SIO 20 (Winter Quarter 2020)
The Atmosphere

Instructor:	Joel Norris	MESOM 327	*jnorris@ucsd.edu*
Teaching Assistants:	Christopher MacPherson	As arranged	*chmacphe@ucsd.edu*
	Shawn Roj	As arranged	*sroj@ucsd.edu*

Class Meeting Times and Location: TuTh 2:00-3:20 pm, Solis Lecture Hall 104

Discussion Section Meeting Times and Locations:
1 – Mon 11:00-11:50 am, HSS 1305
2 – Mon 12:00-12:50 pm, HSS 1305
3 – Wed 1:00-1:50 pm, HSS 1305
4 – Wed 2:00-2:50 pm, HSS 1305

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. 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: 30% homework, 25% midterm, 40% final exam, 5% participation (measured via clicker in lecture class starting at the beginning of the third week)

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 provided for attendance and participation in discussion sections starting at the beginning of the third week (not counting weeks with a Monday holiday).

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 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, in the homework, and provided on the course website. The midterm will be administered **in class on Thursday February 13**. 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.

Class Schedule

Date	**Topics and *key concepts***	**Reading**	**HW/Exam**
Tu 1/7	Weather Measurements *temperature, pressure, wind, precipitation, vertical structure*	pp. 1-16, 47-49	
Th 1/9	Weather Stations and Weather Maps *station model, surface maps, highs and lows, ridges and troughs, types of fronts*	pp. 17-25, 168-171	
Tu 1/14	More Maps, Atmospheric Composition, Cloud Types *upper-level maps, atmospheric gases, sources and sinks, aerosols, cloud types*	pp. 25-28, 42-50, 113-116	
Th 1/16	Energy Transfer and Radiation *conduction, convection, electromagnetic radiation, emission, absorption, transmission, scattering, reflection, radar, halo, rainbow, blackbody*	pp. 51-61, 28-29, 124-125	
Tu 1/21	Radiation and Satellite Imagery *selective absorption, types of satellite images, energy balance, greenhouse effect*	pp. 60-66, 29-41	
Th 1/23	Energy Imbalance, Saturation and Humidity *radiation imbalance, diurnal and seasonal cycle, land/ocean contrast, evaporation, condensation, saturation, vapor pressure, relative humidity*	pp. 66-74, 75-82	**HW 1 due**
Tu 1/28	Dew Point, Fog and Cloud Generation *dew point, dew and frost, nucleation, radiative and adiabatic cooling, fog and cloud*	pp. 82-89, 90-102	
Th 1/30	Lapse Rate, Stability and Instability, and Clouds *dry and moist adiabatic lapse rate, orographic lifting, rain shadow, stability, instability, clouds*	pp. 94-109	
Tu 2/04	Conditional Instability, Convection, and Precipitation *conditional instability, deep convection, collision and coalescence, Bergeron process, ice nuclei, accretion, cloud seeding, types of precipitation*	pp. 107-112, 117-123	
Th 2/06	Pressure and Wind *pressure gradient force, Coriolis force, geostrophic wind, gradient wind, cyclonic and anticyclonic, friction*	pp. 126-140	**HW 2 due**

Tu 2/11	Local and Global Wind Systems *sea/land breeze, mountain/valley breeze, katabatic wind, Santa Ana wind, global patterns of temperature, precipitation, pressure, and wind, three-cell model*	pp. 128-130, 140-157	
Th 2/13	**Midterm Exam**		**Midterm**
Tu 2/18	Regional Climate, Air Masses, and Fronts *monsoon, El Niño, teleconnections, California climate and weather, air masses, fronts and associated weather*	pp. 157-170	
Th 2/20	Fronts and Midlatitude Cyclones *Fronts in a developing midlatitude cyclone, role of upper-level wave, convergence and divergence*	pp. 170-187	**HW 3 due**
Tu 2/25	Severe Weather *thunderstorm types, gust front, microburst, squall line, lightning, tornadoes*	pp. 188-200	
Th 2/27	Tropical Cyclones *geographical distribution of tropical cyclones, structure, development, and dissipation*	pp. 201-212	
Tu 3/03	Forecasting *probability and uncertainty, numerical models, initial conditions, ensemble, chaos*	pp. 213-226	
Th 3/05	Air Pollution *smog, particulates, adverse weather conditions and topography*	pp. 227-233	**HW 4 due**
Tu 3/10	Climate Change *radiative forcing, climate feedbacks, effects of global warming on circulation and precipitation*	pp. 234-243	
Th 3/12	**Review Session**		
Th 3/19	**Final Exam**		**Final**