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THE NUMURKAH TORNADO OF AUGUST 1964

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ABSTRACT

Numurkah was struck by a tornado on 10 August 1964. It left in its wake a narrow trail of damage extending over a distance of about seven miles. An on-the-spot investigation was conducted. Skip distances in which there was little or no damage were evident along its path. Interviews with local inhabitants provided information on the meteorological aspects of the tornado. The synoptic situation is discussed.

1. INTRODUCTION

At Numurkah, leap years appear to have more than a romantic significance, as in the past two leap years, as well as 1964, Numurkah has been devastated by tornadoes. This is a high frequency for a phenomenon which over the north and northwest of Victoria is a rare occurrence. (Clarke (1962) stated that in these areas, for the 38 year period between 1920 and 1957, there were approximately three tornadoes reported for every 10,000 square miles.)

Numurkah, which is located in northern Victoria on Broken Creek at approximately 36°N, 145° 30′E, was hit by the tornado in the late afternoon of 10 August 1964. Four days later I arrived in Numurkah to investigate its meteorological aspects. Local Government Authorities, the public and a reporter of the 'Leader' newspaper proved very helpful and cooperative in providing information about the storm. Major structural damage was still evident, although workmen were fast returning the town to its usual well-kept appearance. This evidence is supported by photographs taken immediately after the tornado, and interviews with numerous people helped to establish its pattern of behaviour.

2. STORM HISTORY

At Numurkah on 10 August 1964, the morning and early afternoon were cold and showery but the mid-afternoon was mainly fine and sunny. A large black cloud built up in the late afternoon southwest of the town. It exhibited the usual characteristics of a severe thunderstorm with big development, thunder and lightning. From heavy mamatus cloud at the base, a funnel, which was first observed about one mile to the west of the town, extended downwards. This funnel was described as being "V" shaped.

The storm and tornado moved eastwards and the funnel of the tornado first reached the ground, unroofing houses and blowing down trees and fences, at the western end of Swallow Street (see Fig. 1). It continued in a general easterly direction up Swallow Street, through the town, crossed the eastern boundary of the shire and disappeared about four miles further east. Thus the funnel below the cloud was evident for a distance of about 11 miles, for 7 of which it was in contact with the ground.

There was a short, light hail shower about two to three minutes prior to the tornado and a small amount of rain immediately after its passage. However, to the south of the tornado track there were heavy hail showers.

At Sloley's Bridge, about half a mile south of the area where the tornado tail was first observed, hail as big as pigeon eggs was reported. Also very heavy hail fell at the hospital, which is approximately one and a half miles to the east of Sloley's Bridge, and to the south of the tornado track. The tornado was located in the left front of the thunderstorm.

Almost all people were unanimous that immediately before the tornado struck there was a sheet of lightning, then a roar like continuous thunder or an approaching express train, and immediately following the tornado, an unearthly silence and no wind. On crossing Broken Creek, water was sucked up to form a water-spout which was clearly visible to observers a quarter of a mile away.

The wind damage varied considerably along the path of the tornado which was approximately 200 to 300 feet in width (for tornado path and directions in which debris were blown see Fig. 1). A description of the damage is in Appendix 1. The lay of the damage enabled the determination of the likely wind flow which was mostly in the direction of movement of the tornado, but there were occasions when there was evidence of winds blowing in towards as well as out from the tornado path, suggesting that strong rotation of winds was taking place in the funnel. This is supported by eye-witness accounts of galvanised iron roofing sheets seen spinning in the funnel, some 200 to 300 feet above the ground, like pieces of paper in a whirlwind. The strength of the winds in both the vertical and horizontal can be gauged from the following:-

a garage roof carried above telegraph wires; a flat roof from a house lifted upwards and deposited two houses further away; a peppercorn tree about 50 feet high and five and a half feet across its main trunk was uprooted; houses had their walls blown out at the base; a rack containing a ton of steel was shifted three feet to hit a lathe.

The height above the ground at which severe structural damage occurred varied considerably along the tornado path. Skip areas were evident between the areas of heavy destruction. Fig. 2 shows a graph of the lowest height at which there was severe structural damage along the tornado path through Numurkah.

