SSCI 587 (Section 35716), Spatial Data Acquisition

*Syllabus*

**Units:** 4

**Term — Day — Time:** Fall, 2018, Online

**Location:** Online

**Instructor:** An-Min Wu, PhD
**Office:** AHF B57B

**Regular Office Hours:** Tuesdays, 3 - 4 p.m. and Thursdays, 11 a.m. - 12 p.m. PT via Blue Jeans – Please contact me via email in advance to ensure I will be online. Also available most days and times by appointment via email.

**Contact Info:** anminwu@usc.edu, 213-740-2876
www.bluejeans.com/anminwu

**Library Help:** Andy Rutkowski
**Office:** VKC B36B

**Hours of Service:** Tuesdays, 10 a.m.-12 p.m. and Thursdays 4:30-5:30 p.m. PT

**Contact Info:** arutkows@usc.edu, 213-740-6390,

**IT Help:** Richard Tsung
**Office:** AHF B57E

**Office Hours:** By appointment

**Contact Info:** ctsung@usc.edu, 213-821-4415(office)
Course Scope and Purpose

This course provides students with the requisite knowledge and practical skills to source and evaluate data against quality standards for use in GIS projects. It informs students approaches in assessing the quality of spatial information. This is a required course for the Geographic Information Science & Technology (GIST) M.S. and Graduate Certificate Programs and the Human Security and Geospatial Intelligence (HSGI) M.S. Program. Several topics are covered during the course, including:

*Data Needs and Types* – We start by focusing on data challenges, defining data needs, and the role of conceptualization, entitation (recognition of an entity that can be studied as a system), and quantification in scientific research and management, and an introduction to some of the ways in which spatial and attribute data can be gathered and used to serve specific needs.

*Data Capture and Estimation* – We discuss the various ways legacy digital data can be sourced, evaluated, and used in specific projects, as well as ways to interpolate attribute values at unsampled locations and/or times.

*Remotely Sensed Data* – We discuss the diverse ways in which data can be collected remotely using various platforms. We focus on Global Navigation Satellite Systems (GNSS) as well as other aerial and satellite systems as valuable sources of spatial data.

*Data Quality* – We discuss data standards and how they are used to promote and/or preserve data quality. We also examine the various types and sources of error that we may encounter as a part of the data stream. We consider the various ways we can check for errors and cope with uncertainty when using GIS to help inform decisions about actions we may take in the real world.

*New Spatial Data Capture* – We explore the ways in which the Esri, Eos, and Trimble software ecosystems can be used along with field-based systems (GNSS and GPS receivers, unmanned-autonomous systems and a variety of sensors) to support spatial data acquisition, analysis, and visualization. A variety of readings and exercises in the first half of the class will help to support a field project conducted during a one-week field trip on Catalina Island in which students design, conduct, and present the results of their own spatial data collection projects using equipment provided by the Spatial Sciences Institute and/or their own devices.

*Master’s Prospectus* – All M.S. students in the GIST program are required to complete a thesis at the end of their studies. To help these students, and GIST Graduate Certificate students planning to transition to the GIST M.S. Program and to move quickly towards the development of their thesis plans, these students apply concepts and ideas gleaned from SSCI 581: Concepts for Spatial Thinking and this course to prepare an abstract, extended abstract, and a preliminary prospectus for their master’s thesis project. The thesis represents the capstone project for the GIST M.S. degree; additional thesis elements are interspersed throughout the required and elective courses leading to SSCI 594a/b: Master’s Thesis. GIST students who do not intend to complete a thesis will complete alternative assignments. All M.S. students enrolled in the HSGI program are required to complete a capstone project that focuses on one or more human security and/or geospatial intelligence challenges at the end of their studies.
Similarly, these students complete on a series of assignments that work towards a project proposal.

Written Communication Skills - Since successful spatial scientists and geospatial intelligence specialists need cutting-edge spatial skills as well as effective communication competence to prosper in today’s rapidly evolving world, faculty members from the USC Writing Program coach students on their writing skills in selected assignments during this course.

Learning Objectives

On completion of this course, students should be able to:

- Specify fitness-for-purpose (i.e. use) criteria and apply them to evaluate geospatial data for specific applications;
- Discuss the conceptual foundations of unmanned autonomous system (UAS)-derived imagery data and describe and demonstrate the methods to collect and process UAS-derived imagery;
- Design and implement a strategy for capturing or sourcing geospatial data and any accompanying metadata;
- Assess the impact of national and international data standards on the sourcing and availability of geospatial data;
- Critically evaluate the potential impacts of data quality on spatial analysis and decision making; and
- Master the basic elements of one or more commonly used systems for the capture of location-based data today so you can acquire, organize, store, analyze, model, visualize, and share your own spatial data going forward.

