

Atmospheric pressure: meaning of atmospheric pressure; the laws of gases; pressure units; pressure instruments; vertical, horizontal and periodic variations; isobars and pressure gradients

Introduction

The detectable atmosphere extends to hundreds of miles above the earth's surface which is held by gravity. The pressure exerted by the atmospheric air on the surface of the earth is called atmospheric pressure. The atmospheric pressure is expressed in terms of certain equivalent values such as mass or height of mercury column that can balance the atmospheric pressure.

Units of pressure

Pressure is measured by a barometer as the height of mercury column supported by the atmosphere and expressed as a force in millibars (mb) and pound. The unit mb is 1000 dynes per sq. cm.

Periodic variation

The atmosphere is not a static body. It is a dynamic medium. Atmospheric pressure varies with time and distance, as also with altitude and weather conditions. The pressure attains the high values and the low values daily. The high values occur at 10 AM and 10 PM while the low values occur at 4 PM and 4 AM. This effect is known as solar tide. This is pronounced in tropics where the difference between maxima and minima can be of the order of 2 to 3 mb.

Vertical variation

The atmosphere is a mixture of gases held to the earth by gravity. Since gases are compressible, the overlying air compresses the lower air considerably and thereby increases the density of air near the ground. Because of this compression, pressure rapidly decreases with elevation. The rate of decrease with height is not constant. Near the ground it is approximately 1 millibar per 10 meters but at 20km, pressure decreases more slowly at about 1 millibar per 130 meters. At the top of a 1000 meter mountain, pressure is about 900mb.

Horizontal variation

Atmospheric pressure is not everywhere uniform. The air over the earth's surface undergoes variety of pressure changes due to non-uniform heating of the earth's surface. The horizontal pressure field is analysed by drawing lines of equal pressure values on a map where atmospheric pressure readings reduced to mean sea level of different stations are plotted. The horizontal variations of pressure are much less than the vertical variations, but the relatively small variations are of fundamental significance in determining wind direction and speed.

The horizontal pressure patterns are of two types,
Those whose average position is roughly the same.
Those whose position moves with the line.

Isobars

Isobars are the lines joining the points of equal pressure. Isobars are usually drawn at pressure intervals of 3, 4 or 5 millibars.

Horizontal pressure gradient

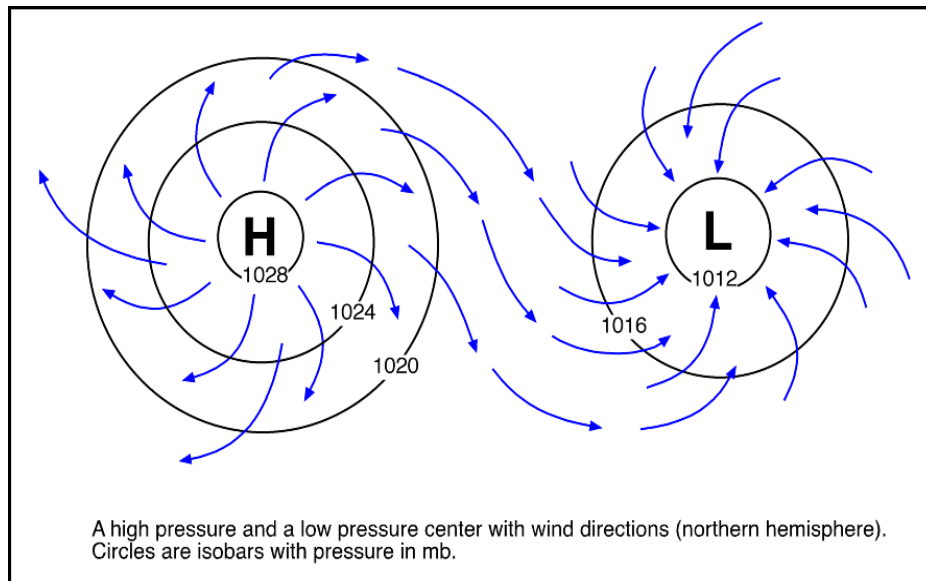
The change in pressure with horizontal distance is called pressure gradient. The pressure gradient is in a direction perpendicular to the isobars.

