

Last Update: 12/15/2023

**SYLLABUS**  
**CLIM-631**  
**Urban Climate**



Spring Semester, 2023  
Wednesdays, 1:30pm - 4:10pm EST

**Innovation Hall 139**

**Instructor: Prof. Zafer Boybeyi**

**Introduction:**

CLIM-631, Urban Climate, is a graduate course (3-credit) under the Department of Atmospheric, Oceanic & Earth Sciences (AOES). Cities affect climate at both local and global scales. Cities are typically warmer, more prone to flooding, and have poorer air quality than their rural surroundings. They are also particularly exposed to the potential hazards of future global climate change, such as increasing temperatures, increasing in severity and frequency of extreme events, and sea-level rise. For most people on the planet, an urban climate is the norm. Over the past 200 years, the global population has increased eightfold, from 1 billion in 1800 to currently about 8 billion; during the same period the fraction of people living in urban areas increased from 3% to more than 50%. The intensity of landscape change and its impact on environmental systems, including the atmosphere (i.e., weather and climate), are profound and this influence is transmitted to regional and global systems far downwind. The primary focus in CLIM-631 is the interactions between a city and the overlying atmosphere. While interactions are two-way, the prime focus of this course is the impact of the city on the atmosphere. Urban development so fundamentally transforms the pre-existing biophysical landscape that a city creates its own climate. To a lesser extent, the course also considers the effects of weather and climate on the city.

**General Course Goals:**

The goal of this course is to provide students with;

- A better understanding of identifying, describing and quantifying the impact of urban growth on atmospheric processes and the consequent development of distinct urban climates,
- a better understanding of the physical principals governing the creation of distinct urban (micro) climates,

- illustrating how this knowledge can be applied to moderate the undesirable consequences of urban development and help create more sustainable and resilient cities.

### **Instructor and Contact Information:**

**Prof. Zafer Boybeyi**

Research I, Room 217

Mail Stop 6A2

**Email:** [zboybeyi@gmu.edu](mailto:zboybeyi@gmu.edu)

Office Hours: Mondays, 9:00-10:30am EST

Additional hours by appointment

### **Course Website:**

GMU Blackboard: <https://gmu.blackboard.com/>

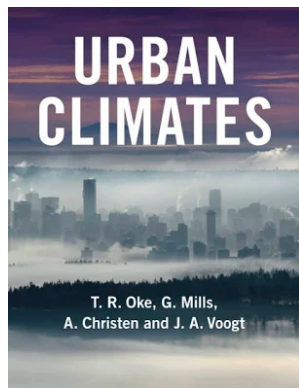
In order to comply with student privacy laws, faculty and students need to use their GMU e-mail accounts when corresponding with each other.

### **Required Textbook:**

Urban Climates

T. R. Oke, G. Mills, A. Christen & J. A. Voogt

ISBN 978-0-521-84950-0, 2017, 525p.



### **Additional Supplementary Readings:**

- OECD (2010), Cities and Climate Change, OECD Publishing (<http://dx.doi.org/10.1787/9789264091375-en>)
- Technical Report (2008), Development and Climate Change: A Strategic Framework for the World Bank Group ([http://siteresources.worldbank.org/DEVCOMMINT/Documentation/21928837/DC2008-0009\(E\)ClimateChange.pdf](http://siteresources.worldbank.org/DEVCOMMINT/Documentation/21928837/DC2008-0009(E)ClimateChange.pdf))

### **Course Format:**

- Lectures
- Homework assignments
- Reading assignments supplemental material
- A final project
- Midterm exam

- Final exam (may be take home exam)
- Lecture notes will be posted on GMU Blackboard

### **Final Project**

- First, identify an urban scale experiment, field or laboratory experiment (a suggested list of urban scale experiments will be provided)
- Then, analyze key characteristics of the selected case
- Finally, write few pages term paper, submit the paper electronically and present the results in class. Each presentation will be about 15 minutes

### **Tentative Schedule for Final Project & Exam Timeline:**

Week 1 (Jan. 25)	Introduction
Week 2 (Feb. 1)	Concepts
Week 3 (Feb. 8)	Methods & Field/Laboratory Experiments
Week 4 (Feb. 15)	Micro & Local Effects on Urban Climate
Week 5 (Feb. 22)	Airflow
Week 6 (Mar. 1)	Radiation
Week 7 (Mar. 8)	<b>(Midterm Exam)</b>
Week 8 (Mar. 15)	Energy Balance
Week 9 (Mar. 22)	Urban Heat Island
Week 10 (Mar. 29)	Water & Atmospheric Moisture
Week 11 (Apr. 5)	Cloud & Precipitation
Week 12 (Apr. 12)	Air Pollution
Week 13 (Apr. 19)	Geographical Controls, Cities & Global Climate Change
Week 14 (Apr. 26)	Urban Climate Modeling & Applications
Week 15 (May 3)	<b>Final Project Presentations</b>
Week 16 (May 10)	<b>Final Exam (1:30pm – 4:15pm)</b>

### **Important Notes:**

- Attendance Policy: Students **MUST ATTEND** all classes.
- If you have a schedule conflict and cannot take an exam on the scheduled day, let me know ahead of time and I will try to arrange an alternative test date.

### **Makeup Policy:**

Students will be permitted to submit late homework on a case-by-case basis. Late exams will be permitted if the instructor is provided with an acceptable explanation and if performed within one week of the original exam. Make-up exams must be scheduled **IN ADVANCE** with instructor permission.

### **Important Course Dates:**

- **First lecture:** Monday, January 25, 1:30pm - 4:10pm EST
- **Midterm Exam:** Monday, March 8, 1:30pm - 4:10pm EST
- **Final Exam:** Wednesday, March 10, 1:30pm – 4:10pm EST

### **Course Grading Policy:**

Homework	20%
Final Project*	15%
Midterm Exam**	25%
Final Exam***	40%

\*The students will submit and present a final modeling project.

\*\*You are responsible for all material from text and any additional assigned readings.

\*\*\*The final exam is comprehensive (covering all material covered in the course).

### **Numerical Grade Ranges:**

A+	97-100%
A	94-97%
A-	90-93%
B+	87-89%
B	83-86%
B-	80-82%
C+	77-79%
C	73-76%
C-	70-72%
D	60-69%
F	Below 60%

### **Policy on Use of Personal Technology in the Classroom:**

Laptops are permitted only for use only for this course and its related activities. Email and web surfing are not allowed and are distracting to both the student and to classmates. **Please use common courtesy and do not use your laptop for any activities other than those related to this course.**

Cellphones must be turned off or on vibrate. Please do not take calls or text in the lectures.

### **Religious Holidays and Observations:**

<http://ulife.gmu.edu/calendar/religious-holiday-calendar/> is available to help minimize difficulties for students of different faiths. **It is the student's responsibility to speak to the instructor in advance should their religious observances impact their participation in class activities and assignments.**

### **Students with Disabilities:**

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

### **George Mason University Honor Code:**

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely.

What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the

performance of that task, you will give full credit in the proper, accepted form.

Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification.

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this:

**Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.**

<http://www.gmu.edu/departments/unilife/pages/honorcode.html>