Confirmed Tornado
Shelburne, Ontario
May 15, 1988

Date- Local: Sunday, May 15th, 1988.
UTC: Monday, May 16th, 1988.
Time-Local: 21:00
UTC: 01:00
Location: Shelburne area
Region: Dufferin - Innisfil
Classification: Confirmed Tornado
Category: A
Casualties: 1 horse
Track Length: 32km (tornado skipped along path)
Width: 500m
Motion: 250°
Damage Estimate: $500 000
F-Scale Rating: F1
Code: UH/BS
Damage Survey: Yes
Spotter Reports: None
Other Documents:

Logged event citing damage due to tornado.
Preliminary report and photos of tornado path.
Newspaper articles and photos from tornado.
Damage Survey forms.

Tornado F-Scale Assessment

Marci Vanhoucke
Tornado Data Production Assistant, Environment Canada
June 30, 2005.

Classification: Confirmed Tornado
Date: Sunday, May 15th, 1988.
Location: Shelburne area, Dufferin – Innisfil

Assessment: F1
F-Code: UH/BS
Explanation of Assessment: Damage survey conducted by the weather office found the most sever damage was that done to 12 barns/houses. There are photos of 2 barns that are destroyed, but they would have been old and weaker barns. There is also a house that was shifted on its foundation. Due to the barn and house damage, this tornado is rated an F1.

CLASSIFICATION: Severe Thunderstorm
SOURCE/WATCHER ID:
EVENT TIME (UTC): 01-00 **EVENT DAY:** 16.0 **MONTH:** 5.0 **YEAR:** 1988.0 **EVENT DURATION (HR):** 0.0 **(MIN):** 0.0
DAY OF THE WEEK:
EVENT LOCALE: Near Shelburne, Dufferin Co.
ASOCTD PUBLIC RGN: Waterloo-Wellington-Dufferin
DETAILED DESCRIPTION: 12 barns/homes damaged. 1 minor injury.

INITIAL ASSESSMENT: YES
SPL WX STATEMENT IN EFFECT ?: UKN **STATEMENT LEAD TIME (HR):** **(MIN):**
WATCH IN EFFECT ?: UKN **WATCH LEAD TIME (HR):** **(MIN):**
WARNING IN EFFECT ?: UKN **WARNING LEAD TIME (HR):** **(MIN):**
TORNADO: YES F?
WINDSPEED:
RAINFALL: MM **RAIN DURATION:**
HAIL DIAMETER: MM **HAIL DESCRIPTION:**
EVENT DESCRIPTION: Tornado
Mesoscale ?: **Synoptic ?:** **Big Event ?:**
Statement Est Hit/Miss:
Watch Est Hit/Miss:
Warning Est Hit/Miss:
Separate Event (30km/30min): YES
Vetted by:
Vetted date:

Twister hit farmhouse 'like a missile'; [ME2 Edition]

Allan Thompson Toronto Star. **Toronto Star**. Toronto, Ont.: May 17, 1988. pg. A.4

Full Text (412 words)

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"I just saw a great big gray cloud twisting around and that's when I grabbed my girlfriend and got down," McDermott said.

A moment later the pair heard a deafening bang as windows blew out and furniture flew around the living room, "like a scene from a movie."

Power out

The 23-year-old man spoke by phone yesterday from the kitchen of his home, which is about 90 kilometres (60 miles) northwest of Metro.

The tornado touched down just after 9 p.m. Sunday, lifting the house off its foundations and knocking out power, but leaving the phone still working.

"It just looks like somebody put a missile through our house. It's still standing but it's twisted all to hell," McDermott said.

The Ontario Provincial Police at Shelburne said the twister left a path of destruction about 15 kilometres (9 miles) long, causing an estimated $500,000 in damages to a number of houses, barns and other buildings. Miraculously no one was injured.

Tornado and severe weather warnings continued through yesterday in southwestern Ontario after another tornado was spotted by a group of schoolchildren near Wingham, 200 kilometres (124 miles) northwest of Metro.

