

## GIS in Water Resources Fall 2014

<p><b>CE 394K.3</b> University of Texas Tue, Thur: 12:30-2 PM, ETC 5.148 Unique Num: 16185</p>	<p><b>GEOG 591</b> UNC Chapel Hill Tue, Thur: 1:30-3:00 PM Peabody 08F</p>	<p><b>CEE 6440</b> Utah State University Tue: Thur, 11:30-1 PM, ENGR 401 Optional Lab Friday 11.30 to 12.30 ENGR 305 Catalog Number: 55772</p>
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### Instructors:

<p>David Maidment Office: ECJ 8.610 University of Texas Phone: (512) 471-0065 Fax: (512) 471-0072 Office Hours: Tuesday - Thursday, 2PM - 3:30PM <a href="http://www.cae.utexas.edu/pr&lt;br/&gt;of/maidment">http://www.cae.utexas.edu/pr of/maidment</a> Email: <a href="mailto:maidment@utexas.edu">maidment@utexas.edu</a></p>	<p>David Tarboton Office: Saunders 304/Institute of the Environment, Europa Center UNC Chapel Hill Phone: (435) 512 7666 Office Hours: Tuesday, Thursday 3-4 PM (Saunders 304). <a href="http://www.neng.usu.edu/cee/&lt;br/&gt;faculty/dtarb/giswr/2014/">http://www.neng.usu.edu/cee/ faculty/dtarb/giswr/2014/</a> Email: <a href="mailto:dtarb@usu.edu">dtarb@usu.edu</a></p>	<p>Tony Castronova Office: UWRL 207, ENGR 230 Utah State University Phone: (435) 797-0852 Office Hours: Tuesday, Thursday 2-3 PM. <a href="https://usu.instructure.com/cou&lt;br/&gt;rses/347407">https://usu.instructure.com/cou rses/347407</a> Email: <a href="mailto:tony.castronova@usu.edu">tony.castronova@usu.edu</a></p>
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### Course Description

Application of Geographic Information Systems in Water Resources. Digital mapping of water resources information. Spatial coordinate systems. Hydrologic terrain analysis using digital elevation models. River and watershed networks. Soil and land use mapping. Flood hydrology modeling and flood plain mapping. Integration of time series and geospatial data. Hydrologic Information Systems.

### Prerequisites

Graduate standing in engineering or a related discipline (or at UNC some prior GIS experience)

### Course Objectives

The five course exercises are intended to enable you to be able to:

- Plot a map of a hydrologic region including measurement sites and associate it with time series of data measured at those locations;
- Use web mapping to access geospatial and temporal water resources information;
- Create a base map of a study region including watersheds, streams, and aquifers by selecting features from regional maps;
- Interpolate measured data at points to form raster surfaces over a region, and spatially average those surfaces over polygons of interest;
- Do hydrologic calculations using map algebra on raster grids;

- Build a geometric network for streams and rivers;
- Analyze a digital elevation model of land surface terrain to derive watersheds and stream networks.

### **Course Web Sites**

#### University of Texas.

Public web site: <http://www.caee.utexas.edu/prof/maidment/giswr2014/giswr2014.htm> This contains the course outline, PowerPoint presentations, class exercises for the course and University of Texas specific information such as UT student work and term papers. An archive of the video of each class in Windows Media format will be provided.

#### Utah State University.

Public web site: <http://www.engineering.usu.edu/dtarb/giswr/2014>. This will serve as both the USU and UNC website and contains links to the course outline, PowerPoint presentations, class exercises. USU specific material will be in <https://usu.instructure.com/courses/347407>.

#### University of North Carolina.

UNC will also use the USU public website: <http://www.engineering.usu.edu/dtarb/giswr/2014>. Sakai <https://sakai.unc.edu/> will be used for any UNC specific content.

### **Method of Instruction**

The course has six elements: lectures, assigned reading materials, homework exercises, a term paper, class interaction, and examinations. All students will prepare a term project in Adobe pdf format that will be posted on the course web site. Part of the final examination will involve synthesis of the term papers presented in the class to provide an assessment of the state of knowledge in particular subject areas. The course material is divided into modules with each module having one or two lectures and a homework exercise involving extensive use of GIS software.

### **Term Project**

The purposes of the term project are:

1. To enable you to explore in-depth some aspect of the subject of personal interest to you and to develop experience in the use of GIS technology to solve that problem.
2. To provide experience in the formulation, execution and presentation of original research, including the proper documentation of a GIS project.
3. To make an oral presentation and produce a report in PDF on the world wide web that will be informative to you and to your classmates.

