Practical exercises:

Exercise

Use the function r.random.surface to generate a raster map with strong contrasts on a short spatial scale (e.g., by using distance=0, exponent=1, float=0, high=100) and a raster map with smooth variations across small spatial scales (e.g., by using the values distance=100, exponent=1, float=1, high=50).

a) Describe the effect of the exponent and the float values on the generated maps by altering those as well.
b) Use now the r.mapcalc function to generate heterogeneous raster maps for hydraulic conductivity and porosity based on those randomly generated raster maps.
c) Subsequently, run two groundwater simulations for both kind of heterogeneities.

Theoretical exercises:

Exercise

Name one method each to assess spatial heterogeneity on a (a) centimeter, (b) meter, (c) kilometer scale.

Exercise

Explain the difference between interpolation and extrapolation

Exercise

Explain why the geometric mean is a better representation for a data set of measured hydraulic conductivities

Exercise

Calculate weighted arithmetic mean, weighted geometric mean and weighted harmonic mean for the following dataset of porosity.

Measured value	Number of probes
3,5 %	6
4,5 %	13
5,5 %	27
6,5 %	15
7,5 %	7

Exercise

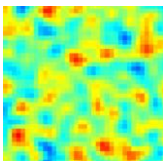
Determine arithmetic mean, median and mode for the following sequence of measurements: 3 4 5 2 4 8 7 5 9 3 8.

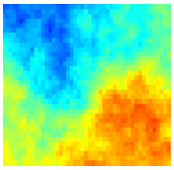
Exercise

Why is the lognormal distribution a better approximation for a heterogeneous distribution of the hydraulic conductivity than the standard normal distribution?

Exercise

Describe the difference in spatial relation between the following distributions of hydraulic conductivity.





Exercise

Explain two possibilities to include parameter heterogeneity in a numerical simulation for groundwater flow.