3. METEOROLOGICAL SITUATION

At 9 a.m. on 10 August 1964 a front on the surface was positioned off the west coast of Victoria (see Fig. 3, showing the front over western Victoria at 3 p.m.).

All synoptic charts at 9 a.m. 10 August 1964 from the surface to 200 mb were very similar, with a deep low pressure in the south Tasman Sea and a west-southwest stream over Victoria.

The upper winds increased with height, from about 35 to 40 knots at 850 mb, to 60 to 80 knots at 300 mb (see Figs. 4 and 5 for 850 mb and 300 mb charts respectively).

The isotherm charts at 700, 500 and 300 mb, all showed an upper cold trough associated with the front. The cold trough was most sharply marked at the 700 mb level, with a cut-off cold pool about the intersection of the New South Wales, Victorian and South Australian borders (see Fig. 6). An upper warm ridge to the east of the cold pool was over western Victoria where the atmosphere was relatively stable. Laverton's and Mt. Gambier's radiosonde soundings are presented in Fig. 7. The Mt. Gambier soundings showed neutral convective instability to 770 mb, convective instability (i.e. a decrease of potential pseudo wet bulb temperature with height) from 770 to 620 mb and convective stability above 620 mb, whereas over Laverton it was convectively stable to 780 mb and from 780 mb to 500 mb was of neutral convective stability. The Showalter Index of approximately $+2^{\circ}C$ at both Laverton and Mt. Gambier reflects the relative stability of the atmosphere over Victoria. Petterssen (1956) suggests that tornadoes are likely when the index is less than $-6^{\circ}C$.

The upper cold pool was advected eastwards to central north Victoria, and in conjunction with the rise of surface temperature to the high fifties, due to a few hours of sunshine in the afternoon, the air mass became strongly convectively unstable (Numurkah had a maximum temperature of $59^{\circ}F$).

In these conditions, the uplift provided by the arrival of the cold front at Numurkah in the late afternoon triggered off the sequence of events leading to the tornado.

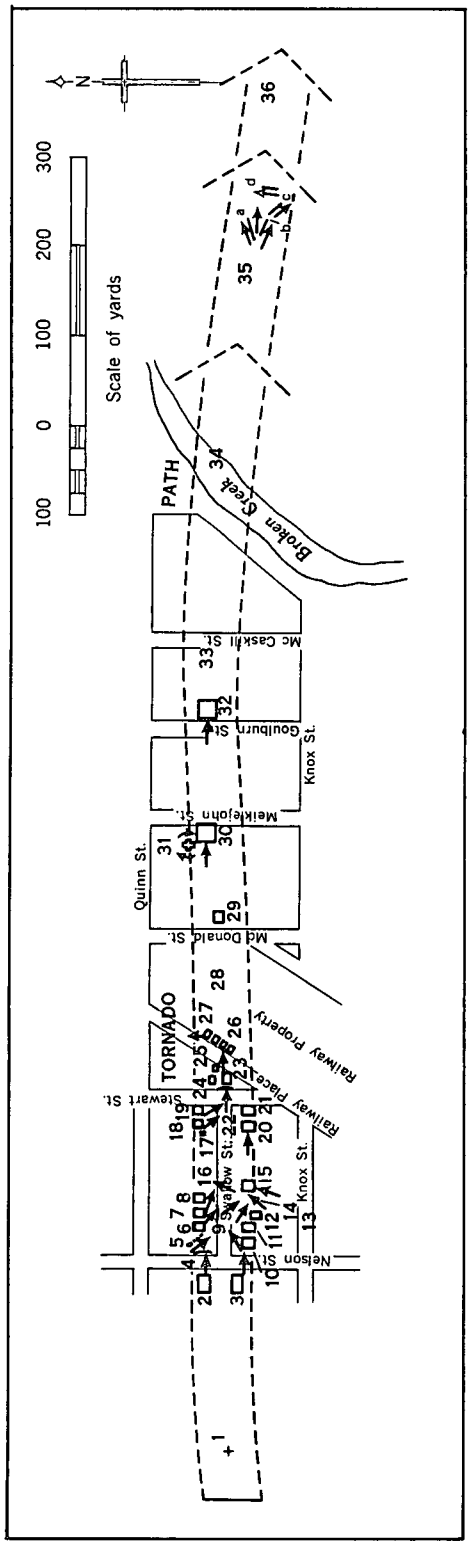

Fig. 1 Map of tornado path through Numurkah. Arrows indicate the direction of debris. (For description of damage at numbered locations see Appendix I)

