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

Course Syllabus Spring 2021

Course Instructor: David M. Straus

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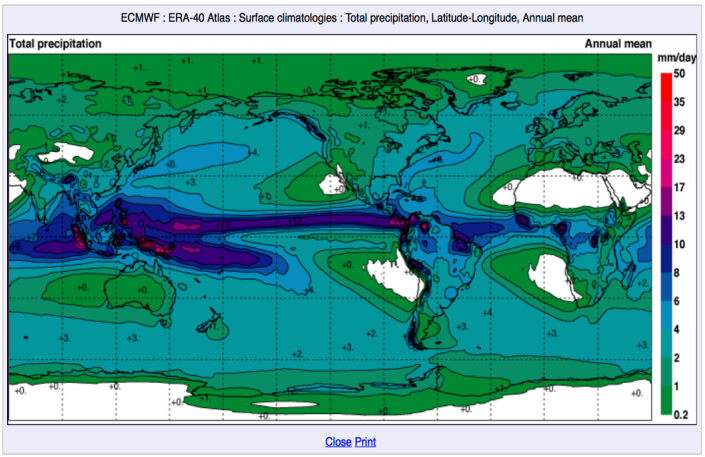
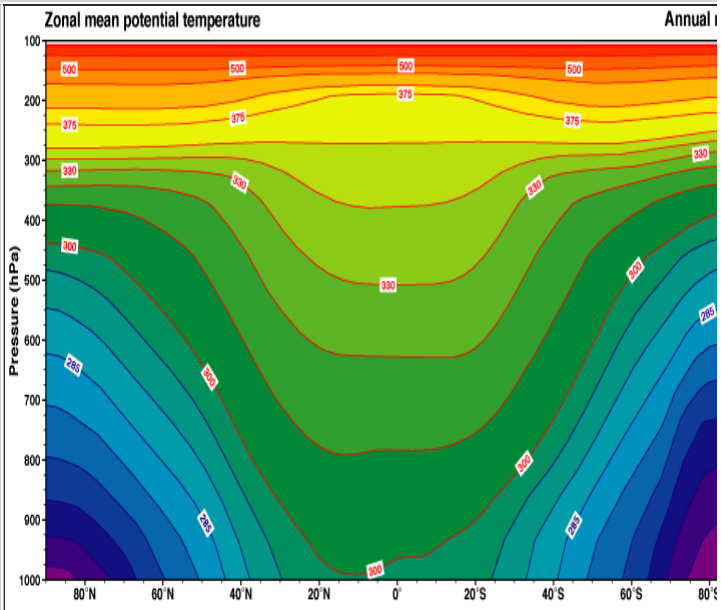


Map of Annual Mean Precipitation (ECMWF)



Zonal Mean of Potential Temperature ECMWF

Class location: Virtual Access via Blackboard

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

- **First class: Tuesday Jan 22**
- **Mid-Term: TBD**
- **Last class: Thursday April 29**
- **Final Exam: Thursday May 6 1:30 PM - 4:15 PM**

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

Primary Reference Books:

- **Hartmann, D. L.: Global Physical Climatology, Second Edition. Elsevier, 2016.**
  - **ISBN-13 978-0-12-328531-7**
- **Andrews, D. G., 2000. An Introduction to Atmospheric Physics., Cambridge University Press, 2000**
  - **ISBN-13: 978-521-62958-4**
  - **ISBN-10: 0-521-62958-4**

Supplementary Reading:

- **Salby, Murry L. Fundamentals of Atmospheric Physics. Academic Press, 1996.**
  - **ISBN-10: 0-12-615160-1**
- **Masaki, Satoh. Atmospheric Circulation Dynamics and General Circulation Models Springer, 2004**
  - **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 trasnport 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** Suggested Journal Articles
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. Atmospheric Thermal Structure
4. Satellite Radiation Maps
5. Planck Function and Blackbody Radiation
6. Radiation and Climate Part 1
7. Introduction to Temperature and Ideal Gas
8. Radiation and Climate Part 2
9. Short Wave Radiation Distribution
10. Radiative-Convective Equilibrium
11. Thermodynamics Part 1
    Enlarged Figures for Thermodynamics Part 1
    Entropy and the First Law
12. Thermodynamics Part 2
    Thermodynamics Problem Set 2
13. Thermodynamics Notes Part 1
14. Thermodynamics Notes Part 2
15. Thermodynamics Figures 2
16. Ocean Circulation and Climate (Dr. Barry Klinger)
17. Atmosphere General Circulation: Introduction-1
18. Hadley and Ferrel Cells
19. Energy Transport
20. Atmosphere General Circulation: Introduction-2
21. Rotational vs. Divergent Flow
22. Isentropic_Hadley_Cell
23. Transient Fluctuations
24. A direct look at Baroclinic Transients
25. The Hydrological Cycle
26. The Indian Monsoon
27. Predictable Component Analysis
28. Extra-Tropical Energy Flux
29. Oceans and Climate
30. Paleoclimate: Observations, Theory and Modeling;
31. Brief Review

Academic Integrity

George Mason is an Honor Code university. The principal of academic integrity is taken very seriously and violations are treated gravely.
When you as the student are responsible for a task, you will perform that task.
When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form.
The homeworks and exams in this course are designed to be undertaken independently.
You may discuss your ideas with others and conference with peers on drafts of the work.
But you are responsible for making certain that the work you hand in is your own.
Please see the Academic Integrity website