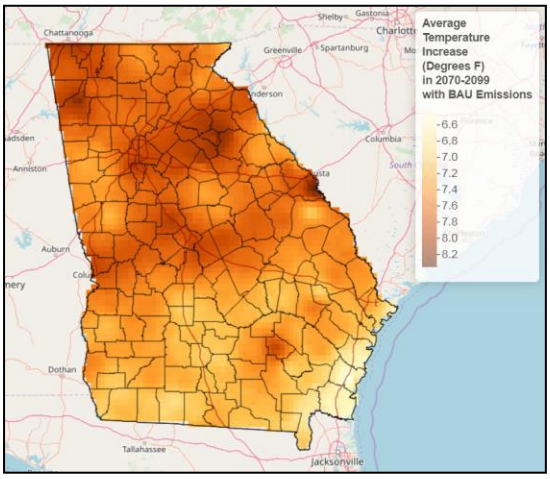
CP 8853-BD: Climate Change Analytics

Mon/Wed 9:30-10:45
William J. Drummond
Spring 2021



Course Syllabus Draft

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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 interested in climate change policy coursework 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

This is a graduate-level course, but it may also be appropriate for undergraduates with interests in climate change and data analytics.

Course software

The primary software environment will be the open-source R package supplemented with specialized R libraries for data wrangling, statistics, and spatial analysis. However, prior experience with R or any other programming language is not a course pre-requisite. The first month of class will cover the basics of R data wrangling using important climate datasets such as the Energy Information Administration's State Energy Data System (SEDS).

Course mode

This course will be delivered in Remote Synchronous Mode. All students are expected to attend all classes at assigned class times using remote video conferencing software. However, class attendance is not a formal, direct component of course grading.

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.

Test, exam, and assignment grades may be curved upward or downward depending on the actual distribution of grades in a particular test, exam, or assignment. Each student's final grade in the class will be based upon these components:

Test #1:	20 percent
Test #2:	20 percent
Final exam:	30 percent
Class project:	30 percent
Total	100 percent

Background online resources

This Website presents the results of R-based analysis and interactive mapping for a selection of Georgia climate datasets:
https://sites.gatech.edu/giscc/

This Website presents the results of the Drawdown Georgia project:
https://cepl.gatech.edu/projects/Drawdown-Georgia

which is a major component of the Georgia Climate Project:
https://www.georgiaclimateproject.org/

Outline of topics

A. Analysis foundations

Week 1: Base R: the primary computational environment for the course
Week 2: R dplyr and tidyverse: R data analysis packages
Week 3: Spatial R for vector data: sp and sf spatial data
Week 4: Spatial R for raster data: raster and stars packages
Week 5: R mapping and visualization: ggplot2, tmap, and leaflet packages

B. Causes of climate change

Week 6: Fossil fuels: coal, natural gas, petroleum products
Week 7: Land use change: deforestation and afforestation

C. Effects of climate change

Week 8: Climate model outputs: data formats, uncertainties, and scenarios
Week 9: Primary effects 1: climate model outputs for temperature and precipitation
Week 10: Primary effects 2: climate model outputs for sea level rise, storms, drought
Week 11: Secondary effects: mortality, agricultural yields, coastal damage, labor markets

D. Solutions for climate change

Week 12: Zero-carbon electricity: solar, wind, and nuclear electricity generation
Week 13: Transportation: electric and hydrogen vehicles
Week 14: Federal climate change initiatives: Net-zero greenhouse gas emissions by 2050
Week 15: Drawdown Georgia: 21 climate change solutions for Georgia