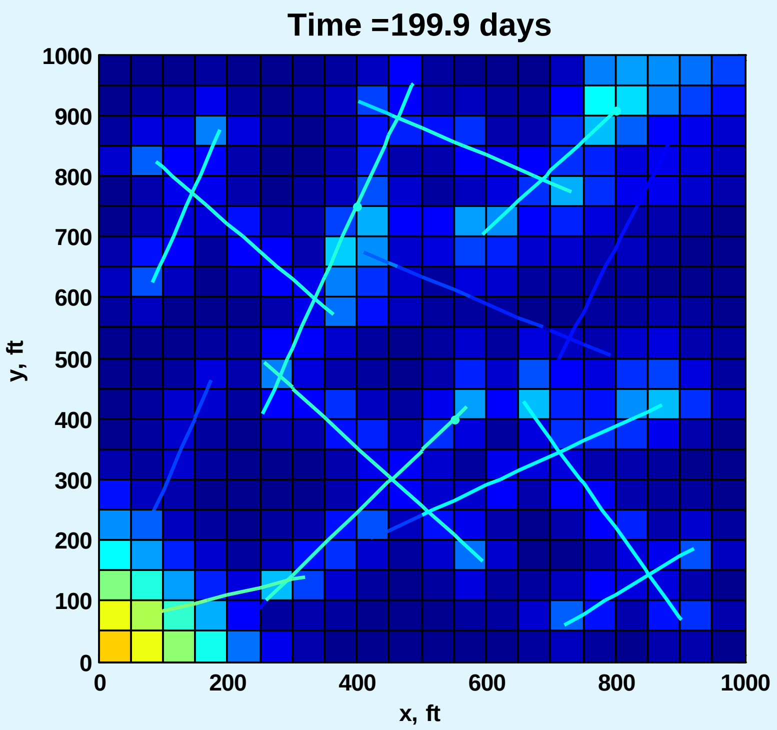

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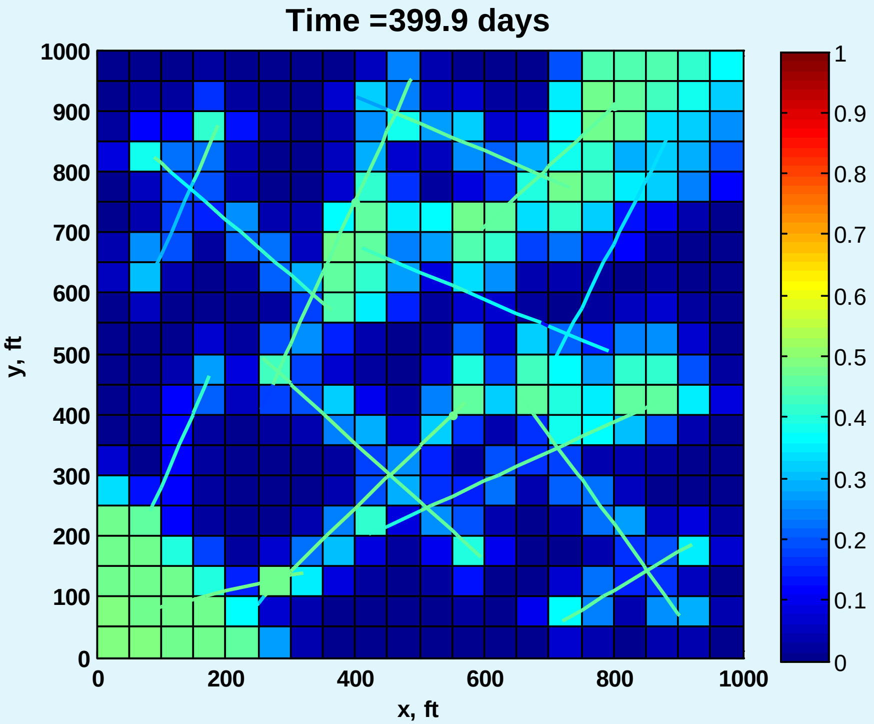

