SAND2017-8503PE

Regional Modeling of Subsurface Brine Flow

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Supervised by

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Org. 8844

8840/8850 Summer Student Mini-Symposium
August, 9th 2017, Sandia Nat'l Labs, Albuquerque NM

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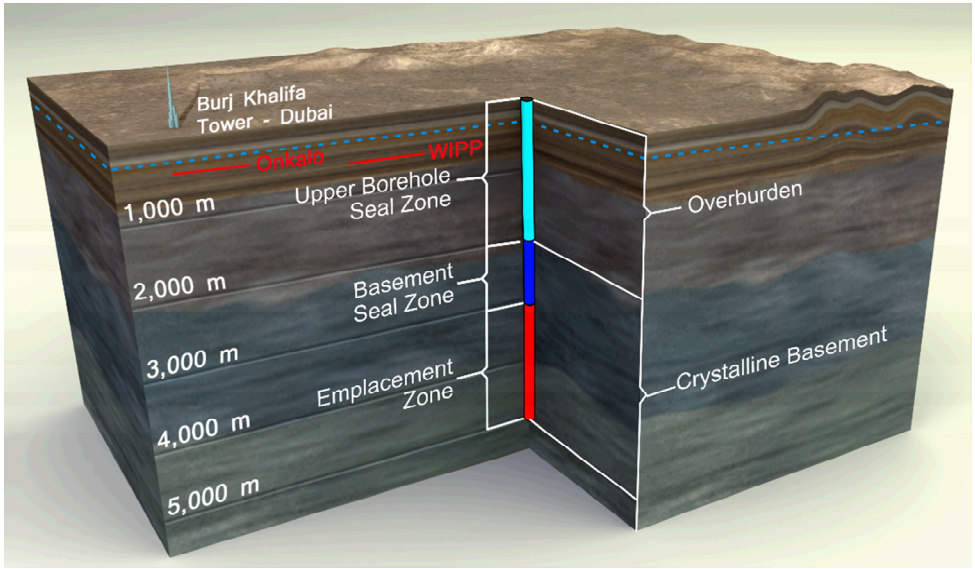
Personal Background

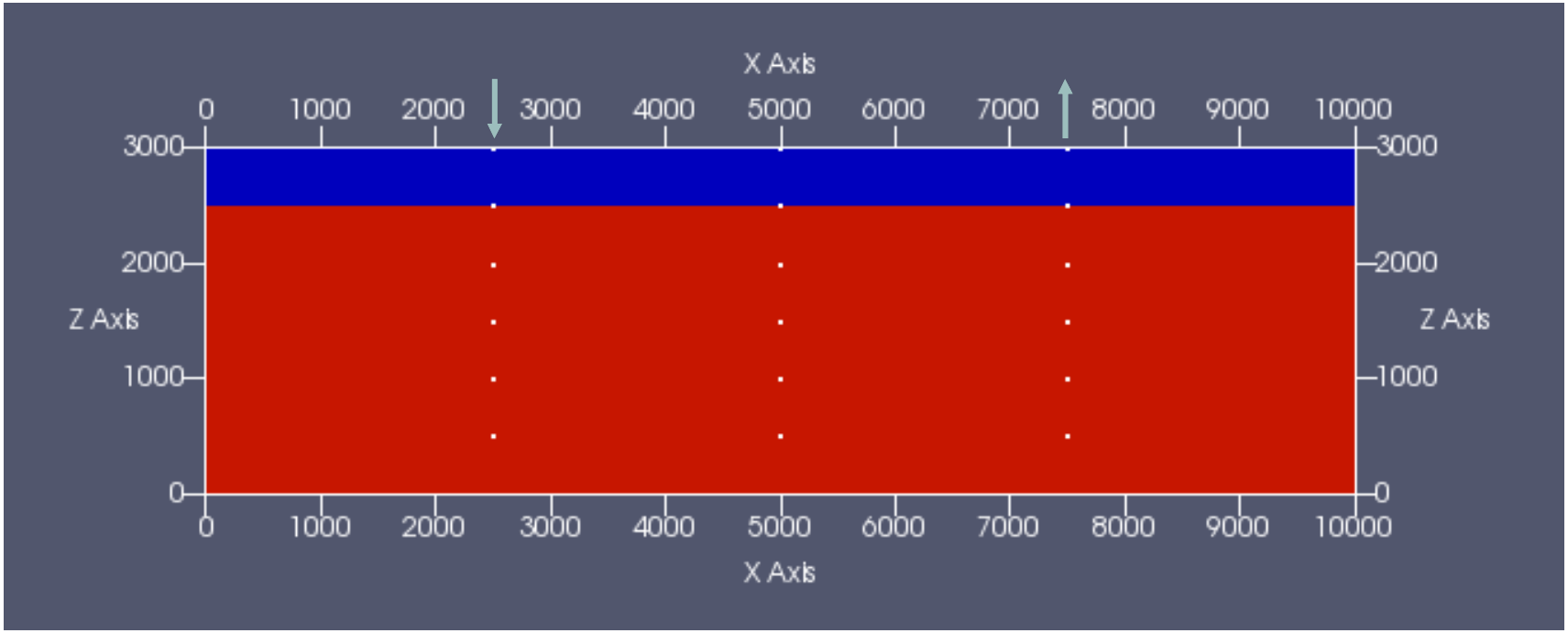
- Majoring in Chemical Engineering
- Intern at Sandia since June 2015
- Graduate May 2020

