FORECASTING -LAB

(THIRD GRADE)

LUCTURERS

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Experiment No.6

Experiment Name: Intensity of the air fronts

The aim of the experiment: **Estimating geostrophic winds from synoptic maps and calculating the slopes of air fronts.**

Theory: Suppose that warm air climbs over cold air, resulting a transition zone between them called an air front. The transition zone is characterized by a sudden change in temperature, while the atmospheric pressure values on both sides of the front do not change. Therefore, from the values of the geostrophic winds Vg1 and Vg2 and the temperatures T1 and T2 on both sides of the front, the slope of the front can be included from following relationship:

$$\tan\Theta = -\partial z/\partial x = -(f\,\bar{T}/g)(Vg2-Vg1/T1-T2) \quad (1)$$

Where:

$f=10^{-4}$ /sec

$\bar{T}$: average temperature in absolute scale on both sides of the front $=(T1+T2)/2$

Vg: Geostrophic wind components can be estimated from the analyzed map according to the following equation:

$$Vg=(9.8\Delta z/2\Omega\sin\Phi)(K/\Delta h) \quad (2)$$

$\Omega=7.29\times10^{-5}$/sec

Where:

K=1: the deformation factor resulting from the projection of the map, so that its value is one at latitudes 30º and 60º and increases at the poles,

Ø=latitude

ΔZ: the interval of contour lines of the analyzed map,

Δh: the distance between the contour lines in centimeters.

The value between the brackets can be a fixed value. along a specific latitude and a specific map.

Fronts are steep and strong at 1/50 mile, while low at 1/300 mile.

Tools: surface pressure map of 850mb.

Methodology:

1. Point the variables of the left side of the forehead with the number 1 and the variables of the right side with the number 2.
2. Starting from latitude 30º and along it, using the usual ruler, measure the distance between the first two consecutive contour lines on the left side (1Δh) and determine the average temperature between these two lines from the information on the station or from the isothermal lines.
3. Using **Equation (2), calculate Vg1** and write the results in **Table (1**) below.
4. Repeat **steps 3 and 4** for two more consecutive lines along the previous line of latitude and calculate 1Δh again.
5. Repeat Operation Steps 3, 4, and 5 for the right side.
6. Repeat steps 3, 4, 5, and 6 for latitudes 35º and 40º.
7. Complete the required calculations in the columns labeled Vg1 - Vg2 and T1-T2.
8. Calculate the slope of the front for each line of latitude and for each two successive lines on either side of the front.
9. Calculate the average slope of the front at all latitudes.

Table (1): variables of equation (2) for Calculations the front slope.

		Vg2-Vg1(m/s)	T1-T2(k)	Right side(2)			(1) Left side			$(f)s^{-1}$	(Ø(º
				Vg2 (cm)	T2 (k)	h2(cm)Δ	Vg1 (cm)	T1 (k)	h1(cm)Δ		

Discussion:

Q1: Predict the intensity of the front at every Ø?

Q2: Does the slope of the front have a relationship with the weather? What is the weather condition based on your results in this experiment?

Q3: Draw the Vg2-Vg1 points on the y-axis and the values of T1-T2 on the x-axis. Also calculate the rate of slope of the front and compare it with the result in Step No. 9?

Q4: Draw the relationship between Ø and Θ and what do you conclude from it?