P4A.6 MESOCYCLONE OCCURRED IN DIFFERENT ENVIRONMENT

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1. INTRODUCTION

Mesocyclone is one of the critical products of weather radar (model WSR-98D). It often associated with severe weather. Mesocyclone was detected many times by JINAN Radar WSR-98D. The mesocyclone was occurred in different weather conditions. The life time, position which occurring and weather condition for different cases was described in the paper.

2.THE MESOCYCLONE IN SUPERCELL

On 23rd August 2001, a severe storm attacked Shandong Province. According radar echo, the storm can be identified as super cell. A series of mesocyclone was observed.

Because of lack of intact Archive2 data, the mesocyclone had been analyzed by replaying data from 2226UTC to 2351UTC, 22nd August discontinuously.

The life times of mesocyclone existed within the storm was about 80 min. At the initial stage, it was minimal mesocyclone, and then developed the moderate and strong stage.

At the beginning stage, the vertical depth was from 2.6km to 5.5 km, afterward the top of the mesocyclone developed upward gradually. At 2351UTC the top reached 8.5 km height. The base was near the surface. the mesocyclone can be seen at 1.5 height all the time.

The rotating velocity increased gradually. The maximum value was 22 $m \cdot s^{-1}$ at 2339UTC 22nd August. The IRS[1] index(Fig.1) reached 16.3 at the same time. The maximum strength in the vertical direction descended downward from the high level 5.7km at 2238UTC to the low level 2.2km at 2339UTC.

At 2339UTC the strong convergence appeared at low level, the velocity (v27) reached 19 $m \cdot s^{-1}$ and -19 $m \cdot s^{-1}$. During the period, damaging wind occurred on the surface and hail with 5cm occurred. The precipitation distributing was not equality at ground. It reached 50 mm at Boshan County and very low on other place.

3. THE MESOCYCLONE IN MINISUPERCELL

On 27th September 2002, the weather condition was not favorable to support that severe convective storm would occurred because the CAPE and Helicity was not high. But due to the low pressure on the surface and the cold advection at higher level, the mini supercell occurred.

That storm was single cell in which the height of echo top was about 9 to 10 km. The mesocyclone existed within the mini supercell almost 90 min. After generated at 0649UTC 27th September it's strength increased gradually and reached the maximum at 0719UTC with the maximum IRS[1] index 10.1(Fig.2). Then it decreased slowly and dissipated at 0820UTC.
The rotating velocity at each height was not high all the time. The IRS index was lower than 8.4 expect one time 0719UTC. It located aloft mid level above 3.5 km all the time expect 0719UTC. The IRS maximal index located at low level when the mesocyclone generated and

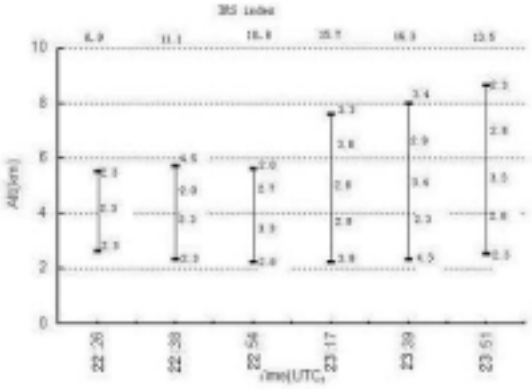

Figure1.The bases, tops and depths of the mesocyclone are represented by "I-Beams" along a time line on X axis for a supercell which occurred on 22 August 2001. Integrated Rotational Strength values are displayed across the top of the graph.

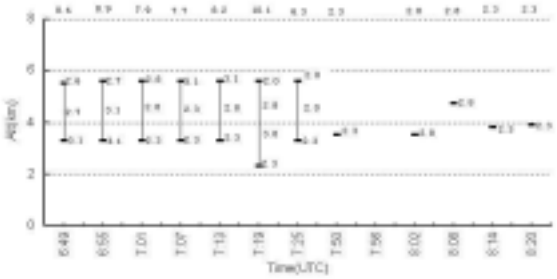

Figure2.The bases, tops and depths of the mesocyclone are represented by "I-Beams" along a time line on X axis for a supercell which occurred on 27 September 2002. Integrated Rotational Strength values are displayed across the top of the graph.