Introduction

- Deep Borehole Disposal
- How do environmental conditions affect brine flow?
- Based on Park et al. (2009)

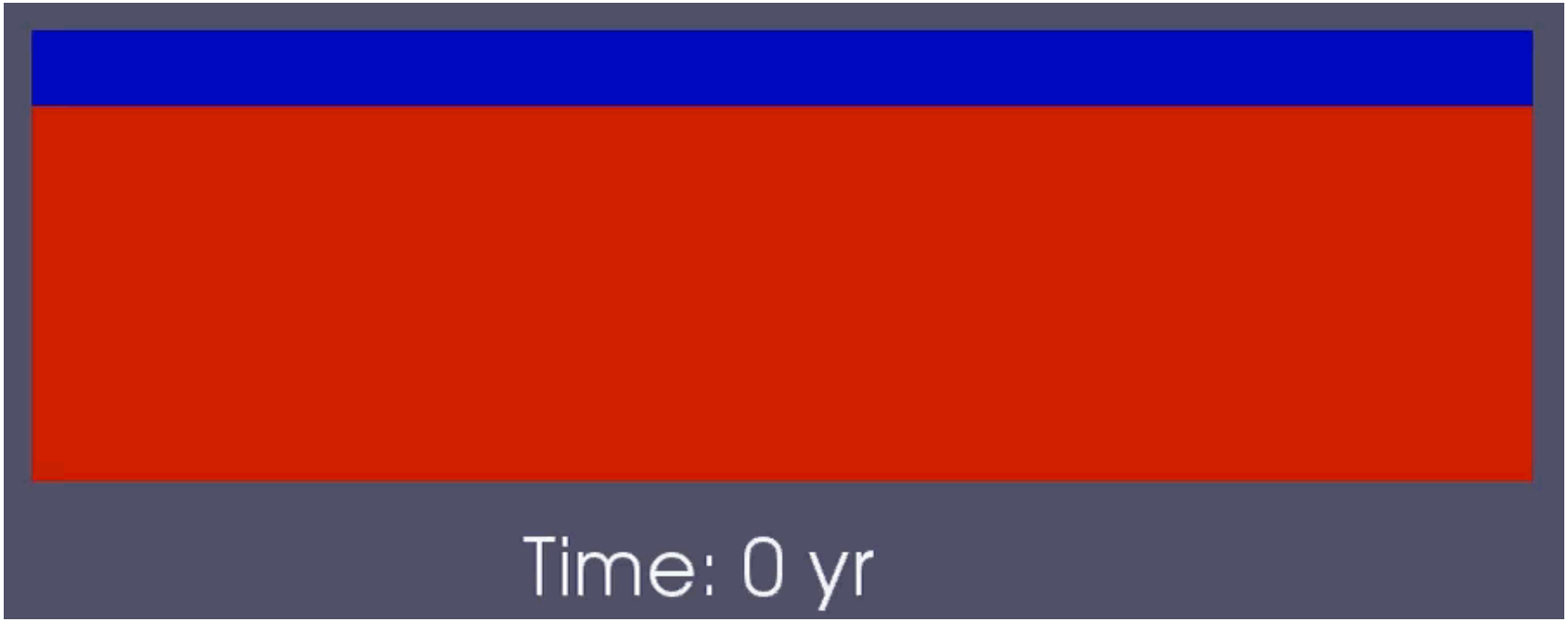


Methodology



- 2D Aquifer
- Parameters
- PFLOTRAN

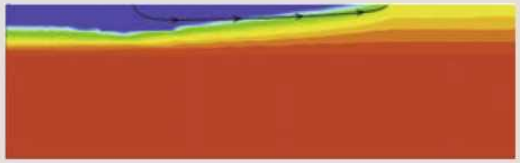
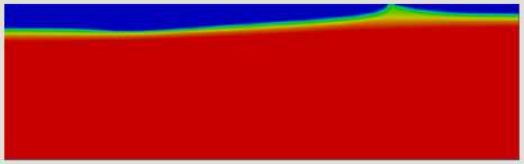
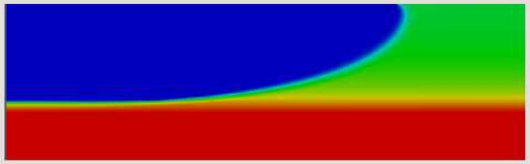
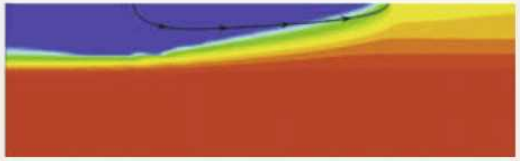
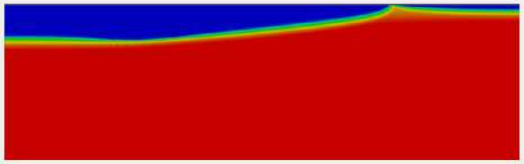
Methodology