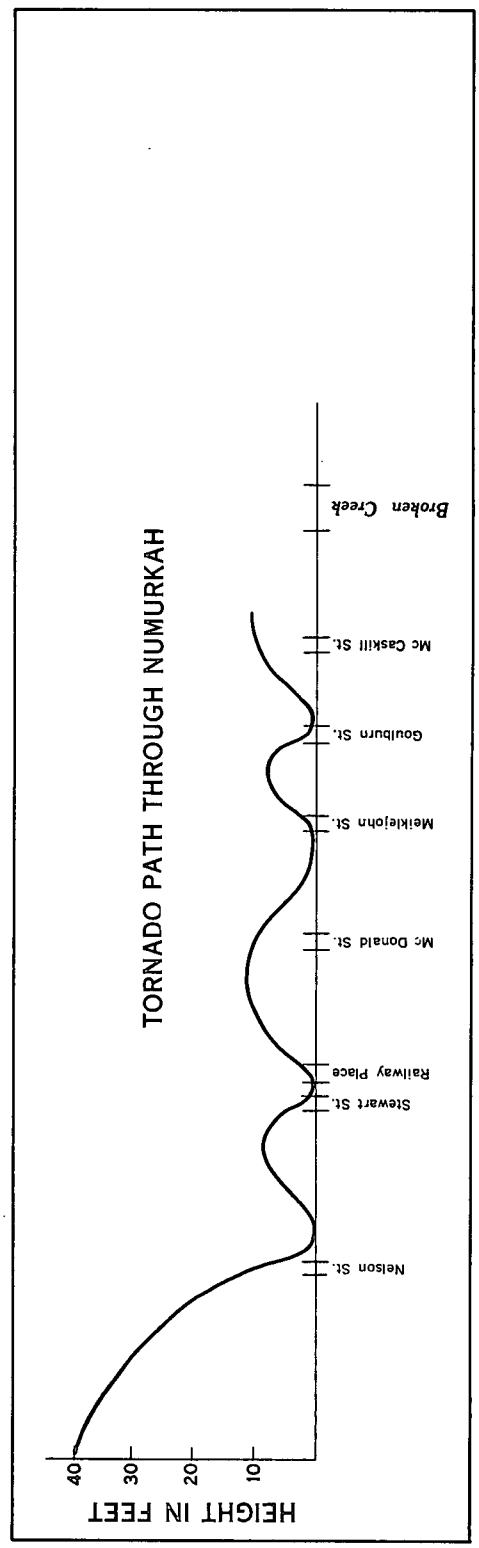

Fig. 2 Estimated lowest height at which severe structural damage occurred along the path of tornado through Numurkah.

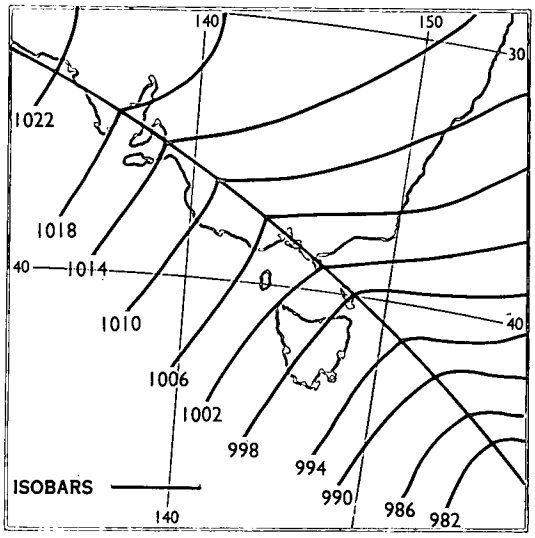

Fig. 3 Mean Sea Level analysis 3 p.m. 10 August 1964.