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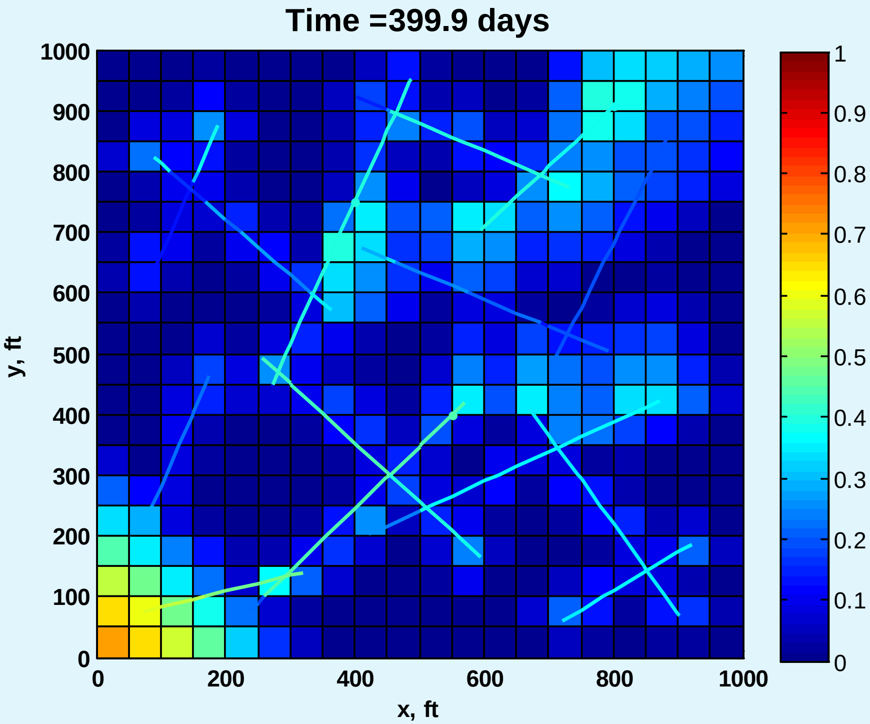

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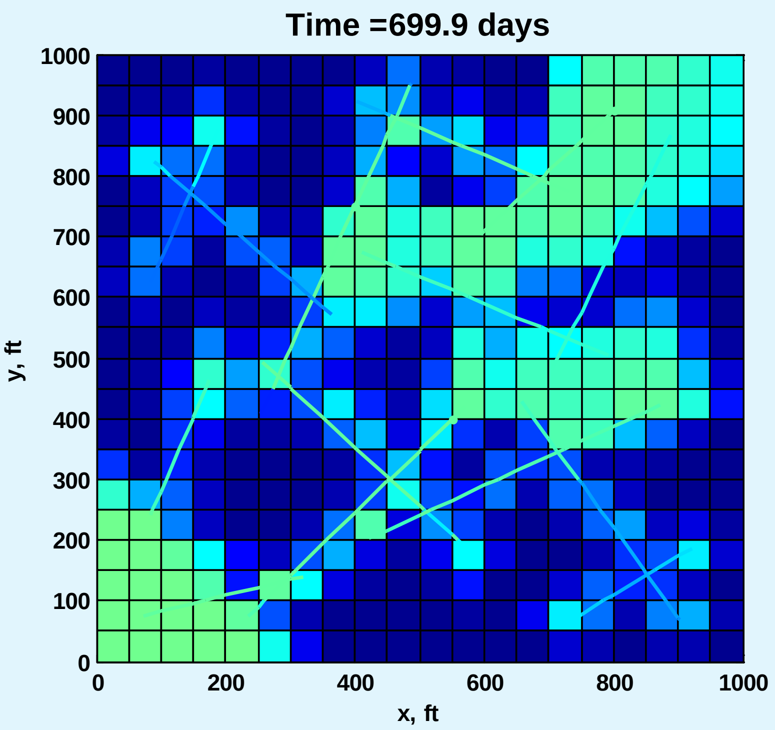

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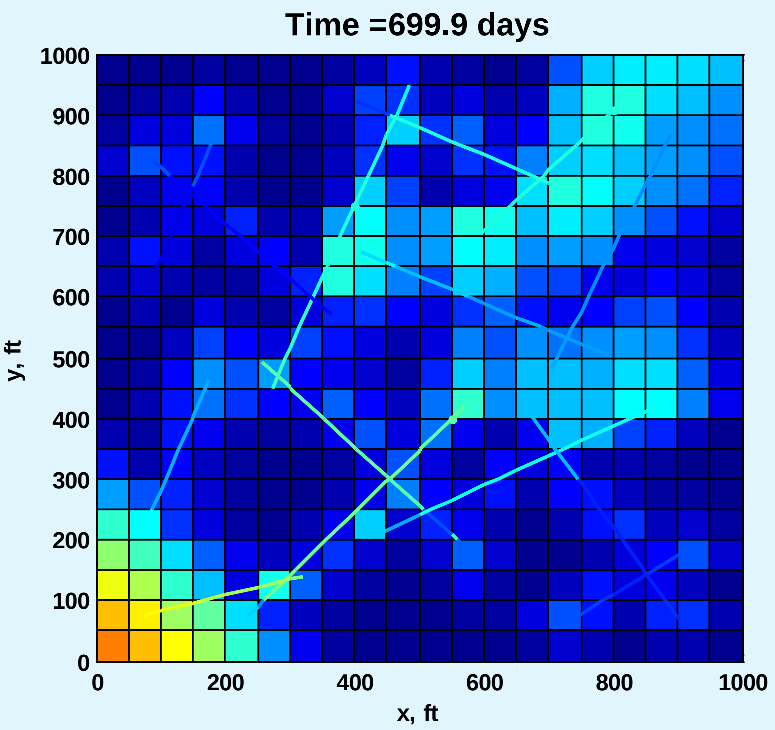

