

Lab No.5

Determine Mid-Latitude Depression Using Weather Maps

The aim:

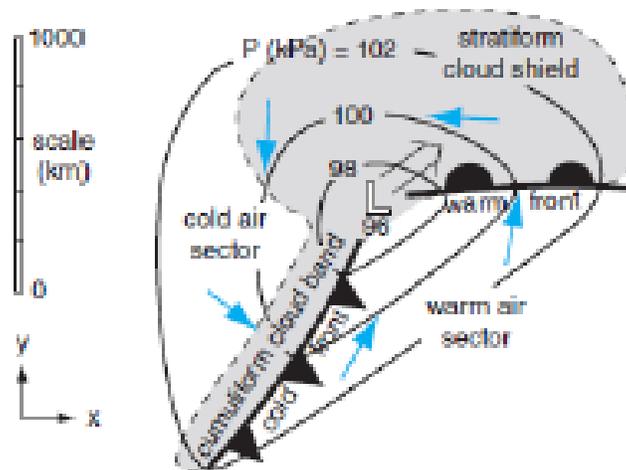
Determine mid-latitude depression using weather maps.

Tools:

Weather maps of 300mb and 500mb surface pressure levels, the geopotential height contours and wind direction are shown on it, and surface temperature distribution map.

Methodology:

At higher latitudes than the tropics, winds converge in levels lower atmospheres, group air masses gathered and form air fronts between them to form a system known as mid latitude depression. This system is short-lived, ranging from three days to a week, moving from west to east by the polar jet stream.



This system is characterized by the intensification of cyclogenesis by the rotation of the horizontal winds above the center of the surface depression.

vorticity (while the upward vertical wind movement) increases, and the surface pressure value decreases at bottom.

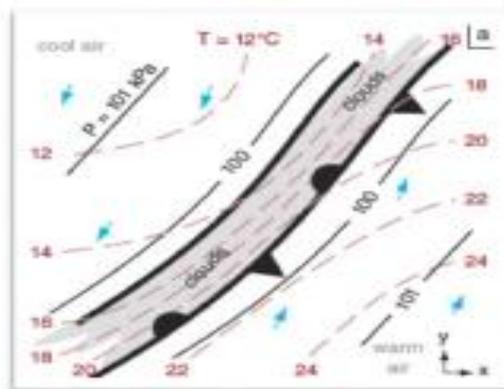
Where these **three factors** lead the process of formation, intensification and decay of the low, when it is the relative vorticity is large, for example, vertical wind currents begin to increase upwards, forming a vacuum region at the surface or the low pressure center.

It is possible to estimate areas of intensification of mid-latitude depression if they are associated with the following:

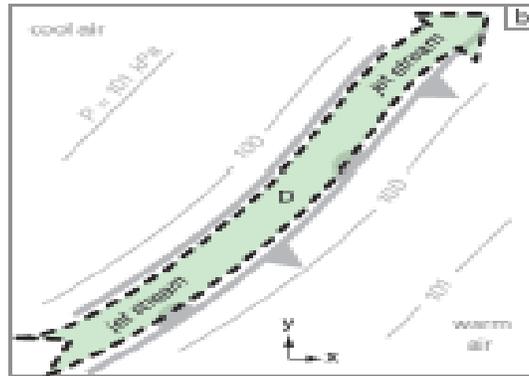
- 1-Mountain ranges located to the east of the direction of the depression's movement.
- 2 - Deep troughs located to the east of the depression (at the level of 500mb).
- 3- A strong ridges located to the west of the depression (at the level of 500mb).
- 4 - In the areas of air fronts where the temperature gradient is large.
- 5 - In areas where the stability values are low, as it does not prevent the vertical movement of air.
- 6 - Areas where cold air moves over hot and moist air.
- 7-Away from the equator northward, this type of depressions is strong because of the Coriolis force.

Stages of depression formation and development:

1 – Mid-latitude depression usually born in the areas of the stationary front separating two masses: Tropical air and polar air, where there is a large thermal gradient within a short distance. This region lies practically beneath the polar jet stream and almost ripples as it ripples.



