Atmospheric & Oceanic Sciences 2/2L

Air Pollution

Summer Session A 2019

AOS 2 offers an introduction to some of today’s most pressing environmental problems, such as the ozone hole, smog, climate change, etc., which are typically classified under the common term Air Pollution. Throughout the class, the different aspects of air pollution, their causes, effects, and possible solutions will be introduced.

This summer’s AOS 2/2L course will be taught as a fully online class. Lecture material will be presented through online modules and activities. Live discussion sections will also be held online.

Enrollment

Enrollment in the course is accomplished by normal means: enroll in one of the discussion sections listed in the Summer Schedule of Classes. These discussion sections will be held online, unless there is demand for one or more in-person sections.

Online “lecture” content and “homework”: Access by logging in to our CCLE site via https://ccke.ucla.edu

Online lectures consist of a series of short videos (or electronic slide modules), with each video having embedded quiz questions or followed by separate activities and quiz questions. This approach is intended to engage students with the material and thus improve the learning experience. To ensure progress, credit for completing content is closed according to the schedule appearing later in this syllabus. The activities may need to be completed satisfactorily before students advance to the next instructional module. All online lessons will be available at the beginning of the summer session, but there will be deadlines to complete each section, spaced a few days apart. Viewing the videos and completing the activity questions before the lessons close will earn completion points and contribute to the overall grade. Keeping a schedule is necessary so that everyone is at the same level during the discussion sections, and to encourage workload spreading over the session instead of cramming it toward the end.

Some of the between-lesson activities are labeled “homework assignments”. These include a mix of fill-in-the-blank, multiple-choice, and essay questions that combine recall and application of material in the preceding set of lessons, and carry somewhat higher point totals per assignment than the lesson activities.

Students who require accommodations due to physical disabilities should contact the UCLA Center for Accessible Education (or your local campus’ disabilities office) for access to specialized equipment that will enable you to use our CCLE website and the lesson videos. In lieu of closed-captioning of videos, transcripts of the audio track along with slide images are available for hearing-impaired students on request, and to all students after each lesson set closes.

Discussion sections

Discussion sections are conducted online by the instructor via Zoom video web conferencing, and in-person by the instructor if demand exists. He will direct individual and group activities related to course material, and review the online lecture material as needed. Each once-weekly session will be about 85 minutes long, which is equivalent to the ten weekly 50-minute discussion sections held during a regular quarter.

Discussion sections WILL meet during Week1, though activities completed during discussion section will be graded starting in Week 2. Close interaction with fellow students and the instructor to complete the activities is strongly encouraged.

1A Monday 2:30 pm–3:55 pm [All times Pacific Daylight Time (PDT)]
1B Tuesday 10:30 am–11:55 am 1D Wednesday 1:30 pm–2:55 pm
1C Tuesday 5:30 pm–6:55 pm 1E Wednesday 8:00 pm–9:25 pm

Although you will be enrolling in your preferred discussion section at the beginning of the course, you can attend any of the scheduled sessions as required by your personal schedule. Sessions with low attendance or registration are subject to cancellation.

Atmospheric & Oceanic Sciences 2/2L Syllabus Summer Session A 2019
Laboratory section

You can enroll in an optional lab section AOS 2L after enrollment in the AOS 2 lecture/discussion. This 1-unit section satisfies the “lab/demo” requirement for the General Education “Foundations of Scientific Inquiry”. This lab section does not have formal classroom meetings, since all assignments are posted and submitted online in our CCLE site. However, this lab section must be taken during the same summer session as the lecture/discussion.

Instructor

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Office hours

Online: Zoom meetings: https://ucla.zoom.us/my/aosjefflew : Mon 11:30 am–2:00 pm PDT, Tue 12:00–3:30 pm PDT (and before/after discussion sessions)

In-person: Mon 11:30 am-2:00 pm PDT, Tue 12:00–3:30 pm PDT, or by appt. in MS 1961

Textbook (optional)

Jacobson, M.Z., Air Pollution and Global Warming: History, Science, and Solutions, 2nd ed. Available at the various booksellers, such as Amazon. Also on reserve at the UCLA College Library (Powell Hall) and as a free e-text to UCLA students via the UCLA Library.