Base Case:

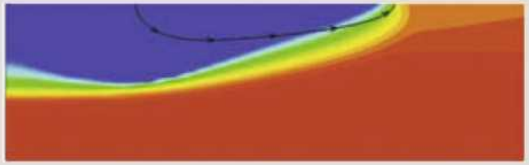
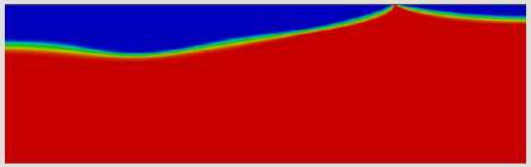
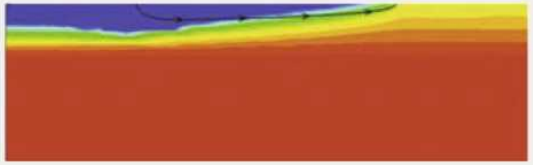
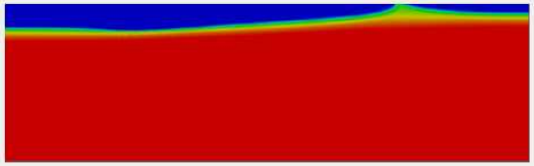
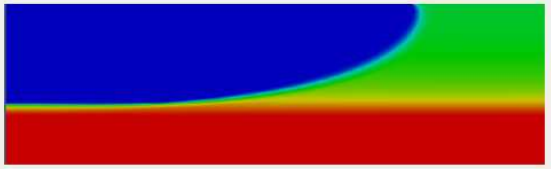
- Head Difference: $\Delta H = 50$ m
- Brine Density: $\rho_B = 1.2$ g/cm^3
- Permeability: $k = 10^{-14}$ m^2

Results: Topography

	1000 y (Park)	1000 y	1 My
ΔH=50 m (Base)			
ΔH=100 m			

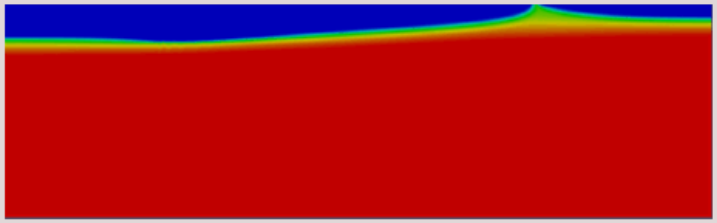
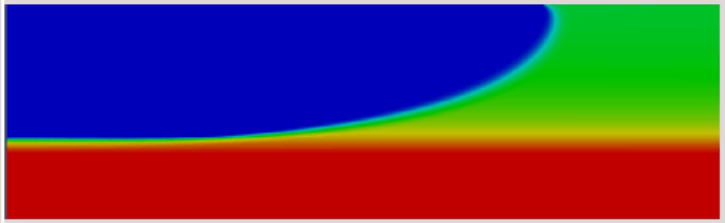
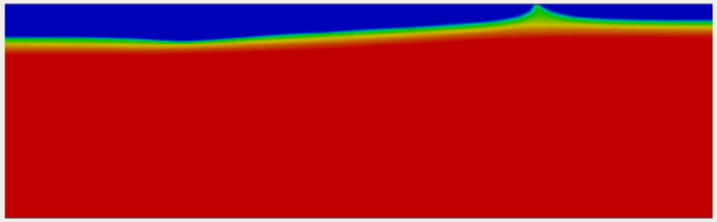
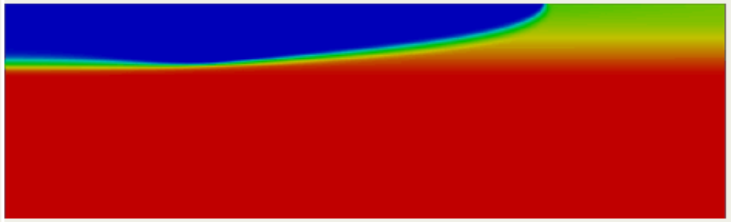
- Brine Density: $\rho_B = 1.2\ g/cm^3$
- Permeability: $k = 10^{-14}\ m^2$

Results: Brine Density

	1000 y (Park)	1000 y	1 My
ρ_B=1.03 g/cm^3			
ρ_B=1.2 g/cm^3 (Base)			

- Head Difference: $\Delta H = 50$ m
- Permeability: $k = 10^{-14}$ m^2

Results: Rock Permeability

	1000 y	1 My
$k=10^{-14}$ m^2 (Base)		
$k=10^{-15}$ m^2		

- Head Difference: $\Delta H = 50$ m
- Brine Density: $\rho_B = 1.2$ g/cm^3

Discussion

- At early times, results were similar to Park's
- Time played a critical role
- Could be made more realistic
- Potential paths forward are many

Conclusion

- Site characterization for deep borehole disposal
- Chapter in the 2017 Deep Borehole Disposal Safety Case Report
- My key takeaways