

Meteo 452 – Tropical Meteorology

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Instructor: William M. Frank
Office: 601A Walker
Phone: 865-0470
Email: frank@ems.psu.edu

Introduction:

The tropics cover roughly half of the Earth's surface, and 2/3 of the global population lives there. Tropical societies are as strongly affected by weather as any other, and it is important to understand their weather and climate as well as the role of the tropics in the global circulation.

Although the laws of physics do not change with latitude, the weather does. Tropical weather systems arise from different processes, derive their energy from different sources, and behave differently from the baroclinic waves and cyclone families that dominate the weather in the middle latitudes. The primary goal of this course is to teach you how the tropical weather works using the tools you have developed in your core meteorology courses. It is also intended to introduce you to some of the ways that weather impacts tropical societies.

Grading:

There will be a midterm exam and a final exam. Each will be worth 25% of the total grade.

Each student will be assigned to a research and forecasting team. Each team will conduct two projects, one on a research topic and one on a forecasting topic. The teams will produce a written report and give an oral presentation on each project. The grades on these will determine 40% of the total grade (10% for each report and presentation).

The remaining 10% will be determined from the instructor's evaluation of your class participation and the quality of your tropical cyclone forecasting.

Academic Integrity:

The course will follow the College of EMS policy on academic integrity. You may consult the college web page for details. The instructor also reserves the right to invoke the general rules and policies followed by pirate sea captains in the tropical Atlantic during the 17th and 18th centuries, when appropriate.

Course Overview

The usual procedure will be to have lectures on the meteorology of the tropics during the Monday and Wednesday class periods. On Fridays and the Tuesday before Thanksgiving, when we meet for two periods in the weather station, we will usually have short introductory lectures on tropical forecasting followed by team forecasting exercises. We will normally forecast tropical cyclones when they are active present.

The Friday double periods will also be used for the midterm exam, the team presentations, and a final class review session.

I will be happy to hold evening review sessions a couple of days before the midterm and final exams, if you would like them.

There is no text book for the class, primarily because there are no good text books on this subject. There are chapters on the general circulation and basic tropical dynamics in Holton's dynamics textbook, which you should all have (chapters 10 and 11). I will have files in my outer office that have paper copies of some of the key figures that I show in class, and I'll try to make some of them available electronically as well.

Outline of Lectures

1. Introduction to the Tropics
2. Overview of the Mean Weather Patterns
3. Tropical Cyclones: Large-Scale Structure
4. Tropical Cyclones: Core Structure
5. Tropical Cyclones: Dynamics and Energetics
6. Tropical Cyclone Climatology
7. Formation of Tropical Cyclones
8. Environmental Effects on TC Intensity and Structure
9. The General Circulation: Radiation Balance
10. General Circulation: Water Balance
11. Jet Streams and the TUTTs
12. The Intertropical Convergence Zone
13. Monsoons: Structure and Cause
14. Monsoon Variability
15. El Nino/Southern Oscillation (ENSO): Observed properties
16. Theories of ENSO
17. Tropical Waves: Theory and Structure
18. The Observed Population of Tropical Waves
19. Convectively Coupled Waves
20. Using Waves to Predict Weather
21. Tropical Dynamics: Scaling, Vertical Structure
22. Geostrophic Adjustment
23. The Gill Model, Responses to Heating
24. Hurricane Formation Revisited
25. Tropical Convection: The Mass Flux Cloud Model
26. Tropical Convection: Cloud Models, Part II
27. The Vertical Energy Balance of the Tropical Atmosphere

Lab Session Schedule

The lab sessions below are listed by date. All are on Fridays except for one lab on the Tuesday before Thanksgiving. L refers to a weather-related lecture session (usually less than one period), and F refers to team forecasting.

2 SEP L – Organization and Overview
B – F

9 SEP L – Tropical Cyclone (TC) Climatology
F

16 SEP L – TC Track Forecasting
F

23 SEP L – TC Intensity and Intensity Change
F

30 SEP L – TC Impact
F

7 OCT L – Station Climatology Reports
F

14 OCT L - Station Climatology Reports
F

21 OCT - Midterm Exam

28 OCT L – Discuss the Exam
F

4 NOV L – Weather Discussion or TBA
F

11 NOV L – Weather Discussion or TBA
F

18 NOV L – Weather Discussion or TBA
F

22 NOV (Tuesday) L – Weather Discussion or TBA

2 DEC Research Presentations

9 DEC Research Presentations