

## Exercise 4a

### Experimental semivariograms

Like for the first exercise you will use again the data registered by the US Geological Survey within the hydrogeochemical and stream sediment reconnaissance (HSSR) phase of the National Uranium Resource Evaluation (NURE) program.

Software: R

1. Read the data into an array holding the specified values `[ID,X,Y,chemical elements chosen by yourself and all your colleagues]` for each sample.
2. Visualise the data using a 3-dimensional scattergram (`scatter3`).  
Hint: `install(package="scatterplot3d"); require(scatterplot3d); ?scatterplot3d`

Choose appropriate colours and insert labels for all axes.

Discuss whether the dataset is sufficient for semivariogram calculation.

3. Create a function, that enables the calculation of experimental semivariograms according to input values for sample coordinates (X, Y), the measured chemical element (e.g., Au, Na, Fe, or Pb), and specified distance and direction classes.

Consider:

- Is there a difference between direction class 0-45° and 180-225°? Discuss this problem. Find an appropriate solution.
  - Adhere to the two preconditions proposed in the lecture part:
    - i. Limit the maximum lag to no more than half of the maximum dimension of the sampling area.
    - ii. Discard experimental semivariogram values for which  $n(h) < 30$ .
4. Calculate the experimental semivariogram in two ways:
    - Isotropic semivariogram
    - Anisotropic semivariogram resolved into 4 distinct direction classesChoose appropriate distance classes and visualise both results. Find an appropriate way to label all direction classes.

Which solution is more appropriate (isotropic or anisotropic)? Accordingly, choose either the isotropic semivariogram or one of the 4 anisotropic semivariograms for further steps. Discuss your choice.

You have one week time to perform this exercise.

During the next lecture we will discuss the results of the exercise (all together) and you have the possibility to ask questions concerning theoretical issues of semivariograms.