

ALMUSTANSIRIYAH -UNIVERSITY
COLLAGE OF SCIENCE
DEPARTMENT OF ATMOSPHERIC SCIENCE

FORECASTING -LAB
(THIRD GRADE)

LUCTURERS

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FORECASTING -LAB

Experiment No.2

Part (1)

Experiment Name:

Calculating Pressure Gradient Using Finite Difference Method

Theory

Finite different method is a numerical method convert the partial differential equations into algebraic equations, the domain divided to a grid point, so we can find the value of the variables adapted at these adjacent grid point.

So, in order to calculate pressure gradient by using finite difference method first we have to draw a grid point for a surface pressure map each point has a value of a pressure on the map, then we can calculate its gradient.

For example, the equation beneath:

$$\frac{du}{dx} = f(u, x)$$

On the interval $a \leq x \leq b$, we divide the interval into a set of $N+1$ grid point, where $\Delta x = \frac{(b-a)}{N}$ is the cell length. Let denote the value of u at the grid point

x ; i.e., $u_i = u(x_i)$

There are different ways to approximate the derivative at the grid point:

1. A forward difference, $\left(\frac{du}{dx}\right)_i = \frac{u_{i+1}-u_i}{\Delta x},$
2. A backward difference, $\left(\frac{du}{dx}\right)_i = \frac{u_i-u_{i-1}}{\Delta x},$
3. A centered difference, $\left(\frac{du}{dx}\right)_i = \frac{u_{i+1}-u_{i-1}}{2\Delta x},$

Tools: paper (A4), Surface pressure map.

Methodology:

Step (1): Draw a grid on a paper (A4), the grid consists of 25 points (5 x 5), the distance between each point and the other is 5cm horizontally and vertically fig (1).

Step (2): Put the grid's point paper over the surface pressure map and fixed on it, then read the pressure value for each station beneath each point in the grid then record it on the point.

Step (2): Keep the paper of grid point in order to use it to calculate pressure gradient for the surface pressure map.

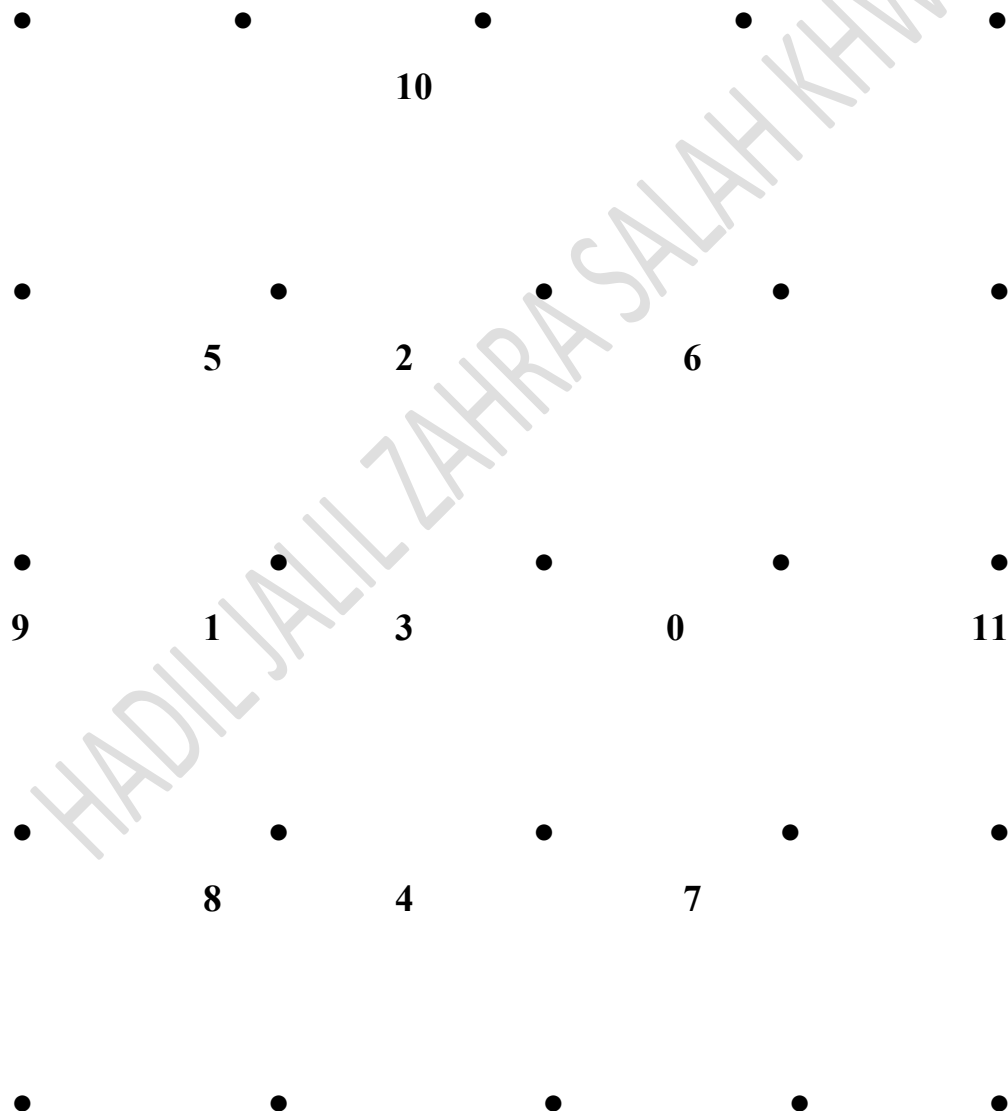


Figure (1): grid point