Jp2J.4 **The Precipitation Characteristics of a Winter Typhoon revealed by the NCU Polarimetric Radar**

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1. Introduction

On Dec. 3rd ,2004, a rare winter typhoon was passing through the southern tip of Taiwan. During its recurvature track near the island, the maximum rainfall accumulation reached 1000mm in two days. A newly set up dual polarization/Doppler radar in National Central University had observed one rainband induced by this typhoon. The DSD and the rainfall estimate had been derived from the dual polarimetric radar variables. Three J-W disdrometers and one 2-D video disdrometer in northern Taiwan provided excellent ground observation of the DSD in this typhoon heavy precipitation event. The rainfall estimate agreed very well with the disdrometer and raingauge network.

2. Data processing

As the first case was observed by NCU C-Band polarimetric radar, the editing procedures for the variables have been tested. The ground clutter and sea clutter were filtered out by applying the threshold of correlation coefficient greater than 0.9. The second step was to process the unfolding and the smoothing of the differential phase shift (ϕ_{DP}) . The specific differential phase shift (K_{DP}) was then derived subsequently. The attenuation compensation of reflectivity (Z_H) and differential reflectivity (Z_{DR}) adopted the method by Bringi et al.(1990). Because the lack of the vertical pointing scan in this case, a modified method was tested. A light rain region with very small ϕ_{DP} difference was selected to calculate the mean Z_{DR} bias, then the Zhh correction was calculated from the Kdp and Zdr constrain equation. A slight modification to the method of Zhang et al. (2001) was developed by Chi(2005). The gamma distribution parameters: No , μ and Λ were retrieved from the Z_{DR} , K_{DP} and the relation between μ and Λ suggested by Brandes(2003). The rainfall estimate were then calculated from the Gamma distribution. During the passage of the rainband, the J-W disdrometer at Nan-Gang site observed the strongest precipitation, the DSD data from this site was used as ground truth of the rainfall retrieval from the polarimetric variables.

3.General Characteristics

When we examined the raw data sets from 01:19 to 03:30 LST, we found one convective band in north-south orientation was embedded in a wide stratiform region.(Fig.1) The maximum reflectivity was about 45dBZ. This rainband was moving slowly toward east in average speed of 2m/sec.

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Fig.2 illustrated one beam data of Z_H, Z_{DR}, ϕ_{DP} along azimuth 29 degrees, elevation angle 0.5 degree at 01:19 LST. Within the convective band the median diameter (Do) retrieved from the polarimetric variables was about 2.0 mm. The Do in the surrounding stratifom region was around 1.5mm to 1.7mm. Fig. 3 show the Do time sequence of two disdrometer sites from 00:05 to 03:30, the average Do in the light rain period also around 1.7mm and the Do slightly increased from 1.9mm to 2.1mm during the convective band passage near 01:19 at Nangang site.

4. Rainfall estimate

At 01:19 LST, the radar retrieved Gamma DSDs of nearest 21 gates above the Nangang disdrometer site were plotted in Fig. 4b, the DSD of the disdrometer was shown in Fig. 4a. The low drop number in smallest diameter in disdrometer caused the discrepancy, but the rainfall estimates were very close(51mm/hr vs. 52mm/hr). The estimated rainfall rate in 10 hours period from polarimetric radar data was also compared to the NanKang disdrometer and ShiDu raingauge. Fig.5 shown the well matched changes along time. The first three hours accumulation rain map was also compared to the raingauge net work data, the strong contrast between the heavy rain accumulation belt and the light rain area was sharply revealed from polarimetric data (figure was not shown).

5. Conclusion

The preliminary results of a winter typhoon rainband demonstrate the good capability of DSD retrieval and the rainfall estimate from polarimetric variables. The DSD characteristics of this winter typhoon rainband was close to the observation of other typhoons in summer and fall. The Do values were close in convective and stratiform regions. The convergence of the drops caused the higher concentration and larger rainfall rate in convective band.

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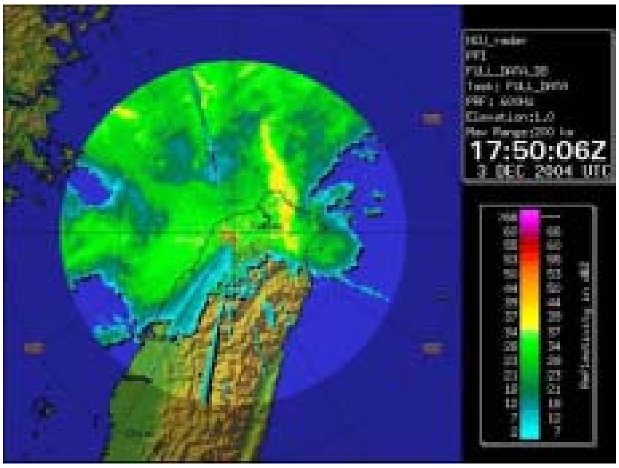


Fig.1 The convective rainband observed by NCU polarimetric radar at 2004 Dec. 4 01:50 LST

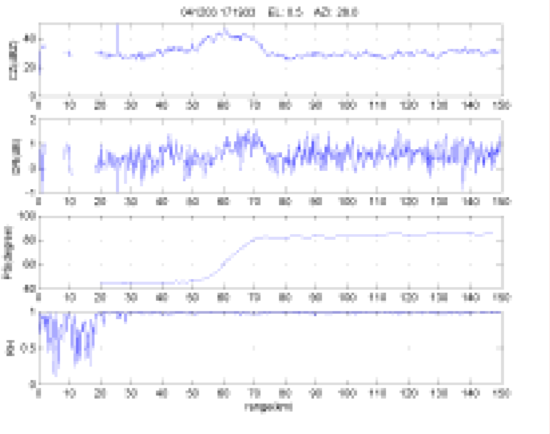


Fig.2 The radial distribution of ZHH, ZDR, DP and at el=0.5, Azi=29.0, Dec. 4 01:19 LST

