

MET 101: INTRODUCTION TO WEATHER AND CLIMATE

Fall Semester 2020

Location: Marine Science Building 100

12:00-1:15 PM Tues, Thurs

Professor

Steven Businger, businger@hawaii.edu

Phone: 956-2569 (note: connects to my cell phone)

Office Hours: after class or by appt.

HIG Room 334

Teaching Assistants:

Jan van der Veken, jjvander@hawaii.edu

Zachary Menzo, zmenzo@hawaii.edu

Phone for both TA's: 956-7110

Office Hours: M 10:30-11:30, W 10:30-11:30 or by appt

Office Hours: Tu and Th 9 - 10:15 am or by appt

HIG Room 370

Prerequisites: none. Since this is an introductory class, technical background in mathematics is not expected nor required. Students looking for more advanced treatments are encouraged to take ATMO 200 or ATMO 302.

Student Outcomes

This class is designed to convey a qualitative understanding of the science of the Earth's atmosphere, weather, and climate. During the first half of the class the relationship between the relatively few variables important to the weather will be demonstrated. These include temperature, pressure, density, and humidity of the air. We will clarify the role of sunlight and invisible infrared radiation leaving the Earth in warming the atmosphere and fueling storms, such as hurricanes. Forces that control wind will be explained, including those that arise because the Earth rotates. During the second half of the class a variety of weather phenomena that result from the interplay of radiation, wind, and water vapor will be illustrated. These include the global-scale circulation of the atmosphere, such as jet streams and the Hadley circulation, and local-scale circulations such as sea-breezes. The structure and source of energy for storms, like kona lows, winter storms, tornados, will be explained. The destructive impact of storms on society leads to the need for accurate forecasts. Finally, since climate is the sum of all weather events, the mechanics of climate change and global warming will be described.

Lab Class (ATMO 101L): Teaching assistants teach the lab course. They will cover many topics that I cover but in a more hands-on way. Students find the lab class to be helpful and some programs require a science course with a lab. But, the lab is an independent class that can be taken with or without the lecture class and vice versa.

Textbook: *Essentials of Meteorology* by C. Donald Ahrens (Brooks/Cole Publishing Co., 6th edition or newer), is at the bookstore and you might find used books at a cheaper price. This is a paperback version that saves you a little money and also gives us a chance to cover most, but not all, of the book. If you have a copy of the larger, hardback text by Ahrens entitled "*Meteorology Today*" you will have similar, but more comprehensive reading. The earlier editions of *Essentials of Meteorology* also will work. We will access weather information on the World Wide Web, especially at weather.hawaii.edu.

iClicker: We will use iClicker in this class. You can either download the iClicker app for your smartphone or buy a clicker from the UH bookstore or online.

Here is a link that shows you how to set up your iClicker account:

<https://community.macmillan.com/docs/DOC-7294-create-a-reef-account-and-register-an-iclicker-remote>

and here is a link for how you find your class once you've set up an account:

<https://community.macmillan.com/docs/DOC-7414-add-your-instructors-course-in-reef>

Tips for Success:

Come to class! Participation counts and questions are encouraged during lecture. Attendance and participation will be tracked using iClicker. There will be questions on exams only covered in class.

Read the assigned material. Preparation helps in understanding new concepts and terms.

Take notes. Note taking that does not interfere with hearing the lecture helps the memory when preparing to take the exams.

Review the previous lecture notes. Lectures (PDF format) are posted on the web following classes at the following link: <http://www.soest.hawaii.edu/MET/Faculty/businger/courses/met101.html>. This site is PW protected since I use copyrighted materials in my lectures. User name: student, PW: weather. The answers to most homework questions will be available in the lecture notes.

Prepare for exams in advance. Quiz yourself (sample quizzes are posted online) and reread the sections in the book on a confusing topic. If you have any questions that remain after consulting the text and your notes, please ask me at the end of lecture or email the TA's Zach, Jan, or me. Or make an appointment and come to see us!

SYLLABUS

The syllabus below is an estimate of what we will try to cover and when. This syllabus is based on *Essentials of Meteorology* by C. D. Ahrens 8th edition. Chapter assignments may differ in older/newer editions.