2- If conditions are right, the jet stream passing over the area will displace a mass of air from the surface creates a zone of intensification of the depression at the point marked with the letter D, which is the region where the low pressure center is expected to form.



3- At this point, the surface air begins to rotate around the center of low pressure, which **enhances** the atmosphere **VORTICITY** value This phase is called the **upward convection phase**.

4 - In the **eastern region of the depression**, warm tropical winds begin to move and rush, **ADVECT** towards the polar air to the north, and **the west of the depression**, the polar winds move south towards the tropical air, and thus a wave front is formed and the wave is divided into two fronts, **the eastern side of it a warm front is formed, and the western side of it is a cold front**.

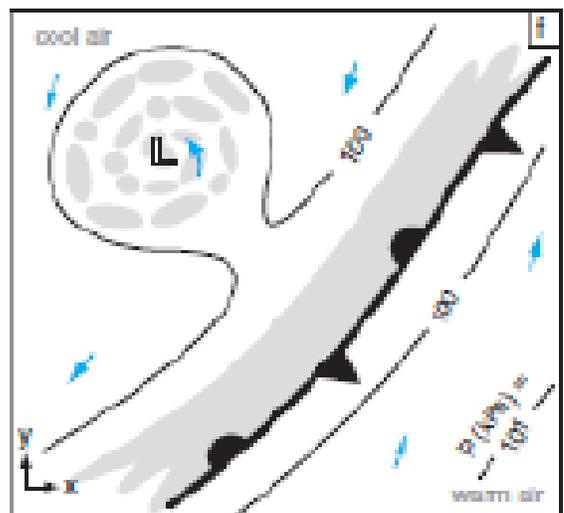
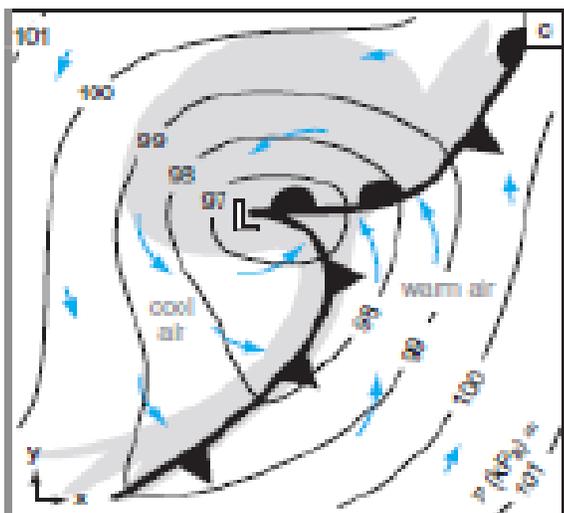
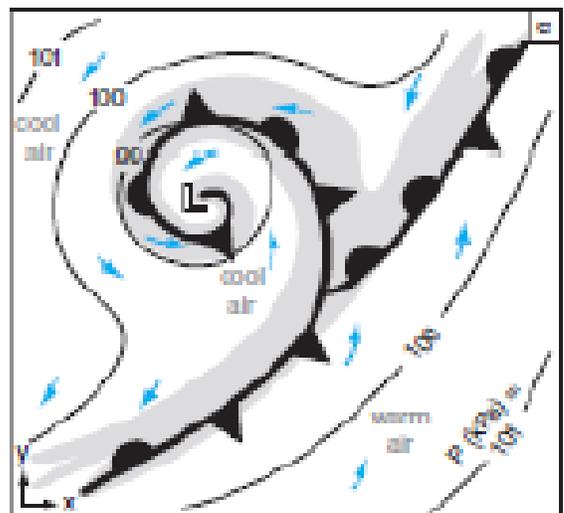
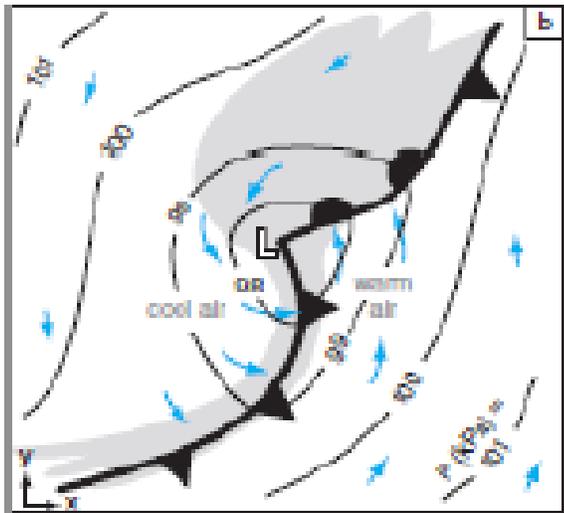
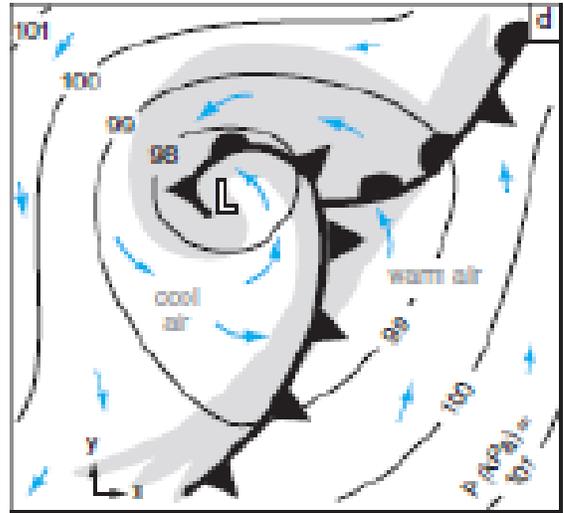
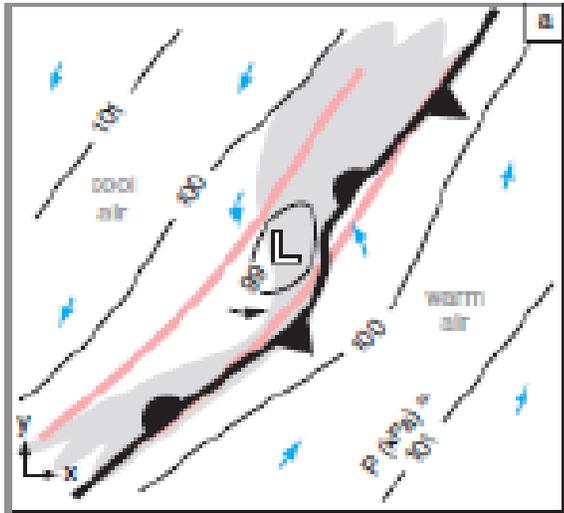
5 - If the conditions of the jet stream are favorable, then the region of the depression center suffers a significant decrease in pressure, and what is called **cyclone deepens occurs**.