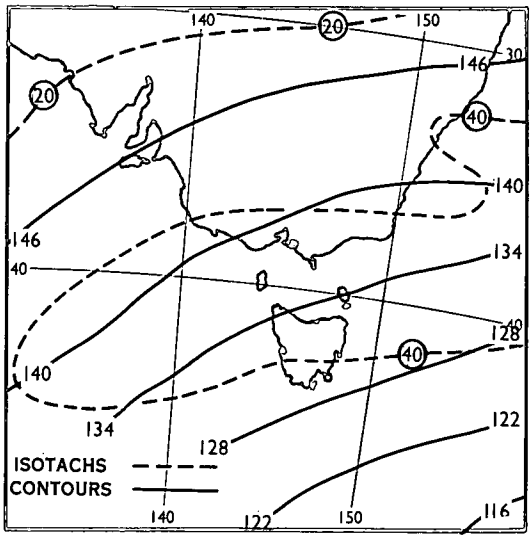

Fig. 4 850 mb analysis 9 a.m. 10 August 1964.

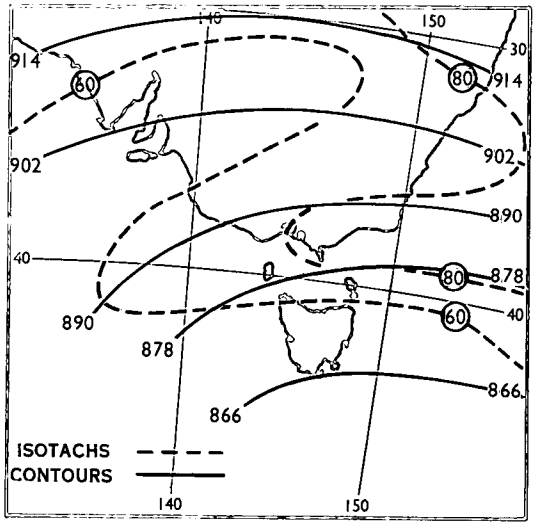

Fig. 5 300 mb analysis 9 a.m. 10 August 1964.

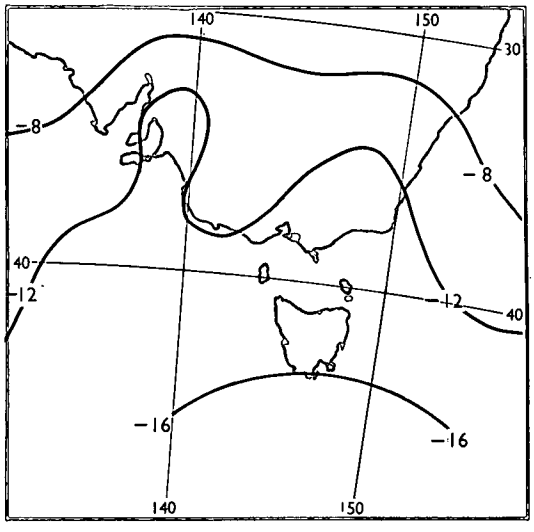

Fig. 6 700 mb Isotherm analysis 9 a.m. 10 August 1964.