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ascended afterward and reached the top before the hail fell.

When the base lowered at 0719UTC, hail fell with maximum diameter 13 mm. No damaging wind was reported during this case and the precipitation is light, only 3-10 mm.

4.MESOCYCLONE OCCURRED IN THE MERGING PROCESS BETWEEN SINGLE CELL AND BAND ECHO.

On 17th July 2002 at 0000UTC, there was a shear line from east to westward located near 120˚E, 42˚N. It moved southward slowly. The convergence along the shear line caused a band convective echo along the shear line. Meanwhile there was a single convective cell in the south of the echo line. The single cell echo was nearly stationary and the band echo reached the single cell. The storm developed very quickly. Strong Hail storm developed in Feicheng County at 1526UTC. Similar storm developed in the afternoon at 0937UTC at Lingxian County.

4.1 GENERATION OF THE MESOCYCLONE

At 1414UTC, beyond the south side of the band echo about 25 km, a single storm cell generated and nearly stationary. When the band echo moved southward near the single cell, the single cell was attracted and started to move towards the band echo and then merged into the band echo. When the single cell generated, the velocity at low level was negative (northward), and positive (southward) at high level. When the single cell approached near the band echo, the negative velocity area developed upward to 6 km high. The velocity of band echo area was positive previously. Just due to the single cell with negative velocity merged into the band echo, the pair of positive and negative velocity occurred.

4.2 THE CHARACTERICTICS OF THE MESOCYCLONE

The diameter of the mesocyclone was about 5.5 km, the depth near 3.0-5.9km. The lasting time was very short, only once it was identified by the WSR-98D. The maximum rotating velocity reached 16 $m \cdot s^{-1}$ and the momentum was 176000 $m^2 \cdot s^{-1}$ .IRS index was about 11.7. The maximum rotating velocity was located at low level. The height was about 3 km. The product v27 convergence at 1.5 km reached the maximal value –13 $m \cdot s^{-1}$ and 19 $m \cdot s^{-1}$ at 1514utc, one volume scan before the mesocyclone was identified.

4.3 THE WEATHER WITH THE MESOCYCLONE

During the short life time of mesocyclone, damaging weather occurred. It was reported that diameter of hailstone was 5 cm and strong wind occurred at ground.

5. THE MESOCYCLONE IN SQUALL LINE

In the afternoon of 27th, September 2002, when the mini supercell occurred, several storm appeared in Hebei province. These storms moved southeastward. they merged each other and became a squall line. When squall line approached 20 km to Jinan radar, a small mesocyclone was detected. Its diameter was only 3 km in radial direction and 3.5 km in azimuthal. It's depth was shallow. The base located at 0.9 km high and top at 1.2 km. The life time was short. It was only once identified by radar. When it occurred, the strong wind also occurred at the surface. The mesocyclone located at the north end of the squall line, the edge of the storm cell. At the south side of the mesocyclone existed a strong jet toward radar, the velocity reached 34 $m \cdot s^{-1}$. It was the jet that caused the mesocyclone and the strong wind on the surface.

6. SUMMARY

The mesocyclone occurred in supercell and mini supercell due to the strong convergence and upward stream. The life time is long. The mesocyclone which occurred in the band echo was due to the single cell echo merged into the band echo. The combination made the convection strong and brought mass with opposite momentum into the band echo. When the maximal rotating velocity located at low level, the damaging wind would occurred on the surface. The mesocyclone identified by radar system at the end of the squall line was different to prior virtually. Just the jet stream made the different velocity at the edge of the stream.

7.REFERENCES

1.Robert R.Lee and Anderson White 1998: Improvement of the WSR-88D Mesocyclone algorithm: Weather and Forecasting.