↑ Wingham May 16/88

Funnel cloud

Ken Scott, principal of East Wawanosh Public School just outside the village of Belgrave, said: "The kids said to me, 'Look at that funny looking cloud formation,' then the next thing you know a funnel cloud touched down in a bush about two miles from the school."

"We were just out the door and all of a sudden there was this thing coming down out of the sky," said Dean Vincent, 14, one of 200 students out for noon recess when the tornado touched down.

Picked up pieces

"We all ran inside and laid down in the halls of the school, but then the tornado went away and we went back to class."

The large, dark funnel cloud that meteorologists believed spawned yesterday's smaller tornado finally broke up south of Walkerton later in the afternoon, an OPP officer said.

While the Wingham schoolchildren were staring in wonder at a funnel cloud some two miles away, Mark Evans of Shelburne was picking up the pieces of a barn and silo ravaged by the twister that rushed by his house the night before.

[Illustration]
Caption: Star photo (Weil): Tony McDermott and Angela King outside tornado damaged home.

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People: McDermott, Tony
Section: *NEWS*
ISSN/ISBN: 03190781

JOHN

- BOTH BARRY & BRIAN WANT A COPY OF THE REPORT
- REPORT IN FILE # SHEL
- BRIAN ALSO WANTS COPY OF TORONTO STAR ARTICLE
- BARRY HAS ONE SET OF SLIDES
  BRIAN HAS 5 REPRESENTATIVE SLIDES
  IF YOUR WONDERING WHERE THEY ALL WENT

THANKS

GEOFF

2

SLIDES

1. Evans Barn ✓
2.
3. gravel pit
4. Triple Box Barn ✓
5. field east of Bufford
6. McDERMOTTS BACKYARD
7. Bufford
8. "
9. gravel pit
10. " MAYBE
11. MICROWAVE TOWER
12. McDERMOTT house
13. MICROWAVE TOWER
14. McDERMOTT
15. McDERMOTT ✓
16. McDERMOTT
17. BACK OF McDERMOTT ✓
18. BACK OF McDERMOTT ✓
19. BACK OF McDERMOTT
20. "
21. WOODS HOUSE
22. gravel pit
23. Evans plaid
24.
25. Triple Box Barn
26. Bufford
27. Violet hill area
28. gravel pit ✓
29. south of Violet Hill
30. Barn near Evans place
31. 89 & airport RD ✓
32. east Violet Hill

33 east McDermott

34 east McDermott

35 Woodi place

36 west of McDermott

37 east of McDermott ✓

38 Microwave Tower

39 Woodi Barn ✓

40 " ✓

41 west of McDermott

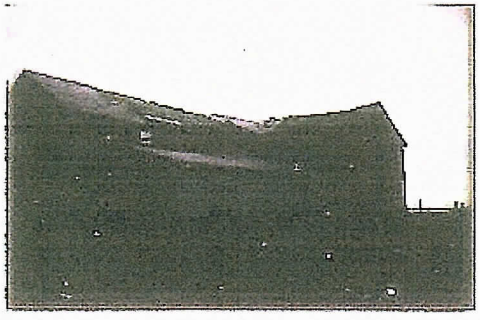
42 east of McDermott

43 McDermott house

44 east of McDermott

45 west of McDermott ✓

46 west of McDermott



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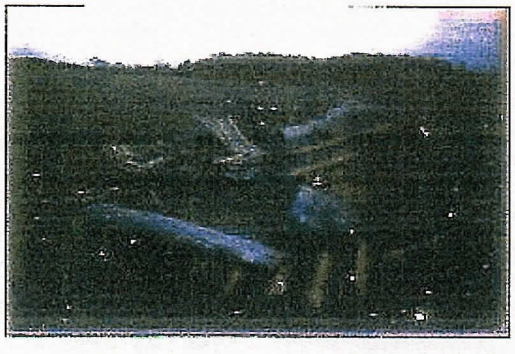

