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Title: Modeling radionuclide migration from underground nuclear explosions

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Modeling radionuclide migration from underground nuclear explosions

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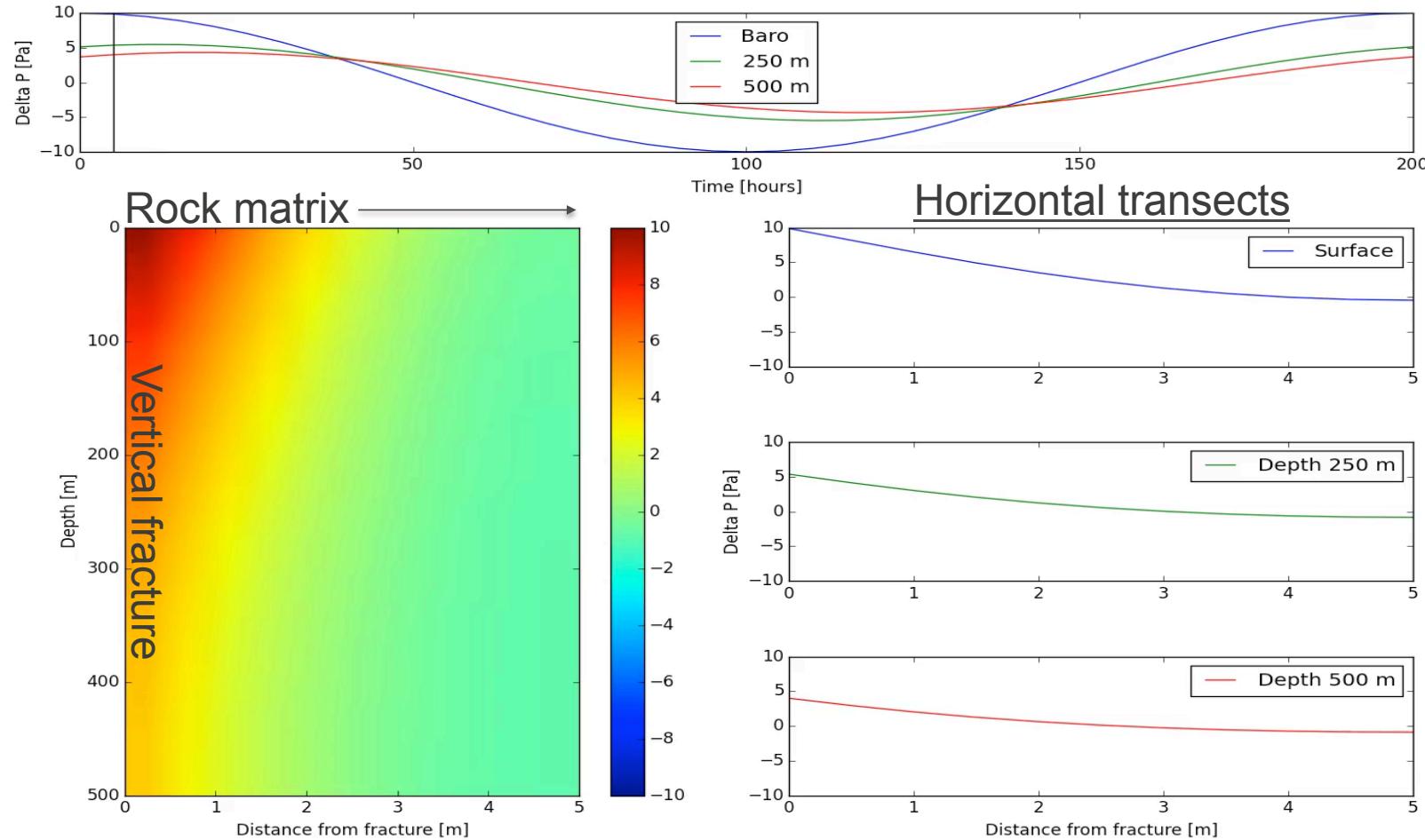
Dale Anderson

