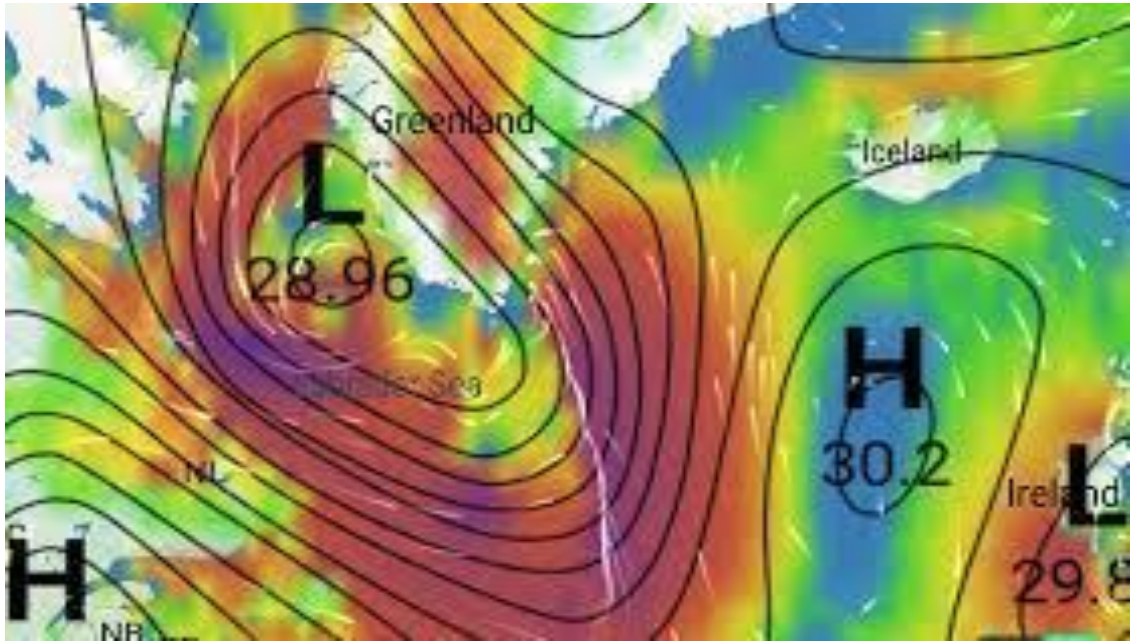
Pressure System and their Distribution



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Pressure System

Air expands when heated and gets compressed when cooled. This results in variations in the atmospheric pressure.

The differences in atmospheric pressure causes the movement of air from high pressure to low pressure, setting the air in motion.

Air in horizontal motion is wind. The wind redistributes the heat and moisture across latitudes, thereby, maintaining a constant temperature for the planet as a whole.

The vertical rising of moist air forms clouds and bring precipitation.

Atmospheric or Air Pressure

Since air has mass, it also has weight. The pressure of air at a given place is defined as a force exerted in all directions by virtue of the weight of all the air above it.

The weight of a column of air contained in a unit area from the mean sea level to the top of the atmosphere is called the atmospheric pressure. The atmospheric pressure is expressed in various units.

Measurement of Air Pressure

Atmospheric pressure is the weight of the column of air at any given place and time. It is measured by means of an instrument called **barometer**.

The units used by meteorologists for this purpose are called **millibars (mb).**

One millibar is equal to the force of one gram on a square centimeter. A pressure of **1000 millibars** is **equal** to the **weight** of **1.053 kilograms per square centimeter**.

The normal pressure at sea level is taken to be about ***76 centimeters (1013.25 millibars).***

Vertical Variation of Pressure

In the lower atmosphere the pressure decreases rapidly with height.

At the height of Mt. Everest, the air pressure is about two-thirds less than what it is at the sea level.

The decrease in pressure with altitude, however, is not constant. Since the factors controlling air density – temperature, amount of water vapour and gravity are variable, there is no simple relationship between altitude and pressure.

In general, the atmospheric pressure decreases on an average at the rate of about 34 millibars every 300 metres of height.

Vertical Variation of Pressure

The vertical pressure gradient force is much larger than that of the horizontal pressure gradient. But, it is generally balanced by a nearly equal but opposite **gravitational force**. Hence, we do not experience strong upward winds.

Due to gravity the air at the surface is denser and hence has higher pressure. Since air pressure is proportional to **density as well as temperature**, it follows that a change in either temperature or density will cause a corresponding change in the pressure.

The pressure decreases with height. At any elevation it varies from place to place and its variation is the primary cause of air motion, i.e. wind which moves from high pressure areas to low pressure areas.

A rising pressure indicates fine, settled weather, while a falling pressure indicates unstable and cloudy weather.

Horizontal Distribution of Pressure

- Small differences in pressure are highly significant in terms of the wind direction and velocity. Horizontal distribution of pressure is studied by drawing isobars at constant levels.

- **Isobars** are lines connecting places having equal pressure. In order to eliminate the effect of altitude on pressure, it is measured at any station after being reduced to sea level for purposes of comparison.