The cold front always moves faster than the warm front, which leads to:

a - Cold air begins to push warm air from both sides of the forehead.

b - The rotation of the wind around the center vortex VORTIX will distort the shape of the two fronts and reduce the area of warm tropical air and a specific region called the warm-air sector.

6 - At that point, the cold front begins to join the warm front, and occluded begin between them, as a result of this and another thermodynamic processes, decay begins with cyclolysis depression and then its fading.



Practical part:

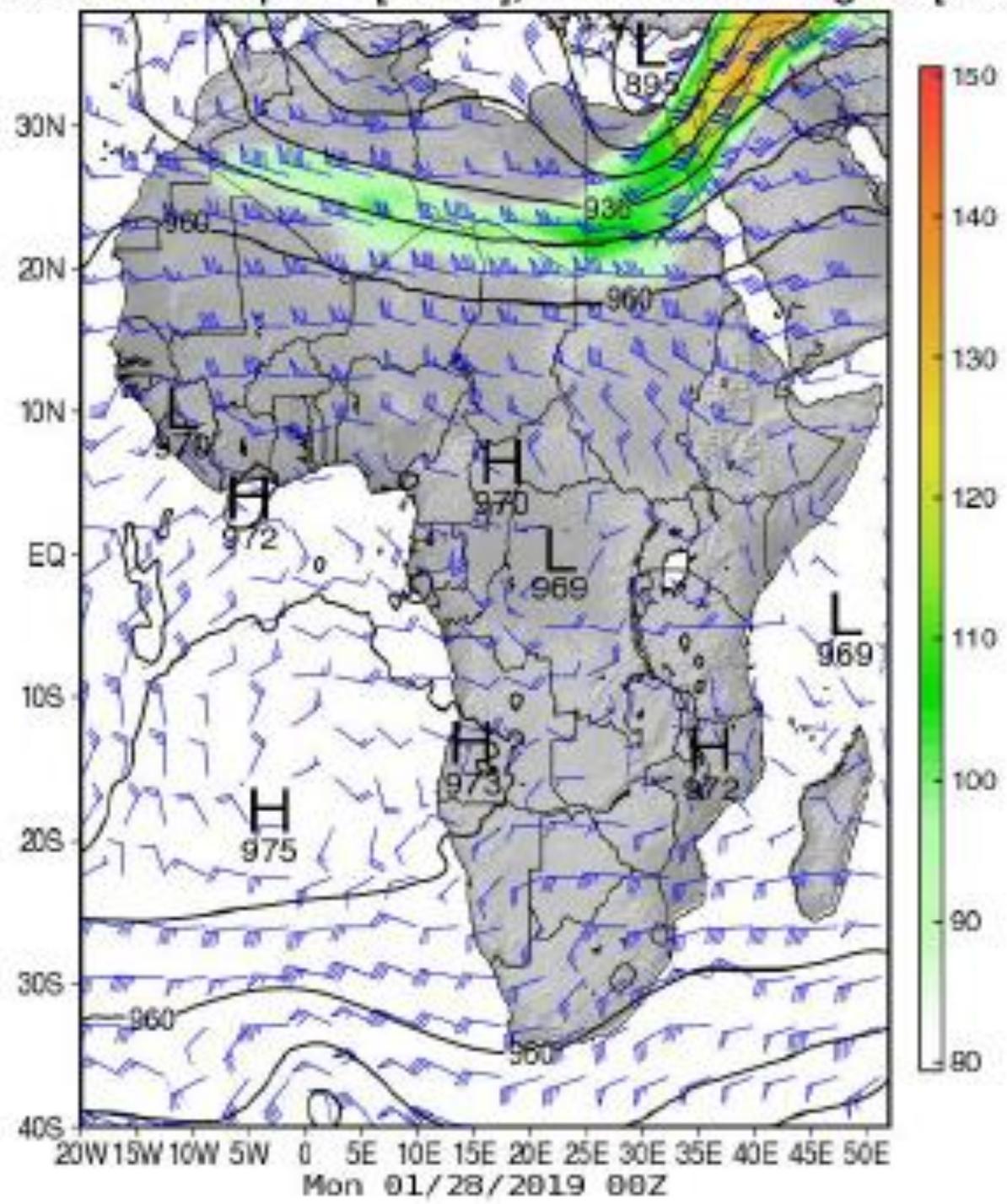
Identified the central regular information

- 1 - The polar jet stream meandering on 300mb weather map.
- 2 - TROUGH and RIDGE areas on 500mb weather map.
- 3 – Calculate relative vorticity and locate of vertical wind ascent zones on 500mb weather map.
- 4 - Determine the periods of warm and cold front on the surface map.

