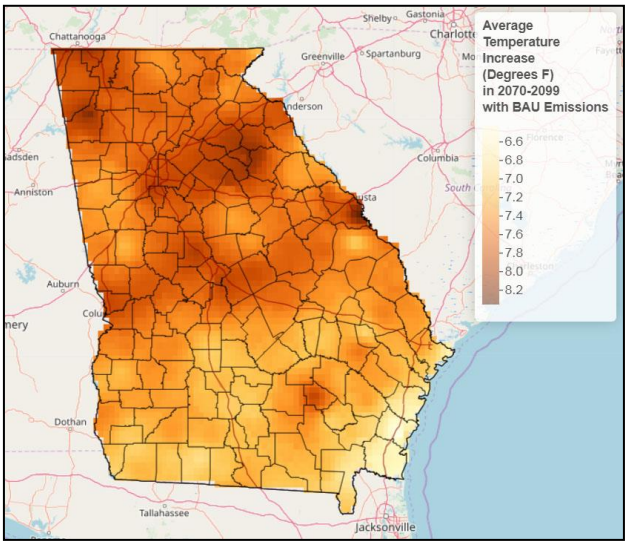
CP 8853-BD: Climate Change Analytics
William J. Drummond
Spring 2021



Course Syllabus Version 1

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Office hours: Thursday 9:00-11:00 via Webex
and by appointment

Course description

This course utilizes a suite of database, statistics, and spatial analysis tools to address the global problem of climate change. Climate change analytics is especially challenging because the time horizons addressed can extend backward and forward for centuries, and any analysis of future climate change must deal with a broad range of unknowns while still applying scientific rigor. In addition, the rapid pace of climate change means that the past conditions are no longer a reliable guide for predicting future conditions. Instead we must be guided by the output of climate models when we decide what actions we must take today to try and forestall the worst effects of climate change in the future.

The course will, at many points, touch on climate change policy. However, climate change data and analysis methods, not policy, are the major foci of the course. Students who are also interested in climate change policy should consider these courses, the latter two of which are being offered in Spring 2021:

- CP 4190/6190: Introduction to Climate Change Planning
- CP 6217: Climate Change and the City
- PubP 6354: Climate Policy
- PubP 6701: Energy Technology and Policy

Learning objectives

Students successfully completing this course will be able to:

- Create R scripts to import and format a variety of data related to climate change

- Utilize R to analyze climate change data to generate useful information
- Import and format relevant vector climate change spatial data
- Import and format relevant raster climate change spatial data
- Visualize climate change data through charting and mapping

Teaching methods

The major teaching methods for this class include lectures, in-class labs, class discussions, required readings with exercises tests, a final exam, and a project related to the Drawdown Georgia project.

At the start of class of the course students will use out-of-class time to systematically work through the details of R using the two class open-source textbooks: R for Data Science and Geocomputation with R. Students are expected to read all assigned material and work the exercises included in the assigned chapters. Substantial material for the tests and final exam will be drawn from the readings and assigned exercises. In-class time will focus on the application of R to specific climate change applications.

This course will be delivered in Remote Synchronous Mode. All students are expected to attend all class meetings at assigned class times via Cisco Webex software. However, class attendance is not a formal, direct component of course grading. Links to the Webex classes are available from the course Canvas site.

Students are encouraged to meet with Bill Drummond as individuals or groups in office hour appointments from 9:00 to 11:00 on Thursdays. Students should reserve one or more 15-minute time slots through Canvas with the following procedure.

1. In Canvas select CP 8853
2. Click on "Cisco Webex" from the left-side navigation menu
3. Click on "Office Hours" from the horizontal menu near the top of the Canvas screen
4. Select one or more appointment slots
5. Press “Confirm Meeting” at the lower right corner of the screen
6. You should receive an email with confirmation and a link to the Webex meeting
7. Cancel an appointment by working through the same process and clicking on an existing appointment.

Course software

The primary software environment will be the open-source R package and RStudio, supplemented with specialized R libraries for data wrangling and spatial analysis. However, prior experience with R or any other programming language is not a course pre-requisite. Students may use College of Design virtual machines with R, RStudio, and a pre-installed set of

R libraries. But R, RStudio, and the necessary R libraries are all open-source software that students may download and install on personal computers.

Students with disabilities

Students with disabilities needing academic accommodation should provide documentation to the Access Disabled Assistance Program for Tech Students (http://www.adapts.gatech.edu/) and bring an ADAPTS accommodation letter to the instructor indicating the nature of accommodations required. This should be done within the first week of class or as soon as possible after a new disability condition arises. All effort will be made to provide reasonable accommodation.

Grading

The Georgia Tech Honor Code is in effect throughout this course. You should review this code and make sure you understand your responsibilities. If you have any questions, please contact the instructor. Exam and project grades may be curved upward or downward depending on the actual distribution of grades in a particular test, exam or project. Each student's final grade in the class will be based upon these components:

Test 1	25 percent
Test 2	25 percent
Final exam:	35 percent
Class project:	15 percent
Total	100 percent

Course Schedule

Classes	Topics	Readings
Week 1: January 20	Introduction to Climate Change Analytics	R4ds chapters 1-3
Week 2: January 25 - January 27	Basics of R, Rstudio, & tidyverse	R4ds chapters 4-8 (skim chapter 7)
Week 3: February 1 - February 3	EIA SEDS data	R4ds chapters 9-12
Week 4: February 8 - February 10	SEDS for electricity analytics	R4ds chapters 13-16.3
Week 5: February 15 - February 17	SEDS for CO2 analytics; Test 1 on February 17	R4ds chapters 17-21
Week 6: February 22 - February 24	Spatial data in R	GwR chapters 1-2
Week 7: March 1 - March 3	Vector spatial analysis in R	GwR chapters 3-4
Week 8: March 8 - March 10	Raster spatial analysis in R	GwR chapters 5-6
Week 9: March 15 - March 17	Mapping spatial data in R	GwR chapters 7-8
Week 10: March 22	Test 2 on March 22	
Week 11: March 29 - March 31	Climate model output data formats and scenarios	NCA volume 1 chapter 4 and NCA volume 1 appendix 3
Week 12: April 5 - April 7	Climate model outputs for temperature, precipitation and sealevel rise	R stars package vignettes 1, 3, & 4
Week 13: April 12 - April 14	Climate solutions: Drawdown Georgia	Drawdown GA, scan entire website Drawdown GA resources, scan entire website
Week 14: April 19 - April 21	Analytics for electricity climate solutions	None
Week 15: April 26	Analytics for transportation climate solutions	None
Final exam period	Final exam: Friday, April 30, 8:00 AM - 10:50 AM Project due: Monday May 3; 11:59 PM	