Prerequisite(s): None
Co-requisite(s): None
Concurrent Enrollment: None
Recommended Preparation: SSCI 581: Concepts for Spatial Thinking

Course Structure

This is a graduate-level course, so you should expect this class to be both academically robust and intellectually challenging. As a graduate student, you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in the reading materials and with one another. As in any graduate-level class, the instructor’s role is that of a guide who keeps you on path of discovery and you will find that you will learn much from your fellow classmates. This is especially the case within the milieu of “online learning”.

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All course materials will be organized through Blackboard. The main theoretical concepts will be provided through the course notes and assigned readings. Hands-on practical exercises will use various software products accessible over the Internet. Assignments will give you an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction.

**Workload** – This is a four credit, one semester graduate-level course. Students should expect to spend 10-15 hours per week to complete the work in this class. Please note that in addition to the weekly workload, there is a required weeklong field excursion to the Philip K. Wrigley Marine Science Center on Catalina Island. *Note: There is a required room and board fee for the Catalina trip of approximately $360 that is supplemental to the regular tuition cost.*

**Technological and Communication Requirements**

The geospatial software and data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute.

ArcGIS is provided online via the SSI Server; hence, you do not need to install it on your own computer. In addition, your instructor will provide laptops with Esri, Eos and Trimble software and a variety of GPS and related data capture devices for the Catalina field component. At their home workspaces, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the SSI server.

**SSI Server and Tech Support** – This course utilizes the SSI Server, which is a virtual desktop giving access to many different professional software programs. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (CC) the instructor (me) on the email.

**Communications** – Apart from the week on Catalina Island, this is a distance-learning course, so most of our interactions will be asynchronous (i.e. not at the same time). All materials to be handed in will be submitted via Blackboard. It is each student’s responsibility to stay informed about what is going on in the course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

I will send via email, or through Blackboard, any notices that are time sensitive. Please be sure that you read all emails sent from Blackboard or from me directly as soon as possible. Check now to make sure that emails sent from both the USC Blackboard accounts and my personal email account does not go into your junk mail.

While I am usually online and will probably respond to emails from students quickly, I will endeavor to respond to all emails within 24 hours of receipt, aiming for no more than 72 hours.
delay. In the rare case when I expect to be offline for more than 72 hours, I will post an announcement on Blackboard.

*Discussions and Collaborative work* – On Blackboard, you will discuss your learnt concepts and theory with classmates and work with them to complete course assignments, exercises, and projects as the need arises. Through discussions and collaborative work, students can provide support to each other while working on their own assignments, and sharing helpful tips.

**Required Readings and Supplementary Materials**

The required textbooks for this course are:


You will recognize that both of these books are also required for SSCI 581: *Concepts for Spatial Thinking*. These textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports, and authoritative websites.

**Supplemental Readings** – The following journal articles will be posted to Blackboard under Weekly Assignments:


• Singh, I. 2016. The future of earth observation is in small satellites. Retrieved from https://www.geospatialworld.net/article/earth-observation-small-satellites-industry/


Description and Assessment of Assignments

Weekly Assignments

There are several different kinds of assignment with at least one due weekly. These are described in the Weekly Folders on Blackboard. Due dates are shown in the Schedule below.

Resume Assignment – 1 worth 2 points. We require all current students to post and maintain a public resume, short biography, and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template that will be provided to you. Unless you opt out, your resume will be included in the Spatial Science Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience, and professional aspirations.

Reading Assignments – 5 worth 10 points. Each student is required to complete a minimum of five of the 10 reading assignments for this class. The reading assignments focus on the theory portion of the course as presented in the weekly readings. The objective is to help you evaluate and integrate the information you have acquired from the course readings. The first reading assignment is required and from there you are free to choose any four of the nine subsequent assignments. However, you must complete and submit them for grading in the weeks specified in the Schedule below. If you complete more than five reading assignments, your instructor will use the first reading assignment and your four highest scores from the subsequent reading assignments to calculate your course grade.

Data Capture and Use Assignments – 4 worth 12 points. Each student is required to complete a minimum of four of the five data capture and use assignments for this class. The “hands-on” data capture assignments require you to work through various skill development activities
and data integration into the ArcGIS Pro platform. To demonstrate that you have completed the steps comprising each of these assignments, you will submit a Word document containing output such as a map and/or brief written answers.

**Discussion Forums – 2 worth 4 points.** These focus on a combination of theory and practice. Discussions provide students a mean to discuss and collaborate, replicating the face-to-face contact you may have in the traditional classroom settings. Anticipate that you will be required to post a minimum of two new messages (i.e. one per forum) and four replies (i.e. two per forum) to messages posted by your classmates at designated times throughout the semester.