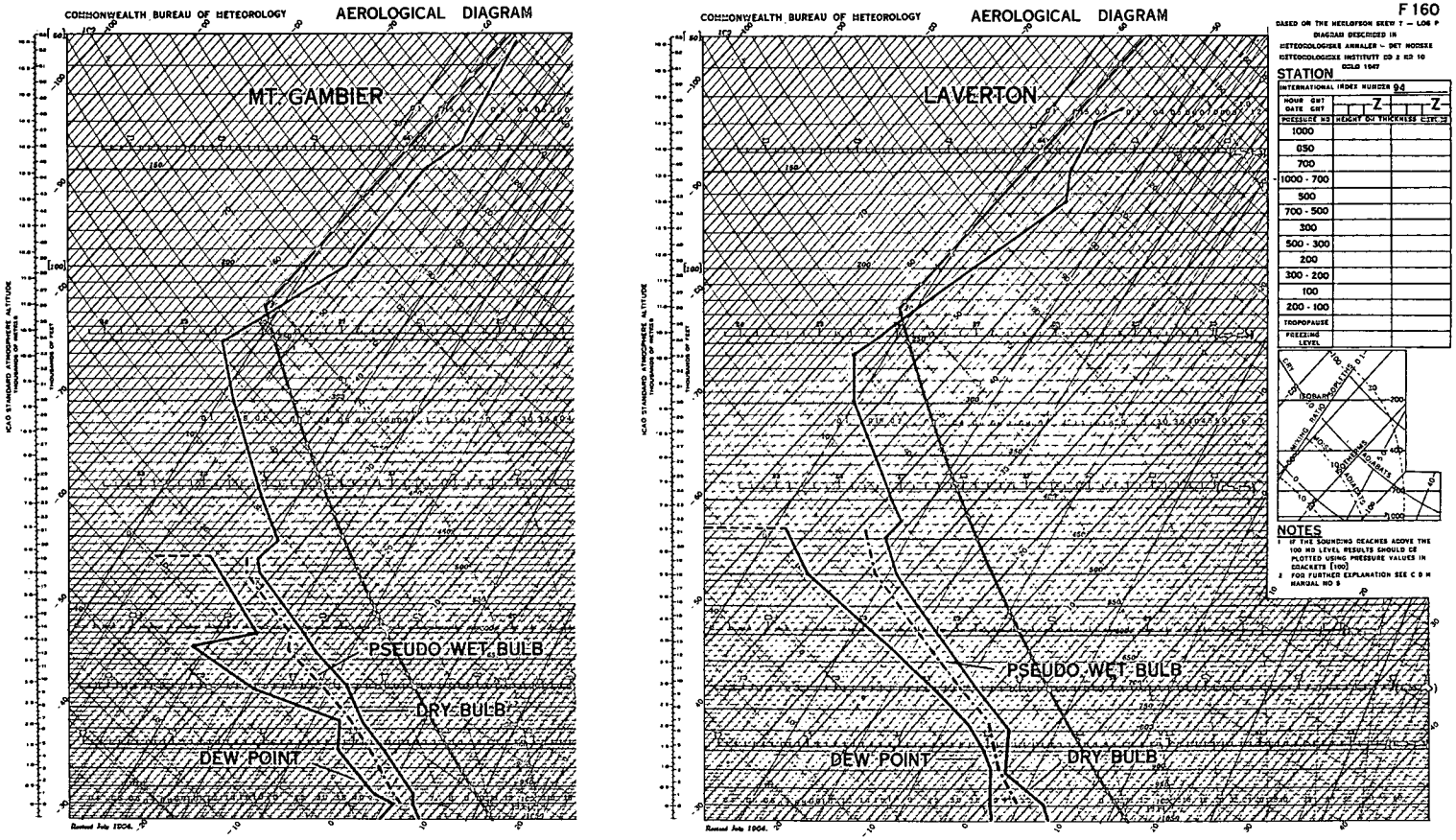

Fig. 7 Aerological soundings for Mt. Gambier and Laverton at 0900 hr 10 August 1964.

4. CONCLUSION

The tornado was positioned at the left front of a large cumulonimbus cloud, in which there were very strong vertical currents capable of supporting very large hail stones. Hail stones as big as pigeon eggs were reported at Sloley's Bridge. Although houses were unroofed and large trees blown down, the extent of the damage varied considerably along the tornado path. The lowest height at which severe structural damage was observed ranged from ground level to about 40 feet above the ground.

This tornado was associated with firstly an increase in convective instability over Numurkah resulting from the arrival of the cold upper air from the west in conjunction with the heating of the lower levels of the atmosphere (due to a few hours of sunshine in the afternoon), and secondly the promotion of absolute instability by the uplift provided by the subsequent arrival of the cold front.

