THE OHIO STATE UNIVERSITY

College of Arts and Sciences
Department of Geography

SYLLABUS

ATMOSSC 4194

Group Studies: Practical Programming and Data Analysis for Atmospheric Science

Fall 2024

COURSE OVERVIEW

Course information

- Class periods: Tuesday, Thursday, 11:10am-12:30pm (80 minutes)
- Credit hours: 3
- Prerequisites: None
- Classroom: Derby Hall 140
- Mode of delivery: In Person, short lectures with plenty of in-class exercises
- Required Textbook: None. Course materials will be in the form of PDFs posted on CarmenCanvas.
- Recommended Textbook: “Python Programming and Visualization for Scientists” by Alex J. DeCaria

Instructors

Instructor: Dr. Man-Yau (Joseph) Chan (address as Dr C or Dr Chan)

- Email address: chan.1063@osu.edu
- Office hours: Fridays from 10.40am to 12.40pm
- Office hour location: Derby Hall 140

Course description

Computer programming and data analysis skills are crucial for nearly all careers in atmospheric science and meteorology. Without these skills, forecasters and scientists cannot navigate and analyze the massive quantities of data that are needed to understand or predict atmospheric behavior.

ATMOSSC 4194 is a ***hands-on, skills-centric*** introductory course on computational data analysis that is ***specifically designed for atmospheric science applications***. This course will use Python, a commonly used programming language in atmospheric science and meteorology. By the end of the semester, students will successfully use visualize and dissect Atmospheric Big Data, compute and understand atmospheric statistics, break big problems into smaller manageable pieces, read Application Programming Interface (API), communicate their code to other programmers, and version control.

There are no prerequisites for the class. We will use basic arithmetic, simple statistics, and a little algebra.

This class has a final group project, homework assignments (due weekly), and graded in-class exercises. There is no final examination.

Course-based Goals

By the end of the semester, students will:

1. Create computer programs for atmospheric science data analysis applications by applying basic programming skills and concepts.

2. Understand and practice good habits that are essential for atmospheric scientific collaborations (e.g., commentaries, code structure and version control)

3. Analyze atmospheric science data for patterns and connect that to concepts learned in other atmospheric science classes.

HOW THIS COURSE WORKS

Mode of delivery: In-person, lecture-based.

Course materials: All course materials will be accessible from OSU's **Carmen Canvas** interface. These materials include:

1. Lecture materials (PDF and PPT formats; released before class)
2. Worksheets for assignments, hands-on exercises (PDF format)
3. Video recordings of lectures and demonstrations (MP4 format)
4. Python code produced during in-class demonstrations (text files)

Weekly activities and materials: This course has twice-a-week classes comprising of interwoven lectures and in-class exercises. ***Assignments are due every week on Thursdays by 11:59 p.m. The final project will have a longer due date (~4 weeks). No assignments will be due within 2 weeks of the final project's due date***. A weekly class schedule will be provided outlining content and assignments. ***The schedule is subject to change so students should be sure to retain the most current version.*** All scheduling changes will be articulated clearly to class via Carmen Announcements.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (assignments and the final project) to receive a passing grade.

Expectations of Students (Outside of Assignments and the Final Project)

- **Exercises:** Students are expected to attend all classes and attendance will be tracked by use of **in-class exercises**. These exercises contribute to the In-Class Exercises category in calculating the final grade (see table under "Grading and Faculty Response").

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

There is no required textbook for this course. Course materials will be provided on Carmen (see previous page).
An optional, but recommended, textbook for this course is "Python Programming and Visualization for Scientists" by Alex J. DeCaria.

Technologies (VERY IMPORTANT)

REQUIRED EQUIPMENT

- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) or landline to use for BuckeyePass authentication

REQUIRED SOFTWARE

- **A web browser (e.g., Google Chrome, Apple's Safari):** This is needed to view course materials (PDFs), watch recorded lectures, and access CarmenCanvas.
- **Zoom** (https://osu.zoom.us/) is the academic audio web conferencing solution for Ohio State and we will be using it for possible office hour options.
    - Getting started with CarmenZoom

OPTIONAL EQUIPMENT & SOFTWARE (HIGHLY RECOMMENDED)

- **Laptop:** Windows OS, Mac or Linux OS. At least 8 GB of Random Access Memory (RAM), at least 10 GB of available storage space, and at least 4 cores in the Central Processing Unit (CPU).
- **Anaconda for Python 3:** Anaconda contains many Python packages and is already installed on the DB 0140 computers. However, if you want to work on your laptop for this class, you need to install Anaconda on your laptop (click here for instructions).
- **Visual Studio Code (VSCode)**: VSCode is the main tool we will be using to write and run Python programs and is already installed on the DB 0140 computers. However, if you want

to work on your laptop for this class, you need to install VSCode on your laptop (click here for instructions).

