The University of Southern Mississippi
College of Science & Technology – Department of Coastal Sciences
COA 616 Geostatistics in Environmental Science

COURSE SYLLABUS

Instructor
Wei Wu
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Email: wei.wu@usm.edu
Phone: 228-818-8855

Office Hours
TBD

Prerequisites
GIS, fundamental statistical theory typically taught in an introductory course on probability and inference, matrix algebra, or permission of the instructor.

Credit Hours
3

Course Description
Quantitative analysis of spatial data has become an essential component of geology, geography, environmental science, biology, and many other disciplines. This course is an introduction to the analysis, description and modeling of geospatial data using traditional geostatistics and spatial statistics for lattice data. It will enable the students to 1) explore spatial patterns; 2) quantify spatial continuity; 3) perform spatial estimation and predictions; and 4) understand stochastic simulation. The practical applications of underlying theory will be emphasized though the use of R. The students are expected to bring their own spatial data for the term project.

Course Objective
The students are expected to be able to apply different spatial interpolation methods and explain their advantages and disadvantages. The students should know how to implement different types of kriging and spatial regression models in R.

Textbook
Geostatistics for Environmental Scientists / 2nd Edition. R. Webster and M.A. Oliver, 2007 John Wiley & Sons, Ltd. Available online at the USM library website.

Other references
Statistical methods for spatial data analysis. O. Schabenberger and C.A. Gotway, 2005. Chapman and Hall / CRC.

An introduction to applied geostatistics. E.H. Isaaks and R.M. Sruvastava, 1989. Oxford University Press, Inc.

Spatial statistics. B.D. Ripley, 1981. John Wiley & Sons, Inc.

Model-based geostatistics P.J. Diggle and P. J. Ribeiro Jr. 2007. Springer Science + Business Media, LLC.

Statistics for Spatial Data. Revised edition. N. Cressie, 1993. John Wiley & Sons.

Research Component
The students are required to bring their own spatial data and test one hypothesis related to Ecology, Environmental Science or Marine Science etc. by applying the tools learned in this course. The students need to write the analyses up in the final paper and do an oral presentation on their paper.

Evaluation Criteria
Homework assignments = 40%
Term project = 30%
Final exam = 30%

Grading Scale

A	93 – 100	Excellent
A-	89 – 92.9	Very Good
B+	85 – 88.9	Good
B	80 – 84.9	Satisfied
B-	75 – 79.9	Adequate, but needs improvement
C+	70 – 74.9	
C	65 – 69.9	
C-	60 – 64.9	Minimum passing
F	0 – 59.9	

Late Assignment or Projects
Lab problems will be due one week after assignment. Labs won't be accepted if they are more than 1 week late. Exception may be considered under the circumstances of family emergency or work-related reasons (e.g. long field trip) AND the instructor being notified timely.

Lab Redo Policy
You may choose to redo the lab assignments to improve your grade, but keep in mind that the full mark for redo is 90 instead of regular 100.

Plagiarism / Cheating Statement:
Students are expected to adhere to the highest standards of academic honesty as outlined in

the USM Student Handbook. Academic dishonesty will result in the grade of a "F" on the assignment and/or in the course, and/or the student may be reported for further disciplinary action.

Disability Statement:
Student with disabilities that qualify under the American with Disabilities Act (ADA) and require accommodations should contact the Office for Disability Accommodations (ODA) for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact ODA if they are not certain whether a medical condition/disability qualifies.

Address:
The University of Southern Mississippi
Office for Disability Accommodations
118 College Drive # 8586
Hattiesburg, MS, 39406-0001
Voice Telephone: (601) 266-5024 or (228) 214-3232 Fax: (601) 266-603
Individuals with hearing impairments can contact ODA using the *Mississippi Relay Service* at 1-800-582-2233 (TTY)
or email Suzy Hebert at Suzanne.Hebert@usm.edu.

Tentative Schedule
August 30: Introduction to the course, statistics review, exploratory data analysis in R (W&O Ch. 1-2)

September 6: Spatial autocorrelation, Moran's I and Geary's C, Local indicators of spatial association (LISA)

September 13: Spatial autocorrelation: Estimating semivariances and covariances (W&O: Ch. 4.9)

September 20: Theory of regionalized variables and variogram modeling (W&O: Ch. 4.2 & 5.2)

September 27: Variogram modeling II (W&O Ch. 5.3 & 5.6)

October 4: Variogram modeling III (W&O Ch. 5.5) and spatial interpolation (Ch. 3)

October 11: No class

October 18: Ordinary kriging (Ch. 8.1 – 8.3)

October 25 10: Ordinary kriging II (Ch. 8.6, 8.12), Mixed effects model

November 1: Final project data presentation and indicator kriging and stochastic simulation (Ch. 11.1-11.3, Ch. 12.1)

November 8: Stochastic simulation II (Ch. 12.2)

November 15: Simple kriging and universal kriging

November 22: Bayesian kriging

November 29: Spatial autoregressive models for lattice data

December 6: Final presentation