

Laboratory of Synoptic Meteorology

**Surface and level map
analysis pressure in the upper
atmosphere**

(Second Semester)

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Basic principles of Synoptic analysis:

The troposphere is the first and bottom layer of the atmosphere in which various weather phenomena occur. The water in the atmosphere, in which the movement of winds is horizontal and vertical, ie convective currents, air turbulence and all cases of instability occur. The surface of this lower layer starts from the surface of the earth, but the thickness of this layer is variable because the height of its upper surface (the tropopause) is not fixed but rather variable, as its height at the equator is 18 km, while its height at the poles is about 8 km, The thickness of this layer also changes in summer and winter, and it rises above areas of high pressure and descends above areas of low pressure. Various weather phenomena occur in this layer such as clouds, fog, precipitation, thunder and sand storms ... etc.

All that the weather forecaster needs before the prediction process is to do two steps, the first is the process of synoptic chart analysis and the second is the diagnosis process. What do we mean by the process of analysis and diagnosis? Simply obtaining numbers for physical parameters for any air sample, such as pressure, temperature, humidity, etc., does not give any indication, as the value of the parameter on any station looks like a word without a sentence does not give any meaning. If the word is placed within the sentence It is possible to obtain a meaningful statement. Also, if the values of a physical parameter are linked to several stations by lines known as lines of equal variables, we can obtain useful anaerobic information on the map, such as determining the centers of high and pressure depressions, determining the areas of the fronts, and determining the cold and warm air masses. This is what is known as synoptic analysis. The process of synoptic analysis in itself is also not sufficient for the forecaster to understand what is happening, so it is necessary to discuss the information obtained from those lines and compare it with previous cases also using all the information related to the physical parameters affecting any air sample and the relationship of these parameters with each other to interpret the lines and obtain a picture It is integrated with the stages of development of the weather situation that is being addressed, and this is what is known as the diagnosis. At the present time, there are many ready-made programs available on the computer that perform the analysis process, but manual analysis remains important, as it gives the weather forecaster an opportunity to stand at each value and analyze it. And also attention to some cases that may not attract his attention if he used a map drawn in a computer program, and here lies the importance of manual analysis.

pressure systems:

1-pressure centers:

The centers of high pressure and low pressure are within closed isobaric lines on the analyzed surface maps. Through these lines, the user can know what the general atmosphere is in the required area. But the high air is often accompanied by good weather, while the depression is accompanied by deposits or bad weather conditions.

2-Low pressure: sometimes called depression or cyclone (but the latter term is often limited to tropical cyclones that are actually depressions). And the atmospheric depression is located in the lower value of the pressure field. The rotation in it is counterclockwise in the northern hemisphere, while the rotation is counterclockwise in the southern hemisphere, due to the Coriolis force. The atmosphere is unstable in the depression with an increase in the amount of clouds, wind speed, temperature and upward movement through the atmosphere Which leads to an increased chance of sedimentation (rain, snow...) For example, polar depressions are formed over ocean waters when cold air masses coming from icy areas sweep them, causing convection and upward movement, and the deposition is usually in the form of snow. Tropical cyclones and winter storms are severe types of depression, such as hurricanes and tornadoes, while thermal depressions over land cause an increase in temperature during summer, such as the Indian seasonal depression that occurs in Iraq starting in May.

3-HighPressure: It is sometimes called an anticyclone, the wind rotates outward in it clockwise in the northern hemisphere and vice versa in the southern hemisphere. The sinking motion of the air in the atmospheric height leads to an improvement in the atmosphere, a decrease in clouds and a decrease in wind speed, which leads to the possibility of a decrease in sedimentation.

4- Ridge: It is an extended area of convexity in any direction outside the atmospheric height, and the line along it is called the ridge line.

5- Trough: It is the extension of the depression in the form of a gully, and the line along it is called the Trough line.

6- Secondary depression: It is a relatively small depression that is generated within the main depression and may separate from the mother depression to form an independent main depression.

7- Collapse zone: It is an area confined between two opposite highs and opposite lows. This area is characterized by light winds with variable speed and direction.

8- Wave lines: Sometimes equal pressure lines are formed in the form of waves that extend over long distances, forming a series of highs and lows.

Isopleths Lines:

Isopleths lines are defined as contour lines for anaerobic variables of equal values such as pressure and temperature. The following table shows the names of lines of equal variables and the variable they represent. The process of drawing isovariable lines is a skill that is acquired over time with training and repetition. The shape of the line may differ from the first to the variable itself, indicating an inverse value for the variable, the line was continuous or intermittent. For example, when we draw lines equal to the wind speed, the western wind appears in the form of continuous lines, while the eastern wind appears in the form of intermittent lines, and so on. The ordinary pencil is used in the process of drawing lines even from Before the experienced person because the possibility of error is possible.

Meteorology variable	Name of lines of equal variables
Pressure	Isobar
Temperature	Isotherm
Geopotential height	Isotypes (height contour)
Dew point	Isodrosotherm
Wind speed	Isotach
Pressure change	Isallobar
Thickness	Thickness line

Drawing the isobars :

The isobar is the line connecting the equal values of atmospheric pressure so that the pressure change is zero along its length (that is, $dp = 0$). The main characteristics of isobaric lines are:

- 1-Simple curved lines with loose ends at the edges of the map or simple closed curves. In other words, it should not have loose ends at the edges of the map.
- 2- They neither intersect nor touch each other, except for the possibility of two ends of the same line to make a curved line.
- 3- Along the isobar, high pressure values always lie on one side and low values on the other.
- 4- It is consistent with the direction of the wind, and the distance between the lines is consistent with the gradient of pressure and wind speed.

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