The steps in carrying out the project are:

1. Identify your course web page. At Texas, I will establish a class web page and put your materials on that. At Utah a web page will be established for you on the CEE Server for the Geomatics lab. See the USU class web site for instructions on accessing this. At

UNC we will use <http://beta.hydroshare.org> to save term project material. See the website for instructions on doing this.

2. Prepare a 1-page proposal in PDF on your website by Thurs Sept 25 specifying the objective of your project and outlining how you plan to go about executing it. Notify the instructor by email that your proposal is available and you will receive a response by email containing an assessment of the scope of work that you propose. After making any revisions in your proposal that seem necessary in the light of this assessment, this proposal defines the scope of your term project.
3. Prepare a two-page status report in PDF on your project to be posted on your website by Tues Oct 28. You are expected to make some progress by mid-semester but the main effort on your term project in the later part of the course once you've learned more about the methods in the course. This report will be read and commented on by the instructor, and perhaps other students.
4. Present a final report orally in class near the end of the semester (you will have 10 -12 minutes for your presentation) and present your term paper in PDF on your web page by the last day of classes (Dec 5). It is critical that you post your paper by this date because your classmates may need to read your paper in order to complete their final exam.

If you would like to work in a group to pursue a term project, that is fine, but you must carry out a particular section of the project on which you will present your oral and written report. Generally team-based term projects are hard to unscramble at the end when it comes time to present the oral and written versions of your term project, so it is probably best to just do an individual term project.

Archives are available showing the reports from more than 300 term papers done by students in this course from Spring 1997 to last year. See:

<http://www.cae.utexas.edu/prof/maidment/giswr2014/docs/termpaperlibrary.htm>

<http://www.engineering.usu.edu/dtarb/giswr/>

### **Course Computer Environment**

This course uses the ArcGIS version 10.2.2 software. The Spatial Analyst and 3D Analyst extensions of ArcGIS will also be used in the course. These programs run under the Windows operating system.

Texas. ArcGIS is available in the Civil Engineering Learning Resource Center. You may want to get a magnetic card so that you can enter the LRC in the evenings or weekends. If you work at the LRC, you'll be assigned a standard amount of disk space for your personal use. You will also be issued a license file to authenticate ArcGIS Desktop 10.2.2 operating on your own desktop computer.

Utah. ArcGIS is available in the Engineering PC lab, ENGR 305.

North Carolina. ArcGIS is available from

[http://software.sites.unc.edu/software/arcgis/#P84\\_1928](http://software.sites.unc.edu/software/arcgis/#P84_1928)

If you have access to the software elsewhere, you can do the computer assignments at that location. You should plan to back up your work on a removable drive (e.g. zip or thumb) to avoid complications from lack of disk space in your personal area.

## **Course Readings**

Readings for this course will be given out as in-class handouts, links to resources on the web, and written synopses of class lectures.

## **Method of Evaluation**

Course grades will be based on a weighted average of results as follows:

Homework 20%  
Term Project Written Report 30%  
Term Project Oral Presentation 10%  
Midterm Exam 20%  
Final Exam 20%

The midterm exam will be an in class exam. The final exam will be a take home distributed in class on Thursday Dec 4 and due in a week later. Special arrangements for submitting the solution electronically for students travelling during that that week can be established. The final exam will include project type GIS analysis as well as essays and short reports that synthesize material from the class and from the term projects of other students in the class.

Letter grades will be assigned as follows:

A = 95 - 100%  
A- = 90 - 95%  
B+ = 87 - 90%  
B = 83 - 87%  
B- = 80 - 83%  
C+ = 77 - 80%  
C+ = 73 - 77%  
C- = 70 - 73%  
C- = 60 - 70%  
F < 60%

There will be no make-up exams or incomplete grades in this course. We reserve the right to change the date of an exam with notice in advance. Class attendance will not be recorded in this class and will not form part of the criteria for establishing grades. All lectures are videotaped and the lecture can be viewed from the archive whose web address is given elsewhere in this syllabus.

At UNC, for graduate students a mapping will be established to associate scores with the High Pass, Pass etc. system used.

## **Course/Instructor Evaluation Plan**

Course/Instructor evaluation will be conducted separately at each University according to the policies of each University.

Texas. Forms will be distributed during the final lecture period. A student from the class will be asked to distribute and collect the evaluation forms, and to return them to the Department of Civil Engineering office on the 4th floor of ECJ.

Utah. USU will use the IDEA system for student evaluations. You will receive email from the university with instructions for how to fill out evaluations online.

North Carolina. UNC students will follow the normal UNC procedure for online evaluations.

We also encourage students to speak to us during the semester, and are open to suggestions relating to the course.

