Met 5534 Spring 2008 MWF 125-215PM, 305 Love Building

Tropical Meteorology II

Instructor: Robert Hart
361 Love Building
645-1552
rhart@met.fsu.edu

Teaching Asst: Clark Evans, 365 Love Building, acevans@met.fsu.edu.

Office hours: Hart: TBD. Tentative: MWF 230-320PM
Evans: Tentative: MWF 1225-125PM [Hour before class].

Course Objectives:

- To further understand the role of the tropics as part of the general circulation
- To explain the development of convection in the tropics, the characteristics of deep convection, and the factors determining its organization
- To understand the structure and role of tropical easterly waves
- To examine and compare the current theories behind tropical cyclone development, intensification, and structural change
- To explain the factors determining tropical cyclone motion
- To explore the methods used for forecasting tropical cyclone evolution
- To critically examine recent assertions relating climate change to hurricane frequency
- Improved skills for tackling new problems mathematically and computationally
- Improved lateral thinking to solve problems not seen
- Overall, an emphasis of understanding why and how hurricanes work.

Course Web Site: http://moe.met.fsu.edu/Classes/Spring2008/Met5534
Please check this web site regularly for updates, including homework clarification.

Course Text: Unfortunately, there is still no tropical meteorology textbook. As a result, you will be provided with material from various sources, including journal articles, chapters from text, and handouts of figures. Many of these journal articles will be made available in PDF format on the web site for you to print out. There will be a copy of WMO TD-693 at Target copy for this class that you will have to purchase. Estimated cost is $30-$35. This will be available by the first week of class.

Prerequisites: Met4501C. Permission of the instructor is required if you don't meet this prerequisite. It is also expected that you have basic programming skills in SOME language – Fortran, C, etc. At least one of the homework assignments will require basic programming. It is also expected that you know one of the basic graphical display packages: GrADS, IDL, Matlab, to name just a few.

If you do not have this experience, I would strongly encourage you to learn ASAP. Your 1st hw assignment will require the use of a graphical display package of your choice.

Exams: Two midterms: TBA [Most likely during sections 4,7].
Final Exam: There is no final exam.

Grading: Your course grade will be weighted as follows:

Exam 1:	20%
Exam 2:	30%
Project:	30% (15% written, 15% oral presentation)
Homework:	20% (there will be 3-4 homework/lab assignments, each taking approximately 2-3 weeks to complete).

Generally, some type of A corresponds to a numerical course grade in the 90s, B in the 80s, etc. Exams and homeworks may be curved as necessary, since the difficulty level of hw and exams varies from year to year. A tentative course grade will be provided to each student after the second midterm. Please note it is possible to get a course grade of C (or lower) in this course if it is clear that the student is performing below the bare minimum to get by, or shows no motivation to learn the material. Typically, 15-20% of the class ends up with a solid A.

Note: It is always encouraged to work on homework assignments together. However, the writeup you provide and the arguments made must be your own. This also applies to any programs you write as part of homework assignments. You should document all programs in your own words, so that I can easily see you understand what you did. If you work with two people on a program, and all three turn in exactly the same program and documentation, then all three will receive a zero on the assignment. I cannot stress how important this is. It is your responsibility to prove to me that you understand the answers to the homework assignment. If you have any questions on this, please see me BEFORE handing in your assignment.

Projects: Each student will write one report, approximately 6-8 pages of double spaced (11-point font or larger) text, on any approved topic related to the course. Any report larger than 8 pages of text will not be read. The report will be due April 6 in class, and oral presentations (of 10 minutes length + 2-3 minutes for questions) will follow during the last five class meetings (April 9-18). There will be four presentations per class. Any remaining time on the last day of class (18TH) will be used for course evaluation. Topics for the projects must be claimed and approved by February 8.

Important: *It is unacceptable to simply present your already-completed (or nearly completed) thesis work for a class project. The class project must represent some degree of additional work that you would not have otherwise done for the thesis. You cannot get two grades for one piece of work. Of course, you are welcome to present a topic that is related to (or is an extension of) your thesis work, such that the class project builds upon your thesis. If you have any questions on your topic, please see me.*

Cancelled Classes:

21 January – 1 Feb - Travel for AMS Annual Meeting & Japan WRAC

The six cancelled classes will be made up through double lectures TBD and based upon the schedules of the students and instructor.

ACCOMMODATIONS AND ACADEMIC DISHONESTY:

Please let me know if you have special needs regarding classroom access, or lecture or exam accommodations as soon as possible so that I may address them in a timely manner. Any student who needs special accommodations of any kind should notify the instructor in advance. All students should read the following document for further information; this document is considered part of the syllabus: http://www.met.fsu.edu/Classes/Common/legalities.html

Students with disabilities needing academic accommodations should:

1. Register with and provide documentation to FSU's Student Disability Resource Center ("SDRC," 8 am - 5 pm, 08 Kellum Hall, Telephone (voice or TDD): 644-9566); and
2. Bring a letter to the instructor from the SDRC indicating you need academic accommodations. This should be done during the first week of class.