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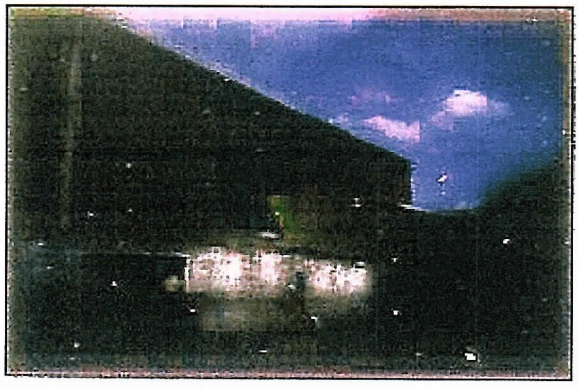

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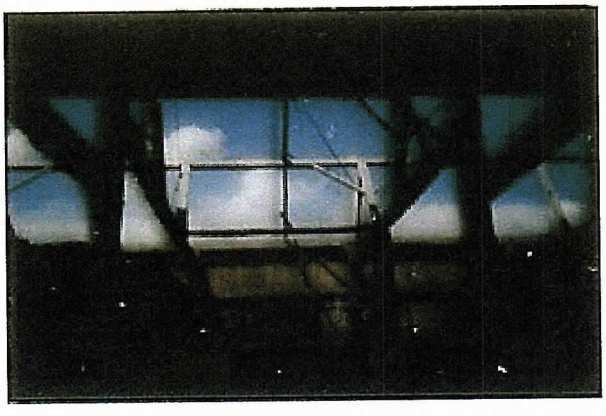

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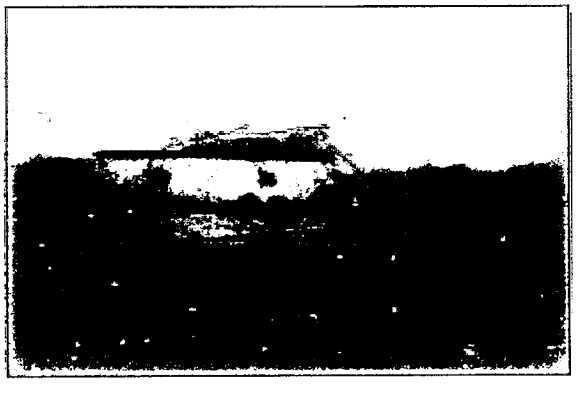

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THE SHELBURNE TORNADO
MAY 15, 1988

BY
GEOFFREY COULSON
GILLES LANGIS

Between approximately 8:40 pm and 9:05 pm on Sunday May 15, 1988 a tornado touched down repeatedly in a west southwest to east northeast line 32 km long from approximately 12 km north of Grand Valley to the vicinity of Rosemount on Highway 89. Areas actually explored and verified as part of the tornado's path by the team from the Ontario Weather Centre can be seen as a solid line on the large scale map and a hatched line on the smaller scale map. Areas which were estimated as having been in the tornado's path from second hand information or inference can be seen as a dashed line on the larger scale map or a dashed pair of lines on the smaller scale map.

The maximum width of the damage path observed by the team was a little over one half a kilometre. No injuries were reported by anyone interviewed by the team aside from the death of one horse and the injury of another. From the damage observed in the aftermath of this tornado the intensity was found to occasionally have been as high as an F2 on the Fujita scale.

The earliest tornado victims to be interviewed were at the Evan's Farm which was located about 5 km south southwest of Shelburne. Their barn and silo were heavily damaged as was at least one large tree in the vicinity. Minor damage was also done to their home. The time of the tornado's arrival was estimated at 8:45 pm.

~~The~~ Next ~~people~~ the team talked to ~~were~~ the occupants of the Mcdermott and Wood households. Both these homes were located about 3 km south of Primrose, Mr. Mcdermott was the only person interviewed throughout the day who actually saw the tornado. He described it as smoke-like in appearance. Hail was also said to have preceded the tornado by both Mr. Mcdermott and Ms. Wood however the size of the hail was not determined. Damage to Mr. Mcdermott's home was extensive and Ms. Wood's barn directly behind the

Mcdermott house was totally destroyed. Ms. Wood also reported the death of one of her horses and the injury of another, the only known casualties of the tornado. In addition to wreaking extensive structural damage the tornado lifted and spun Mr. Mcdermott's 15 foot boat dropping it more than 15 feet from its original location. Pieces of the corrugated metal roof of Ms. Wood's barn were found up to 1.5 km to the east northeast of the barn's original position. The time of the tornado impact was estimated at 8:55 pm.

