

Syllabus  
Physics of Weather  
(Physics 2400)  
Spring Semester 2021

### Instructor Information:

<b>Instructor:</b>	Prof. Jens Oberheide <a href="http://globaldynamics.sites.clemson.edu/index.html">http://globaldynamics.sites.clemson.edu/index.html</a>
<b>Office:</b>	103 Kinard Lab
<b>Department:</b>	Dept. of Physics and Astronomy, CU
<b>Phone:</b>	864-656-5163* <i>Note that the University phone number won't be monitored every day during the pandemic. Leave voice message.</i>
<b>Email:</b>	<a href="mailto:joberhe@clemson.edu">joberhe@clemson.edu</a>
<b>Office Hours:</b>	Prof. Oberheide's Zoom office hours are Thursdays 5:15 pm. The office hours will last until all questions have been answered but will end at 5:30 pm if no student dials in. Individual appointments can be made through email.
<b>Class Hours:</b>	Tu & Th 11:00 – 12:15, Strom Thurmond Institute Auditorium; you may leave class if Prof. Oberheide has not arrived after 15 minutes
<b>Teaching Asst:</b>	Rafael Mesquita, <a href="mailto:rmesqui@clemson.edu">rmesqui@clemson.edu</a> (no '@g.clemson.edu'). His Zoom office hours are Mondays from 3-4 pm. The zoom link for his office hours is on the course home page on Canvas. Additional appointments can be made through email requests to Rafael.

### Course Mode of Delivery:

*This section gives you the big picture of how we are going to do the course.* Most importantly, talk (zoom, email) to me if the pandemic impacts your ability to meet expectations. *I can only help if you let me know!*

The most important link is <https://clemson.instructure.com/courses/120638/modules> (Course Canvas site, Modules section). You will find all material and assignments there, including what to do, and when and where. *It is your responsibility to be aware of assignments and deadlines.*

**Course mode of delivery:** This is an in-person class and in-person attendance is mandatory. I will record each class in case a student has an excused absence but the recordings are not intended to substitute the in-person instruction.

***(1) Before class, you will need to work through reading assignments (provided for each Module).*** This is to understand the foundations and to allow you to ask questions during class.

***(2) During class, I will do a traditional lecture with emphasis on the more difficult concepts.*** This will also allow you to ask questions and we will do interactive applications from the AMS eInvestigations Manual (see required text below) as appropriate. You will do in-class quizzes through Canvas that will count attendance and contribute to your grade. Specific instructions will be provided in each of the modules on Canvas.

***(3) After class (once a module is finished, about weekly), you will complete a 2-part homework assignment.*** Part 1 are conceptual questions related to the textbook and part 2 are exercises that use real-world data from the AMS eInvestigations Manual. You will usually have one week to complete the homework assignment.

***(4) There will be two midterm exams and one final exam.***

## Course Information

**Course Rationale:** The course is designed (1) to give you an appreciation of the broad variety of phenomena that occur in the atmosphere, (2) to give you a basic understanding of the physical phenomena responsible for those phenomena, and (3) to use the atmospheric phenomena as an illustration of the principles of physics in a broader context. The course has relatively little math, but you are expected to be able to apply physical principles and scientific reasoning to explain various atmospheric phenomena and effects. This course fulfills the General Education competency “Natural Science (NS)” and includes special topics of current interest, such as the effect of environmental pollution on weather and the effect of weather on health.

**Objectives/Learning Outcomes:** The atmosphere is an extremely important physical system that strongly influences everything in our daily activities and both the short-term and long-term future of our society. It creates effects that range from minor inconveniences, in the form of inclement weather, to hazards, in the form of severe weather. Some of the most beautiful phenomena in nature occur in the atmosphere and are related to atmospheric optics effects and other types of physics. By the end of this course, you will be able to:

*Natural Sciences:* Demonstrate scientific literacy by explaining the process of scientific reasoning and applying scientific principles inside and outside the classroom.

- Understand the structure of the atmosphere and the physical processes responsible for the structure.
- Assess the role of solar radiation and the Earth’s orbital parameters and rotation in creating the seasons and large-scale climate zones.
- Describe the processes responsible for the planetary circulation.