Grades

Course grades are based on 1000 points earned from:

- Discussion section group activities (20–25 points each) 120 points (12% of total grade)
- Online Lessons and Homework 230 points (23% of total grade)
- Midterm examination 250 points (25% of total grade)
- Final examination 400 points (40% of total grade)

The optional lab section (2L) adds 200 points to this total. Students enrolled in the 2L lab section in addition to the regular course (2) will have a course grade computed from a percentage of the 1200 points earned during the quarter. These students will have the same final course grade posted on their transcripts for both 2 and 2L.

The course will be graded on a curve, following UCLA’s average undergraduate grade distribution. Generally, the B-/C+ cutoff occurs at around the class average, but this could change if the score distribution is unusually narrow or wide. Students who take the course “P/NP” will pass the course after earning 650 points or better, or with the equivalent of a “C” or better grade, whichever requires the lower minimum score.

If you are taking the 2 course “Pass/Not Pass” and also enroll in the 2L lab section, be sure to set the grade detail for 2L to “Pass/Not Pass” also—it is not automatic. Likewise, if you change your grade detail between letter grade and “Pass/Not Pass”, be sure to make the grade detail for 2 and 2L the same, as changes are not automatic.

Homework

The five homework assignments include fill-in-the-blank questions, graph drawing, and short answer questions. Assignments will be submitted electronically in our CCLE site as an online module. Typically, homework is due a week after it has been released to the students, and they may require that certain online lesson sections be completed first. Homework submitted after the submission deadline, but within 48 hours will be accepted with a 25% point deduction. Homework will not be accepted more than 48 hours after the submission deadline.
We expect that students submit homework that represents what you as an individual would write, as if the assignment was given to you in an examination. It is permissible to consult with other students in the course or with tutors or instructors; however, it is not permissible for you to simply copy another student's answers, or text from another source (internet, books, etc.) and submit it as your own. It is also not permissible for other students to write up your homework assignment for you, unless this has been arranged through the Center for Accessible Education (CAE).

Examinations

Examinations will be conducted online using ProctorU.com. There will be a fee for this service and you must have a quiet room with no other people moving through, a suitable computer, and a webcam.

Alternatively, local students may take the exams in person at the UCLA campus during the same time periods. This will need to be arranged in advance.

Midterm (through ozone hole, section 6)  
Friday, July 12, 2019, 6:30–7:45 pm PDT

Final (cumulative)  
Friday, August 2, 2019, 6:30–9:30 pm PDT

Examination Policies

1) There will be no makeup and no alternate-scheduled (i.e., “early”) exams, unless otherwise required by Center for Accessible Education (CAE) and California Education Code Section 92640(a). An exception may be granted for certain overseas students, but this will need to be worked out in advance.

2) Students who normally require the assistance of CAE to take exams must consult with the instructor as soon as possible regarding test-taking procedures.

3) Examinations are multiple-choice, fill-in-the-blank, and short-essay. They include material from the lecture, homework, and the discussion sections. Graph-drawing may be involved, so the student’s computer must be capable of using Adobe Flash.

4) To take the exam, you must present your photo identification, either student ID, driver's license, or passport. ProctorU usually requires two pieces of ID. All exams are closed-book unless otherwise noted beforehand.

Laboratory Assignments

The 1-unit 2L laboratory section is an optional add-on to the standard 4-unit course, essentially making this course into a 5-unit physical science GE course with lab/demo credit. Students who do not need the lab/demo credit because they have already satisfied or intend to satisfy it with a different 5-unit GE science course may opt to not enroll in the 2L section and instead earn only 4 units of credit with the regular course. Those students do not need to complete any laboratory assignments.

