FORECASTING -LAB

Experiment No.4

Experiment Name: Calculating of wind divergence

The aim of the experiment:

Calculating wind divergence at pressure level 850 hpa by analyzing horizontal components of wind speed.

Theory:

The figure (1) show the horizontal component of wind speed, Latitudinal component (u) and Longitudinal component (v).

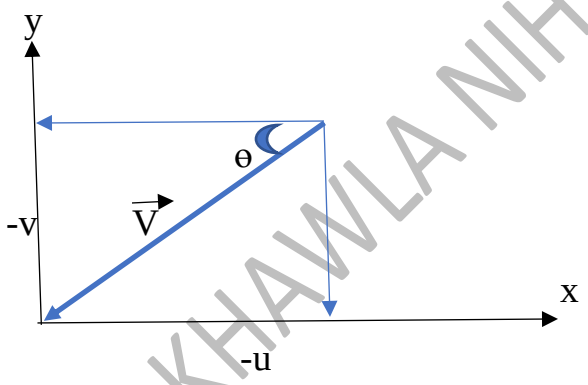

Figure (1): Wind speed in horizontal components

The components u and v are calculated by equations:

$$\left.\begin{aligned} u &= V\cos\theta \\ v &= V\sin\theta \end{aligned}\right\} \text{---------- (1)}$$

Θ = Wind direction in degrees. V= The amount of wind speed.

The horizontal wind divergence (D) at any constant surface pressure calculated by the following equation (note Δx = Δy = H):

$$D = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} \cong \frac{\Delta u + \Delta v}{H} \quad \text{---------(2)}$$

The units of standard quantities $\frac{\partial u}{\partial x}$, $\frac{\partial v}{\partial y}$ measured by inverted time S^{-1}. the range of its value is (10^{-5}-10^{-4}) S^{-1} at the lower part of the atmosphere. Large values (Bigger than (10^{-3}) S^{-1} indicates existence of thunderstorm or vortices resulting from surface symptoms, while the values at small range (10^{-7}-10^{-6}) S^{-1} find at westerly waves.
If the values of equation (3) is positive that mean there is wind divergence either, if it is negative that mean there is wind convergence (note the bottom of figure (2)). In this experiment will be calculated horizontal divergence at pressure level (850 hpa) because of airflow dimension about surface obstacles while we get seamless flow.

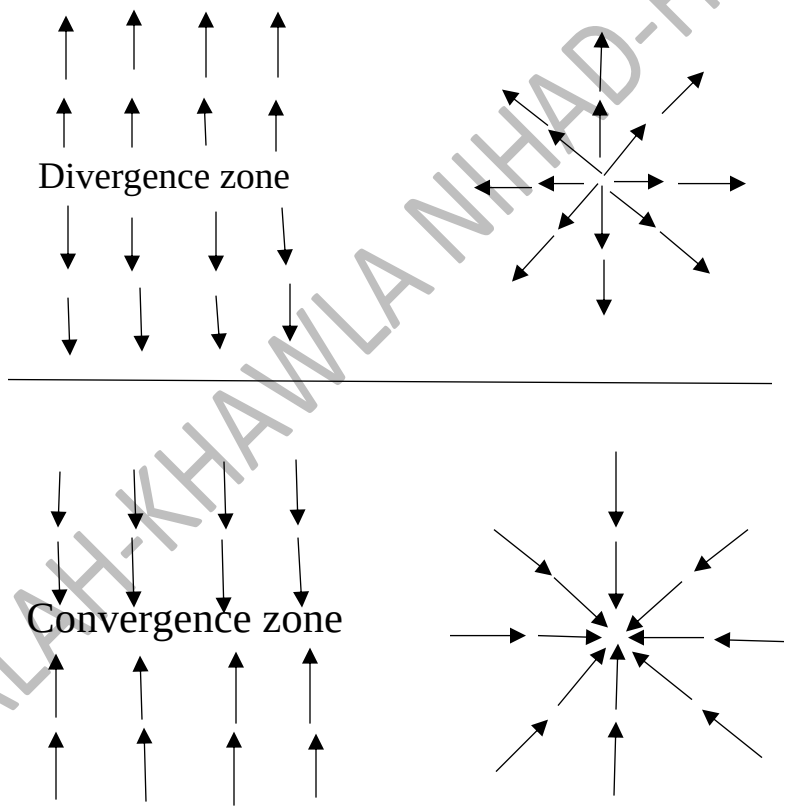

Figure (2): Airflow divergence (the upper part), convergence (the lower part).

Tools: Pressure map at 850hpa level, grid point that used in the previous experiment .

Methodology:

1-Prepare analyst pressure map at level (850 hpa).

2- Prepare an empty grid point.

3-By using wind directions arrows and wind speed bars that located at the end of the arrows around observation stations, calculate u and v by the equation (1) at all stations of using map.

4-Derive the values of u and v at the grid point after dropping them on the map using steps in the previous experiment (two values for each point), then put u values above stations and v values below them.

5- Calculate Δu in the x direction around the points in the same table of previous experiment (table below).

6-Calculate Δv in the y direction around the same points in the previous step.

7- Calculate horizontal divergence at level (850 hpa) D_{850} using equation (2) around the points in the table below.

Table(1):Values of horizontal and vertical speed differences and divergence.

8	7	6	5	4	3	2	1	0	Point number
									$\Delta u(m/s)$
									$\Delta v(m/s)$
									$D_{850}(s^{-1})$