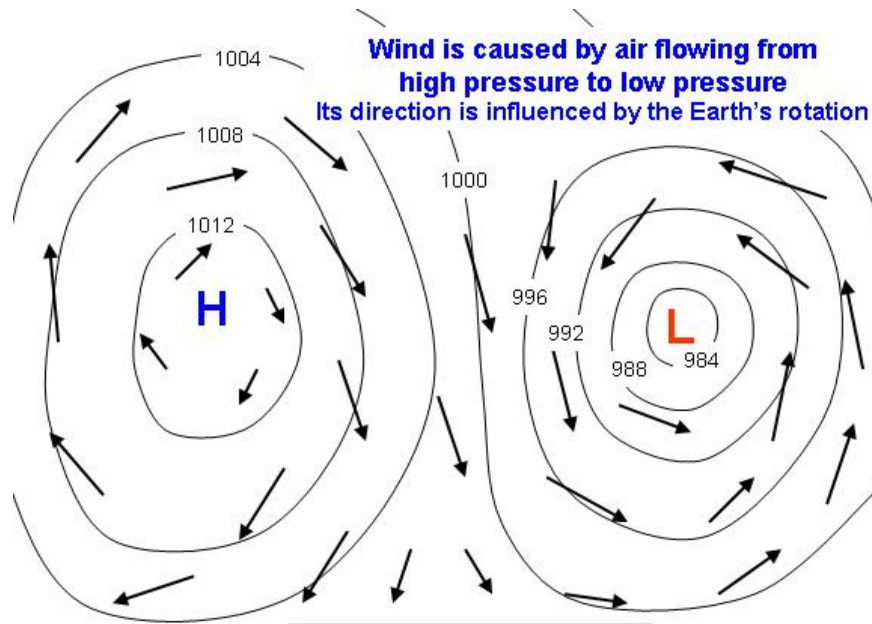
Isolobars

It is often important to know the magnitude of the pressure change rather than simple pressure over a particular region. The change in pressure in the hours prior to observable recording time is called pressure tendency and it is a net value. The line connecting places having equal pressure tendencies is called ' Isolobars' and constitute an important tool in weather analysis.

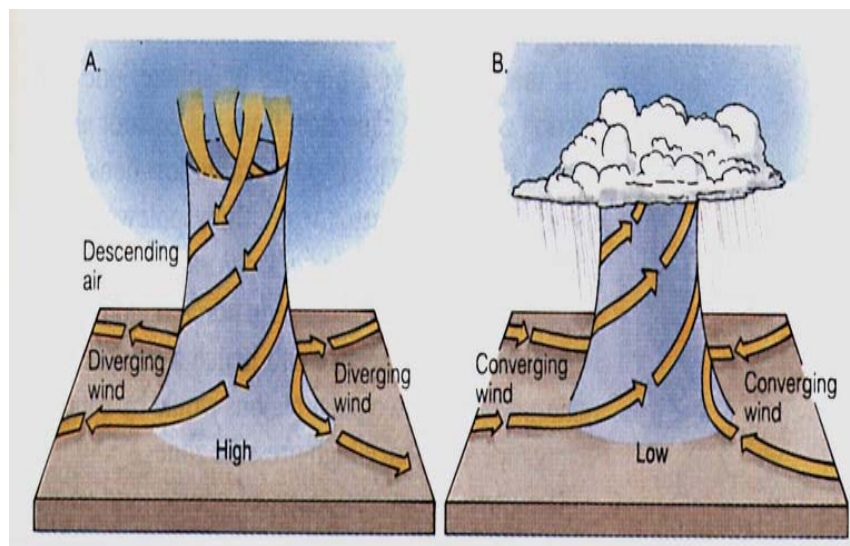
High and low pressure areas

An area which has low pressure than surrounding areas at the same elevation is called as low. If there is a fairly identifiable centre of low pressure on a weather map, it is referred as cyclone or depression. A region which has high pressure than surrounding areas at the same elevation is called high. If a centre of high pressure can be identified on a weather map, it is referred as high or anticyclone.





Atmospheric pressure



Pressure measuring instruments

Aneroid Barometer:

A barometer which is cheap, robust and handy for home and travel is the aneroid. Essentially it consists of an air tight box from which the air has been partly evacuated. When the atmospheric pressure increases, the box will be slightly compressed and when the pressure decreases the box will expand and these motions are transferred through amplifying levers to a pointer which moves across a scale graduated in millibars or inches of mercury.



Barograph:

The aneroid barometer may be made to be self-recording so that a trace is drawn on a sheet of paper. The instrument is then called a barograph and the record paper is called a barogram.

