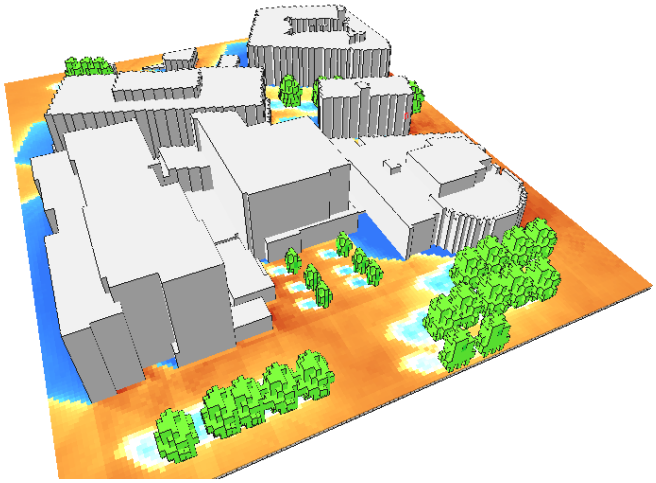
CLIM 759: Micrometeorological modeling for local climate action



Meeting times and Location
Mondays 10:30-1:1

Requisite
Students should be familiar with calculus and differential equations, computer programming, have familiarity with climate data, and climate change impacts.

Instructor: Dr. Luis Ortiz
Contact: lortizur@gmu.edu

Class text: Reference materials will be shared by the instructor throughout the course.
Optional text: Urban Climates (Oke, Mills, Christen, and Voogt). ISBN 9781139016476

Course description
Temperatures are projected to rise throughout the 21st century as a consequence of global climate change. These rising temperatures are often exacerbated in cities. Urban environments, which include streets, buildings, and other human-built infrastructure, have significantly different geometric, thermal, and optical properties to those found in natural landscapes. These characteristics of urban environments often lead to local, yet significant changes to the energy balance at the land surface, resulting higher temperatures in cities compared to their rural surroundings a phenomenon dubbed the Urban Heat Island (UHI).

In this project-based course, students will learn the fundamental concepts describing the impact of human infrastructure and activity on near-surface environments and human heat stress. Students will learn the various ways urban environments modify local atmospheric processes. Through the course, students will work on a project co-designed by a community stakeholder using a micrometeorological model taught in class. As part of this community project, students will present intermediate and results to the community stakeholder, receive feedback, and iterate on solutions.

Course Goals and Learning Outcomes
This course will:

1. Learn the fundamental concepts of how human-built environments modify local climate and their impacts on human health
2. Learn to design and run micrometeorological simulations using existing modeling suites.
3. Learn to translate scientific concepts, data, and insights to community-scale actors.

Course Structure and Grading Criteria

Students will be evaluated through a combination of assignments and a course-long project. The project will include two periodic evaluations: one at the midterm period and one at the end of course that will serve as a final exam. As part of their work, students in this course will prepare a final presentation showcasing their work to the community stakeholder. Students are expected to describe their simulation design and critical assumptions in detail. Students will have 30 minutes to present their work, with 15 minutes of questions.

In-class quizzes: 30%
Participation & Attendance: 10%
Project Midterm Review: 25%
Project Final Presentation: 35%

Grading Scale

A+ = 97 – 100% A = 93 – 96% A- = 90 – 92%	B+ = 87 – 89% B = 80 – 86%	C = 70 – 79%	F = 0 – 69%

Course Schedule

Week	Theme	Topic
1	Introduction	Course Introduction
2	Micrometeorological modeling	What is micrometeorological modeling and Why does it matter? Introduction to community stakeholder and project
3		Describing urban environments: Geometry, materials, and the urban environment, Micromet modeling Hands-on
4		Landscape and meteorology controls on urban temperature variability Micromet modeling Hands-on
5		Fundamental concepts of modeling urban climates at human scales, Pts 1 & 2 Micromet modeling Hands-on
6		Introduction to Micrometeorological Modeling (Envi-Met), Micromet modeling Hands-on
7		
8	Impacts	Impacts: Human energy balance, Project Planning, Micromet modeling Hands-on
9		Impacts: Energy demand and generation, project check-in, Micromet modeling Hands-on

10	Solutions	Policy mechanisms for climate action, Micromet modeling Hands-on
11		Framing heat risk for action, Interventions for heat adaptation and mitigation
12		Heat interventions in a changing climate, Project update and feedback
13		Heat interventions in a changing climate, modeling challenges
14		Final Project Presentation

GMU Email Accounts

Students must use their own Mason email and Blackboard accounts to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

Policy on Student AI Use

When explicitly stated by the instructor, Generative AI tools are allowed on the named assignment. Students will be directed if and when citation or statement-of-usage direction is required. Use of these tools on any assignment not specified will be considered a violation of the academic standards policy. All academic standards violations will be reported using the Academic Standards Referral Form.

Use of Generative AI tools will sometimes be in alignment with the learning outcomes for this course; when meeting the outcome requires original human action, creativity or knowledge, AI tool use would not align with the stated course goals.

Some student work may be analyzed using an originality detection tool focused on AI tools. Generative AI detection tool use will be revealed when the assignment directions are provided to students

Disability Accommodations

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit http://ds.gmu.edu/ for detailed information about the Disability Services registration process.

Disability Services is located in Student Union Building I (SUB I), Suite 2500.
Email:ods@gmu.edu | Phone: (703) 993-2474

Privacy

Students must use their Mason email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information

Cell Phones & Laptop Computers

Laptop or tablet computers are required for participation in the labs. Cell phones must be turned off or set to silent.

Gender identity and pronoun use

If you wish, please share your name and gender pronouns with me (lortizur@gmu.edu) and how best to address you in class and via email.

Mason Diversity Statement

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty, and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study, and personal growth.

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual, group, and organizational level. The implementation of this commitment to diversity and inclusion is found in all settings, including individual work units and groups, student organizations and groups, and classroom settings; it is also found with the delivery of services and activities, including, but not limited to, curriculum, teaching, events, advising, research, service, and community outreach.

Acknowledging that the attainment of diversity and inclusion are dynamic and continuous processes, and that the larger societal setting has an evolving socio-cultural understanding of diversity and inclusion, Mason seeks to continuously improve its environment. To this end, the University promotes continuous monitoring and self-assessment regarding diversity. The aim is to incorporate diversity and inclusion within the philosophies and actions of the individual, group, and organization, and to make improvements as needed.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

Useful Campus Resources

Mason has several support services for students. Please go to https://stearnscenter.gmu.edu/knowledge-center/knowing-mason-students/student-support-resourceson-campus/ for a directory of services.