

Mesoscale Precipitation Patterns in an Occluded Frontal System

Shinn-liang Shieh

Central Weather Bureau, Taipei, Taiwan, ROC

(Manuscript received 15 March 1976, in revised form 30 March 1976)

Abstract

A case study is presented which illustrates the characteristics and behavior of mesoscale precipitation features associated with an occluded frontal system passing through western Washington State. During the storm period (December 5-7, 1973), six rainbands were observed by means of autographic raingauge and radar data. The first five bands were similar in size, about 50 km in width on average, while the width of the last band was 100 km. The first two bands, observed on December 5, appeared to have been parallel to the warm front of the occluded system. The next two bands, observed on December 6, occurred in the warm sector of a wave which had developed on the cold front and were probably parallel to the cold front. These two bands moved from the southwest at about 35 km h⁻¹. The final two bands, observed on December 7, were parallel to the cold front and accompanied its passage. Smaller scale elements, with mean sizes of 50-240 km², were embedded in the rainbands in concentrations of 1 to 3 per 1000 km² and they moved with the wind between 850 and 700 mb (presumably the levels where precipitation particles were generated). The vertical extent of all of the mesoscale rain areas was estimated to be between 3 and 7 km.

1. Introduction

In recent years, several studies of the mesoscale structure of precipitation in extra-tropical cyclones have been presented. Some of these investigations have revealed the existence of rainbands on the order of 50 km in width and hundreds of kilometers in length within frontal cloud systems. Elliott and Hovind (1964), in a study of Pacific fronts in California, found that organized convective bands were frequently embedded in the large-scale precipitation region of the

storm. Browning and Harrold (1969) analyzed a wave depression over the British Isles in great detail. They showed that bands of heavy rain occurred parallel to and ahead of warm front. Kreitzberg and Brown (1970) in studying mesoscale weather systems within an occlusion also found that the convection is aligned in bands roughly parallel to the wind shear in the convective layer. Houze (1969) and Austin and Houze (1970, 1972) examined seventeen cyclones over New England. They found that precipitation areas on the sub-synoptic scale with rather clearly