

Physical Climatology: Principles (GEOG 4211/5211)

Boundary Layer Climates

MIDTERM: 27 October 1998

1.
 - (a) Give a definition of the planetary boundary layer (PLB).
 - (b) What is the height of the PBL during day compared to during night?
 - (c) Name the four types of energy fluxes at an ideal surface.
 - (d) What is the equation of the energy balance at the surface (give your sign convention).

2. *Define the following terms:*
 - (a) Blackbody radiation.
 - (b) Albedo.
 - (c) Solar constant, and give the value outside the atmosphere on a plane surface normal to the solar beam.

3.
 - a) Name three instruments for temperature measurements.
 - b) Describe the basic principle of these instruments (how do they measure the temperature).
 - c) What instrument would you use to measure the air temperature to an accuracy better than 10^{-1} degree C, and with a response time better than 1 s?

4.
 - a) Describe the difference between a pyrradiometer and a pyranometer.
 - b) Name other instruments to measure radiation.
 - c) Why do we need to correct for long-wave radiation loss of the pyrradiometer surface?

5. Explain why the saturated adiabatic lapse rate must be smaller than the dry adiabatic lapse rate. Describe entire process of the wind called Chinook (also called Foehn, Zonda, Puelche).

6. What are unstable conditions, stable conditions, and neutral conditions for surface layer climates?

7. Describe the typical condition in which you would expect the Bowen ratio to be as follows:
 - (a) Much less than unity
 - (b) Much greater than unity
 - (c) Negative

8. *Heat transport mechanism:*
 - (a) What are the basic assumptions underlying the simple theory of soil heat transfer.
 - (b) How do the mechanism of heat transfer in the atmosphere differ from those in a subsurface medium, such as soil and rock?

9.
 - (a) Compare a zero-dimensional and one-dimensional energy balance model (EBM).
 - (b) Give a parameterization scheme for the albedo in the one-dimensional EBM.