SIO 20 (Winter Quarter 2017)
The Atmosphere

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Class Meeting Times and Location: TuTh 2:00-3:20 pm, Center Hall 113

Evening Review Session Meeting Times and Location: To be determined

Office Hours:	Joel Norris	Wed 2:30-4:30 pm	MESOM 327
	Shang-Ping Xie	Wed 2:30-4:30 pm	MESOM 323
	Dillon Amaya	Mon 2:30-4:30 pm	Galbraith 364
	Momme Hell	Fri 2:30-4:30 pm	Galbraith 364

Email Communication: Any email sent to the instructors or teaching assistants should include **SIO 20** in the subject line. Questions about course material should be asked in class, during office hours, or at a review session, not via email.

Course Description: This course is an introduction to weather and climate. After describing the basic structure of the atmosphere, we will explore how the local imbalance between incoming solar radiation and outgoing terrestrial radiation drives temperature differences, the development of clouds and precipitation, and atmospheric circulation at regional and global scales. Further topics include mid-latitude weather systems, forecasting, severe storms, and global climate change.

Grading Criteria: 30% homework, 25% midterm, 40% final exam, 5% participation (measured via clicker)

Textbook: *Essentials of Meteorology: An Invitation to the Atmosphere* (7th edition) by C. Donald Ahrens

The textbook is on reserve at the UCSD library. You are welcome to use previous editions, but note that page numbers for topics may be different. The textbook is recommended but not required.

Course Website: On UCSD TritonEd

Attendance Expectations: Students are expected to attend and participate in every lecture class. Review sessions are optional.

Clickers: **Clickers are required for this class** (the basic iClicker is fine). Register your clicker under "Tools" on the TritonEd SIO 20 website. Do not register on the iclicker.com website. Your response on clickers will not be graded. The primary purpose for using clickers is not to force attendance but instead to promote participation in class and your success in learning.

Reading: Educational research has demonstrated that students who read the material ahead of class learn more, perform better on exams, and earn higher grades. Think about how you would answer the questions at the end of each chapter, but it is not necessary to turn anything in.

Homework Exercises: **Homework exercises must be completed on time** and will be collected in class. If you must miss turning in homework due to an unavoidable emergency (e.g. serious illness), you must contact Prof. Norris within 24 hours of the homework due date to determine whether you can have an extension. You will be required to provide documentation, without which there will be no extension, and you will receive a zero for that assignment. Do not ask for a homework extension for any reason other than a dire emergency. Homework extensions are decided on a case-by-case basis and may involve something different than the original assignment. Students may collaborate on homework exercises so long as each student does his or her own work (i.e., no copying).

Examinations: There will be a midterm exam and a final exam. The exam format will be closed-book, closed-notes in multiple choice format. You will be accountable for understanding all material covered in lectures and provided on the course website. The midterm will be administered **in class on Tues Feb 14**. Put this on your schedule now. Graded exams may be viewed by appointment with Prof. Norris, but may not be taken home. No collaboration is allowed on the midterm or final exams.

Alternate exams: **There will be no alternate exams.** Make sure your class schedule has NO exam conflicts, including the final exam. If you must miss an exam due to an unavoidable emergency (e.g. serious illness), you must contact Prof. Norris within 24 hours of the missed exam to determine whether you are eligible for a make-up exam. You will be required to provide documentation, without which there will be no make-up exam, and you will receive a zero for that exam. Do not ask to reschedule an exam for any reason other than a dire emergency. Make-up exams are decided on a case-by-case basis.

Academic integrity:
Academic dishonesty undermines the hard work of all students in the class who take responsibility for their learning. Academic dishonesty is incompatible with science and the search for truth. It will not be tolerated, and any student caught engaging in academic dishonesty will fail the course. Academic dishonesty includes:

- clicking for another student
- copying from another student's homework or exam
- cheating on an exam

All exams will be closed-book and closed-notes, so all personal materials must be stowed under your seat. Because all exams are required for satisfactory completion of this course, any student caught cheating on an exam may receive a failing grade for the course. He or she may also be suspended from UCSD.

