1.841/12.817: Atmospheric Composition and Global Change

Spring 2023, MW 9:00-10:30am, Room 48-308

Instructor: Colette Heald (heald@mit.edu)
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OBJECTIVE: To explore how atmospheric chemical composition both drives and responds to changes in the earth system, including climate change.

PRE-REQUISITE: 1.84J/12.807 or equivalent

PRIMARY TEXT:
IPCC Sixth Assessment Report, Working Group 1 Report "The Physical Science Basis" (available online: http://www.ipcc.ch/report/ar6/wg1/). All other material will be taken from the recent literature.

BACKGROUND TEXTS:
John H. Seinfeld and Spyros N. Pandis, *Atmospheric Chemistry and Physics: from Air Pollution to Climate Change*, 3rd Ed. John Wiley and Sons, 2016.

COURSE STRUCTURE:
We will cover a series of topics in paired lecture and discussions (2 classes each topic). The second class for each topic will be a student-driven discussion. Topic sign-up will be done on the first day of class. Each discussion leader will select 2-3 papers (depending on length) on the topic from the recent literature that all students will read in advance. The discussion leader will prepare an overview oral presentation on the papers (~15-20 min), highlighting why they chose the papers, the big picture objectives, the main results, how the studies fit together (or don't!). The discussion leader is encouraged to incorporate material from additional studies to complement the primary papers.

The discussion leader will then moderate a group discussion of the papers. In general, the goal for the discussion is to analyse, critique, and connect the material, ranging from small details to the big picture. All students will read the assigned papers in advance, prepare a brief written summary of the key points (max 1 page) to be graded PDF, and participate in the general discussion. Each student should come to class prepared to discuss: (1) A concept that was unclear or an open question raised by one of the studies (2) An idea for a potential follow-up study.

Note that the discussion leader must provide the references for discussion to the class by email at least 3 days in advance of the class discussion.

The class will culminate with each student preparing a written research grant proposal related to a topic discussed in the course that could be submitted to a government agency (e.g. NSF, EPA, DoE, etc). Students will also present these research proposals orally in class. Further guidelines will be provided. Written proposals will be due by 5pm on May 3, 2023.

CLASS SCHEDULE:

DATE			TOPIC	DISCUSSION LEADER
February	6	M	Class Introduction	
	8	W	Wildfires & Biomass Burning	
	13	M		Lexia Cicone
	15	W	Land Use & Land Cover Change (Biome shifts, Deforestation, Urbanization, Croplands, Plantations)	
	21	Tu	*(Note: MIT Monday schedule on 2/21)*	Eric Roy
	22	W	Biogenic VOCs	
	27	M		Joe Palmo
March	1	W	Carbonaceous Aerosol (BC, PBAP, SOA, marine OA)	
	6	M		Xinyuan Yu
	8	W	Nitrogen (Ammonia, NOx, Nitrate, N2O)	
	13	M		Emmie LeRoy
	15	W	Sulfur (DMS, volcanoes, OCS, sulfate, CLAW)	
	20	M	Session on writing research proposals (online)	
	22	W	No class	
	27	M	MIT Holiday (Spring Break)	
	29	W		
April	3	M	Sulfur discussion	Steph Elkins
	5	W	Methane	
	10	M		Jacob Bushey
	12	W	Dust, Metals, Nutrients (Fe, Hg, Pb, P)	
	17	M	MIT Holiday (Patriot's Day)	
	19	W	Dust, Metals, Nutrients discussion	Olivia Norman Evan Routhier
	24	M	No class	
	26	W	Air Quality & Climate (changing meteorology, extremes, transport) *Note: 4/26 lecture online*	
May	1	M		Lucas Estrada
	3	W	Geoengineering	
	8	M		Shreya Sharma
	10	W	Proposal Presentations	
	15	M	Proposal Presentations	

GRADING CRITERIA:

Discussion Leader Presentation (20%)
Research Proposal (30%)
Discussion Participation & Summaries (30%)
Research Proposal Presentation (20%)

COVID-RELATED:
In anticipation of students being ill this semester lectures will be recorded (slides only with voice-over, no video of classroom). If you have tested positive for Covid-19 and must isolate, please contact Colette so we can make sure you have access to course materials and make arrangements for you to participate remotely in discussions, as needed. You can always contact GradSupport for additional assistance. If Colette becomes ill and needs to isolate, some lectures may be delivered online and/or changes may be made to the lecture schedule. Any changes will be communicated via canvas and email.

Ventilation and filtering are highly effective at mitigating the spread of Covid-19. HEPA filters will be running in the classroom at all times to improve air filtration. Colette will be wearing at KN95 mask at all times while teaching; she requests that you consider also wearing a mask to protect yourself and your classmates. However, masking is optional at MIT and will not be enforced unless campus policies change.