- Understand weather systems, including the high and low pressure systems that constitute what is referred to as synoptic meteorology, as physical systems.
- Describe and analyze mesoscale weather systems, including thunderstorms and tornadoes.
- Explain the physical processes that lead to atmospheric electrification and lightning.
- Describe the processes that lead to atmospheric pollution and the effects of pollution on weather, climate, and health.
- Understand the physics of atmospheric optical phenomena.
- Understand basic techniques used in forecasting, primarily as a means of improving our understanding of how the atmosphere works.
- Describe the major climate cycle variations over decadal, century, and geological time scales and the mechanisms responsible for each. – This is only a secondary objective as it is the focus of PHYS 2450 – Physics of Global Climate Change (offered each fall semester).

Each student comes to the course with differing levels of competency. By honoring course policies, attending class regularly, completing all assigned work in good faith and on time, each student has the opportunity to meet these course learning outcomes.

**Course Outline:** The course contains twelve modules, each covering approximately one chapter in the textbook by Aguado & Burt and consisting of the following components.

- **Lecture:** In each lesson, you will learn the key topics from the course materials in the book by Aguado & Burt. You are expected to read the relevant text *before each class*.
- **Class:** During regular *class hours*, we will reiterate on the more difficult concepts in the textbooks, do selected examples, and exercises from the *eInvestigations Manual* that uses real-world data to further illustrate the concepts described in the text material. And there will be plenty of time for discussions!
- **Individual Assignments:** These assignments will give you the chance to apply what you have learned and to demonstrate development of your skills related to the course content. You will complete a these assignments on Canvas for each module to demonstrate your mastery of the module material. Each assignment will include questions related to the textbook material, as well as an exercise from the *eInvestigations Manual*. These assignments will be your homework grade and will be done *after we finished a course module, approximately once per week*.

Directions for completing course assignments, including deadlines, are provided in the [Modules](#) area of the course Canvas site. Each module requires about 2-3 additional hours for reading, working assignments, and preparing for quizzes and tests. A detailed time table - which will be updated as the course progresses - is on Canvas in the syllabus section (linked [here](#)). The modules are:

1. Composition and structure of the atmosphere (Chapter 1)
2. Solar radiation and seasons (Chapter 2)
3. Energy balance and temperature (Chapter 3)
4. Atmospheric pressure and wind (Chapter 4)
5. Atmospheric moisture (Chapter 5)
6. Cloud systems (Chapter 6)
7. Precipitation processes (Chapter 7)
8. Atmospheric circulation (Chapter 8)
9. Midlatitude cyclones (highs and lows) and fronts (Chapters 9 & 10)
10. Lightning, thunder, and tornadoes (Chapter 11)
11. Tropical storms and hurricanes (Chapter 12)
12. Putting everything together

**Method of Teaching:** This is a lecture course based upon a very popular textbook. You will prepare by reading the chapters and answer included study questions. The main points (including mathematical examples) will be reviewed and discussed in class, along with additional material presented by the instructor. We will also engage in a number of exercises exploring various web-based models and applying the knowledge. ***Laptop (or smartphone with a big enough screen) with web access and calculator is required for each class.*** Assignments, exams, in-class quizzes are administered through Canvas.

**Grading:** Assignments (all through Canvas) in this course are divided into these general categories, which carry the following weight in your final grade calculations:

Category	Weight
In-class quizzes – during regular class hours	15%
Homework assignments – after each module is completed	40%
Midterm exams	30%
Final exam	15%

There will be ***two midterm exams*** (tentative dates: Feb 18, Apr 1) and one ***final exam*** (Apr 28). Each exam carries a weight of 15%. The short ***in-class quizzes*** will be related to what we did in class. The password will be provided during class. The two lowest in-class quiz scores will be dropped for the final grade calculation. You will also complete a ***homework assignment*** after we finished a module, so on a ~weekly basis, to put the lecture material and in-class exercises into context. The two lowest homework scores will be dropped for the final grade calculation.

Late homework won't be accepted if you do not give me a very good reason.

All exams will be open book and a lockdown browser will not be required. You won't be able to find answers to the exam questions on google.

You are treated as a professional in the course. Accordingly, the grading is strict, but fair. Reading the directions and grading criteria provided for each assignment is the key to understanding how you will be graded. Following those directions is the key to doing well.