The 2L laboratory section must be taken during the same quarter as the A&O Sci 2 lecture/discussion course because the scores are combined into one grade, as if one was taking a single 5-unit course. Attempting to take 2L during a quarter separate from 2 will result in a failing grade (and no lab/demo credit) in 2L.

Students enrolled in the 2L laboratory section will perform four experiments or simulations during the quarter. These assignments will be posted online in our CCLE site; there are no formal classroom meetings associated with the lab assignments. At the end of each assignment, a report will be submitted electronically via our CCLE site, either as a PDF file or Microsoft Word/Office document. Students may also submit a hardcopy report to any of the instructors. The report may include numerical computations, graphs, and short-answer/short-essay questions. The purpose of the laboratory is to learn how to perform experiments to test scientific hypotheses, interpret observations, and summarize results in a concise, written form.
Lab 1: Atmospheric Methane Increase

The importance of methane as a greenhouse gas and the increase of its mixing ratio over the past 300 years raise the following questions:

- How much methane is released each year into the atmosphere?
- How can one explain the rise of atmospheric methane?
- How does this relate to global population growth?
- By how much will methane increase over the next fifty years?

In this laboratory assignment, you will learn the methods scientists use to answer these questions. In the first part of the assignment you will use the steady state box model to determine the source rates (or emission rate; source and emission rate are terms for the same quantity) for the years 1700 and 2000. The second part of the assignment will show you how one can simulate the increase of methane in the atmosphere.

Lab 2: Ozone Layer Measurements

An important part of scientific work is the presentation and analysis of observations in the atmosphere, such as those of the total ozone column (TOC). The observations reveal how the atmosphere works and thus improve our understanding of atmospheric processes. In addition, these measurements are used to monitor air pollution effects such as the ozone hole.

In this laboratory assignment, we will study how the ozone layer varies over different parts of the Earth, and learn how scientists present and interpret observational data. We will use observations from a NASA satellite that is currently flying around the Earth making measurements of total ozone columns (see https://aura.gsfc.nasa.gov).

Specifically, we want to answer the following questions:

- How does the TOC change with latitude?
- How does the TOC change with longitude?
- How does the TOC change over the period of a year?

Lab 3: Atmospheric Stability and Dispersion

In this lab, we will test the stability of a simulated atmospheric environment by pushing around an air parcel that is at equilibrium. We will also set up typical cases of positively buoyant air parcels and see how well they convect under different environmental conditions. Finally, we will study a case of a temperature inversion aloft and how afternoon heating of the ground affects dispersion in this type of atmosphere.

You will be plotting graphs of environmental temperature vs. altitude, called temperature soundings. These soundings can represent environmental temperature profiles with a single lapse rate (environmental lapse rate, ELR or $\Gamma_e$ or $\gamma$) or multiple lapse rates. On these plots, you will also be plotting the temperature inside a rising air parcel as a function of altitude. These plot lines will represent temperature trajectories of the air parcels, and will have a fixed, common slope that corresponds to the dry adiabatic lapse rate (ALR or $\Gamma_d$ or just $\Gamma$).

For the temperature inversion cases, we will use an online air parcel motion simulator that allows us to configure different types of temperature inversion profiles and shows the expected motion of buoyant air parcels released in those environments.

Lab 4: Photochemical Smog Modeling

In this laboratory assignment, we are going to learn how scientists simulate the behavior of ozone in the atmosphere as the emission rates of various primary pollutant reactants are changed.

This assignment formerly used an interactive online module that computed smog concentrations with a numerical simulation. Due to the untimely death of the module’s author, the server running the module has been decommissioned, so we are now providing the data that would have been obtained by students running the model.
Schedule of Topics

These are the days that the lesson sections are open. Generally, they will close at 11:55 pm PDT of the last day of the period. Given the fast pace of the six-week summer session, it is important to make steady progress and not wait until a few hours before each deadline to complete a topic, particularly sections 5–11, which require minimum viewing times of the videos.

