Study on the Mesoscale Structure of Heavy Rainfall on Meiyu Front with Dual-Doppler Radar

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I. INTRODUCTION

Dual-Doppler radar wind retrieve technology can improve the accuracy of the three dimensional wind fields. Armijo (1969) studied the wind synthesize method with dual-Doppler radar firstly. Many new retrieve methods were proposed in recent years (Bousquet and Chong, 1998; Shapiro and Mewes, 1999; Chong and Bousquet, 2001). It is an important way to study the 3D structure of the heavy rainfall, hail and squall line et al (Jeffrey et al, 2006; Kropfli and Miller, 1976; Parsons, et al, 1987; Smull and Houze, 1987; Zhou and Wang 2005; Zhou and Zhang, 2005;).

II. PRESENTATION OF RESEARCH

The dual-Doppler radar network is composed by the radars located in Hefei and Maanshan city in South China. Due to the effect of the convergence line and the mesoscale convection system, it produced a heavy precipitation in the dual- Doppler coverage area between 26th and 27th June 2003. The heavy rainfall is 108.1mm in Quanjiao city from 2200 LST to 2400 LST on 26th.

The 3D wind fields are retrieved by MUSCAT method using the dual-Doppler volume scan data. This method is proposed by Bousquet and Chong (1998). Zhou and Zhang (2002) use it to retrieve the ground-based dual-Doppler 3D wind.

By 2050 LST 26 June, some cells had begun to develop at the east of Hefei city. These cells developed and combined very quickly. After one hour, a mesoscale band echo system extended from southwest to northeast near Caohu and Quanjiao city and propagated eastward. The peak reflectivity is greater than 45dBZ. The heavy rainfall occurred after the band formed. The band system lasted for more than 2 hours. The high reflectivity core in the band began to decrease after 2400 LST. At the same time, the rainfall began to weak.

The retrieve wind by dual-Doppler radar on 2107 LST shown that the retrieve area was contraled by southwest wind. By 2151 LST, the convergence line formed at 1.5km AGL. By 2202 LST, the convergence line is more stronger than the former time and propagated to the upper levels. The higher-reflectivity band was corresponded to the convergence line. It indicated that the wind field is the kinematic foundation of the reflectivity field evolution.

Fig. 1 showed the wind fields on 2235 LST. There are strong convergence line at the low and middle level (1.5~4.5km AGL) which are more clear than former time, but the convergence line is weak at the middle level. The upper level above 5km AGL were controlled by southwest air flow. There was strong reflectivity on the low and middle level near Quanjiao.

Fig. 2 showed the velocity of the vertical cross section along x=69km. There are strong updrafts near the convergence area. The flow at the low level formed the inflow and the flow at the upper low in the north area is the outflow region which moved northward. Strong precipitation was occurred in the updraft with high reflectivity. There was a strong cell near Quanjiao city. This configuration was an important mechanism for the initiation and maintain of the heavy rainfall.

This configuration lasted for more than 2 hours which caused the heavy rainfall on 2200~2400 LST, up to 108.1mm in Quanjiao.

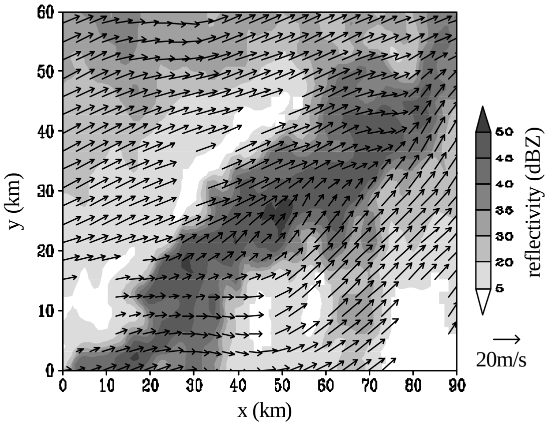

FIG. 1: Horizontal wind at height of z=1.5km AGL on 2235 LST

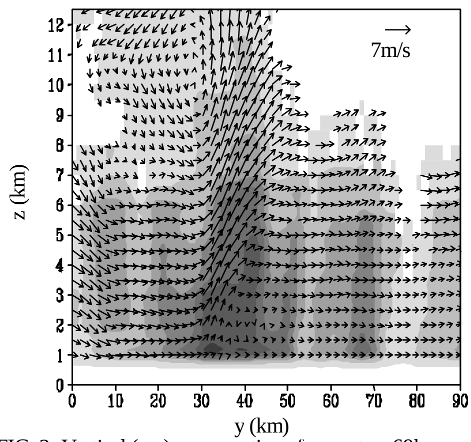

FIG. 2: Vertical (y-z) cross section of v-w at x=69km on 2235 LST

After 2337 LST, the local storm began to weak, and the reflectivity near the convergence line decreased while high reflectivity was still strong at the low level of Quanjiao. The convergence line at the low and middle level was still maintained. This shown that the local rainfall will last. By 0125 LST 27th, the high-reflectivity cells at the low and middle level were more weaken while the rainfall was weak. In the vertical cross section, the flow at the middle and upper level is smooth and weak. All these details showed that this storm would dissipate.

III. RESULTS AND CONCLUSIONS

In this, the three-dimensional wind fields of the heavy rainfall on the Meiyu front were retrieves and studied that occurred on 26th-27th June 2003 in Huaihe river basin, using the volume scan data of the dual-Doppler radar located in Hefei and Maanshan cities. The mesoscale convective system (MCS) and the cells located on the MCS play important role on this heavy rainfall. The wind retrieval showed that this heavy rainfall was caused by the mesoscale convergence line at the low and the middle level which triggered and maintained the heavy rain. There are strong convergence and vorticity at the lower and middle layer of the MCS. The three-dimensional kinematic structure model was also given and discussed.

IV. AKNOWLEDGMENTS

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