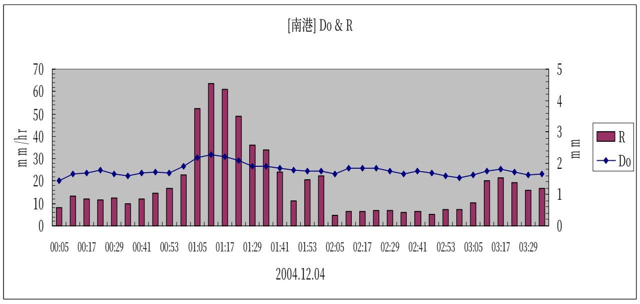
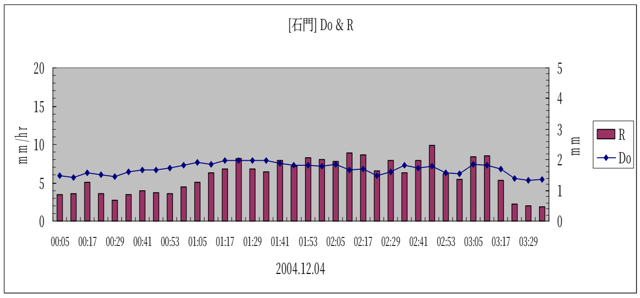


Fig. 3 (a) The Do and R time series from 00:05 to 03:30 at Nangang site



(b) for Shi-Man disdrometer site

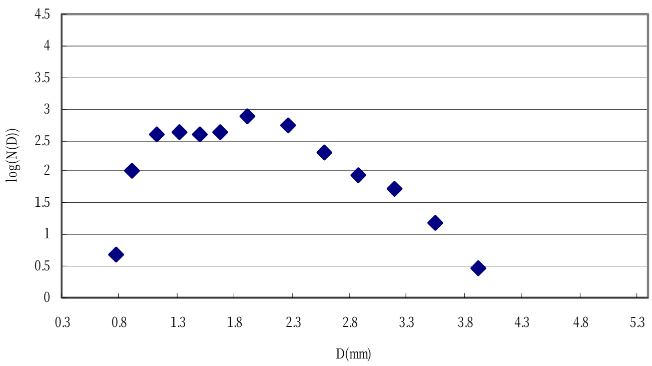
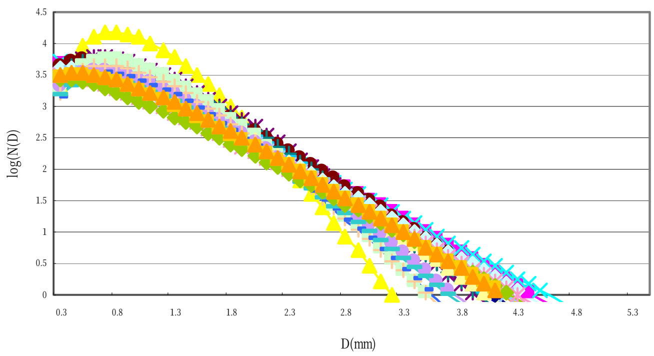


Fig. 4 (a) The Drop size distribution of NanGang disdrometer.



(b) The retrieved DSDs from polarimetric radar variables.

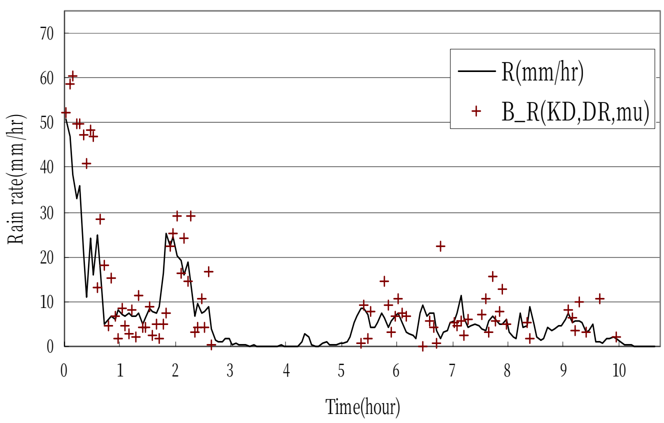
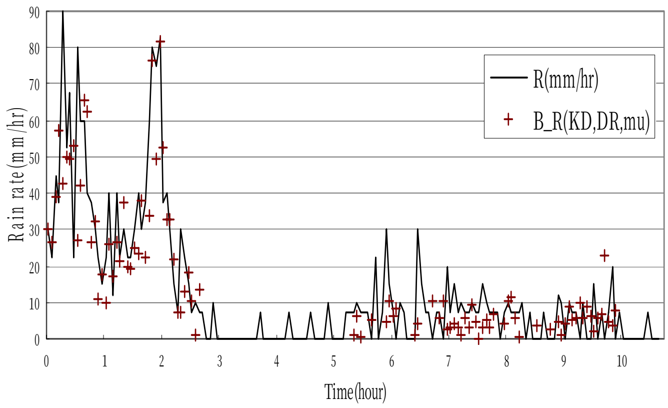


Fig. 5 (a) The 10 hours time sequence of the radar rain rate estimate vesus the disdrometer at NanGang



(b) The radar rain rate estimate vesus the raingauge at ShiDu.