March 8, 2017

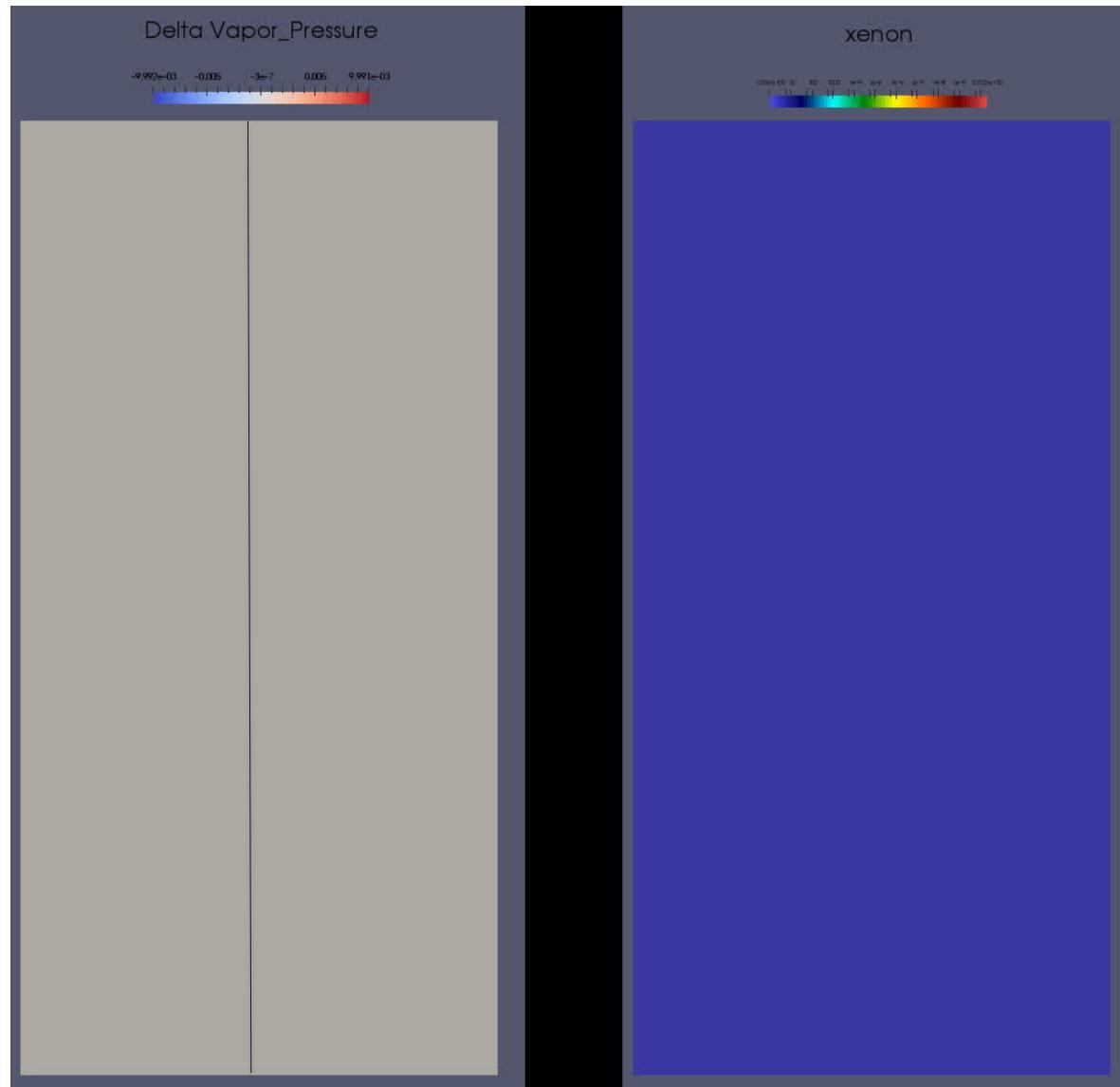


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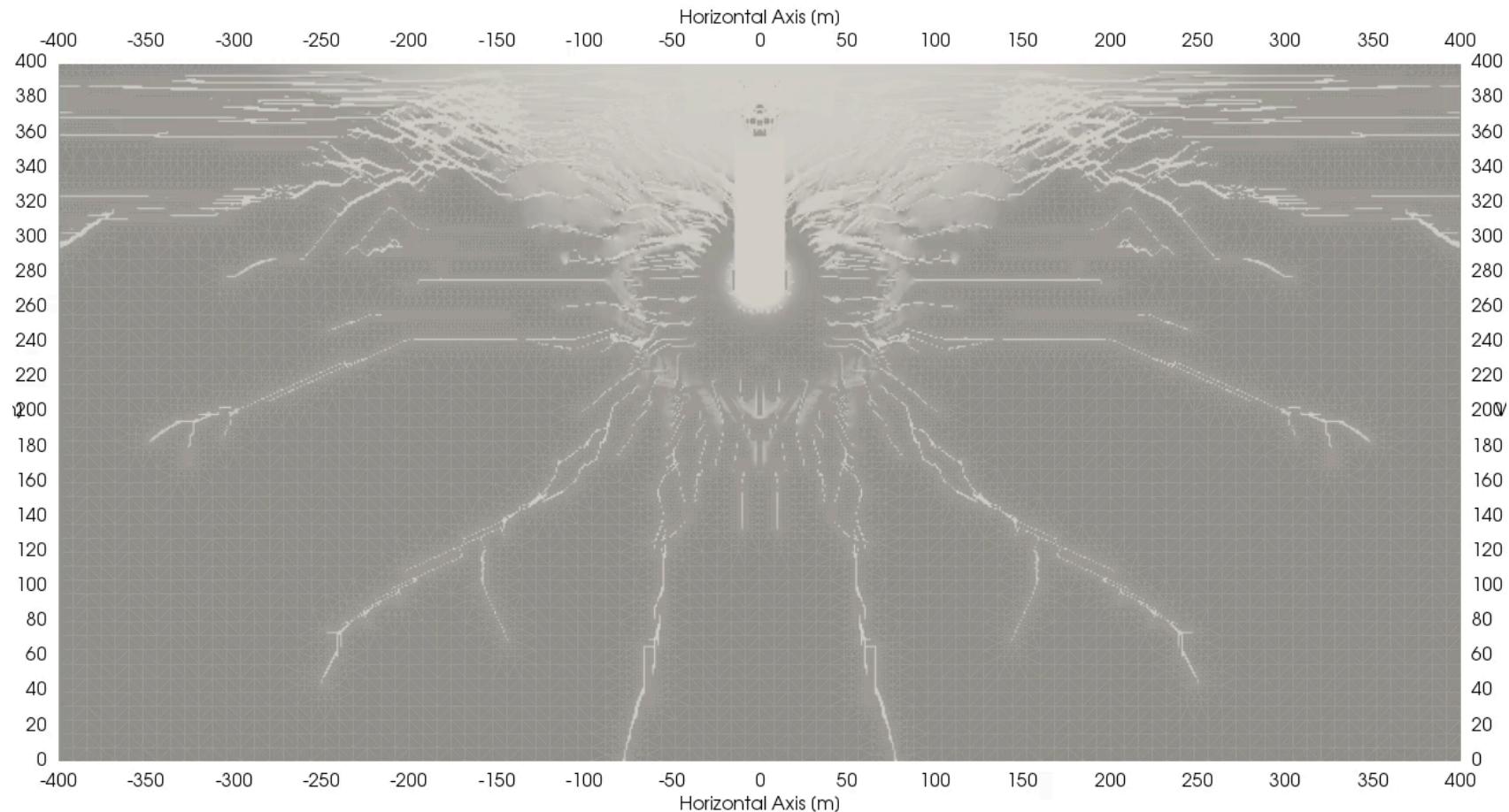
Barometric pressure variations drive radionuclide gas migration in fractured rock



Simulation of radionuclide gas migration in a single fracture due to barometric pumping