Moving east northeastwards along the tornado's path the team came across the Bulford house (about 2.5 km south southeast of Primrose). They suffered damage to the garage attached to their home and the siding and gutters at the back of the house. As well a bedroom window was blown out. They also mentioned hail preceding the tornado as well as some flooding in their house due to the very heavy rain entering through the seams around the windows. Tornado impact was estimated at 8:45 pm by the Bulfords however from previous times earlier in the track of the tornado, a time closer to 8:55 pm seems more likely.

Continuing along the path of the storm we interviewed the owner of the Triple Bar Ranch (3.5 km east southeast of Primrose). A barn roof was blown off and thrown into a second barn causing more damage. Tornado impact was estimated at 9:00 pm by the owner who was not home at the time but was in fact nearby in her truck. She was forced to stop driving as the force of the storm began to rock the vehicle.

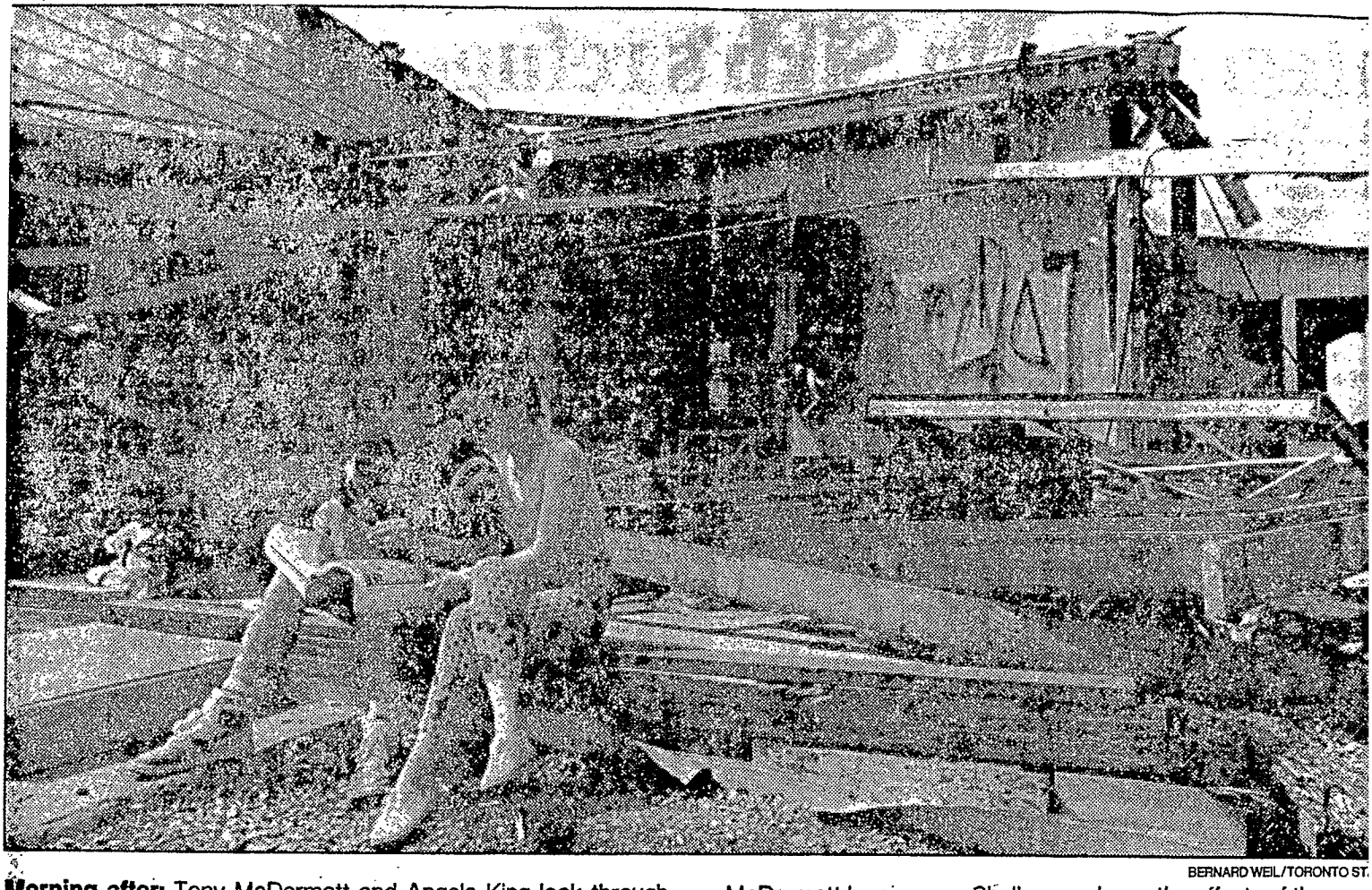
A gravel pit (4 km east southeast of Primrose) was the next site visited. Extensive tree damage on both the north and south side of the pit was noted. Many of the trees damaged up to this point had been older or had root systems not firmly in the ground. However the trees in the vicinity of the pit appeared both young and strong making the extensive damage even more impressive.

