SSCI 684, Spatial Modeling with GIS

Syllabus

Units: 4

Term—Day—Time: Spring, 2018, Mondays, 2:00 p.m. – 4:50 p.m.

Location: Spatial Sciences Institute, AHF 57G

Instructor: Laura C Loyola, Ph.D.
Office: AHF B56G
Regular Office Hours: Mon 10:00-11:00 a.m. and Tues 1:00-2:00 p.m. PT. Also available by appointment.
Contact Info: loyola@usc.edu, 213-740-5612
www.bluejeans.com/loyola

IT Help: Richard Tsung
Office: AHF B57B
Hours of Service: Mondays to Fridays, 9:00 a.m.-5:00 p.m.
Contact Info: ctsung@usc.edu, 213-821-4415 (office)

Library Help: Andy Rutkowski
Office: VKC B36B
Hours of Service: Tuesdays, 10:00 a.m.-12:00 noon; Thursdays 4:30-5:30 p.m., or other times by appointment
Contact Info: arutkows@usc.edu, 213-740-6390 (office)
Course Description
This course explores how geographic information systems and related technologies (global positioning systems, remote sensing, etc.) can be used to promote and support the construction and simulation of dynamic models of human and environmental systems. The fundamental feature of such systems involves diffusion over time and space and individual cases may range from diffusion of pollutants and invasive species across landscapes to the diffusion of disease by contact between individuals. The approaches used to model these phenomena may range from the continuous representation of system dynamics to the discrete interactions of individual, agent-based models. The measurement and modeling techniques that can be used to describe spatially distributed processes and patterns affecting human and environmental systems will be introduced with an assortment of weekly readings and discussions. The course is aimed at doctoral students and a series of individual and group projects allow class participants to develop and use their own models for more detailed research. Calculus and programming experience may be helpful but are not required. In addition to the textbooks, exercises and readings will be provided from a variety of sources as required.

Learning Objectives
On completion of this course, students will be able to:

• Describe the fundamental building blocks (data sources, data models, spatial analysis methods, programming tools, etc.) used in geographic information technologies and spatial models.
• Discuss how dynamic spatial models have been implemented to both simulate the functioning of human and environmental systems and understand their behavior under altered conditions.
• Discuss the ways in which advances in our knowledge of human and environmental systems on the one hand and computer technologies on the other hand have combined to allow more realistic and detailed representations of the spatiotemporal variability of these systems in spatial models.
• Discuss the impact of sampling, resolution, uncertainty, and error on spatial model outcomes and some of the new opportunities afforded by modern instrumentation and measurement techniques.
• Critically evaluate the types of models that will be required in the future to effectively manage land, water, air and biotic resources, assess environmental risks, and promote human health and well-being.

Prerequisite(s): None
Co-Requisite (s): None
Concurrent Enrollment: None
Recommended Preparation: Students must be enrolled in an existing USC PhD program
Course Notes
The course will be taught as a seminar and class meetings will be used to discuss the assigned readings and any questions and related topics that arise from the readings. The learning and teaching strategies are student-centered. They aim to encourage a deep-learning approach by using reflection and self-evaluation. The individual class sessions will be organized around class readings that are designed to provide the essential background and framework for study. Students will be required to reflect on their learning through in-class discussions and a series of carefully crafted assignments.

Technological Proficiency and Hardware/Software Required
Students are expected to have a working knowledge of GIS and the Microsoft Office suite. The modeling software and geospatial data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute.

Required Readings and Supplementary Materials


Description and Assessment of Assignments

Students must participate in class discussion on a regular basis, prepare written assignments in the form of weekly briefs and model reports, and complete team projects and presentations.

Class Participation (17%): A class participation grade for the semester will be assigned based upon how actively students engage in the course. Students will be required to read all material outlined for each week of the course, and be prepared to lead and participate in group discussions about the readings in class. Failure to attend or to be adequately prepared to discuss the readings will lead to the assignment of a lower grade for that week. Students should also maintain a written log of insights and observations from the classroom discussions and accompanying homework projects that will assist in completing the final project.

