Multiple-point geostatistics for reconstructing continuous soil structures at a landscape scale

Promoter: Prof. dr. ir. M. Van Meirvenne (Dept. of Soil Management)
PhD student: ir. Eef Meerschman (Dept. of Soil Management)

Introduction

Geostatistical estimation and simulation methods are based on the variogram as a model for the structure of spatial variability. Because this model only reflects the two-point covariance, algorithms based on a variogram fail to reconstruct repetitive or curvilinear patterns. Recently multiple-point geostatistics (MPG) has been developed in the petroleum- and hydrogeology. In MPG the variogram is replaced by a training image (TI), a conceptual representation of the expected spatial structure of the phenomenon to be simulated which reflects the covariance between multiple points.
To our knowledge, MPG has never been applied in soil science. The purpose of this PhD is to examine which contribution MPG can make towards the characterization of spatially continuous soil phenomena. Therefore, alternative methods to construct soil science TI's will be examined based on auger en proximal soil sensor measurements.

Research hypothesis

Multiple point geostatistics in combination with information provided by proximal soil sensors is suited for the reconstruction of spatially continuous soil phenomena.

Research questions

1. What is the most appropriate method for the construction of soil structure TI's?
2. What is the potential of multiple point geostatistics for the reconstruction of soil structures on a landscape scale?

Applications

To answer those research questions, MPG will be applied on real case studies in soil science:

1. the simulation of polygonal networks of frost-wedge pseudomorphs
2. the simulation of curvilinear patterns of fluviatile structures

Both phenomena are visible as crop marks on aerial photographs of Flanders and can be detected by the proximal soil sensors of our research group.