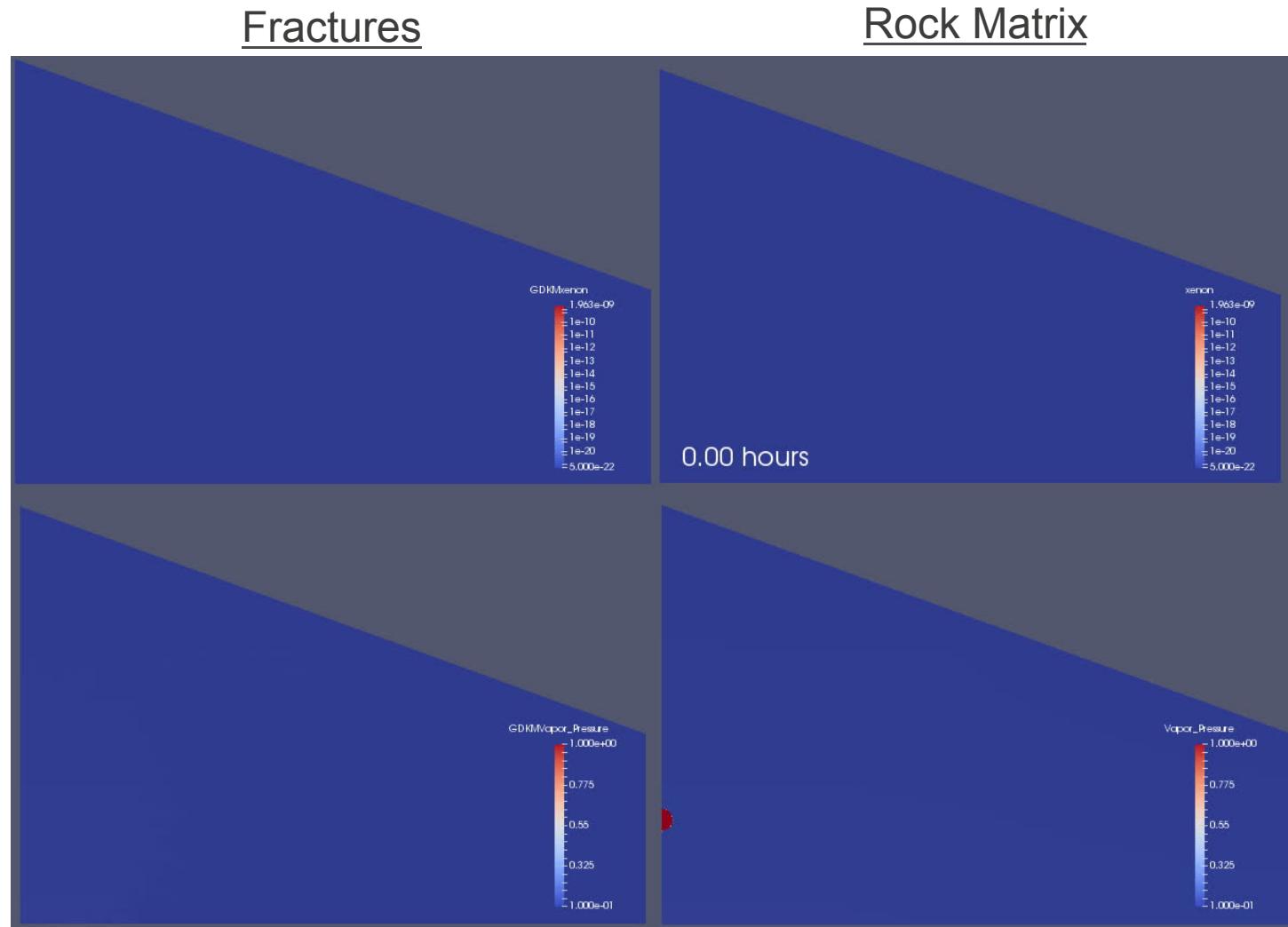
Simulation of radionuclide gas migration due to barometric pumping in detonation fractured rock



0.0 days

Simulation of radionuclide gas migration due to detonation overpressure

Concentration



Pressure

Summary

- The travel time of radionuclide gases to the ground surface in fracture rock depends on many complex factors:
 - *barometric variations (frequency, amplitude, etc.)*
 - *gas/aqueous phase partitioning (Henry's Law)*
 - *fracture/matrix properties (permeabilities, porosities, saturation, etc.)*
 - *detonation induced rock damage (fractures) and existing faults and fractures*
 - *radionuclide decay chains*
 - *radionuclide properties (solubility, diffusion coefficient, dissolution/exsolution rate, half-live, etc.)*
- Numerical simulators are the most complete repositories of knowledge of the complex processes governing radionuclide gas migration to the ground surface allowing us to:
 - *verify conceptualizations of physical processes against observations (NPE test, Nevada Test Site data)*
 - *radionuclide breakthrough curves*
 - *isotopic ratios*
 - *forecast radionuclide gas travel times to the ground surface and isotopic ratios*