Date	Lecture Topics	Reading (Ahrens Text)
8/27	Intro Lecture, What is meteorology? Weather satellites	Chapter 1
8/29	Pressure, Temperature, Weather maps	Chapter 1&2/+Ch-6 (p-146-152)
9/3	Heat/Heat transfer/radiation/radiation balance	Chapter 2
9/5	Seasons/diurnal cycle	Chapter 2/3
9/10	Water/unusual properties/latent heats	Chapter 4/Lecture notes
9/12	Water in the atmosphere/hydrologic cycle	Chapter 4
9/17	Cloud formation/fog	Chapter 4
9/19	Cloud forms/ Quiz #1	Chapter 1-4
9/24	Stability and cloud forms/latent heat release	Chapter 5
9/26	Production and types of precipitation	Chapter 5
10/1	Forces, force balance, and wind	Chapter 6
10/3	Local winds	Chapter 6
10/8	Global winds and the general circulation	Chapter 6
10/10	El Niño, la Nina, and ENSO	Chapter 7
10/15	Atmospheric optics	Chapter 15
10/17	Atmospheric optics/ Quiz #2	Chapter 5-7
10/22	Hurricane formation and structure	Chapter 11
10/24	Hurricanes near Hawaii, impacts and forecasting	Chapter 11
10/29	Air masses/air mass modification/fronts	Chapter 8
10/31	Mid-latitude cyclone evolution and hazards	Chapter 8
11/5	Weather Forecasting/ Observation Hwk Due	Chapter 8/Lecture notes
11/7	Hawaiian weather patterns, wind & flood hazards	Chapter 8/9/Lecture notes
11/12	Air mass thunderstorms/Lightning	Chapter 10
11/14	Ocean Waves and surf forecasting	Chapter 9/Lecture notes
11/19	The simple science of flying / Quiz #3	Lecture notes
11/21	Severe thunderstorms/Tornadoes	Chapter 10
11/26	Air pollution/ozone hole/acid rain	Chapter 12
11/28	Thanksgiving Holiday	
12/3	Past climate/ice ages/climate change	Chapter 14
11/5	Global warming: the observations/local impacts	Chapter 14
12/10	Global warming/the human factor	Chapter 14
12/12	Modeling/combating global warming	Chapter 14
12/17	Final Examination MSB100/Quiz #4	12:00-2:00 PM

There will be a brief current weather discussion at the beginning of most lectures to highlight interesting weather and to introduce practical applications in weather forecasting. Access to updated weather and ocean data and imagery is available via the UH Atmospheric Sciences **weather server at: <http://weather.hawaii.edu>**.

Grading

Homework is composed of short answer questions that emphasize important concepts from the lectures and reading. Homework will be *due on the date of the next quiz*. If you wish to have homework graded and returned for study purposes, please turn it in two lectures (one week) prior to the quiz and plan to pick it up the following lecture.

Exams: Quizzes are composed of multiple choice questions, largely taken from lecture and homework. The quiz grade is calculated from the three best quiz scores. The lowest quiz will be dropped. All four quizzes must be taken. Approximate weights used in computing the final grade are given below.

Grading: Grading will be curved, but only to improve scores, not to limit the frequency of good grades. It is possible for all of you to earn an "A". Sincere efforts are rewarded. If you are struggling, please see us

so that we can help – we're here for that. Your workload consists of reading the chapters we cover. I estimate 2-4 hours per week of reading.

4 Quizzes	50%
5 Homework	45%
<u>Class Participation</u>	<u>5%</u>
	100%

Extra credit can be earned by submitting an "observation" of the atmosphere as defined by the Observation Assignment emailed out during the first week of class (limit two, submitted no later than 12/12). The extra credit, up to 6% points, will be added to the final exam grade.

You cannot depend on your eyes if your imagination is out of focus. – Mark Twain
Learning, however difficult or painful, is superior to ignorance, no matter how comfortable.

Student Learning Objectives (SLOs): Upon completion of ATMO 101, the student should be able to:

1. Demonstrate a familiarity with the basic vocabulary of meteorology.
2. Understand the mechanics of the earth's atmosphere.
3. Describe and explain the origin, composition, structure, short-term and long-term behaviors of the earth's atmosphere.
4. Understand and analyze important environmental problems related to the earth's atmosphere.
5. Have a basic understanding of the atmosphere and its processes to enhance appreciation of our planet.
6. Critically examine the phenomena of the Solar and Terrestrial Radiation and understanding the energy transfer by radiation, conduction, convection, and evapotranspiration and explain the factors that determine the distribution of solar energy over the Earth's surface and describe global patterns of temperature.
7. Understand and critically examine the atmospheric phenomena of temperature, moisture conditions, atmospheric stability, forms of condensation and precipitation, air pressure and winds, circulation of the atmosphere, role of air masses, and weather patterns.
8. Describe the major cloud types and explain the phenomena of rainfall, fog, snow, sleet, and frost.
9. Define a cold and warm front and explain the processes leading to the formation of each and also explain the formation of cyclones and anticyclones, tornadoes, hurricanes and typhoons.
10. Understand and describe the formation of thunderstorms, lightning and thunder.
11. Describe and analyze the changing climate in the past, present and future
12. Understand the impact that people have on the atmospheric environment.
13. Differentiate between global warming and the greenhouse effect
14. Describe the phenomenon of El Nino-Southern Oscillation and the impacts it has on global precipitation and cloud patterns.
15. Describe various types of atmospheric optical phenomena including rainbows, mirages, halos, crepuscular rays, sun dogs, sun pillars, corona and glories.

Title XI Statement:

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know is experiencing any of these, the University has staff and resources on your campus to support and assist you. Staff can also direct you to resources that are in the community. Here are some of your options:

As members of the University faculty, your instructors are required to immediately report any incident of potential sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and your instructors cannot guarantee confidentiality, you will still have options about how your case will be handled. Our goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need.

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, use the **confidential resources available here**:

<http://www.manoa.hawaii.edu/titleix/resources.html#confidential>

If you wish to directly REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support,

contact: Dee Uwono Title IX Coordinator (808) 956-2299 t9uhm@hawaii.edu.