N464300 Geostatistics

Instructor: Kuo-Chin Hsu 徐國錦〔資源工程學研究所〕

Lectures: Wednesday 9:10–12:00,

Office hour: Thursday 10:00-11:00

Classroom: Resources Engineering Building, Room 4350

課程學習目標：獲得地質統計學基本知識，學習環境地質資料分析、解釋與應用技術

Teaching Assistant: 汪柏岑 burtonburton0504@gmail.com

課程資料：moodle 系統或 http://140.116.74.159/

考古題下載：系網頁→師資→徐國錦→序率地下水文研究室→授課資料

Textbooks：

Caers, Modeling uncertainty in the earth sciences, Wiley, 2011.(成大可連結電子全文)

Chiles, Geostatistics: modeling spatial uncertainty, 2nd edition, Wiley, 2012.（550.72 C437）

Davis, J. C., Statistics and data analysis in geology, 3rd edition, John Wiley & Sons, 2002.（550.72 D294-2）

Deutsch, C. V., and A. G. Jounel, *GSLIB:Geostatisticsal Software Library and User's Guide*, 2nd editions, Oxford University Press, 1998.（551.028553 D489b-2 guide）

Hsu H., *Probability, random variables, & random processes*, McGraw-Hill, 1996. (成大可連結電子全文)

Isaaks, E. H., and R. M. Sivastava, An Introduction to Applied Geostatistics, Oxford University Press, 1988.（551.72 Is1）

Journel, G., *Fundamentals of geostatistics in five lessons*, American Geophysical Union, 1989.（成大可連結電子全文 TCUS Wiley ebook trial period 2013.06.01-2014.02.28）

References:

Banerjee, S., Carlin, B., Gelfand, A., Hierarchical modeling and analysis for spatial data. Chapman and Hall/CRC, New York, 2004.（519.5 B223）

Beirlant, J., Goegebeur, Y., Teugels, J., Segers, J., Statistics of extremes: theory and applications. Wiley, New York, 2004（519.5 St29bb）

Bolstad, W. M., Introduction to Bayesian Statistics, 2nd edition, Wiley, 2007.（519.542 B638）

Chandler, Statistical methods for trend detection and analysis in the environmental sciences, Wiley, 2011. 577.011 C361（577.011 C361）

Coles, S. G., An introduction to statistical modeling of extreme values. Springer, London, 2001. （519.24 C679）

Cressie, N. A. C., Statistics for spatial data. Wiley, New York, 1993.（519.5 C864）

Cressie, N., and Wikle, C. K., Statistics for spatial-temporal data, Wiley, 2011.（519.5 C864b）

Deutsch, C. V., Geostatistical Reservoir Modeling, Oxford University Press, 2002.

Diggle, P.J., Ribeiro, P.J., Model-based geostatistics. Springer, New York, 2007.（550.15195 D569）

Goovaerts, P., *Geostatistics for Natural Resources Evaluation*, Oxford University Press, 1997. （550.72 G645）

Kitanidis, P. K., *Introduction to GEOSTAISTICS: Application in Hydrogeology*, Cambridge University Press, 1997.（551.49072 K646）

Sherman, Spatial statistics and spatial-temporal data – covariance functions and directional properties, Wiley, 2010. （519.5 Sh55）

張仁鐸, 空間變異理論與應用, 科學出版社, 2005.

王仁鐸, 地質統計學的發展趨勢, 地質科技情報, 1996

杜德文, 馬淑珍, 地質統計學方法綜述, 世界地質, 1995

王仁鐸, 胡光道, 線性地質統計學, 地質出版社, 1987.

顏月珠, 應用數理統計學, 7th edition, 三民書局, 1999.

李文堯，林心雅，地圖會說話，時報文化，2007.

簡體中文之地質統計相關講義 http://www.docin.com/p-66919815.html, http://www.docin.com/p-48577376.html

Prerequisites: Statistics or Engineering statistics

Assignment of Grades

Midterm exam I, 25%
Midterm exam II, 25%
Final report, 30%,
Homework and class participation, 10%
Paper review, 10%

What is Geostatistics?

Geostatistics is a theory to deal with the analysis and estimation of spatially (spatial-temporally) distributed variables having a stochastic spatial structure. It is a part of science, a part of art, and one great adventure which lines to geoscience, geography, environmental engineering, public health and social science.

Who will be benefited from this class?

Students who want to analyze the spatial or spatial-temporal dada.

Software used in class:

GSLIB: versatile in interpretation, simulation, a strong community, free and open source at Stanford University

WINGSLIB,

geoR. (Ribeiro and Diggle, geoR: A package for geostatistical analysis, *R News*, 1/2, 15-18, 2001)

http://www.est.ufpr.br/geoR.

http://www.maths.lancs.ac.uk/~ribeiro/publications.html

R: A language and environment for statistical computing, ISBN: 3-900051-07-0

http://www.R-project.org

General outline：

Week 1: Introduction (R: 使用介紹; youtube 教學）

Week 2: Linear algebra (R: solve linear system)

Week 3: Probability, statistical, random variable (R: r.n. genertor)

Week 4: Linkage of statistics and geostatistics (R: statistcs)

Week 5: Exploration Data Analysis, variogram, covariance (R; GS＋: covariance)

Week 6: Lagrange multiplier, Midterm Exam I

Week 7: Simple kriging (R: simple kriging)

Week 8: Ordinary kriging (R: ordinary kriging)Week 9: OK Example

Week 10: Model validation (R: model validation) and sampling technique (LHS)

Week 11: Simulation, Block kriging (R: simulation)

Week 12: Universal kriging and Continuous part kriging (R: university kriging)

Week 13: Midterm Exam II

Week 14: Paper review report

Week 15: Indicator kriging (R: indicator kriging)

Week 16: Cokriging (R: cokriging), spatial-temporal geostatistics

Week 17: Transition probability (TPRO)

Week 18: Final report （使用嘉南平原地電阻）