

TROPICAL METEOROLOGY: METR 5803.003

Fall 2009

Syllabus: Course Outline:

1. Introduction:

- What are the tropics? Possible definitions.
- Why study the tropics separately? Examples of tropical circulations: weather and climate.

2. Governing Equations:

- Momentum, mass, heat, moisture and other “tracers”, energy, etc.
- Forcing terms: convection, turbulent transfer, radiation and clouds, wind (oceans), etc.
- Scaling analysis in the tropics.

3. Linearization of the Governing Equations

- Derivation of the linearized equations.
- Equatorial Waves I: Normal (Free) modes.
- Equatorial Waves II: Forced modes (e.g. by diabatic heating, wind stress, radiative cooling, friction).

4. The Gill Model

- What is the Gill Model? Why is it still important 25 years later?

5. Tropical Weather Systems

Convective systems: cloud clusters; squall lines, MCSs, solitary waves, diurnal variations etc.

- Easterly waves.

6. Tropical Cyclones:

- Vortex motion in the tropics: beta drift.

Current theories of TC structure.

Modeling of tropical cyclones: operations and research.

Predictability aspects of tropical cyclones.

Tropical cyclones in past, present and future climates.

7. Dynamics of Tropical Climate Systems I:

- The general circulation; Hadley Circulation; Walker Circulation; Monsoons; Trade Winds.

- Trade Wind Regime.

8. Dynamics of Tropical Climate Systems II:

- ENSO, QBO, PDO, NAO, MJO

- Teleconnections.

9. Climate Models:

- How well do they model the tropics?

- Examples of simulations with simple and complex coupled models.

- Wavelet and other methods of evaluating model performance.

10. Predictability of/in the Tropics

- What is it, and how is it measured? Methods for predictability estimation in the tropics. Examples of predictability.