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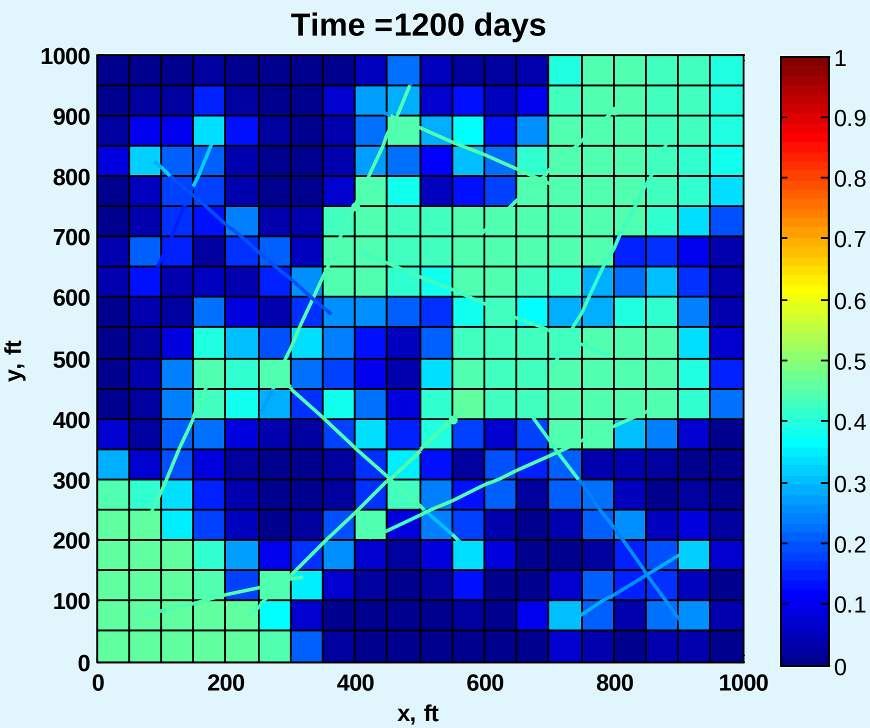

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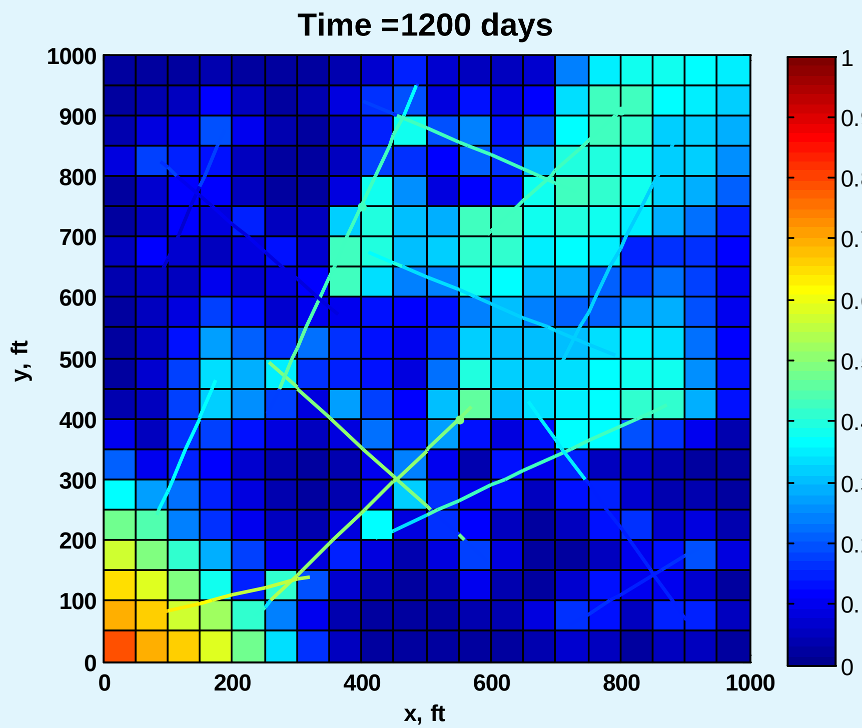

