GEOG 401 Midterm Study Topics

Videos:
An Inconvenient Truth
Jeffery Sachs lecture
Steve Sherwood climate sensitivity and clouds
James Hansen lecture

Reading:
Text, chapters 1-3
Anderegg paper
NY Times article “Most Republicans say they back climate action . . .”

Atmospheric gases; permanent gases and variable gases
Aerosols
Vertical structure of the atmosphere
Energy
Electromagnetic radiation
The electromagnetic spectrum
Blackbody
Gray body
Emissivity
Planck’s law
Planck curves
The Stefan-Boltzmann equation
The Wien displacement law
Shortwave and longwave radiation
Lambert’s law
Inverse square law
Earth motion: rotation, orbit
Sun angle
Seasons
Daylength
Atmospheric attenuation of shortwave radiation by scattering and absorption
Albedo of different land surfaces
Greenhouse effect
Net radiation at the earth’s surface
The net radiation equation
Radiation measurement
Earth’s energy balance
Radiative equilibrium temperature of earth
Why the actual mean global temperature of earth is not equal to the radiative equilibrium temperature
Solar constant
Planetary albedo
Amount of longwave radiation emission necessary to balance the absorbed incoming radiation

Given a temperature, calculate the amount of radiation emitted using the Stefan-Boltzmann equation.

Given a temperature, calculate the wavelength of peak radiation using the Wien displacement law.

Given the temperature of the sun, the radius of the sun, and the earth-sun distance, calculate the intensity of radiation reaching the outside of the earth’s atmosphere.

The global carbon cycle
Carbon reservoirs
Carbon fluxes
Imbalance in the global carbon cycle
The Keeling curve
Mauna Loa Observatory
Use of carbon isotopes to identify the source of added CO2 in the atmosphere
Carbon footprint
Carbon footprint methodologies
Country by country greenhouse gas emissions
Per capita emissions
Personal carbon footprints
Carbon credits
Carbon tax
Greenhouse gases
Changes in greenhouse gas concentrations
Effects of atmospheric aerosols
Observed temperature change since the mid-19th century
The “hiatus”
Observed radiative imbalance
Observed heat storage in the oceans
Explanation for the hiatus
Svante Arrhenius
The facts about climate change
Climate forcings – “radiative forcing” – and feedbacks
  Solar output (Forcing)
    Long-term increase
  Sunspot cycle
    Anomalies in sunspot cycle (e.g., Maunder Minimum)
  Orbital characteristics (Forcing)
    Milankovitch Cycles
  Atmospheric transmission (Forcing or Feedback)
    Volcanic eruptions
    Dust, smoke, etc.
Earth albedo (Forcing or Feedback)
Ice/snow cover changes
Changes in cloud cover/characteristics
Atmospheric longwave radiation absorption (Forcing or Feedback)
Variations in greenhouse gas concentrations

Milankovitch Cycles
   Obliquity (22.1 – 24.5 degrees; 41,000-yr cycle; currently 23.44 degrees)
   Eccentricity (0.005 – 0.058); 100,000-yr cycle; currently 0.017)
   Precession (21,000-yr cycle)

Milankovitch cycles and the Pleistocene glacial-interglacial cycles
Effects of volcanic eruptions
Ice-albedo forcing/feedback
Snow-albedo forcing/feedback
Cloud forcing/feedback
Greenhouse forcing/feedback
Net radiative forcing
Climate sensitivity
Equilibrium climate sensitivity (ECS)
Transient climate response (TCR)
Ways of estimating climate sensitivity
Consensus range for climate sensitivity
Projected range of temperature increase by the end of the 21st century under a high emissions (business as usual) scenario

What does IPCC stand for?
What were the two organizations that established the IPCC?
What are the themes of the three IPCC working groups?
What were the UNFCCC and the Kyoto Protocol?
What are some of the criticisms of the IPCC?