270.224 OCEANS AND ATMOSPHERES
Spring 2017
Monday, Wednesday, Friday 1:30-2:30, Olin 304

FACULTY
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COURSE DESCRIPTION

This course is a broad survey course of the Earth's oceans and atmosphere, and their role in climate. Topics covered include waves, tides, ocean and atmosphere circulation, weather systems, hurricanes, El Nino, and climate change. Details of the topics we will cover are in the Schedule below. This is a Natural Sciences class. There are no pre-requisites for this class. This does not mean that we expect you to know nothing! Instead, it means that you are not required to have taken other classes. Taking freshman physics and chemistry is an advantage, however, and a few concepts taught in those classes will be used here without exhaustive explanation. Some students may need to do additional reading to fully grasp all aspects of this class (see below). In terms of intellectual challenge, this class is similar to freshman physics or chemistry. The class is designed for freshman and sophomore science/engineering students. If you do not fit these categories, you should take another class in marine and/or atmospheric science (ask the professors).

Format: The course will be taught as three 50min lectures. There will also be review sessions and discussion of graded homeworks. Class materials will be posted to the class Blackboard site.

Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, studentdisabilityservices@jhu.edu.

BOOKS

We will be using material out of two textbooks:
• "Essentials of Oceanography" by T. Garrison, Brooks/Cole Cengage Learning, 5th Ed., 2009 [ISBN-10:0-495-55531-2, GC11.2.G36 2009 QUARTO].
• "Meteorology Today" by C. D. Ahrens, Brooks/Cole Cengage Learning, 9th Ed., 2008 [ISBN-10: 0495555738, QC861.3.A47 2009 QUARTO].

We strongly advise students to look at buying used earlier editions of these texts (new these texts are in the $150 range, online both new and used versions of this and earlier editions are available for $20-$30). One site that we've checked is

http://www.abebooks.com/servlet/SearchResults?kn=ahrens+Meteorology+today&n=100121501&x=0&y=0

http://www.abebooks.com/servlet/SearchResults?kn=%22Essentials+of+Oceanography%22+%22Garrison%22&sts=t&x=0&y=0

Essentials of Oceanography may also be rented online by the chapter. We will be using 5-7, 13 and 16.

These, and the following books, are available at the library:
• "Oceanography: A view of the Earth" by Gross and Gross [GC11.2.G76 QUARTO]
• "Oceanography" by Summerhayes and Thorpe. [QG11.2.O22]
• "Introduction to Ocean Sciences" by Segar. [QG11.2.S443 QUARTO]
• "Essentials of Meteorology" by Anthes. [QC861.3.A39 2008 QUARTO]
• "The Atmosphere" by Lutgens and Tarbuck. [QC861.2.L87]
• "Meteorology: The atmosphere ..." by Moran and Morgan. [QC861.2.M625]

Almost all of the material in the class texts is also contained in these other books (among others). The class text covers most, but not all the material you will need to learn. In particular, there are some quantitative aspects of the class which are not covered in the books (and the books is not 100% free of errors). As always, the primary source of your information should be your own notes and the fruits of your own initiative. If you have not taken freshman physics or chemistry classes at Hopkins or at high school, you may need to sometimes refer to texts such as: Fundamentals of Physics, 8th Edition, Volume 1, by Halliday, Resnick, and Walker, and Principles of Modern Chemistry by Oxtoby.

ASSESSMENT

There will be two exams – a mid-term and a final – and four homework assignments. The midterm is worth 20% of the final grade, the final 30% and each homework 10%. During 13, randomly selected classes there will be quizzes that will be graded for participation only (this is both a way for us to take attendance and to get a sense for what students do and don't understand). Each quiz will count 1% point towards the final grade, up to a maximum of 10%. Homeworks handed in late without an acceptable reason will be penalized, or returned un-marked, at the instructors' discretion. Please inform the instructors before the homework deadline if you anticipate a delay in submitting your work.

The policy for homeworks and tests is to set questions with a range of difficulty. Some questions will require quantitative answers and careful thinking about basic (physical, chemical) principles. Some homework questions may require some straightforward research (e.g. online searching). Students very rarely score 100% in homeworks or tests, so you should not expect to either.

This is the fourth time this course has been taught at the 200 level. In the previous three years about 1/3 of the students earned an A or A- grade. Our expectation is that the grade distribution should be similar, but we will not be enforcing quotas (if 70% of the class gets over 90%, then 70% gets an A).

Among the few students who scored a D or worse in the last 9 years (6 of which it was taught at the 100 level), the average attendance in class was 34% and the average rate of submission of homeworks and tests was 50%. So if you don't want a poor grade, come to class and hand in written work! In addition, students are expected to read independently on the topics being taught in class. The relevant sections of the course text are indicated in the schedule below.

