Syllabus
EES 717, Earth Systems II
Spring Semester 2019

Professors:
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Schedule: Wednesday, 2–5 pm, room 4433

Course Description and Objectives:
This seminar-style course is divided into two parts: (1) Dynamics and composition of Earth's Interior, led by Prof. Longpré; and (2) Atmosphere and climate dynamics, led by Prof. Booth.

Each week, the group will be required to read 2–4 scientific journal articles on pre-determined topics (see tentative list on last page). In class, subgroups will discuss given questions related to the articles, and a designated group member(s) will then summarize the subgroup findings to the entire class and lead the subsequent open discussion. A central objective of this course is the production of a term paper on a topic of the group members' choice, hopefully related to their PhD research. In addition to learning about the geosphere and atmosphere, by the end of this course you will also have improved your skills at:

- *Reading, understanding, synthesizing and evaluating scientific literature*
- *Oral presentation and discussion of scientific results*
- *Writing scientific papers*
- *Collaborating with your peers*

Student Learning Outcomes
By the end of this course, you will be able to:

- Describe the primary evidence that led to scientific consensus on the Plate Tectonics Theory;
- Discuss mechanisms of core–mantle differentiation in the early Earth and the workings of the geodynamo;
- Explain the mechanisms of continental crust formation in Earth history;
- Discuss the evidence for whole vs. layered mantle convection and debate the existence of mantle plumes;
- Describe key processes within the Subduction Factory;
- Explain the mechanisms by which volcanic eruptions affect global climate;
- Explain the links between global energy imbalances and large-scale atmospheric wind circulation patterns and storms;
- Use first principles of physics to explain differences between the atmosphere and the ocean coupling and atmosphere and land surface coupling;
- Describe the leading mode of response of the northern hemisphere atmosphere to large-scale forcing: the Northern Annular Mode;
- Explain the advantages and limitations of General Circulation Models;
- Explain the difference between natural and forced climate variability;
- Synthesize and apply theory of the various natural and anthropogenic climate change mechanisms to explain the context of global warming.

Assessment:

- **Reading summaries (20 %)**

  You will be expected to have completed the assigned readings; the success of the course relies on this. In teamwork (2 students), you will write 1 reading summary (2 pages each, no more, no less) per week, on the article of your choice, using a standard format to be provided and discussed in class. The summaries will be due before each meeting for upload on Blackboard. A single grade per team will be assigned and will be returned promptly with comments.

- **Participation and leading discussions (15 %)**

  This course requires your contributions to discussions in subgroups and to discussion summaries in the full group. Subgroup members should alternate responsibilities to present discussion findings to the whole group and lead the subsequent open discussion. Visual support, i.e. a PDF of the articles, will be available to refer to figures when necessary. Participation will be evaluated throughout the semester.

- **Term paper (5+20 %)**

  In no less than 2000 and no more than 3000 words (i.e. ~8–12 double-spaced pages in Times New Roman 12 point font), you will write a term paper on the topic of your choice. Note that the word count excludes the abstract, figure captions and references. Include as many figures as relevant. The abstract should be no more than 250 words written in the third person. Ideally, you will use this opportunity to produce a thorough but concise literature review on your PhD research topic (or closely related). *We ask that, in this process, you compile relevant published data and analyze them in a new way.* The paper will be done in two steps: (1) A first version worth 5% of the final grade will be due on April 3rd. This first version should contain all the key components of the paper (i.e., title, abstract, introduction, discussion, conclusion, references cited), including references and supporting figures. We will read, provide detailed comments and suggest improvements on this version within 2 weeks. (2) You will submit a final version of your improved paper at the end of the semester (*exact date to be announced*). The final version of the paper will be worth 20% of the final grade.

- **Mid-term exam (20 %)**

  A mid-term exam will take place on March 20th. This will cover topics seen in the first part of the course (Earth's interior) only.

- **Final exam (20 %)**

  A final exam will take place in the final exam period (*exact date to be announced*). This will cover topics seen in the second part of the course (atmosphere and climate) only.

Notes

Readings, attendance and participation in class: It is expected that group members will arrive to meetings on time and be active participants in all discussion sessions. Attendance to all meetings is expected unless justification for absence is provided prior to the time of meeting.

Blackboard: Blackboard will be routinely used to make announcements, distribute reading materials, and collect writing assignments, so make sure that you regularly check for updates.

Academic integrity: This course is subject to the academic integrity policy at CUNY. Therefore all group members must understand the meaning and consequences of cheating, plagiarism and other academic offences. For details, see:

http://www2.cuny.edu/about/administration/offices/legal-affairs/policies-procedures/academic-integrity-policy/

Tentative Schedule

Week	***Topic***
1 (30 January) MAL & JB	Introduction
2 (6 February) MAL	Plate Tectonics
3 (13 February) MAL	Core–Mantle Differentiation and the Geodynamo
4 (20 February) MAL	The Continental Crust
5 (27 February) MAL	Mantle Convection and Mantle Plumes
6 (6 March) MAL	The Subduction Factory
7 (13 March) MAL	Volcano-Climate Interactions
8 (20 March) MAL	**Mid-Term Exam**
9 (27 March) JB	Introduction to Climate Dynamics, Coupled/Ocean Atmosphere, Climate Models, and Statistical Methods
10 (3 April) JB	Natural Climate Variability (decadal vs interannual; the NAO) **Term paper first version due**
11 (10 April) JB	Geostrophic Wind, Thermal Wind, the Eddy-Driven Jets
12 (17 April) JB	Arctic Amplification and Midlatitude Dynamics
13 (1 May) JB	Climate Sensitivity, Aerosol and Cloud Forcing, and Emergent Constraints
14 (8 May) JB	Climate Change Attribution. Weather Extremes Attribution
15 (TBD) JB	**Final Exam**