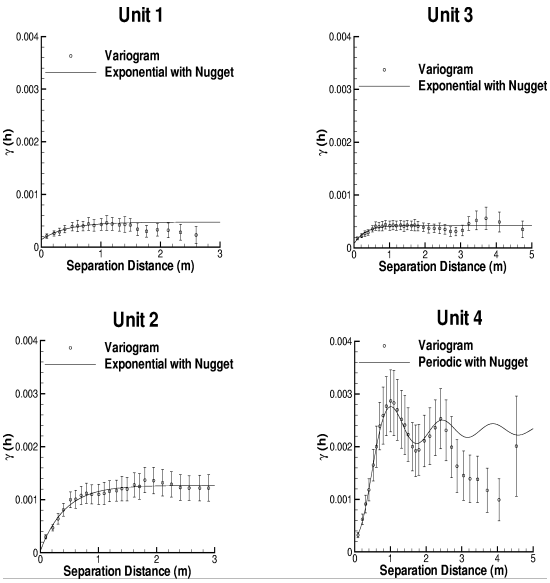
# Hydrology of Heterogeneous Environments

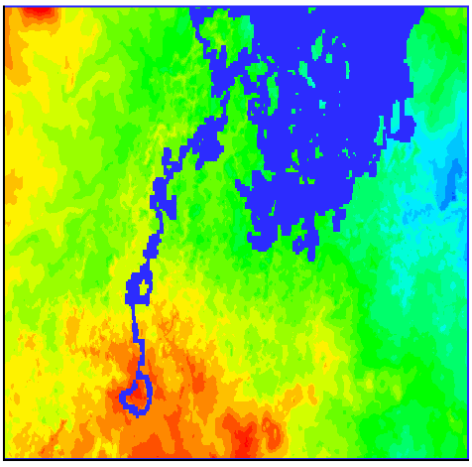
New analytical approaches are needed to characterize, understand, and predict the hydrology of highly heterogeneous groundwater systems. New methods are needed to extrapolate limited measurements at numerous point locations to larger scales. These new approaches will require an understanding of how hydrologic parameters vary in the subsurface. Borehole geophysics provides the ability to acquire both numerous and low cost point measurements but at limited locations. Seismic, radar and potential field geophysics can provide non-invasive measurements at larger scale than borehole measurements. The spacial variation of hydrologic parameters is ultimately controlled by the geology of the subsurface. Combining geophysical, geological, and hydrologic information provides a much better understanding of the groundwater system than can be gained from one source alone.




In the past few years we have explored a wide variety of method to gain an understanding of spacial variations in the subsurface. We used principle component analysis of epithermal neutron, natural gamma and induction resistivity logs to characterize the lithologic units in unconsolidated cobble and sand deposits and to correlate these units with hydrologic properties. We used geostatistical analysis of epithermal neuron logs to deduce the spatial structure of porosity in unconsolidated cobbles and sands. We created a method to stochastically generate lava flow structures that are consistent with geologic characterization of the Snake River Plain basalt flows.

We are currently developing a hydrologic tomography approach to synthesize distributed water pressure measurements and data from cross-borehole ground penetrating radar measurements.

**Simulated Basalt Flow over Wapi Lava Field**



## Selected References

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