The tornado then began to curve more northeastward towards Highway 89 and actually ran close to it for the remainder of its track. Barn and tree damage was noted in the vicinity of Highway 89 to the east of Violet Hill

with some of the most extensive damage occurring at the southeast corner of Highway 89 and airport road. At this site a storage shed was totally destroyed and a house damaged. The owner of the house stated that tornado impact also happened around 9:00 pm. This was the farthest east the team travelled in search of the end of the tornado track. However after interviewing other people damage was said to extend into the vicinity of Rosemount.

Given the approximate times and distances the tornado covered the speed of the tornado ~~travelled at~~ must have been around 100 km/hr. The tornado probably lifted and settled back to the ground several times during its track but by covering the area by car and encountering many cleared fields it was difficult to ascertain specific examples of this rising and lowering.

The finnicky nature of the tornadic damage was striking. On more than one occasion weak structures or trees were left intact while more sturdy objects were heavily damaged. A case in point was the devastation of the barn and silo at the Evan's farm while flowers in a nearby garden lay untouched.



BERNARD WEIL/TORONTO ST.

Morning after: Tony McDermott and Angela King look through the Yellow Pages yesterday seeking someone to repair car windows smashed by a tornado Sunday night. Behind them the McDermott house, near Shelburne, shows the effects of the sam twister that tore the house off its foundations, smashed windov and tossed furniture around. No one was injured.

Twister hit farmhouse 'like a missile'

By Allan Thompson Toronto Star

Seconds before a tornado ripped through his three-bedroom farmhouse near Shelburne, Tony McDermott opened his kitchen door and stared straight into a swirling, gray funnel cloud.

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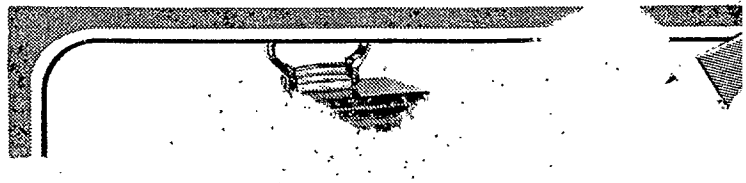

The Shelburne Storm - May 15, 1988

Ford Doherty

December 21, 1988

1 INTRODUCTION

On the evening of Sunday May 15, 1988 a severe thunderstorm caused damage along a 1/2 km wide band from 12 km north of Grand Valley in an east northeastward direction to the town of Rosemount. The storm was within range of the King City weather radar installation for over 2 hours prior to the time of the reported damage and an hour afterwards. This report is primarily concerned with the storm as seen by the radar in both the conventional and Doppler modes. A brief description of the

damage and of the synoptic scale weather situation is presented to orient the reader.

2 DAMAGE

The damage track, confirmed by an AES team (The Shelburne Tornado, Coulson and Langis) is shown in Fig. 1 along with some estimated times. Storm damage included a barn destroyed, extensive damage to a house, sections of roofs blown off and trees knocked down. The AES team estimated the damage to be occasionally as high as F2 on the Fujita scale. The type of damage sugests that a tornado was responsible.