### **Students with Disabilities**

Texas. The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259 (voice) or 232-2937 (video phone) or <http://www.utexas.edu/diversity/ddce/ssd>

Utah. Students with ADA-documented physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations. Veterans may also be eligible for services. All accommodations are coordinated through the Disability Resource Center (DRC) in Room 101 of the University Inn, (435)797-2444 voice, (435)797-0740 TTY, or toll free at 1-800-259-2966. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) are available with advance notice.

North Carolina. Students seeking academic accommodations should register with Disability Services and then contact me to make particular arrangements. See <http://disabilityservices.unc.edu> for more information, policies, and procedures.

### **Course Drop Policies**

#### **University of Texas**

From the 1st through the 4th class day, graduate students can drop a course via the web and receive a refund. During the 5th through 12th class day, graduate students must initiate drops in the department that offers the course and receive a refund. After the 12th class day, no refund is given. No class can be added after the 12th class day. From the 13th through the 20th class day, an automatic Q is assigned with approval from the Graduate Advisor and the Graduate Dean. From the 21st class day through the last class day, graduate students can drop a class with permission from the instructor, Graduate Advisor, and the Graduate Dean. **Students with 20-hr/week GRA/TA appointment or a fellowship may not drop below 9 hours.**

#### **Utah State University**

Students may drop courses without notation on the permanent record through the first 20 percent of the class. If a student drops a course following the first 20 percent of the class, a W will be permanently affixed to the student record. Under normal circumstances, a student may not drop a course after 60 percent of the class is completed. (Check the Registration Calendar <http://catalog.usu.edu/content.php?catoid=6&navoid=1180> for exact dates.)

## University of North Carolina Chapel Hill

UNC Drop Add procedures are given at <http://registrar.unc.edu/registration/registration-policies/drop-add-procedures/>.

### Course Fees

#### Utah State University

Students attending at Utah State University will be charged an additional \$50 course fee to pay for computer lab software and administration, and distance education broadcasting.

Class	Date	Subject	Lecturer
1	Thu, Aug 28	Introduction to GIS in Water Resources. Review the course curriculum, course outline.	Maidment
2	Tue, Sep 2	Introduction to ArcGIS.	Maidment
3	Thu, Sep 4	Exercise 1: Introduction to ArcGIS	Tarboton
4	Tue, Sep 9	Data sources for GIS in water resources	Tarboton
5	Thu, Sep 11	Exercise 2: Building a base map	Tarboton
6	Tue, Sep 16	Geodesy, map projections and coordinate systems	Maidment
7	Thu, Sep 18	Spatial analysis using grids	Tarboton
8	Tue, Sep 23	Exercise 3: Spatial analysis in hydrology	Tarboton
9	Thu, Sep 25	Digital Elevation Based Watershed and Stream Network Delineation. <i>1 page Term project proposal due</i>	Tarboton
10	Tue, Sep 30	Terrain Analysis Using Digital Elevation Models (TauDEM).	Tarboton
11	Thu, Oct 2	Exercise 4: Watershed and Stream Network Delineation.	Tarboton
12	Tue, Oct 7	Water data in space and time	Maidment
13	Thu, Oct 9	Review for Midterm Exam.	Maidment
14	Tue, Oct 14	Midterm Exam	All
15	Thu, Oct 16	Arc Hydro for Groundwater [USU and UNC Fall Break, class optional for USU and UNC students]	Maidment
16	Tue, Oct 21	Extending ArcGIS using programming.	Tarboton
17	Thu, Oct 23	Data Collection and Processing (Web services + Python processing)	Castronova
18	Tue, Oct 28	Exercise 5: Collecting and processing data from USGS using programming. <i>2 page term project status report due</i>	Castronova
19	Thu, Oct 30	Green infrastructure, groundwater and the sustainable city	Larry Band
20	Tue, Nov 4	Hydro Networks	Castronova
21	Thu, Nov 6	Flood mapping	Maidment
22	Tue, Nov 11	HydroShare	Tarboton
23	Thu, Nov 13	Open Water Data	Maidment
24	Tue, Nov 18	Presentation of Term Papers	Students
25	Thu, Nov 20	Presentation of Term Papers	Students
26	Tue, Nov 25	Presentation of Term Papers. UNC group 1.	Students
	Thu, Nov 27	Thanksgiving	
27	Tue, Dec 2	Presentation of Term Papers. UNC group 2. Discussion of final exam at UNC.	Students
28	Thu, Dec 4	Presentation of Term Papers, Course evaluation, discussion of final exam	Students
	Fri, Dec 5	<i>Term project due</i>	Students