The professors and teaching assistant are available to answer specific questions on course material, but will not give explicit solutions to homework problems. Please approach us at the end of class or send an email to arrange an appointment.

Ethics: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assign- ments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. In addition, the specific ethics guidelines for this course are: (1) Homework assignments must be completed without any collaboration with anyone else. All printed and online information source, other than the Garrison and Ahrens texts should be accurately cited. (2) Tests must be completed without any collaboration with anyone else with strict adherence to the rubric of the test.

Report any violations you witness to the instructor. You may consult the associate dean of students and/or the chairman of the Ethics Board beforehand. See the guide on "Academic Ethics for Undergraduates" and the Ethics Board web site (http://ethics.jhu.edu) for more information.

Schedule

Part 1: Intro, vertical processes in oceans and atmospheres

1/30, Lecture 1: (Gnanadesikan) Geography of the earth (Ahrens, Appendix)

2/1, Lecture 2: (Gnanadesikan) Atmospheric pressure, what is it? Ideal gas law Hydrostatic relationship (Meteorology Chapter 1, Ch 2. up to section on Radiation)

2/3, Lecture 3: (Gnanadesikan) Composition of the atmosphere and ocean, relationship between composition and density (Oceanography, Chapter 6, Water and ocean structure).

2/6, Lecture 4: (Gnanadesikan) Vertical structure of the atmosphere and ocean. Potential temperatures and density. Boundary layers

2/8, Lecture 5: (Gnanadesikan) Impact of the water cycle on atmospheric and oceanic structure. (Ahrens, Chapter 4)

2/10, Lecture 6: (Gnanadesikan) Radiation, energy balance, seasonal cycling (Ahrens, remainder of Chapters 2, 3)

2/13, Lecture 7: (Gnanadesikan) More on radiation, energy balance- why is the earth habitable?

2/15, Lecture 8: (Gnanadesikan) More on energy balance, ocean heat storage and budgeting

2/17, Lecture 9: (Gnanadesikan) More on energy balance, ocean heat storage and sea level rise

Part 2: Horizontal circulations

2/20, Lecture 10: (Haine) Air pressure and winds- atmospheric weather (Meteorology, Chapter 8, Oceanography Chapter 9).

2/22, Lecture 11: (Haine) Coriolis force, geostrophic winds and currents

2/24, Lecture 12: (Haine) Jet streams in oceans and atmosphere

2/27, Lecture 13: (Haine) Friction and Ekman flows

3/1, Lecture 14: (Haine) Global wind patterns-Hadley cell (Meteorology, Chapter 10, 256 to p.276)

3/3, Lecture 15: (Haine) Seasonal cycling of winds and currents

3/6, Lecture 16: (Haine) Coastal circulations

3/8, Lecture 17: (Haine) Large-scale circulation, gyres

3/10, Lecture 18: (Haine) Heat transport in atmosphere and ocean

3/13, Lecture 19: (Haine) Heat transport in atmosphere and ocean

3/15, Lecture 20: (Haine/Gnanadesikan) Review of first half, catch-up if necessary

3/17, Lecture 21: MIDTERM

Part 3: Climate and natural hazards

3/27, Lecture 22: (Gnanadesikan) Hurricanes, phenomenology (Ahrens, Chapter 15, Hurricanes)

3/29, Lecture 23: (Gnanadesikan) Controls on hurricane intensity

3/31,Lecture 24: (Gnanadesikan) Long gravity waves, storm surge

4/3, Lecture 25: (Haine) Anthropogenic climate change, forcings

4/5, Lecture 26: (Haine) Anthropogenic climate change, feedbacks

4/7, Lecture 27: (Haine) Anthropogenic climate change, impacts

4/10, Lecture 28: (Haine) Ocean chemistry, ocean carbon uptake, acidification

4/12 Lecture 29: (Haine) Estuarine circulations

4/14 Lecture 30: (Haine) Ocean pollution and hypoxia

4/17: Lecture 31: (Gnanadesikan) Oceanic biomes and climate

4/19 Lecture 32: (Gnanadesikan) Terrestrial biomes and climate

4/21, Lecture 33: (Gnanadesikan) Atmospheric pollution

4/24, Lecture 34: (Gnanadesikan) Ozone depletion

4/26, Lecture 35: (Gnanadesikan) Ozone depletion

Part 4: Variability

4/28, Lecture 36: (Gnanadesikan) El Nino (Oceanography chapter 10, Ocean circulation)

5/1 Lecture 37: (Gnanadesikan) El Nino, variability

5/3 Lecture 38: (Gnanadesikan) Other modes of climate variability

5/5, Lecture 39: (Gnanadesikan) Milankovitch and the ice ages. (Additional reading provided)