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. [Glossary of Meteorology]

Our goal is to develop an understanding of fundamental physical processes to describe the behavior of the cloudy atmosphere and its radiative impacts. We will focus on processes that can occur in one day or less and within one 1km or less, and learn about how and why clouds form, why they linger or dissipate, 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:
Primarily Wallace and Hobbs “Introduction to Atmospheric Science”
    Chapter 6 on Cloud Microphysics
    Chapter 4 on Radiative Transfer
And Petty, Grant: A First Course in Atmospheric Radiation
The WH chapters will be handed out in class. We will follow the Cloud Microphysics text fairly closely, while the Radiative Transfer section will rely on a combination from both texts, which I will aim to hand out as class notes. Some class material will also be placed under http://www.rsmas.miami.edu/users/pzuidema/teaching.html

Grading:
~10 homework assignments, due 1 week after handout, 40%
Midterm 20% (cloud physics only),
Final 30% (covers full class but emphasizes radiation)

Homework will probably include computer labs. These can be conducted either in the auxiliary lab to MSC main office or in Unger 301, and rely on Matlab coding.
Cloud Microphysics Syllabus

1. Thermodynamic review
2. Globally-observed cloud distributions
3. (All-liquid) Cloud Physics
   a. nucleation
   b. equilibrium conditions between cloud droplets and environment
   c. aerosols
   d. droplet growth – collision-coalescence
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)

Midterm: March 9 or 11
Spring break: March 15-19

Radiative Transfer Syllabus

1. Earth’s Energy Balance
2. Units, Spectrum
3. Thermal Emission: Planck’s law, Wien’s law, Stefan-Boltzman’s law, Krichoff’s law
4. Global Energy Balance
5. Greenhouse Effect
6. Local radiative heating processes
7. The 3 basic cloud radiative parameters
8. Scattering: rainbows and other optical phenomena
9. How radars work.
10. Aerosol indirect effects: Twomey (1977) and Albrecht (1989) papers
11. Depending on time: relevant aspects from IPCC report; cloud remote sensing.

Last day of class: April 29
Final: May 6, Wedn, 11 am-1:30 pm.

I’m open to suggestions for class material, if there is something you would like to see covered that I am not currently including.