- The spacing of isobars expresses the rate and direction of pressure changes and is referred to as **pressure gradient.**

Horizontal Distribution of Pressure

- Close spacing of isobars indicates a steep or strong pressure gradient, while wide spacing suggests weak gradient.

- The pressure gradient may thus be defined as the decrease in pressure per unit distance in the direction in which the pressure decreases most rapidly.

There are distinctly identifiable zones of homogeneous horizontal pressure regimes or **'pressure belts'.** On the earth's surface, there are in all seven pressure belts.

Closed Isobars or Closed Pressure centers

- Low pressure system is enclosed by one or more isobars with the lowest pressure in the centre.

- High-pressure system is also enclosed by one or more isobars with the highest pressure in the centre.

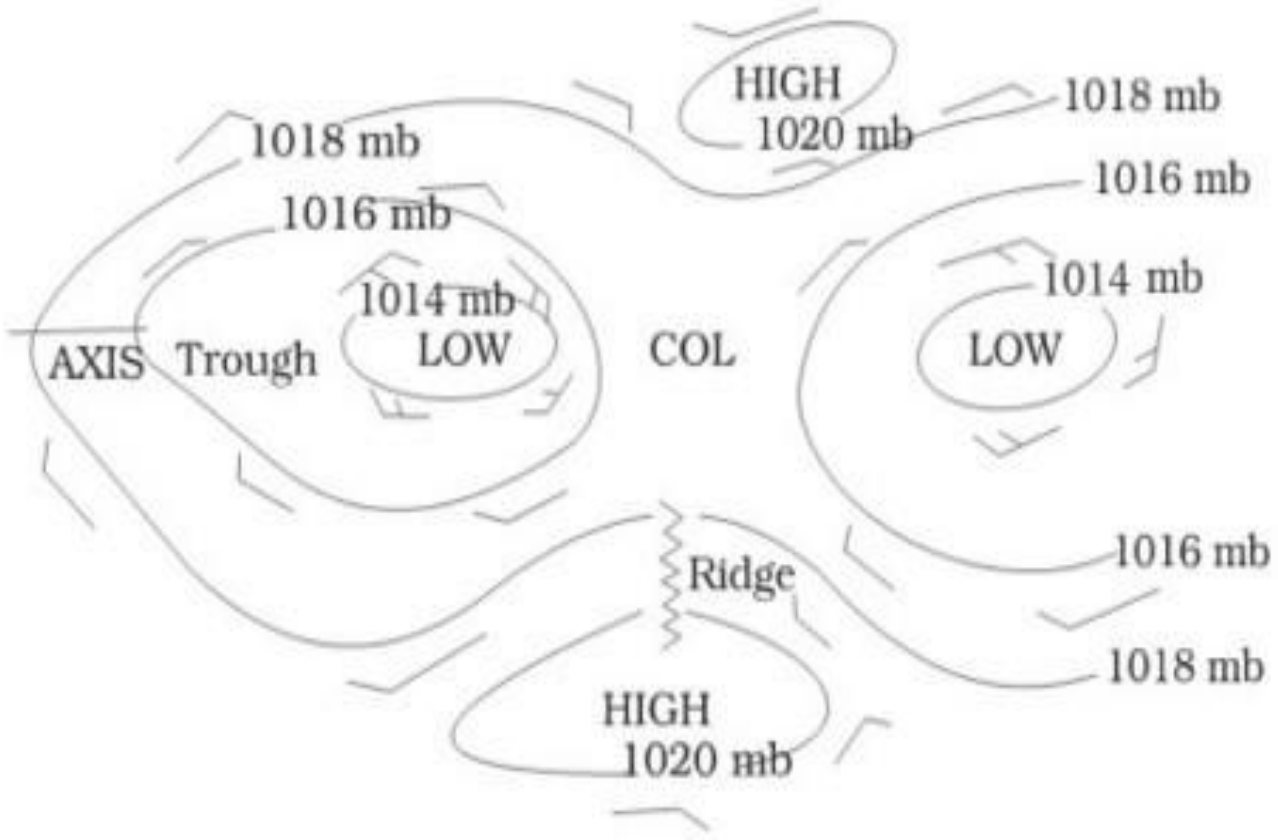

Fig.: Pressure centers and isobars

World Distribution of Sea Level Pressure

The atmosphere exerts a pressure of **1034 gm per square cm** at sea level. This amount of pressure is exerted by the atmosphere at sea level on all animals, plants, rocks, etc.

Near the equator the sea level pressure is low and the area is known as **equatorial low**. Along 30° N and 30° S are found the **high-pressure areas known as the subtropical highs.**

Further pole wards along 60° N and 60° S, the **low-pressure belts are termed as the sub polar lows.** Near the poles the **pressure is high and it is known as the polar high.**

These pressure belts are **not permanent** in nature. They oscillate with the apparent movement of the sun. In the northern hemisphere in winter they move southwards and in the summer northwards.

Thank You