SIO 20 (Winter Quarter 2019)
The Atmosphere

Instructor:	Joel Norris	MESOM 327	*jnorris@ucsd.edu*
Teaching Assistants:	Dillon Amaya	MESOM 269	*djamaya@ucsd.edu*
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Class Meeting Times and Location: TuTh 2:00-3:20 pm, Warren Lecture Hall 2005

Discussion Section Meeting Times and Locations:
1 – Mon 5:00-5:50 pm, HSS 1128A
2 – Mon 6:00-6:50 pm, HSS 1128A
3 – Wed 2:00-2:50 pm, CENTR 217A
4 – Wed 3:00-3:50 pm, WLH 2112

Office Hours with Instructor or Teaching Assistants: by appointment

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, in a discussion section, or during office hours, 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 in lecture class)

Textbook: Weather: A Concise Introduction
by Gregory Hakim and Jerome Patoux
The textbook is required, but it is relatively inexpensive. The textbook is placed on reserve at the UCSD library.

Course Website: On UCSD TritonEd

Attendance Expectations: Students are expected to attend and participate in every lecture class. Up to 5% extra credit will be provided for attendance and participation in discussion sections.

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.

Homework Exercises: Students may collaborate on homework exercises so long as each student does his or her own work (i.e., no copying). **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. Graded homework exercises will be returned in the following discussion section.

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, in the readings, and provided on the course website. The midterm will be administered **in class on Thursday February 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	**Topics and *key concepts***	**Reading**	**HW/Exam**
Tu 1/8	Weather Measurements *temperature, pressure, wind, precipitation, station model, vertical structure*	pp. 1-16, 47-49	HW 1 topic
Th 1/10	Weather Stations, Weather Maps, Radar *surface maps, upper-level maps, ridges and troughs, types of fronts, radar*	pp. 14-29, 168-171	HW 1 topic
Tu 1/15	Atmospheric Composition, Heat Transfer *atmospheric gases, aerosols, sources and sinks, conduction and convection, advection*	pp. 42-53	HW 1 topic
Th 1/17	Radiation, Satellite Imagery, Cloud Types *electromagnetic radiation, blackbody, emission, absorption, transmission, scattering, reflection, types of satellite images, types of clouds, halo, rainbow*	pp. 53-64, 29-41, 113-116, 124-125	HW 1 topic
Tu 1/22	Radiation, Weather, and Climate *greenhouse effect, clouds, radiation imbalance, diurnal and seasonal cycle, land/ocean contrast*	pp. 61-74	HW 2 topic
Th 1/24	Water and Humidity *evaporation, condensation, saturation, vapor pressure, absolute humidity, relative humidity, dew point*	pp. 75-89	HW 2 topic **HW 1 due**
Tu 1/29	Cloud Formation *nucleation, radiative and adiabatic cooling, fog and cloud, dry and moist adiabatic lapse rate, orographic lifting, rain shadow*	pp. 90-102	HW 2 topic
Th 1/31	Convection and Clouds *stability, instability, conditional instability, convection, clouds*	pp. 102-112	HW 2 topic
Tu 2/05	Precipitation *collision and coalescence, Bergeron process, ice nuclei, accretion, types of precipitation*	pp. 117-123	HW 3 topic Midterm topic

Th 2/07	Pressure and Wind *pressure gradient force, Coriolis force, geostrophic wind, gradient wind, cyclonic and anticyclonic, friction, trajectories*	pp. 126-139	HW 3 topic Midterm topic **HW 2 due**
Tu 2/12	Local Wind Systems *sea breeze, mountain/valley breeze, katabatic wind, Santa Ana wind*	pp. 128-130, 138-144	HW 3 topic
Th 2/14	**Midterm Exam**		**Midterm**
Tu 2/19	Atmospheric Circulation and Climate *global patterns of temperature, precipitation, pressure, and wind, three-cell model, monsoon, El Niño, teleconnections*	pp. 145-166	HW 4 topic
Th 2/21	Air Mass, Fronts, and Weather *air mass, warm front, cold front, occluded front, convergence and divergence, midlatitude cyclone development*	pp. 167-187	HW 4 topic **HW 3 due**
Tu 2/26	Severe Weather *thunderstorm types, gust front, microburst, squall line, lightning, tornadoes*	pp. 188-200	HW 4 topic
Th 2/28	Tropical cyclones *geographical distribution of tropical cyclones, structure, development, and dissipation*	pp. 201-212	HW 4 topic
Tu 3/05	Forecasting *probability and uncertainty, numerical models, initial conditions, ensemble, chaos*	pp. 213-226	Final topic
Th 3/07	Air Pollution and Climate Change *smog, particulates, adverse weather conditions and topography, radiative forcing, feedbacks, effects of global warming on circulation and precipitation*	pp. 227-243	Final topic **HW 4 due**
Tu 3/12	Past Climate Change *climate proxies, ice age, Milankovitch cycles, climate feedback*	pp. 235-236	Final topic
Th 3/14	**Review Session**		
Th 3/21	**Final Exam**		**Final**