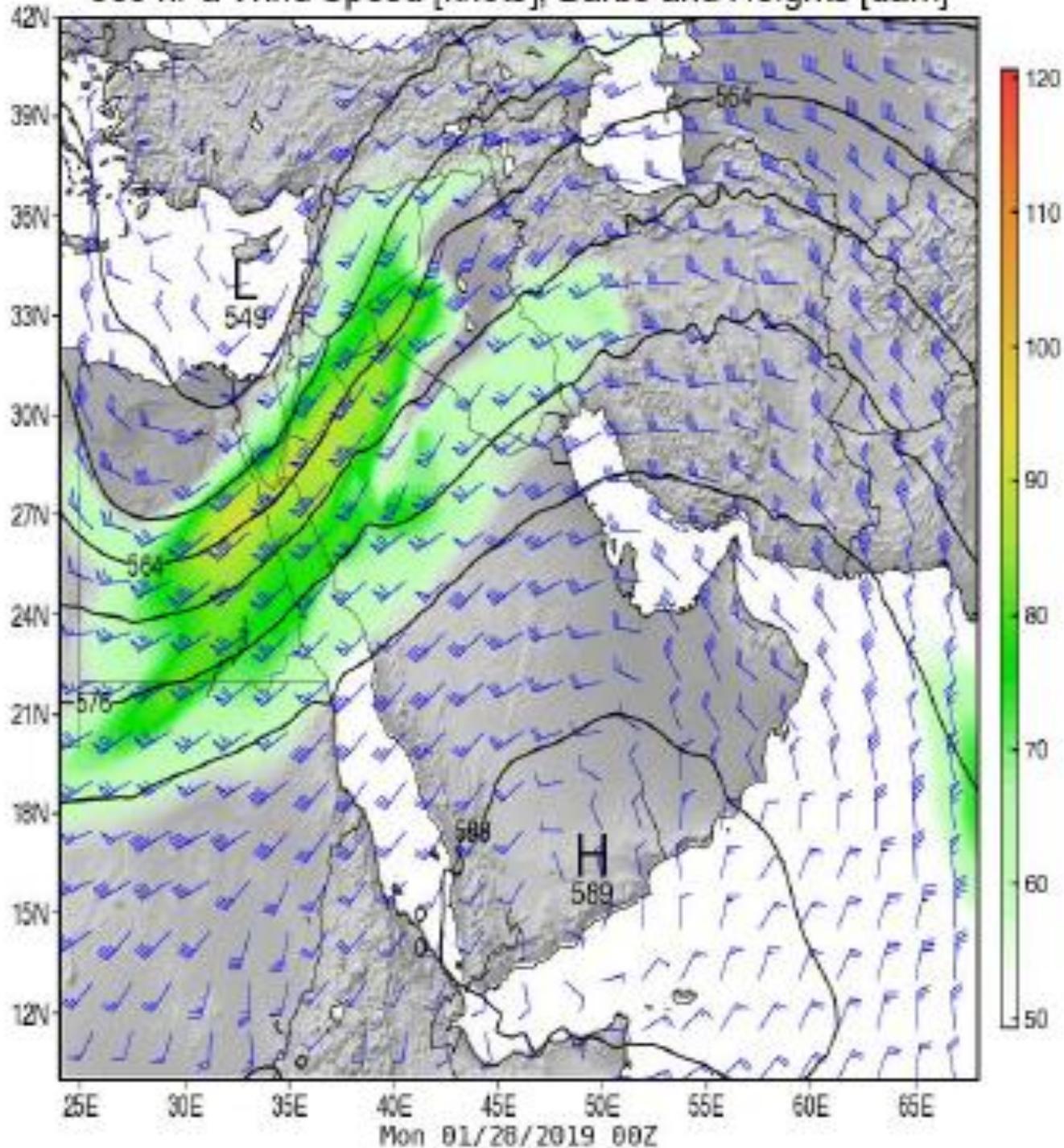
Dissection:

- 1-Try to anticipate the atmosphere associated with the above situation
- 2- Try to guess the age of the depression (what stage it is going through) emergence, intensification, deepening, or decay.
- 3 - Where can be expected precipitation and what is the expected intensity, if you know that the amounts of moisture in the tropics air are relatively high quantities.

300 hPa Wind Speed [knots], Barbs and Heights [dam]



500 hPa Wind Speed [knots], Barbs and Heights [dam]



2-Meter Temperature (C)

