# TROPICAL METEOROLOGY

# Fall 2008

## Syllabus: Course Outline:

**1. Introduction:**

**- What are the tropics? Some possible definitions.**

**- Why study the tropics separately?**

**- Why have the tropics been (relatively) neglected for so long?**

**- Examples of tropical circulations – weather and climate.**

**- Teleconnections: tropics -> extra-tropics and conversely.**

**2. The 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. Derivation of the shallow water equations for the tropics and simple baroclinic models.**

**3. Linearization of the Governing Equations**

**- Derivation of the linearized equations.**

**- Equatorial Waves I: Normal (Free) modes.**

**- Equatorial Waves II: Forced modes (e.g. diabatic heating, SST, wind stress, radiative cooling, friction).**

**4. The Gill Model**

**- What is the Gill Model? Why is it so important more than 20 years later?**

**5. Tropical Weather Systems**

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

**- Easterly waves.**

**- Local effects.**

**6. Tropical Cyclones I:**

**- Vortex motion in the tropics: the beta drift.**

**- Theories of tropical cyclogenesis, intensification, maturity (including maximum potential intensity) and decay.**

**7. Tropical Cyclones II:**

- **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.**

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

**- The general circulation.**

**- The Hadley Circulation.**

**- The Walker Circulation.**

**- The Monsoons.**

**Trade Wind Regime.**

**- The Tropical Oceans.**

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

**- ENSO**

**- QBO**

**- PDO**

**- NAO**

**- MJO**

**- Etc. (by request, and if time permits!)**

**- Teleconnections.**

**10. Climate Models I:**

**- Global.**

**- Tropics.**

**- Models of ENSO.**

**11. Climate Models II:**

**- How good are they in the tropics? How do they differ from GCMs?**

**- Examples of simulations with simple and complex coupled models.**

- **Wavelet and other methods of evaluating model performance.**

## 12. Predictability of/in the Tropics

**- What is it, and how is it measured?**

**- Methods for predictability estimation in the tropics.**

**-.Examples of predictability.**

## 13. A look to the Future

**- Summary of exciting new developments.**

**- Roadblocks and showstoppers.**