3 SYNOPTIC SITUATION

The May 16, 0000Z 500 mb geopotential height field was dominated by a large trough extending from over Hudson Bay to Wisconsin (Fig. 2). A trailing ridge is centered over a line extending through Alberta southward

to Utah.

The surface analysis indicates a frontal wave in northern Michigan with associated thunderstorm activity through southern Ontario.

The surface weather map (Fig. 3) for 0000Z shows a cold front through Michigan moving toward southern Ontario. Thunderstorms are occuring in advance of the front. Temperatures are between 17 and 22 C and dew points near 15 C. Winds are southwesterly and are bringing in somewhat warmer and more moist air with temperatures and dew points of 25 and 17 C respectively.

The wind profile at Buffalo, N.Y. shows some shear in the lower levels with southeasterly winds of 8 kts at the surface and near west southwesterly winds of 20 kts at 2100 m. At 1200Z the next morning, Sault Ste. Marie was showing very strong vertical shear from 12 kt easterlies at the surface to 57 kt southwesterlies at 1200 m and 60 kt westerlies at 4000 m.

4 CONVENTIONAL RADAR

The MAXR display for 2300 and 2320Z (Fig. 4a) show several thunderstorm complexes within radar range, moving to the northeast at about 100 km/hr. The Severe Storm Map and echo top heights greater than 16 km indicate the potential for severe weather from several cells. Five of the cells are nearly contiguous and form an arc or bow echo. A bow echo results from a divergent flow of descending air near the surface which spreads the precipitation out in front of it. The warm air in advance of this meso-scale cold front is lifted over the descending cool air and as a result convection is increased. The cyclonic shear in the northern half of the bow echo also tends to increase convection and encourages the formation of tornadoes (Fig. 5) (there was in fact a report of a funnel cloud near Wingham at this time). As the cool air spreads further the source of warm air to the cells is cut off and the cells die down. In this case the cells strengthened until 2320Z and then entered a relatively quiet phase, with a slow buildup to the time of the reported damage 80 minutes later.

At 0020Z (Fig. 6a), a well defined line of cells is seen to the west and southwest of the radar. The Shelburne cell is due west of the site. The precipitation pattern reflects the shape of the meso-low and resembles a synoptic scale comma cloud system. The most intense convective activity occurs in a narrow band along the cold front, near the low pressure center. A large area of relatively light precipitation exists over the warm frontal surface.

The line of cells with the highest rainfall rates is kinked to the west at 0020Z. 10 minutes later the kink has disappeared (Fig. 6b) and another 10 minutes later at 0040Z, a bow echo has formed (Fig. 6c). The Shelburne cell is on the northern end (or left flank) of the bow echo and, at 0040Z, is causing damage at the surface. Since the damage occured during the strong updraft phase (i.e. early in the cell's lifetime as described in the next section), neither the mid-level reflectivity (Severe Storm Map, Fig. 6d), nor the echo top height provided any warning. In this case the changing shape of the convective line constituted the only prior indication of the severity of this storm from conventional radar data. As will be shown below, other clues were available from the Doppler radar displays.

5 VERTICAL STRUCTURE OF THE STORM

The reflectivity on a vertical cross section through the Shelburne cell is shown in Fig. 7 for 0040 and 0050Z. The section is oriented in a NW (on the left) to SE direction (on the right) and also intersects a smaller neighbouring cell. The Shelburne cell at this time has a reflectivity core greater than 50 DBZ (purple colour) at 4 km altitude. The ¿50 DBZ core grows in vertical extent and rises to 6 km in the following ten minutes (Fig. 8). The storm is clearly in the strong updraft phase so that the presence of a tornado from 0040 to 0050Z is not incompatible with the conventional radar data.

The generation and decay of neighbouring cells can also be seen in Fig. 7 and 8. In the 0040Z picture there appears to be only one cell at very low levels on the right flank of the main cell. Just 10 minutes later there are two well developped cells and mid-level reflectivities on the left flank have dropped below 45 DBZ. At 0100 (not shown) the high reflectivity core of

the Shelburne cell has dropped below 1 km, whereas another cell to the southeast has developped a strong core (above 50 DBZ) at an altitude of 4.5 km.

