

- In this chapter, we will examine
 - Surface and upper level pressure charts
 - The forces that influence the winds
 - The equations that govern atmospheric motion
 - Simple balanced flows
 - Geostrophic wind (quantitative)
 - Gradient wind (qualitative)
 - Boundary layer wind
- Read Stull pp. 179-189, 196-197

A model of the atmosphere where air density remains constant with height. The air pressure at the surface is related to the number of molecules above. When air of the same temperature is stuffed into the column, the surface air pressure rises. When air is removed from the column, the surface pressure falls.

It takes a shorter column of cold air to exert the same pressure as a taller column of warm air. Because of this fact, aloft, cold air is associated with low pressure aloft and warm air with high pressure aloft. The pressure differences aloft create a force that causes the air to move from a region of higher pressure toward a region of lower pressure. The removal of air from column 2 causes its surface pressure to drop, whereas the addition of air into column 1 causes its surface pressure to rise. (The difference in height between the two columns is greatly exaggerated.)

- The statement on Ahrens (10th Edition) p.200, RHS column, last 3 lines, should read as follows:
 - *Warm air aloft is normally associated with high atmospheric pressure aloft, and cold air aloft is associated with low atmospheric pressure aloft.*
- Fig. 8.3 suggests the following:
 - *Warm air aloft is normally associated with low atmospheric pressure at the surface, and cold air aloft is associated with high atmospheric pressure at the surface.*

The top diagram (a) shows four cities (A, B, C, and D) at varying elevations above sea level, all with different station pressures. The middle diagram (b) represents sea-level pressures of the four cities plotted on a sea-level pressure chart. The bottom diagram (c) shows isobars drawn on the chart (dark lines) at intervals of 4 millibars.

- Station Pressure:
 - Actual pressure measured at weather stations
 - Because pressure changes rapidly with altitude, plots of station pressure are mainly dominated by the effects of elevation (Fig. 8.9a)
- Sea Level Pressure:
 - To show distribution of pressure on a horizontal surface, all pressure observations are normally adjusted to a level of mean sea level (Fig. 8.9b-c)
 - This adjusted *sea level pressure* is what is usually plotted on surface weather charts (Fig. 8.10)

Each map shows isobars on a constant height chart. The isobars represent variations in horizontal pressure at that altitude. An average isobar at sea level would be about 1000 mb; at 3000 m, about 700 mb; and at 5600 m, about 500 mb.

When there are no horizontal variations in pressure, constant pressure surfaces are parallel to constant height surfaces. In the diagram, a measured pressure of 500 mb is 5600 m above sea level everywhere.

The two horizontal lines represent levels having same pressure. When an air column is cooled, the whole air column shrinks, and the height of the pressure level lowers. On the other hand, when an air column is warmed, the whole air column expands, and the height of the pressure level rises. Note that high pressure aloft corresponds with high height of the pressure surface, while low pressure aloft corresponds with low height of the pressure surface.

The area shaded gray in the above diagram represents a surface of constant pressure, or isobaric surface. Because of the changes in air density, the isobaric surface rises in warm, less-dense air and lowers in cold, more-dense air. Where the horizontal temperature changes most quickly, the isobaric surface changes elevation most rapidly.

- Upper-level charts:
 - Usually, instead of plotting pressure at a constant altitude, height of a constant pressure surface is plotted instead
- A rule-of-thumb for interpreting constant pressure charts:
 - High height on a constant pressure chart is equivalent to high pressure on a constant height chart (and vice-versa)