Letter grade: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F:<60%

**Required Materials:** Smartphone or laptop with Canvas & Zoom Apps. *Must bring to each class to do the attendance quiz.*

**Required Textbooks:**

- *Understanding Weather & Climate* (Seventh Edition) by Aguado and Burt  
eText: ISBN-13 **9780133943641** (~\$40)  
Print: ISBN-13 **9780321987303** (~\$193)

You may use the ebook edition, which is substantially less expensive. The course will follow this textbook. Some of the versions are offered with *Mastering Meteorology* included. *Mastering Meteorology* is not required for the course.

- *AMS Weather Studies Manual 2020-2021*. ISBN 978-1-944970-61-1, \$84. This eInvestigations Manual published by the American Meteorological Society is only available in digital format and is required for homework. A digital version of the manual can be ordered at URL <https://edubooks.ametsoc.org/WXIM-20> (or see the Clemson bookstore). This includes access to the AMS RealTime Weather Portal which we will use in the course. AMS is offering digital versions and a package that includes a softcover version and a webBook version, if you prefer a printed copy.

The digital versions of both course texts are less expensive and, in some cases, more convenient than the print versions. Please be sure that you want to take the course before deciding to purchase digital versions of the books since there are no refunds for the digital editions.

**Web Sites:** The main course web site is on Canvas, accessible at <http://clemson.edu/canvas/>. Module material, announcements, and assignments will be posted here. All exams will be administered through Canvas.

In addition to the main course web site, we will use the American Meteorological Society web site that is a companion to the *eInvestigations Manual* used in the course. The site (called RealTime Weather Portal) is accessible at <https://edubooks.ametsoc.org/user/anonymous> You will need to login in with your eInvestigations Manual credentials. That site has information about current weather, links to current meteorological data in the format used by meteorologists and forecasters, and links to other web sites with resource material that may be useful or of general interest. The site also has online quizzes that you can take for practice or to help you in learning

terminology and course-related information. You may also want to visit “student resources” as it points you to *internships and student organizations in climate*.

## Course Policies

*The following policies are the standard syllabus material with COVID-19 specific provisions in red. Please read completely.*

**Prerequisites:** None. However, this is an algebra-based physics course, similar to PHYS 2000, which requires MATH 1020. Successful participation will require some algebra, manipulating numbers in scientific notation, reading and preparing graphs, and understanding text problems. Students who feel very uncertain in these areas should consider taking a different course.

**Attendance Policy:** This course is designed for active in-person learning and engagement. Attendance and active participation in this course will provide the most benefit for learning. Therefore, *attendance and participation are required* for all classes and will be checked through the in-class quizzes. *A student who misses more than four classes without a valid excuse may be dropped from the course.* See also the specific COVID-19 information below. I am not going to penalize you if you are sick or if you have other important (valid) reasons. So, talk (zoom, email) to me. What I won’t accept is if you just stop attending/participating.

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather-related cancellation.

**Specific COVID-19 related attendance information:** For a student who reports testing positive or is being asked to quarantine/isolate because of exposure to the virus, it will be up to the student to inform the instructor that they will be moving to online only instruction for at least the next two weeks. Students are directed to use the Notification of Absence module in Canvas to initiate this notification. Additional communication via email is encouraged; students should follow up with their instructor to develop a continued plan of study for each course. Students cannot be penalized in their grade for needing to move to online instruction.

Students who are attending in-person classes in traditional or hybrid/blended courses and are not approved to be online for all spring semester courses are expected to return to in-person attendance once cleared by the University.

## University Policies

**Academic Integrity:** The Clemson University statement on academic integrity reads: “As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a “high seminary of learning.” Fundamental to this vision is a mutual commitment to truthfulness, honor and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating or stealing in any form.”

**Student Accessibility Statement:** Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu). Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student’s responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

**Clemson University Title IX Statement:** Title IX Policy: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran’s status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University’s Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware.

There are two important exceptions to this requirement about which you should be aware:

- Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

- Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is [alesias@clemson.edu](mailto:alesias@clemson.edu).

**COVID-19 Related Expectations for Face Coverings:** Per UG class regulations, 2021 Spring Term: "While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. Please be familiar with the additional information on the [Healthy Clemson website](#), such as the use of wipes for in- person classes. If an instructor does not have a face covering or refuses to wear an approved face covering without valid accommodation, students should notify the department chair. If a student does not have a face covering or refuses to wear an approved face covering without valid accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the [Office of Community & Ethical Standards](#) as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222."

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency: (a) Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>), (b) Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>), (c) Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)