WEEK 1

1. **Introduction / Motivation**
   - Wed., 6/19/19 – Sun., 6/30/19
   - 1.1. What is “Air Pollution”?  
     (suggested completion date: Wed., 6/26/19)
   - 1.2. How does air pollution impact our lives?

2. **Measurements, Chemistry, and Concentrations**
   - Wed., 6/19/19 – Sun., 6/30/19
   - 2.1. Introduction / Definitions  
     (suggested completion date: Wed., 6/26/19)
   - 2.2. Chemistry
   - 2.3. The Steady State Box Model

WEEK 2

3. **Atmospheric Evolution**
   - Wed., 6/19/19 – Mon., 7/1/19
   - 3.1. Primordial Atmosphere
   - 3.2. Secondary Atmosphere
   - 3.3. Nitrification
   - 3.4. Catastrophic Atmosphere-changing Events
   - 3.5. Human Impact

4. **The Atmosphere**
   - Wed., 6/19/19 – Mon., 7/1/19
   - 4.1. Atmospheric Structure
   - 4.2. Atmospheric Gases
   - 4.3. Aerosol Particles

5. **Global Climate Change**
   - Wed., 6/19/19 – Sun., 7/7/19
   - 5.1. Introduction
   - 5.2. Atmospheric Radiation
   - 5.3. Atmospheric Greenhouse Effect
   - 5.4. Global Climate Change
   - 5.5. Remediation

WEEK 3

6. **Stratospheric Ozone Depletion**
   - Wed., 6/19/19 – Wed., 7/10/19
   - 6.1. Introduction
   - 6.2. Ozone Layer
   - 6.3. Health Effects
   - 6.4. Chlorofluorocarbons (CFCs)
   - 6.5. Ozone Chemistry
   - 6.6. Ozone Hole
   - 6.7. Regulation and Abatement

**MIDTERM EXAMINATION:** Friday, July 12, 2019, 6:30–7:45 pm PDT (covers through Section 6)
WEEK 4

7. **Air Pollution Toxicity**  
   - 7.1. Risk Assessment Tools  
   - 7.2. Quantifying Health Effects  
   - 7.3. Physiological Effects on Humans  
   - 7.4. Examples  

8. **Air Pollution Meteorology**  
   - 8.1. Transport Processes  
   - 8.2. Atmospheric Stability and Convective Dispersion  
   - 8.3. Temperature Inversions  
   - 8.4. Impact on Daily and Seasonal Smog Variation  
   - 8.5. Application: Chimney Plumes  
   - 8.6. Plume Type vs. Stability  
   - 8.7. Enhancing Plume Dispersion  

WEEK 5

9. **Acid Rain / London Smog**  
   - 9.1. Brief History  
   - 9.2. London Smog  
   - 9.3. Acids / Bases  
   - 9.4. The Sulfur Cycle  
   - 9.5. The Nitrogen Cycle  
   - 9.6. Acid Rain  
   - 9.7. Environmental and Health Effects  
   - 9.8. Abatement  

WEEK 6

10. **Los Angeles Smog**  
    - 10.1. History of Smog in Los Angeles  
    - 10.2. Components of Los Angeles Smog  
    - 10.3. Ozone Formation  
    - 10.4. Smog and Visibility  
    - 10.5. Smog Meteorology  
    - 10.6. Air Pollution Mitigation  
    - 10.7. The Future of LA Smog  

11. **Indoor Air Pollution**  
    - 11.1. Indoor Air Pollution  
    - 11.2. Sources and Health Effects  
    - 11.3. Indoor Air Pollution Remediation  

**FINAL EXAMINATION:** Friday, August 2, 2019, 6:30–9:30 pm PDT (covers all course material)