

ADVANCED TROPICAL METEOROLOGY: METR 5453.001

T R 11:30-12:45, NWC 5820

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1. Introduction

- **What are the tropics? Possible definitions and their limitations.**
- **Why study the tropics separately? Examples of major tropical circulations on weather and climate scales.**

2. Governing Equations

- **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. Tropical Weather Systems

- **Convective systems: monsoons, trade winds, cloud clusters; squall lines, MCSs, solitary waves, diurnal variations etc.**
- **Easterly waves.**

5. Tropical Cyclones

- **What are they? How do they differ from extratropical 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.**

6. Dynamics of Tropical Climate Systems I:

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

7. Dynamics of Tropical Climate Systems II:

- **ENSO, QBO, PDO, NAO, MJO**
- **Telecommunications: Theory and examples**

8. Climate Models:

- **What are they? How well do they model the tropics compared with the extra-tropics?**
- **Examples of current and future climate simulations with simple and complex coupled models.**
- **Wavelets and other methods of evaluating model performance.**

9. Predictability of/in the Tropics

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