## Problem 3.3

3. Consider a horizontally uniform atmosphere in hydrostatic balance. The atmosphere is isothermal, with temperature of −10°C. Surface pressure is 1000 mbar.

(a) Consider the level that divides the atmosphere into two equal parts by mass (i.e., one half of the atmospheric mass is above this level). What is the altitude, pressure, and density at this level?

(b) Repeat the calculation of part (a) for the level below which lies 90% of the atmospheric mass.

## Problem 4.7

7. Assume the atmosphere is in hydrostatic balance and isothermal with temperature 280 K. Determine the potential temperature at altitudes of 5 km, 10 km, and 20 km above the surface. If an air parcel was moved adiabatically from 10 km to 5 km, what would its temperature be on arrival?

## Problem 5.1

1. Figure 5.5 shows the net incoming solar and outgoing long-wave irradiance at the top of the atmosphere. Note that there is a net gain of radiation in low latitudes and a net loss in high latitudes. By inspection of the figure, estimate the magnitude of the poleward energy flux that must be carried by the atmosphere-ocean system across the 30° latitude circle, to achieve a steady state.

## Problem 6.4

4. A punter kicks a football a distance of 60 m on a field at latitude 45° N.

Assuming the ball, until being caught, moves with a constant forward velocity (horizontal component) of 15 m $s^{-1}$, determine the lateral deflection of the ball from a straight line due to the Coriolis effect. [Neglect friction and any wind or other aerodynamic effects.]