In order to better illustrate the growth and decay of the main cell, the height and intensity of the high reflectivity core has been plotted in Fig. 9. At 0040 a mid-level (6 km) high reflectivity core appears and is caused by the developping updraft. Ten minutes later, high reflectivities are found to an altitude of 8 km. At 0100 the reflectivities are dramatically lower at mid to high levels indicating the collapse of the updraft.

6 STORM TRACK

The position of the damage and of the high and low level reflectivity cores are plotted in Fig. 10. The position of the storm as given by the Severe Storm display is also included. The low elevation reflectivity core is closely tied to the damage. This suggests that the damage was caused by a sustained downburst, however, the data do not rule out a tornado close

to the downdraft region. The Severe Storm display is based on mid to high level reflectivities and so both it and the high level reflectivity peak are close together. The position of the updraft at mid to high levels with respect to low level precipitation is consistent with westerly winds increasing with height and throwing the precipitation downwind.

7 DOPPLER RADAR - RADIAL VELOCITY DISPLAYS

Fig. 11C shows the radial wind field at 0.6 deg. elevation, 10 minutes prior to the storm's damaging phase. There are several cells at about 75 km range from 250 to 270 deg. azimuth (Fig. 12a). The low level inflow from the warm air in advance of the storm is seen as a red and blue area on the east flank of the storm (Fig. 11c). Since the storm is moving at approximately 100 km/hr to the northeast, the low wind speeds in this area indicate a strong inflow relative to the storm. The inflow persists until at least 0050Z and is not evident at the highest elevation angle

(Fig. 12b). The inflow is therefore confined to a surface layer lying below about 2 km.

An approaching low level inflow jet of strong towards velocity (in green) can be seen to the southwest of the warm inflow region below about 2 km (Fig. 11 and 12b). The northeastern edge of the green area coincides with the Shelburne cell at 0040Z (Fig. 12c) The wind maximum associated with the jet approaches the line of cells and undercuts them, thereby causing uplift of the warm inflow air and initially, increasing convection. The jet maximum coincides with the line at the same time as the maximum reflectivities occur (0040 - 0050Z) A bow echo is again seen (Fig. a,b).

Later time frames show the jet maximum continuing to move in a northeastward direction behind a gust front (Fig. 12d). The gust front is seen as an expanding arc of high away velocities to the northeast of the radar site. The highest reflectivities are also along the front.

8 MESO-CYCLONE ALGORITHM AND RESULTS

The meso-cyclone algorithm implemented on the King radar system looks for any area with high radial velocity shear in the azimuthal direction. Such a feature is consistent with a rotating column of air and precipitation and may indicate the presence of a meso-cyclone. The classical life cycle of a meso-cyclone begins at mid-level in the atmosphere and generally precedes the appearance on the ground of a tornado. As a result, the algorithm examines all three Doppler radar scans in order to identify a descending and/or ascending meso-cyclone. In this case the algorithm first detected a very strong feature at all levels at 0040Z, thereby providing no prior warning of a tornado touch down.

Maximum shear values and the size and position of the features seen by the meso-cyclone algorithm are plotted in Fig. 13 and 14. The maximum shear increased to 0110Z, well after the strongest updraft had peaked. The very large error bars at 0040Z correspond to a feature 30 to 45 km in

diameter. This is undoubtably the large scale shear produced by the approaching jet maximum. It is interesting to observe that the meso-cyclone detected at subsequent times is located on the left flank of the 0040Z feature or jet maximum, in the area of cyclonic shear. The jet not only contributed lift to the warm air in front of it but also provided cyclonic shear to initiate the meso-cyclone.

9 CONCLUSIONS

This report describes features seen in the conventional and Doppler radar data which may indicate increased potential for severe weather from thunderstorms.

The conventional radar showed a bow echo developping 20 to 30 minutes prior to the severe phase of the Shelburne cell. The radial velocity data from the Doppler radar showed a meso-scale descending jet undercutting the convection during the most severe phase. The Shelburne cell developped on the left flank of the jet in an area of cyclonic vorticity due