**Exercises – 3 worth 15 points.** To demonstrate your understanding of the basic concepts and skills learned in the class, you will complete three exercises that will integrate key concepts and ideas and require independent thought. The final two exercises will take one of three forms depending on your program status. Students enrolled in the GIST M.S. Program and GIST Graduate Certificate students planning to transition to the GIST M.S. Program will work on their proposed thesis prospectus; the remainder of the GIST Graduate Certificate students will tackle a pair of exercises focused on fundamental geospatial information data capture and management challenges; and the HSGI M.S. students will start work on their proposed capstone project proposal.

**Summative Assignment – 1 worth 4 points.** A final summative written assignment to be completed during the final examination period is required. In this assignment, you will reflect on the course learning outcomes and explain how the assigned work completed during the semester address these.

**Catalina Field Component**

For this part of the course, you will be divided into small teams to undertake your field work together. In addition to completing the data collection project, each team will deliver two oral presentations and a poster summarizing your project and results.

**First Presentation – 5 points.** This 10-15 minute presentation will take place at the start of the week and will describe your team’s proposed research project.

**Second Presentation – 10 points.** This 15-20 minute presentation will take place at the end of the week and will summarize your team’s methodology, results and findings.

**Poster – 8 points.** The poster will present a summary of your project and visualization of results. The posters must be submitted for grading to Blackboard before leaving the island.

**Research Reports**

Two research reports provide students an opportunity to integrate learning from various aspects of the course through the practice of a more in-depth assignment.

**First Report – 10 points.** The first report will provide you with an opportunity to describe the data capture options and challenges for a project of your choice from a list of projects spanning a variety of application domains. The first report must not exceed six single-spaced pages excluding figures, maps, tables, and references.
Second Report – 20 points. The second report will take one of three forms depending on your program status. Students enrolled in the GIST M.S. Program and GIST Graduate Certificate students planning to transition to the GIST M.S. Program (Group 1) will prepare a prospectus for a thesis project and outline some of the methods and geospatial data sources that could be used in such a project. The remainder of the GIST Graduate Certificate students (Group 2) will be afforded the opportunity to integrate all that they have learned in the semester in an investigation of data quality for one or several specific applications that your instructor will designate. The HSGI M.S. students will prepare a proposal for their capstone project. The second report (for all groups) must not exceed 10-12 single-spaced pages excluding figures, maps, tables, and references.

Grading Breakdown
Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other GIST courses. The table below summarizes the SSCI 587 course assignments and their point distribution:

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Number</th>
<th>Points</th>
<th>Total Points</th>
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</thead>
<tbody>
<tr>
<td>Weekly Assignments</td>
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<tr>
<td>Resume Assignment</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Reading Assignments</td>
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<td>2</td>
<td>10</td>
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<td>Data Capture and Use</td>
<td>4</td>
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<td>12</td>
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<td>Discussion Forums</td>
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<td>2</td>
<td>4</td>
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<tr>
<td>Exercises</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>Summative Assignment</td>
<td>1</td>
<td>4</td>
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<tr>
<td>Catalina Island Excursion</td>
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<tr>
<td>First Presentation</td>
<td>1</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Second Presentation</td>
<td>1</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Poster</td>
<td>1</td>
<td>8</td>
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<tr>
<td>Research Reports:</td>
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<tr>
<td>First Report</td>
<td>1</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Second Report</td>
<td>1</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Totals</td>
<td>23</td>
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<td>100</td>
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Assignment Submission Policy

Unless otherwise noted, assignments must be submitted via Blackboard by the due dates specified in the Schedule below and on the assignment instructions.

Unless otherwise noted, all Reading Assignments, Exercises, Discussions, and Tutorials are due by 11:59 p.m. PT on Mondays. Fieldwork components have different due dates as indicated on the Schedule below. Attention to on-time assignment submission is essential if your instructor is to meet the goal to return comments on submitted assignments before the next one is due. Sometimes this is impossible, and your instructor will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:
• All assignments will be penalized 2 points for up to FOUR days late. No points will be given for submission more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.

• Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes.
## Course Schedule: A Weekly Breakdown

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Topics</th>
<th>Readings / Assignments</th>
<th>Deliverables / Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong>&lt;br&gt;8/20</td>
<td>Introduction to class</td>
<td>Wilson &amp; Fotheringham, Ch. 1  Resume Assignment  Discussion Forum 1</td>
<td>No deliverables</td>
</tr>
<tr>
<td><strong>Week 2</strong>&lt;br&gt;8/27</td>
<td>Geospatial data types</td>
<td>Bolstad, Ch. 2  Chrisman (1984)  Reading Assignment</td>
<td>Resume Assignment: 8/27  Discussion Forum 1: 8/27</td>
</tr>
<tr>
<td><strong>Week 3</strong>&lt;br&gt;9/4*&lt;br&gt;Monday, 9/3 is university holiday</td>
<td>Fitness-for-use</td>
<td>Core reading TBD  Fisher et al (2010)  Reading Assignment 2  Data Capture and Use Assignment 1</td>
<td>Reading Assignment 1:  <strong>Tuesday, 9/4</strong></td>
</tr>
<tr>
<td><strong>Week 4</strong>&lt;br&gt;9/10</td>
<td>Maps and other legacy geospatial datasets</td>
<td>Bolstad, Ch. 3 &amp; 4  Bolstad et al. (1990)  Hutchinson (1989)  Reading Assignment 3  Data Capture and Use Assignment 2</td>
<td>Reading Assignment 2:  Monday, 9/10  Data Capture and Use Assignment 1:  Monday, 9/10</td>
</tr>
<tr>
<td><strong>Week 6</strong>&lt;br&gt;9/24</td>
<td>Aerial and early satellite images</td>
<td>Bolstad, Ch. 6  Pasquearella et al. (2016)  Robinson et al. (2005)</td>
<td>Reading Assignment 4:  Monday, 9/24  Exercise 1:  Monday, 9/24</td>
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<tr>
<td><strong>Week 7</strong>&lt;br&gt;10/1</td>
<td>Newer satellite-based images</td>
<td>NASA (2015), Ch. 1-2  Singh (2016)  Reading Assignment 5  Exercise 2</td>
<td><strong>Report 1:  Monday, 10/1</strong></td>
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<tr>
<td><strong>Week 8</strong>&lt;br&gt;10/8</td>
<td>Unmanned Autonomous Systems (UAS)</td>
<td>Greenwood, Ch. 4  Whitehead &amp; Hugenholtz (2014)  Course Notes  Reading Assignment 6</td>
<td>Reading Assignment 5:  Monday, 10/8  Exercise 2:  Monday, 10/8</td>
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<tr>
<td><strong>Week 9</strong>&lt;br&gt;10/15</td>
<td>Role and importance of scales</td>
<td>Goodchild (2011)  Frank (2010)  Strominger et al. (2016)  Reading Assignment 7</td>
<td>Reading Assignment 6:  Monday, 10/15</td>
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<tr>
<td>Week 10</td>
<td>Catalina</td>
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</table>
| 10/22    | Course notes  
Proposal Presentation  
Final Presentation  
Poster |
|          | Reading Assignment 7:  
SUNDAY, 10/21  
--------  
First Presentation:  
Tuesday, 10/23  
Second Presentation:  
Sunday, 10/28  
Poster: Sunday, 10/28 |
| Week 11  | Data standards,  
data quality and  
uncertainty |
| 10/29    | Bolstad, Ch. 14  
De Genst et al. (2001)  
Hunter and Goodchild (1995)  
Hunter and Goodchild (1996) |
|          | Exercise 3:  
Monday, 10/29 |
| Week 12  | Geocoding |
| 11/5     | Goldberg et al. (2007)  
Zandbergen (2008)  
Jones et al. (2014) |
|          | Reading Assignment 8  
Data Capture and Use  
Assignment 3 |
|          | Reading Assignment 8:  
SUNDAY, 11/4  
Data Capture and Use  
Assignment 3:  
Monday, 11/5 |
| Week 13  | Spatial sampling |
| 11/12    | De Smith et al. (2015), Ch. 5.1.2  
Frank (2010)  
Kassie et al. (2017)  
Smith et al. (2017)  
Wang et al. (2002) |
|          | Reading Assignment 9  
Data Capture and Use  
Assignment 4  
Introduce Report 2 |
|          | Data Capture and Use  
Assignment 4:  
Monday, 11/12 |
| Week 14  | Spatial interpolation/  
spatial estimation |
| 11/19    | Bolstad, Ch. 12  
Reading Assignment 10 |
|          | Reading Assignment 9:  
Monday, 11/19  
Data Capture and Use  
Assignment 5:  
Monday, 11/19 |
| Week 15  | Class Wrap-up |
| 11/26    | Onsrud (2010) |
|          | Reading Assignment 10:  
Monday, 11/26  
Report 2:  
FRIDAY, 11/30 5:00 PM PT |
| Exam Week| Summative Assignment |
| 12/5     | Summative Assignment |
|          | Summative Assignment:  
Wednesday, 12/5 |
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” [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](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](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](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](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](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](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](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](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.