Course Schedule

Date	Instructor	Topic	Reading	HW/Exam
Tu 1/10	Both	Introduction to the Atmosphere *key concepts: composition, vertical structure, weather, recent climate events*	pp. 4-21, 26-27	
Th 1/12	Norris	Atmospheric Radiation *key concepts: electromagnetic radiation, wavelength, blackbody, emission, absorption, transmission, greenhouse effect*	pp. 35-36, 38-42, 55-57	
Tu 1/17	Xie	Temperature, Heat Transfer *key concepts: heat, latent heat, pressure, Earth's energy balance*	pp. 30-35, 43-46, 55-57, 158, 160-161	
Th 1/19	Xie	Seasonal and Daily Cycles *key concepts: Earth's orbit, equinox, solstice, annual range, nighttime cooling*	pp. 46-57, 60-64, 68-73, 81-83	
Tu 1/24	Norris	Water Cycle and Humidity *key concepts: evaporation, condensation, saturation, vapor pressure, absolute humidity, relative humidity*	pp. 86-94, 119-121	HW 1 due
Th 1/26	Norris	Dew, Fog, and Clouds *key concepts: dew point, condensation nuclei, haze, fog, cloud types, satellite images*	pp. 98-121	HW 1 returned
Tu 1/31	Norris	Cloud Development *key concepts: stability, instability, conditional instability, convection, orographic uplift, rain shadow*	pp. 124-134, 153-155	

Th 2/02	Norris	Precipitation *key concepts: collision and coalescence, Bergeron process, ice nuclei, accretion, precipitation types*	pp. 134-155	
Tu 2/07	Xie	Atmospheric Pressure *key concepts: Sea-level pressure, isobaric maps, pressure gradient force, Coriolis force*	pp. 158-169, 182-183	HW 2 due
Th 2/09	Both	Wind *key concepts: geostrophic balance, cyclone, surface friction, convergence* **Midterm Review**	pp. 170-183	HW 2 returned
Tu 2/14	Xie	Regional Atmospheric Circulation *key concepts: scales of motion, thermal circulation, sea breeze, Chinook wind* **Midterm Exam**	pp. 184-198, 219-221	Midterm
Th 2/16	Xie	Global Atmospheric Circulation *key concepts: monsoon, Hadley cell, trade winds, ITCZ, jet stream*	pp. 199-210, 219-221	
Tu 2/21	Xie	Atmosphere-Ocean Interactions *key concepts: ocean currents and upwelling, El Nino, Southern Oscillation, Teleconnections, climate prediction*	210-221	
Th 2/23	Norris	Air Mass, Fronts, and Weather *key concepts: air mass, warm front, cold front, occluded front*	pp. 224-244, 254-255	HW 3 due
Tu 2/28	Norris	Cyclone Development, Forecasting *key concepts: mid-latitude cyclones, jet stream, numerical models, chaos*	pp. 244-255, 258-269	HW 3 returned

Th 3/02	Amaya	Severe Weather *key concepts: different types of thunderstorms, gust front, microburst, squall line, lightning, tornadoes*	pp. 288-318, 329-331	
Tu 3/07	Norris	California Weather *key concepts: Mediterranean climate, Pacific High, coastal upwelling, marine layer, sea breeze, mountain/valley breeze, Santa Ana wind, North American monsoon, atmospheric river*	pp. 188, 190-192, 194-200, 202-207, 210-213, 231-232, 383-388	
Th 3/09	Xie	Past Climate Change *key concepts: climate proxies, ice age, Milankovitch cycles, climate feedback, volcanic cooling*	pp. 368-372, 398-413, 428-429	HW 4 due
Tu 3/14	Xie	Anthropogenic Climate Change *key concepts: radiative forcing, global warming, cloud feedback, climate models, sea level rise, Paris Agreement*	pp. 413-429, 393	HW 4 returned
Th 3/16	Both	**Review Session**		
Th 3/23	Xie	**Final Exam**		Final