- **Git**: It is very important to track and document code changes (aka “version control”). This course will use the ubiquitous Git software and the Github website for version control and collaborations. If you want to work on your laptop for this class, you need to have Git on your laptop (click here for installation instructions).

Carmen: Accessibility, Help, Skills & Multi-Factor Authentication

ACCESSIBILITY OF CARMEN

This course requires use of Carmen (Ohio State's learning management system) and a web browser. If you need additional services to use these technologies, please request accommodations with your instructor.

- CarmenCanvas accessibility
- CarmenZoom accessibility

HELP WITH CARMEN (OR OTHER IT ISSUES)

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Basic computer and web-browsing skills are expected, and navigating Carmen is an essential skill for this course. For questions about specific functionality, see the Canvas Student Guide.

REQUIRED TECHNOLOGY SKILLS SPECIFIC TO THIS COURSE

- CarmenZoom virtual meetings (e.g., for snow days)
- Uploading assignments on CarmenCanvas

- Using web browsers

CARMEN MULTI-FACTOR AUTHENTICATION

You will need to use BuckeyePass multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated (% breakdown)

ASSIGNMENT CATEGORY	% POINTS
In-Class Exercises	20
Homework Assignments	45
Final Project	35
Total	**100**

Assignment descriptions:

In-Class Exercises: A set of in-class exercises will be released on Carmen every class. These exercises will reinforce the course material covered during the class. Students will submit their answers as Python scripts (.py files) on Carmen by 11.59pm on the same day. ***In-class exercises are not graded – simply attempting them in-class and turning them is sufficient.*** Collaboration between students is permitted, but ***every student must turn in their own work***. Artificial intelligence (AI) tools can be used without penalty as long as the student acknowledges and documents their usage in their submitted work. **Please contact the instructor if you are missing class with a valid reason.**

Homework Assignments: Every week, a homework assignment will be due. These homework assignments are Python coding assignments and students will turn in Python scripts (i.e., .py files) on Carmen. Students should expect to spend 3-6 hours on each assignment. ***In-class time can be used to complete assignments if the student has completed the in-class exercises assigned to that particular class period.*** Collaboration between students is permitted, but ***every student must turn in their own work***. Artificial intelligence (AI) tools can be used without penalty as long as the student acknowledges and documents their usage of such tools in their submitted work.

Final project: In the last month of the semester, a final project will be released. This project is programming assignment that will take approximately 33 hours to complete (including 9 hours of in-class time dedicated to the final project). Students should expect to take around 24 hours of out-of-class time to complete this project. This project's deliverables are Python files (.py files) and a PDF document containing their answers to a set of posed questions. **The final project is a group assignment**. AI tools can be used without penalty as long as the student acknowledges and documents their usage such tools in their submitted work.

Late assignments

Please refer to Carmen for due dates. Late homework assignments will be penalized by 10% per day late, and only accepted up to a maximum of 4 days late. If students anticipate having conflicts, they are expected to discuss with instructors ahead of time.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Instructor feedback and response time

Grading and feedback: Students can generally expect feedback within 14 days.

Email: Emails are the fastest way to contact the instructor. The instructor will generally reply to emails within **48 hours on business days when class is in session at the university**.

COURSE SCHEDULE

ATMOSSC 4194 WEEKLY SCHEDULE*
Class Lecture Topics, Exercises*, and Homework Assignments*
*Note: These topics, exercises, and homework assignments are *subject to change.* Students will be advised of updates to the schedule on Carmen and should follow the version with the most current date.

Classes 2x/week (80 mins).

HA stands for Homework Assignment. Dates are in day (month/day) format [e.g., T (8/20) means Tuesday Aug 20th, R (8/22) means Thursday Aug 22nd].

