

Trough Displacement Study of Rossby Waves at 45°N Latitude

Mr. Muhammad Zawar¹

Abstract

This study concerns with an important middle latitude weather phenomena (Rossby Waves). In west to east slow moving waves amplitude being 30° and wavelength being 90° almost. Only three to five troughs with their intervening ridges can coexist over the whole of the northern hemisphere.

The rate of displacement of troughs and ridges of Rossby waves at the level of 500 hpa have been studied and it is transpired that the movement of trough over pacific ocean in winter is somewhat uniform where as over landmass area it is not uniform. The average speed of movement at 45°N over Pacific Ocean is 5.05° i.e. 252.5 km per day whereas over landmass area it is 5.74° i.e. 287 km per day.

Introduction

Man has always been eager to learn more and more about his surroundings and environment. Man's life is directly affected by weather conditions. Therefore over the ages, he has tried to acquire knowledge about those atmospheric phenomenons, which result in a weather change.

One such phenomenon is a Rossby waves. Rossby waves comprise of troughs and ridges and it moves from west to east along 45°N with some fluctuations. Efforts have been made to study its troughs movement over Pacific Ocean and land mass area with the help of 500 hpa maps. The displacement of the trough along with its tilt between 40°N to 60°N has been studied. This phenomenon of the trough is part of the global waves, which determine weather patterns, intensity of the weather, cloud development and its movement. Objective of this research is to determine per day speed of troughs over oceanic and land mass area so that calculations for approaching system can be made and early warning can by issued.

Methodology

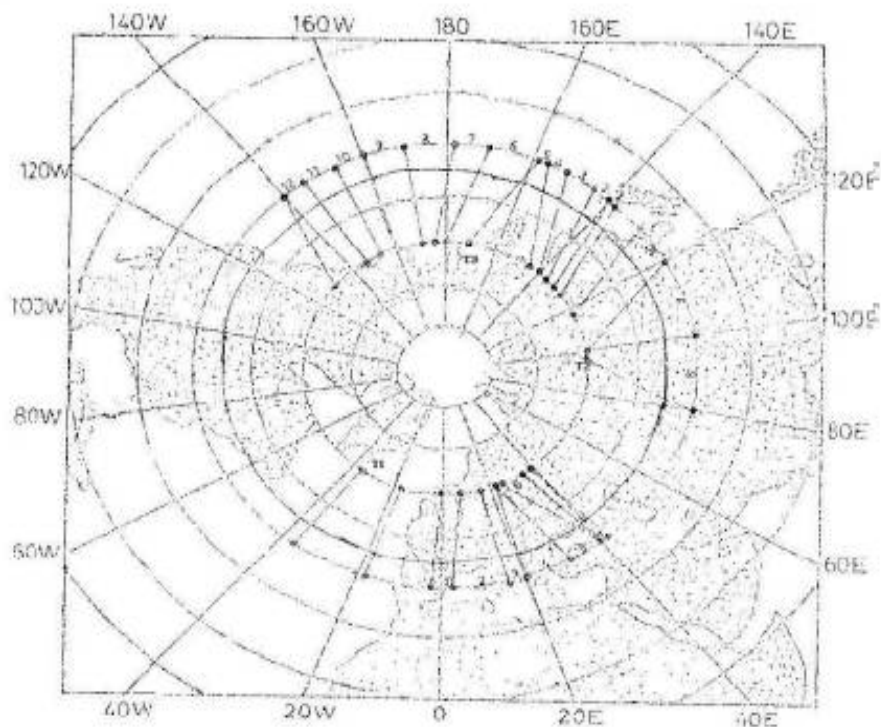
Effort has been made to mark the trough positions of Rossby waves at 40°N and 60°N using 500 hpa charts w.e.f 24-12-1997 to 01-01-1998. By joining these two trough positions the longitudinal distance (θ) traveled by the trough of the wave at 45°N has been measured with the help of adjacent day trough position. One-degree longitude at 45°N equals 50km distance. Thus by using formulae $S = 50 \times \theta$, the average distance traveled by trough over land mass area and oceanic region is calculated separately.

Secondly from this study I have also come to know that the distance traveled per day on oceanic region does not vary on long ranges, however over land mass area it undergoes wide range of variation i.e. from 1° to 11.2° per day.

From trough position study (figure 01) it has also been concluded that tilt orientation of trough undergoes a significant change, which is, opposite for both over land mass area and oceanic region. This results from faster movement of trough at lower latitude and slower at higher latitude over land mass area, while slower movement of trough at lower latitude and faster movement at higher latitude over oceanic region.

¹ Pakistan Meteorological Department

Global positions of the troughs of Rossby wave during 24-12-1997 to 01-01-1998



Fig(1)

Table 1: Trough position of wave during 24-12-1997 to 01-01-1998:

Sr. No	Date	T1		T2		T3	
		40°N	60°N	40°N	60°N	40°N	60°N
1	24-12-97	37°W	37°W	80°E	95°E	158°E	170°E
2	25-12-97	18°W	18°W	100°E	100°E	170°E	180°E
3	26-12-97	03°W	00°W	120°E	100°E	177°E	177°W
4	27-12-97	03°E	06°E	130°E	117°E	170°W	172°W
5	28-12-97	14°E	14°E	137°E	130°E	160°W	160°W
6	29-12-97	21°E	23°E	140°E	134°E	154°W	154°W
7	30-12-97	31°E	23°E	145°E	137°E	146°W	146°W
8	31-12-97	40°E	25°E	152°E	140°W	140°E	130°W
9	01-01-98	40°E	35°E	157°E	144°E		

Table 2: Speed over oceanic region in degrees per day:

Sr. No.	01	02	03	04	05	06	07	08	09	10	11	12
Speed	3.6	4.4	4.5	04	4.4	7.2	4.8	6.4	6.5	4.8	5	5
Average Speed = $5.05^\circ = 252.5 \text{ km/day}$ at 45°N .												

Table 3: Speed over land mass in degrees per day:

Sr. No.	01	02	03	04	05	06	07	08	09	10
Speed	3.6	08	3.2	06	05	01	01	11.2	11.2	7.2
Average Speed = $5.74^\circ = 287 \text{ km/day}$ at 45°N .										

Conclusion

Rossby waves trough has somewhat uniform movement over pacific ocean and its rate of propagation over land mass area is not uniform.

The average speed of Rossby waves is 5.05° i.e. 252.5km/day over pacific ocean but it is 5.74° i.e. 287km/day over land mass area.

There is a significant change in the tilt orientation of the trough over land mass area and oceanic region and it is opposite for both terrains.

Refrences

1. **Toby, N. carlson, 1991** "Mid-latitude weather systems" Harper collins publishers, London-U.K.
2. **Robin, MC liveen, 1992**, "Fundamentals of weather and climate" chapmen and Hall university and professional division, London, Newyork, Tokyo, Glenn, T Trawartha
3. **Lye H. Horn, 1980**, "An introduction to climate", GMC Raw Hiss International Book company Auckland, Bogota and London.
4. **RAG. Barry by Butler and Tanner limited 1978** "A course in elementry meteorology,her Majesty's stationary Office, London-U.K.
5. **John J. Hide, 1969** "Geography of the Atmosphere" W.M.C. Brown company publishers U.S.A.
6. **Aeolus, 1952**, "Tech yourself meteorology" W.M.C. Brown company publishers U.S.A.