SIO 20 (Winter Quarter 2022)
The Atmosphere

Instructor:	Joel Norris	MESOM 327	*jnorris@ucsd.edu*
Teaching Assistants:	Veronica Berta	Keck 223	*vberta@ucsd.edu*
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Class Meeting Times and Location: TuTh 2:00-3:20 pm, HSS 1330

Discussion Section Meeting Times and Locations:
1 – Fri 1:00-1:50 pm, WLH 2112
2 – Mon 2:00-2:50 pm, HSS 1315
3 – Mon 4:00-4:50 pm, HSS 1315
4 – Fri 2:00-2:50 pm, MANDE B-104

Office Hours with Instructor or Teaching Assistants: Tues 12:30-1:30 pm, Keck 223 or 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. You will learn how to read weather maps, identify clouds, and interpret radar and satellite images. The basic composition, structure, and circulation of the atmosphere will be described, along with the processes by which energy and moisture is transported and transformed. Additional topics include sea breeze, generation of clouds and precipitation, and development of thunderstorms, hurricanes, and midlatitude weather systems plus forecasting, air pollution, and climate change.

Grading Criteria: 40% homework, 10% first midterm, 20% second midterm, 25% final exam, 5% participation (measured via clicker in class starting at the beginning of the third week). If COVID restrictions prevent an in-class exam, the exam will be online and the weighting of that exam towards the course grade will be halved and the weighting of homework towards the course grade will be correspondingly increased.

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 Canvas

Attendance Expectations: Students are expected to attend and participate in every lecture class. Up to 5% extra credit will be awarded for attendance and participation in discussion sections starting at the beginning of the third week (not counting weeks with a Monday holiday).

Reading: Educational research has demonstrated that students who read the material ahead of class learn more, perform better on exams, and earn higher grades.
Extra Credit Photos: Up to 2% extra credit will be awarded to students who submit their own photos of weather, clouds, optical phenomena, etc. and describe what they found interesting about it.

Clickers: **Clickers are required for this class** (the basic iClicker is fine). Register your clicker under the iClicker tool on the Canvas 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 to promote participation in class and your success in learning.

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. Failure to submit homework will result in a zero for that assignment. If you must miss turning in homework due to an unavoidable emergency, you must contact Prof. Norris within 24 hours of the homework due date to determine whether you can have an extension. Documentation of the emergency may be required. 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 two midterm exams 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, in the homework, and provided on the course website. The midterm exams will be administered **in class** on **Tuesday February 1** and **Tuesday March 1**. If you have a good reason for not being able to take the exam in class, contact Prof. Norris as soon as possible to arrange another location. 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. Failure to take an exam will result in a zero for that exam. If you must miss an exam due to an unavoidable emergency, you must contact Prof. Norris within 24 hours of the missed exam to determine whether you are eligible for a make-up exam. Documentation of the emergency may be required. 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, or cheating on an exam. All in-class 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.

Class Schedule

Date	Topics and *key concepts*	Reading	HW/Exam
Tu 1/4	Weather Measurements *temperature, pressure, wind, precipitation, vertical structure of the atmosphere*	All Ch. 1, 3.5	
Th 1/6	Weather Stations and Weather Maps *station model, surface maps, highs and lows, ridges and troughs, types of fronts, upper-level maps*	2.1, 2.2, 2.3, 10.2	
Tu 1/11	Atmospheric Composition and Cloud Types *atmospheric gases, sources and sinks, aerosols, cloud types*	All Ch. 3, App. 6.1	
Th 1/13	Energy Transfer and Radiation *conduction, convection, electromagnetic radiation, emission, absorption, transmission, scattering, reflection, radar, halo, rainbow, blackbody*	2.4, 4.1, 4.2, 4.3, 4.4.1-4, App. 7.1	
Tu 1/18	Radiation and Satellite Imagery *selective absorption, types of satellite images*	2.5, App. 2.1, 4.4.5-7	
Th 1/20	Greenhouse Effect, Diurnal and Seasonal Cycle *greenhouse effect, radiation balance and imbalance, diurnal and seasonal cycle, land/ocean contrast*	4.5	
Tu 1/25	Saturation, Humidity, and Dew Point *evaporation, condensation, saturation, vapor pressure, relative humidity, dew point, dew and frost*	All Ch. 5	**HW 1 due**
Th 1/27	Fog and Cloud Generation *nucleation, radiative and adiabatic cooling, fog generation mechanisms, cloud generation mechanisms*	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8	
Tu 2/01	**Review and First Midterm Exam**		**Midterm 1**
Th 2/03	Lapse Rate, Stability and Instability, and Convection *dry and moist adiabatic lapse rate, orographic lifting, rain shadow, stability, instability, conditional instability, deep convection*	6.3, 6.4, 6.5, 6.6, 6.9	
Tu 2/08	Precipitation Processes *collision and coalescence, Bergeron process, ice nuclei, accretion, cloud seeding, types of precipitation*	All Ch. 7	**HW 2 due**

Th 2/10	Pressure and Wind *pressure gradient force, Coriolis force, geostrophic wind, gradient wind, cyclonic and anticyclonic, friction*	8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8	
Tu 2/15	Local and Regional Wind Systems *sea/land breeze, mountain/valley breeze, katabatic wind, Santa Ana wind, land/ocean pressure and wind, monsoons*	8.3, 8.9, 9.1.3, 9.4.2-4	
Th 2/17	Global Circulation and San Diego Climate *precipitation, global temperature and jet stream, three-cell model, El Niño, teleconnections, California climate and weather*	9.1, 9.2, 9.3, 9.4.1, 9.4.5	
Tu 2/22	Air Masses, Fronts, and Midlatitude Cyclones *air masses, fronts and associated weather, midlatitude cyclone development, role of upper-level wave, convergence and divergence*	All Ch. 10	**HW 3 due**
Th 2/24	Severe Weather *thunderstorm types, gust front, microburst, squall line, lightning, tornadoes*	All Ch. 11	
Tu 3/01	**Review and Second Midterm Exam**		**Midterm 2**
Th 3/03	Tropical Cyclones and Forecasting *geographical distribution, structure, development, and dissipation of tropical cyclones, probability and uncertainty in forecasting, numerical models, initial conditions, ensemble, chaos*	All Ch. 12, All Ch. 13	
Tu 3/08	Air Pollution and Climate Change *smog, particulates, adverse weather conditions and topography, radiative forcing, climate feedbacks, effects of global warming on circulation and precipitation*	All Ch. 14, All Ch. 15, Box 4.5	**HW 4 due**
Th 3/10	**Review Session**		
Th 3/17	**Final Exam**		**Final**