PRESSURE AND WIND

I. Pressure and wind are related.
   A. Pressure is caused by the weight of the air column above it.
   B. Pressure changes result from changes in altitude, gravity and temperature.
      1. warmer air is less dense so column of warm air will be higher than a column of cool air at the pressure

II. A difference in pressure between two columns of air results in a "pressure gradient force" in which air will move from an area of higher pressure to an area of lower pressure.

III. The measurement of pressure:
   A. Pressure is measured by a barometer. Originals were tubes of Hg (mercury) Later aneroid barometers were used.

   B. Pressure is the one thing that is consistant – it gets less as one goes higher.

   C. Pressure is measured in the US in millibars.

   D. What measurement is used for pressure:

      1. Pressure = force per area = P=F/A

      2. It is measured in many ways:

         a. Pounds per square inch
         b. Atmospheres (ATM)
         c. Inches or millimeters of mercury (Hg) 29.92 inches of Hg
         d. Bars or millibars 1 bar= 14.50377 psi; 29.92 inches of mercury = 1013.203477792 millibars 10 meters of sea water = 1 bar
         to convert inches of mercury to millibars, multiply the inches value by 33.8637526
         To convert millibars to inches of mercury, multiply the millibar value by 0.0295301.
         e. Pascals Pascals = N/m^2 Where N=newtons and m^2=square meters
         f. Pascals (Pa) Pascals = N/m^2 Where N=newtons and m^2=square meters
         1 hectopascal (hPa)=100pascals = 1 millibar. So hPa's and millibars are the same.
         One Pascal = 0.000145038 pound force per square inch.

IV. Shape of the earth (geoid) means that gravity is not the same everywhere. Diameter at equator is greater than at poles.
   A. As a general rule pressure diminishes 10 mb for every 100 meters in altitude when ELR is 6.5^0C/1000m
   B. The altitude of weather stations will have an effect on the reading so all readings must be calibrated to sea level to make them equitable.

V. Weather charts.

a. Isobars are plotted 4 mb apart. Weather station reported pressures (corrected to sea level) are placed in position on or near the bars (near, if pressure is not on a 4 mb isobar. Isobar lines are called contour lines These are irregular and are often "smoothed out" on the maps

VI. Surface and upper level maps

A. As one ascends, the pressure decreases. Since sea level pressure is roughly 1000mb, at some altitude one would reach a level of 500mb at which time half the atmosphere would be above you and half below. Generally this is 5600 meters on the average but not always. It is higher near the equator (air is warmer hence 500mb is higher) and lower at the poles (air is colder so 500mb is lower in the denser atmosphere)

B. Isobaric Surface Maps can be drawn for any given isobar showing the height at which that isobar can be found.

Isobaric Surface	Approximate elevation meters	feet
1000mb	120	400
850mb	1400	4800
700mb	3000	9800
500mb	5600	18,400
300mb	91801	30,100 (air lines use)
200mb	11,800	38,700
100mb	16,200	53,200

C. The isobaric surface take on wave like undulations and form "ridges" and "troughs"

D. Winds around high and low pressure centers move across isobars; in upper levels they move parallel to them

1. At low levels, pressure gradient forces cause winds to move across isobars (the closer the isobars – a 4mb intervals – the faster the wind will travel.
2. winds around lows move into the low pressure center, winds around highs move out of the high pressure center

E. Other factors have an impact on the wind movement

a. Coriolis Force

1. is 0 at the equator and grows stronger toward the poles
2. deflects movement to the RIGHT in the N. Hemisphere and LEFT in the S. Hemisphere
3. the effect increases with the speed of the object moving
4. the effect changes the DIRECTION of the object not the SPEED

b. Surface winds cross isobars; winds aloft travel parallel to the isobars. This is the result of the Coriolis force. Upper level winds move towards lower pressure across isobars, but are moved to the right by the Coriolis force until the pressure gradient force and the Coriolis force balance one another at which point the wind is moving parallel to the isobars.

c. Friction. Friction occurs at the surface level where movement against geological features impacts the wind movement. Air aloft is ABOVE the area where there is friction from geological features

G. Geostrophic winds are winds that flow in a straight path parallel to the isobars at a constant speed. The Low pressure is to the left, the high pressure to the right.

H. Gradient winds are winds that blow at a constant speed but parallel to curved isobars above the level of frictional influence.