Weekly Briefs (13%): Each week students will use the Blackboard Discussion Forum to respond to an assigned article or critique one of their own choosing. These electronic commentaries are for sharing among the class, and the overall quality of the contributions will be considered in the semester evaluation. To help simulate discussion, each student should comment on at least one other student’s critique each week.

Model Reports (25%): Written reports will be assigned regularly to document steps in model formulation and/or to reflect upon assigned readings. Different criteria will be specified for model construction and deconstruction.

Class Presentation (15%): Students will be divided into 2-4 groups (depending on class size) and these groups will conduct a seminar on a topic determined in consultation with the instructor in the second half of the classes scheduled in Weeks 10 and 11. A one-page summary will be distributed in advance of the class itself and the topic may be an evaluation of a model or software (Caline, RePast, etc.), a complex systems subject (fractals, modifiable areal unit problems, neural networks, etc.) or some specific technique or application that is relevant but not otherwise covered in the course.

Team Project (30%): In the second half of the course, students will work in teams on projects determined in consultation with the instructor. The team will construct a spatial model to address some geographically relevant health problem. The final report and class presentation will summarize insights from each phase of the modeling process as experienced in the problem context.
Grading Breakdown

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Number</th>
<th>Points Each</th>
<th>% of Grade</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>17</td>
<td>1</td>
<td>17</td>
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<tr>
<td>Weekly Briefs</td>
<td>13</td>
<td>1</td>
<td>13</td>
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<tr>
<td>Model Reports</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Class Presentation</td>
<td>1</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Team Project</td>
<td>1</td>
<td>30</td>
<td>30</td>
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<tr>
<td><strong>Total</strong></td>
<td>35</td>
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<td>100</td>
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Assignment Submission Policy
Assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below.

Additional Policies
Students are expected to attend and participate in every class session and to complete and upload all assignments before the deadlines detailed in the Course Schedule. Late work will be assessed a penalty of 10% per day and zero grades will be assigned for work that is more than one week late.

Course Schedule: A Weekly Breakdown

<table>
<thead>
<tr>
<th>Week 1 1/8</th>
<th>Topics/Daily Activities</th>
<th>Readings</th>
<th>Deliverables/Due Dates</th>
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<tr>
<th>Week 2 1/16* Monday, 1/15 is a university holiday</th>
<th>GIS as a Modeling Platform:</th>
<th>Submit briefs by 5 p.m. on Wed, 1/17. Comments due by 10 a.m. on Fri, 1/19.</th>
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<td>Week 7 2/20* Monday, 2/19 is a university holiday</td>
<td>Model Elements I (Spatial Patterns &amp; Processes): A discussion of some of the ways forces of attraction and segregation, individual mobile entities, and processes of spread are featured in models of social and environmental systems.</td>
<td>Brimicombe (2010) Ch. 9 Brown &amp; Duh (2004) Jarvis &amp; Stuart (2001a, b) Hutchinson (1989)</td>
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<td>Week 8</td>
<td>Model Elements II (Stocks &amp; Flows): A discussion of the various ways stocks accumulate and flows occur in time and the mathematical modeling protocols used for stocks (integrals) and flows (differentials).</td>
<td>Ford (2009)</td>
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<td>Week 9</td>
<td>Model Elements III (Agents): A discussion of some of the ways which agents have been used to represent mobile individuals in dynamic models of human and environmental systems, and how complex system dynamics may be agent/individual-based or differential equation-based or both.</td>
<td>Railsback &amp; Grimm (2012)</td>
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<td>Week 11</td>
<td>Modeling Process II (Air Pollution Examples): An introduction to some of the ways spatial modeling has been used to characterize one or more forms of air pollution exposure.</td>
<td>Briggs (2005) Jerrett et al. (2005) Kanarogloua et al. (2005) Moore et al. (2007); Pastor et al. (2004)</td>
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**Statement on Academic Conduct and Support Systems**

**Academic Conduct**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” at [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, [http://policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

**Support Systems**

*Student Counseling Services (SCS)* – (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

*National Suicide Prevention Lifeline* – 1 (800) 273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org)

*Relationship and Sexual Violence Prevention Services (RSVP)* – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)
Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.
Provides overall safety to USC community. dps.usc.edu

Resources for Online Students
The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/. Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. This includes instructional videos, remote access to university resources, and other key contact information for distance students.