Students are expected to uphold the **Academic Honor Code** published in *The Florida State University Bulletin*, in the *Student Handbook*, and at the FSU Web site (http://registrar.fsu.edu/bulletin/undergrad/info/acad_regs.htm - AcademicHonor). The Academic Honor System at FSU is based on the premise that each student has the responsibility (1) to uphold the highest standards of academic integrity in the student's own work, (2) to refuse to tolerate violations of academic integrity in the University community, and (3) to foster a high sense of integrity and social responsibility on the part of the University community. Instructors will uphold this Honor Code. This includes the possibility of bringing someone to "honor court if there is a perceived violation of the Honor Code.

Please reread the prior page with respect to Grading and Projects in this regard.

Potential Projects (only a few examples)

- The reasoning behind the raising of Hurricane Andrew (1992) to category 5. Should also include the dissenting view, and numerical analysis supporting your view that has not yet been performed by another.
- A comparison of the factors behind Hurricane Opal's (1995) rapid strengthening (and then weakening).
- Why did Isabel (2003) dramatically weaken, and what is the predictability of this rapid weakening?
- Detailed case study of an unusual hurricane or typhoon.
- The physics of storm surge
- Trapped fetch waves produced by rapidly moving hurricanes
- Subtropical cyclone structure and development
- Baroclinic genesis of tropical cyclones
- Large-scale influences on tropical cyclone development
- High latitude warm-core cyclones (polar lows, Mediterranean storms) as hurricane-type vortices
- Tropical cyclone intensity and climatology change as a result of potential climate change
- Deriving historical hurricane frequency from paleo records
- Relationship between Fujiwhara rotation and storm intensity
- Examining reasons for specific storms not reaching MPI
- The role of African dust in influencing TC genesis
- Sensitivity of upwelling to TC intensity, size, motion, latitude
- Evolution of sensible and latent heat fluxes during tropical disturbance passage
- Diagnosing the various roles of the Gray genesis parameters 1950s-2000s
- Variation and explanation of hurricane track density variability over the past decades
- Long-term AEJ/TEJ location/intensity shift & associated AEW change
- Gray's seasonal forecasting: Whether there is true skill and how & why that skill varies yearly
- Southern Atlantic tropical storms
- The variability in pressure-wind relationships
- Unique characteristics of tropical cyclogenesis near the Equator
- Land-based tropical cyclogenesis
- Internal vs. external forcing of rapid intensification
- Occurrence of lightning in hurricanes
- Tropical cyclone trigger of El Nino
- Mediterranean hurricanes
- Atlantic TC activity modulation by NAO, QBO, MJO

There are far more out there. However, pick one that interests you.

In each case, it is expected that you will perform a significant amount of data analysis or computation within the project. In other words, this is not simply an report on what others have found. The more accurate, independent data/synoptic analysis you perform as part of your report, the easier it will be to attain an A. If you have no independent data analysis as part of your project, you'll have to write as good as a Nobel Laureate to get an A. From experience, a student presenting a report without any independent statistical/numerical analysis will receive no higher than a B, and often lower.

Your oral presentation is graded using a weighted mean of individual grades for:

Content:	The actual work presented
Complexity:	Appropriateness of the level of detail and insight [this does not mean overwhelm]
Pacing/Contact:	Was the time used evenly, or was it weighted too much toward intro/method, etc Did the speaker make good eye contact with the audience, or stare at the screen?
Q&A:	Did the speaker provide a fair answer to the questions, evade/blowoff
# Slides:	Typically, you should aim for about 1.5 slides per minute.
Time Length:	Did the talk run long or end too early.

Met5534 Spring 2008 Course Outline:

1. Introduction (4)
   - Overview of tropics role in general circulation
   - Lorenz energy cycle
   - Formation of subtropical jet, TEJ, and barotropic instability
   - Tropical Convection
     - Formation
     - Role of shallow cumulus
     - The characteristics of deep convection
     - Organization

2. Tropical Cyclone Climatology (2)
   - Genesis locations, tracks, Gray conditions

3. Tropical Cyclogenesis (3)
   - GATE, CISK, WISHE

4. Tropical Cyclone Structure (7)
   - Basic symmetric structure
   - Asymmetries
   - Spiral bands as waves
   - Vortex Rossby Waves
   - Regions of a tropical cyclone
   - Balance in the core, envelope and outer storm region
   - Sawyer-Eliassen Equation
     - Derivation & Interpretation
     - Secondary Circulation
     - Convective Ring Model

5. Tropical Cyclone Intensity Change (7)
   - Maintenance of a static storm
   - Factors affecting intensity
   - Maximum Potential Intensity
   - Role of convection and its organization
   - Eyewall cycles

6. Tropical Cyclone Motion (6)
   - Environmental steering
   - Beta-effect
   - Environmental Beta-effect
   - Fujiwhara rotation
   - Vertical Wind Shear

7. Tropical Cyclone Structural Transition (2)
   - Decay vs. Extratropical transition
   - Trough interaction
   - Eliassen-Palm Flux

8. Tropical Cyclone Forecasting Tools (2)
   - Analog, Statistical, Deterministic
   - Vortex bogussing vs data assimilation

9. Individual student presentations (5)