CSS 921 Geostatistics  
Fall 2009

Instructor:  
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Office Hours:  
Tu 1-3 pm at A376 Plant & Soil Sci Bldg

Class meets:  
MW 10:20-11:40 am at 149 Plant & Soil Sci Bldg

Credits: 3

Course web site:  
http://courses.css.msu.edu/

Grading scale:  
90% of the total points for the semester  4.0
80% of the total points for the semester  3.5
70% of the total points for the semester  3.0
60% of the total points for the semester  2.5
50% of the total points for the semester  2.0
40% of the total points for the semester  1.5
Less than 40% of the total points for the semester  1.0

Percentage distribution:  
Homework  50%
Due every other week

Project  
Due one week before the finals  50%

Required textbook:  

Recommended reading:  
Course objectives and outline:

The main focus of the course will be detailed introduction of geostatistical methodology with emphasis on applications in agricultural and environmental research. The following main topics will be discussed: spatial variability and its characterization; mapping agricultural and environmental variables via geostatistical tools; and accounting for spatial variability in analysis of designed experiments.

Outline:

1) Spatial continuity and its description for individual variables and pairs of variables:
   a) semi-variogram, covariance, correlogram, general relative variogram, cross-variogram, cross-covariance, cross-correlogram;
   b) effect of number of samples and sampling configurations on accuracy of spatial variability characterization;
   c) applications of randomization, bootstrap, and Monte Carlo methods in spatial variability assessment.

2) Theory of regionalized variables.

3) Fitting variogram models via:
   a) ordinary least squares, weighted least squares, cross-validation;
   b) maximum likelihood methods.

4) Kriging - theory and applications:
   a) simple kriging;
   b) ordinary kriging;
   c) universal kriging;
   d) factorial kriging;
   e) effect of search neighborhood, i.e. number of samples and sampling configurations, on accuracy of kriging estimations.

5) Improving accuracy with secondary information:
   a) regression kriging;
   b) cokriging;
   c) principal component kriging;
   d) multivariate factorial kriging;
   e) factors influencing improvement in estimation accuracy with secondary information.

6) Assessment of spatial uncertainty - simulations:
   a) sequential Gaussian simulation;
   b) simulated annealing.

7) Including spatial information in the analysis of designed experiments:
   a) nearest neighbor analysis;
   b) trend analysis;
   c) random field analysis.

8) Additional topics:
   a) fuzzy kriging;
   b) characterizing variability in space and time.