PE5.1

CONCENTRIC EYEWALL STRUCTURE OF TYPHOON LEKIMA: AN INVESTIGATION OF DOPPLER RADAR REFLECTIVITY AND RADIAL WIND DATA.

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1. Introduction

According to typhoon survey report over the past 50 years (1951-2001) (http://www.npmoc.navy.mil/jtwc/atcr, http://rdc.cwb.gov.tw/rdcweb/lib/clm/typhoon1.htm and http://www.cwb.gov.tw/V4/index.htm), Taiwan was influenced or attacked during 50 years by 13 typhoons that had concentric eyewall structure, in which several typhoons caused Taiwan heavy losses. For example, super typhoon Winnie in 1997 hit Taiwan and triggered floods and landslides that killed at least 24 people on the island. Although such concentric typhoons bring so many disasters to Taiwan, but we had no precision instrument like Doppler weather radar to observe and analysis until 2000, that is too bad! In 2000, super typhoon Billis hit Green Island and destructed the antenna of Air Force Weather Wing. Fortunately, concentric eye wall structure was observed and documented by GI radar before it was destructed (Jou et al., 2001). During its landfall period, the storm intensified abruptly and this suggests that very short-term forecast of typhoon is an important subject in Taiwan.

2. Case and Data Description

Lekima formed in the Philippine Sea and initially moved west for approximately 72 hours after which the cyclone abruptly turned north and made landfall over the DaWu of TaiDong (Fig. 1). According to Taiwan Central Weather Bureau's post-analysis determined that the cyclone attained a maximum intensity of 75 knots during the north movement phase in the Luzon Strait. Post-analysis further indicated that the cyclone passed over southern and western Taiwan before dissipating in the Taiwan Strait in the coastal waters near Fuzhou, China.

Kenting Doppler weather radar data were collected in typhoon Lekima on 25-26 September 2001 while they had concentric eye wall structures.

3. Results

Lekima developed the first concentric eyewalls observed by Kenting Doppler radar on 25 September 2001 and it provided an unprecedented view of the storm's complex and dramatic evolution over about 5.5 hours. Since Taiwan radar network has been established, this is the first typhoon that had concentric eyewalls.

During about 5.5 hours of eyewall replacement cycle (Fig. 2-4), Lekima underwent intensity change; central pressure retrieved by Atkinson and Holliday (1977) wind-pressure relationship indicated it reduced when concentric eye wall formed. As the outer eye wall contracted, the intensity of typhoon stopped increasing and started to weaken. Later, the outer eye wall replaced the inner core and became a new primary eye wall.

4. Conclusions and future study

The first replacement cycle experienced about 5.5 hours and closed convective ring formed around the eye wall and wind maximum is within the convective ring (not shown). The conclusion is in partial agreement with what Willoughby et al., (1982), Black and Willoughby (1992) had found in their

observational studies of Hurricane. The difference is that typhoon exhibited highly asymmetric structure during eye wall replacement cycle. In the future, GBVTD technique (Lee et al., 1999) will be used to retrieve the 3-D mesoscale circulation.

5. Reference

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Willoughby, H.E., J.A. Clos and M.G. Shoreibah, 1982: Concentric eyes, secondary wind maxima, and the evolution of the hurricane vortex. J. Atmos. Sci., 39, 395-411.

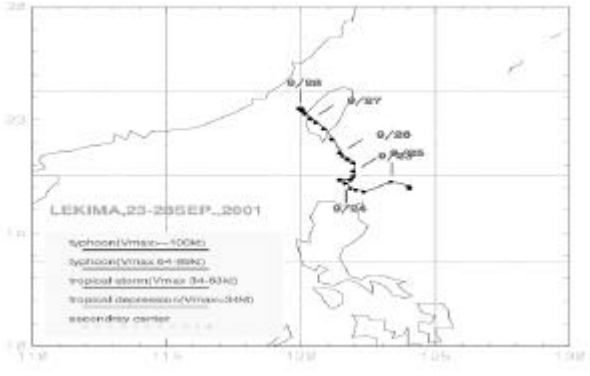

Fig. 1 Storm track of Lekima typhoon

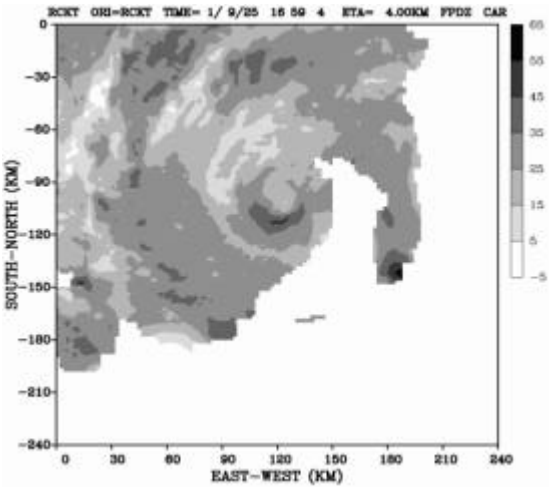

Fig.2 The 4km height reflectivity field of typhoon Lekima at 1704LST September 25,2001. Contour interval is 10dBZ. (Concentric eyewall formed)

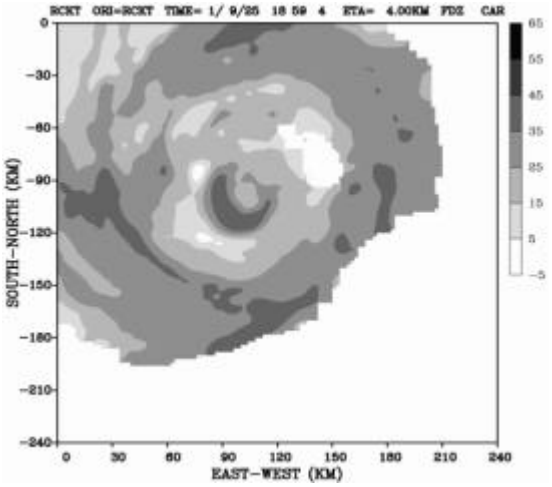

Fig.3 As in Fig.2, except for 1904LST. This figure indicates close convective ring structure.

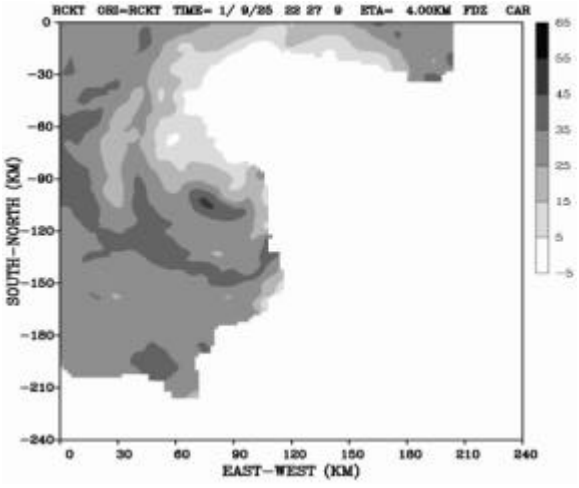

Fig. 4. As in Fig.2, except for 2232LST. This figure indicates replacement cycle would complete.