

# **TROPICAL METEOROLOGY: METR 4443/5443**

**T R 1:00 – 2:15pm, NWC 5600**

**Instructor: Dr. Lance Leslie**

*Syllabus: Fall 2017*

## **1. Introduction**

- **What are the tropics? Possible definitions.**
- **Why study the tropics separately?**
- **Overview of the tropics. Examples of the main tropical circulations on both weather and climate scales.**

## **2. Governing Equations**

- **Simple “models” of the tropics, including 1-D model**
- **Governing equations for the tropics: Momentum, mass, heat, moisture and other “tracers”, energy, etc.**
- **Forcing terms in the tropics: convection, turbulent transfer, radiation and clouds, wind (oceans), etc.**
- **Scale 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, ITCZ, cloud clusters; squall lines, MCSs, solitary waves, diurnal effects, etc.**
- **Easterly waves: what are they and how do they form?**

## **5. Tropical Cyclones**

- **TC motion: environmental steering and beta drift.**

- Current theories of TC structure.
- Modeling of tropical cyclones: operations and research.
- Tropical cyclones in past, present and possible future climates.

6. **Dynamics of Tropical Climate Systems I:**

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

7. **Dynamics of Tropical Climate Systems II:**

- Tropical oscillations: ENSO, QBO, PDO, IOD, MJO
- Teleconnections: 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.
- Wavelet and other methods of evaluating model performance.

9. **Predictability of/in the Tropics**

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

**Course Text:** No formal course text. Lecture notes and other references will be provided in class. However, a useful book is:

**Holton, J. R., *An Introduction to Dynamic Meteorology.***