Climate Dynamics 440: Climate Dynamics (Introduction to the Physical Climate System)

Course Syllabus Spring 2020

Course Instructor: David M. Straus

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Map of Annual Mean Precipitation (ECMWF)

Zonal Mean of Potential Temperature ECMWF

Class location: Research Hall Room 121 (Climate Dynamics Lab)

Class time: Tuesday - Thursday 3:00 PM to 4:15 PM

- First class: Tuesday Jan 21
- Mid-Term: TBD
- Spring break: Tuesday Mar 10, Thursday Mar 12
- Last class: Tuesday May 5
- Final Exam: Thursday May 7 1:30 AM - 4:15 PM

Primary Required Reading (Course Notes):
http://mason.gmu.edu/~dstraus/CLIM_610_syllabus.htm

Primary Reference Books:
Supplementary Reading:

  - ISBN-10: 0-12-615160-1
  - ISBN-10: 3-540-42638-8

Course Goals and Student Learning Outcomes

- Acquire knowledge of the basic physics principals that govern weather and climate.
- Understand the overall energy balance of the earth-atmosphere-ocean system.
- Be able to articulate the reasons for global atmosphere and ocean transport of energy.
- Become familiar with the atmospheric structures that transport energy and moisture.
- Acquire basic skills for examining current data sets of weather and climate variables.
- Develop the ability to read basic journal papers on the subject, and report the main findings.

Student Work Components

1. Mid-Term Exam = 20% percent of grade
2. Final Exam = 20% percent of grade
3. Four Homework Sets = 30% percent of grade
4. Journal Paper Presentations = 20% of grade
5. Class Participation = 10% of grade

Homework Policy

Course Topics

(Note: Content of lectures subject to updating!)

1. Overview Lecture
2. Global Energy Balance
3. Satellite Radiation Maps
4. Planck Function and Blackbody Radiation
5. Radiation and Climate Part 1
6. Introduction to Temperature and Ideal Gas
7. Radiation and Climate Part 2
8. Short Wave Radiation Distribution
9. Radiative-Convective Equilibrium
10. Thermodynamics Part 1
   Enlarged Figures for Thermodynamics Part 1
   Entropy and the First Law
11. Thermodynamics Part 2
   Thermodynamics Problem Set 2
12. Thermodynamics Notes Part 1
13. Thermodynamics Notes Part 2
14. Thermodynamics Figures 2
15. Ocean Circulation and Climate (Dr. Barry Klinger)
17. Hadley and Ferrel Cells
18. Energy Transport
20. Rotational vs. Divergent Flow
21. Isentropic Hadley Cell
22. Transient Fluctuations
23. A direct look at Baroclinic Transients
24. The Hydrological Cycle
25. The Indian Monsoon
26. Predictable Component Analysis
27. Extra-Tropical Energy Flux
28. Oceans and Climate
29. Paleoclimate: Observations, Theory and Modeling;
30. Brief Review

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