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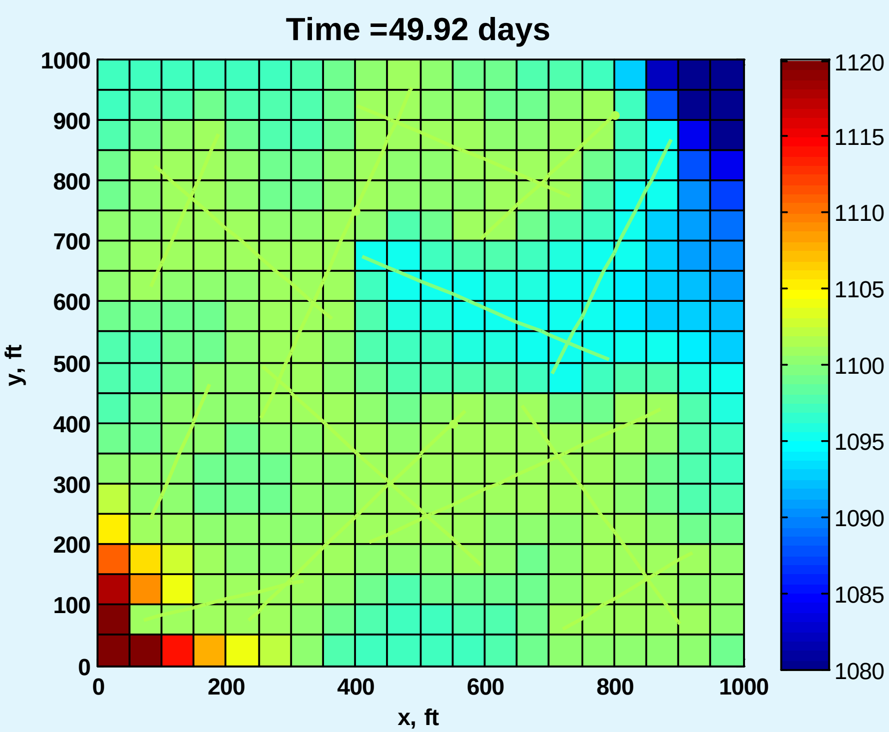

Pressure,
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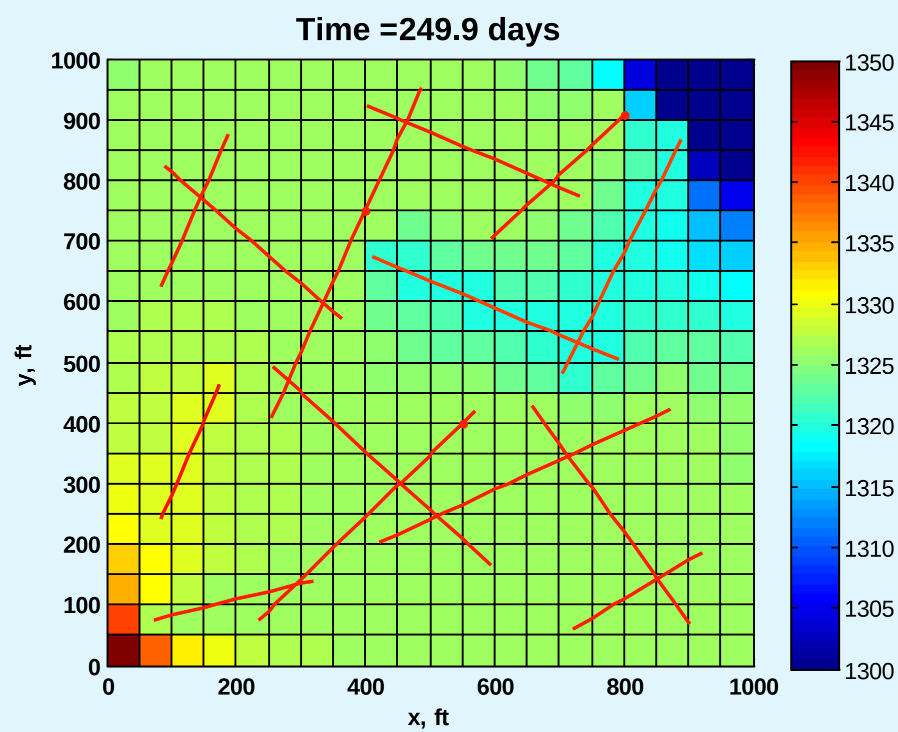

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THANK YOU