physical meteorology—A subfield of meteorology generally restricted to that part of meteorology not explicitly devoted to atmospheric motions. There is no real distinction between atmospheric physics and physical meteorology. Physical meteorology usually deals with optical, electrical, acoustic, and thermodynamic phenomena of the troposphere, its chemical composition, the laws of radiation, and the physics of clouds and precipitation.

Our goal is to develop an understanding of fundamental physical processes to describe cloud behavior and radiative impacts. We will focus on processes that can occur in one day or less, within one 1km or less, learning about how and why clouds form, why they linger (or not), and how clouds interact with sunlight and infrared radiation. Large-scale dynamical processes (synoptics) are ignored. The course is split into 2 halves: the first half covers cloud physics, the 2nd half covers atmospheric radiation. Spring break provides a neat division of the two halves.

Texts:
Wallace and Hobbs “Introduction to Atmospheric Science”
  Chapter 6 on Cloud Microphysics
  Chapter 4 on Radiative Transfer
These will be handed out in class. We will follow the Cloud Microphysics text fairly closely, while the Radiative Transfer text is primarily supplemental, with class notes forming the primary text. The radiative transfer notes will also make use of material from
  Petty, Grant: A First Course in Atmospheric Radiation.
Some class material will be available at
http://www.rsmas.miami.edu/users/pzuidema/teaching.html

Grading:
~8 homework assignments, due 1 week after handout, 40%
Midterm 20% (cloud physics only),
Final 30% (covers full class but emphasizes radiation)
2 labs, participation + writeup, 10% .
Computer labs conducted in auxiliary lab to MSC main office, rely on Matlab coding.
Cloud Microphysics Syllabus
1. Overview of class: observed cloud distribution
2. (All-liquid) Cloud Physics
   a. nucleation
   b. equilibrium conditions between cloud droplets and environment
   c. aerosols
   d. droplet growth – collision-coalescence
3. Thermal cloud model lab (in Unger 301, time still TBD)
4. Microphysics in clouds with temperatures below 0 Celsius
   a. Ice nucleation
   b. Ice crystal habits and growth
   c. Relationship to lightning
   d. Microphysical processes leading to rain formation
   e. Cloud seeding
   f. Hurricane microphysics (STORMFURY)
5. Atmospheric Electricity (relationship to Florida)

Midterm (March 10 or 12)
Spring break: March 16-20

Radiative Transfer Syllabus
1. Earth’s Energy Balance
2. Units, Spectrum
3. Thermal Emission: Planck’s law, Wien’s law, Stefan-Boltzman’s law, Kirchhoff’s law
4. Global Energy Balance
5. Daisyworld Lab
6. Greenhouse Effect
7. Local radiative heating processes
8. The 3 basic cloud radiative parameters
10. Relevant aspects from IPCC report
11. Rainbows, other optical phenomena

Last day of class: April 24
Final: May 6, Wedn, 11 am-1:30 pm.