ACKNOWLEDGMENTS

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REFERENCES

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Petterssen, S. 1956 Weather Analysis and Forecasting, Vol. II pp. 148 and 173

APPENDIX 1

Position No. in Fig. 1	Damage
1	Tall tree stripped of upper branches at a height of about 40 feet above the ground.
2	House, garden and fence undamaged - only effect of storm was to blow off a wind guard on top of chimney at height of about 20 feet.
3	Petrol bowsers slightly damaged.
4	Barbed wire fence blown down.
5	A tree about 4 feet in diameter which was leaning to the north was blown down in a SE direction.
6 to 8	A flat roofed house had its roof lifted vertically off; the two chimneys through the roof were unaffected. This roof smashed the chimney on the front of the house 7 and finally crashed into house 8. Both houses 7 and 8 received wind damage to their roofs in the front.
9	The strong picket fence of house 7 was blown outwards towards the road.
10	House unroofed and badly damaged and leaning in the direction taken by the tornado. Also its fence on the east side, i.e. along Nelson Street, blown inwards.
11	Front half of house unroofed. Tin from the hip roof flew over house 12, hit ground in open allotment at 13 and still with battens attached finished against hedge 14 at the side of house 15. Iron from roof of house 11 was also detected embedded in trees on open allotment at 16 opposite house 15.
12	This house was very old and in a poor state of repair but received no damage as it was set back about 30 feet further from the road than the neighbouring houses. Damage was much less about the middle of Swallow Street and an old barn (17) was undamaged.
15	House received very strong winds blowing towards the front of the house. Fig. 8 shows house 15, next to vacant allotment, with trees at side of house leaning towards street whereas fence of vacant allotment is blown inwards, and iron wrapped around telegraph pole indicates a strong wind blowing off the road.
18	Other than damage to top of wall near front of houses, the TV aerial was sloping to front and in direction of tornado.
19	Tiled roof lifted, front fence bowed out towards the road.
20	House had its wall on the leeward side blown out about a foot at the bottom, suggesting that the house exploded.
21	Front of house unroofed.

Position No. in Fig. 1	Damage
22	Tin fence blown inwards.
23	House very severely hit and completely unroofed (see Fig. 9). Lady of the house reported that before the roof was lifted off, the carpets and linoleum rose several feet off the floor. A 4 in. by 2 in. batten of hardwood, with galvanised iron attached, was speared into the top of the back wall of wire netting and concrete which faces to the north. (See hole above back door in Fig. 9). The rotary hoist is leaning to the west and the tree on the right to the east. Thus the wind blew from north, west and east, suggesting a vortical circulation of very small dimensions.
25	A garage was located here. Eye witness described that the garage roof was lifted over the telegraph wires in Railway Place.
26	Three railway houses of breeze brick, all of which lost their roofs. However, their front fences and the trees on the footpath were undamaged, suggesting that the tornado was most destructive some 10 feet or more above the ground.
27	Some roofing material removed and the top of the gable on the south was pushed towards the north.
28	In railway station ground no damage was evident and further along the tornado's path, in McDonald Street, damage was relatively minor.
29	Lost part of roof.
30	Powells' engineering store, a large tin shed 66 ft by 72 ft well constructed with 3 in. iron pipes for uprights, was severely damaged. At the back of the store, which was directly in the path of the tornado, these pipes were bent inwards whereas at the front of the store two blocks of cement of 28 in. x 28 in. x 36 in., which were buried in the ground and in which the iron pipes were embedded, were lifted out of the ground.
31	A roof of a well-built brick garage was lifted off and dropped at right angles to its original position which was in the direction of the tornado path. This suggests that the wind was strongly rotating.
32	A girl was blown through the window of Bitcon's store and a small detachedbuilding at the back of Telegraph Hotel was torn apart.
33	Very little evidence of damage here.
34	The tornado sucked up water from Broken Creek to form a water spout.
35	At this position about three miles to the east of Numurkah, (a) A peppercorn tree, $5\frac{1}{2}$ feet in diameter near the base of the main trunk and about 50 feet high, was blown out of the ground;

Position No. in Fig. 1	Damage
	(b) Another similar peppercorn tree was blown over;
	(c) About 100 feet from (a), a pine tree about 50 feet in height was snapped off and pointed outwards from the tornado path;
	(d) About 160 feet from (c) large branches from a tree were torn off and blown inwards towards the tornado path.
36	A 60 foot tree on the boundary of the shire of Numurkah, had big branches near the top snapped off, whereas sheets of galvanized iron which were nailed loosely to a fence below the tree were unaffected, indicating that the strong wind did not penetrate below the crown of the tree.
	This was the last evident damage of the tornado.