Wk	Date	Class Topic(s) [30-min lecture + 50-min in-person exercise(s)]	Assignment
1	T (8/20)	Introductions and installing programs	

	R (8/22)	Creating Anaconda environments, basic usage of Visual Studio Code with Python, variable assignment, and floating-point arithmetic	Install Anaconda & Git on personal laptop (if available) Complete the first pulse-taking survey (must be done by the end of week 1)
2	T (8/27)	Computing Thermodynamic Quantities (Functions & nested functions)	
	R (8/29)	Atmospheric Time Series and Profiles I (Integers and 1D arrays)	**HA1 released on – due on R (9/5)**
3	T (9/3)	Readable code and APIs (Comments, structure, multilining, indentation and API reading)	
	R (9/5)	Atmospheric Time Series and Profiles II (Coordinate arrays & visualization)	**HA2 released – due on R (9/12)**
4	T (9/10)	Atmospheric Time Series and Profiles III (Loops)	
	R (9/12)	Atmospheric Time Series and Profiles IV (Classes & Instances)	**HA3 released – due on R (9/19)**
5	T (9/17)	Atmospheric Time Series and Profiles V (Strings)	
	R (9/19)	Atmospheric Time Series and Profiles VI	**HA4 released – due on R (9/16)**

		(Lists and Dictionaries)	
6	T (9/24)	Spatiotemporal Atmospheric Data I (2D NumPy arrays, coordinate arrays, indexing and contour plots)	
	R (9/26)	Spatiotemporal Atmospheric Data II (3D NumPy arrays, coordinate arrays and array slicing)	**HA5 released – due on R (10/3)**
7	T (10/1)	Spatiotemporal Atmospheric Data III (Interpolation and unstructured data)	
	R (10/3)	Spatiotemporal Atmospheric Data IV (Nesting)	**HA6 released – due on T (10/15)**
8	T (10/8)	Review	
	R (10/10)	**Autumn Break**	
9	T (10/15)	Strings	
	R (10/17)	Reusable Python scripts for atmospheric science (Command-line inputs, string comprehension & datetime)	**HA7 released – due on R (10/24)**
10	T (10/22)	Reading NetCDFs (NetCDF reading, string manipulation, dictionaries, keys and handling)	
	R (10/24)	Writing and editing NetCDFs	**HA8 released – due on R (10/31)**
11	T (10/29)	Probability, Monte Carlo sampling, uncertainty propagation & ensembles	

	R (10/31)	Forecast validation	**HA9 released – due on R (11/7)**
12	T (11/5)	Version control and pickling (REMOTE)	**<u>Final project released</u>** Content: T (8/22) to T (11/14), inclusive. **Due on Dec 5th at 11.59pm.**
	R (11/7)	Hypothesis Testing and Field Significance	
13	T (11/12)	Obtaining Gridded Atmospheric Model Data from Online Sources	
	R (11/14)	Accessing Atmospheric Observation Data from Online Sources	
14	T (11/19)	In-class time to work on final project	
	R (11/21)	In-class time to work on final project	
15	T (11/26)	In-class time to work on final project	
	R (11/28)	**Thanksgiving**	
16	T (12/3)	In-class time to work on final project	

Final project due on December 5 at 11:59pm

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: Students should use proper grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics in class discussion forums.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. ***Remember that sarcasm doesn't always come across online.***

Academic integrity policy

- **Fortnightly assignments**: Working with other students is permitted, but ***every student must submit their own work.*** The use of ChatGPT and other AI tools is permitted as long as the student indicates that they have used them in their submission.
- **Reusing past work**: In general, students are prohibited in university courses from turning in work from a past class, even if modified. Students should discuss the situation with instructors in advance if there is any doubt.
- **Final project**: This course includes a final group project. AI tools can be used as long as the students indicates that they have used such tools in their submission.

OHIO STATE'S ACADEMIC INTEGRITY POLICY

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-48.7 (B)). For additional information, see the Code of Student Conduct.

Requesting accommodations for disabilities

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Requesting religious accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual

belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity. (Policy: Religious Holidays, Holy Days and Observances)

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student’s ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life’s Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on

the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and **24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.**

Statement on Title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu.

Statement on Diversity

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.