

Groundwater Protection in the 21st Century

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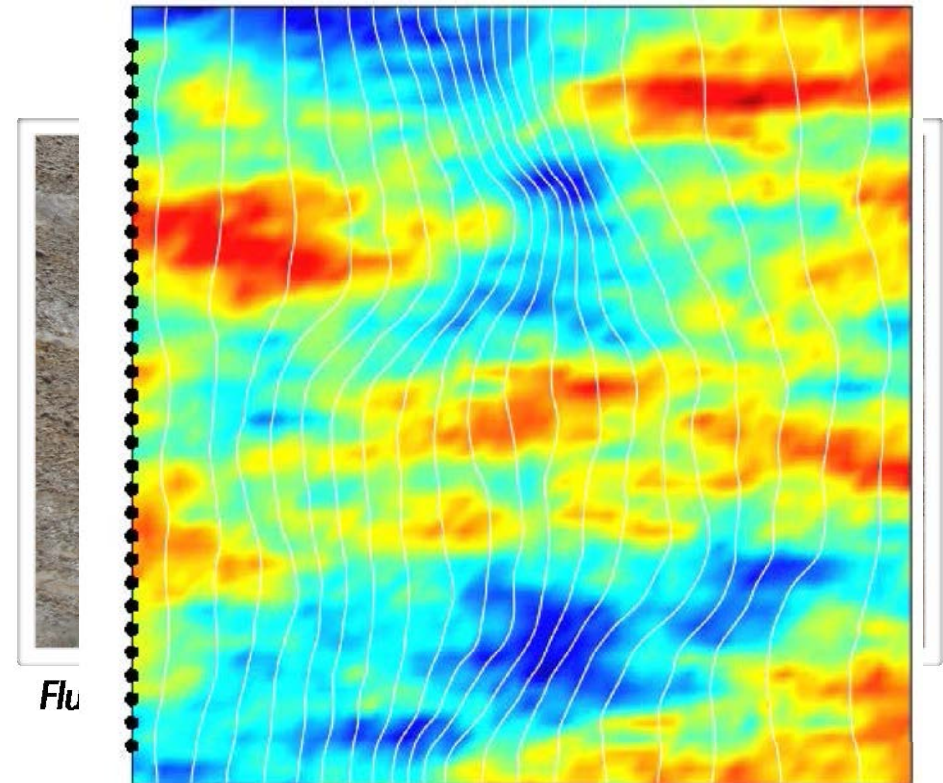
Understanding permeability variations is key to hydrogeologic predictions

How will a contaminant advect and disperse?

- Average permeability
- Small-scale permeability variations

Is my groundwater protected from contamination?

- Continuity of aquitards
- Connectivity of high-permeability zones



Numerical simulation of effect of spatially-variable permeability (colors) on tracer dispersion

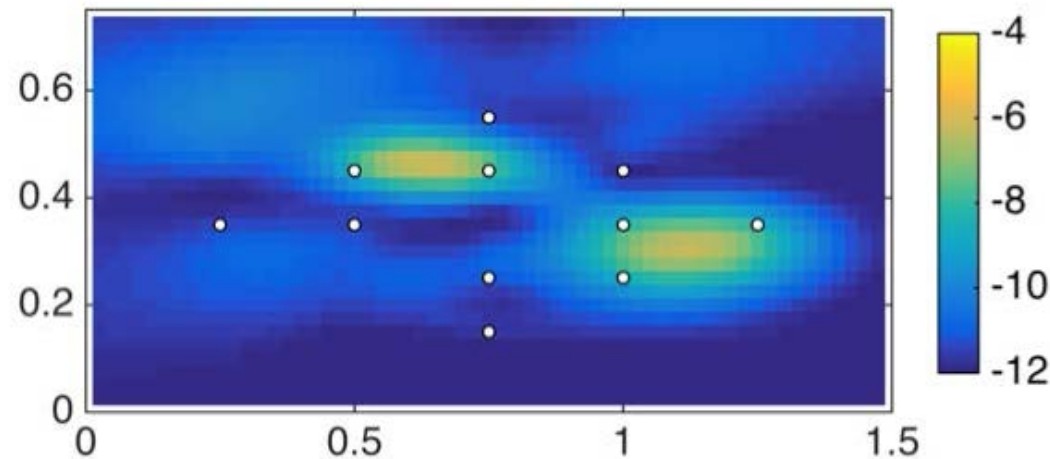
Imaging the Subsurface

To make predictions, we need the data to infer subsurface properties:

- **High K:** Preferential flow paths
- **Low K:** Contaminant trapping and back-diffusion

We need all the data we can get!

- Pumping tests
- Geophysical measurements



Sandbox imaging of heterogeneity through tomographic pumping tests



More / cheaper data:

- Electrical / Electromagnetic surveying
- “Direct Push” observations
- Sensor Networks

Better data:

- Fiber-optics for distributed pressure and temperature sensing
- Experimental design