551.515.3 (94-12)

THE TORNADO AT TARNAGULLA, VICTORIA - SEPTEMBER, 1964

by D.J. Linforth

Regional Office, Bureau of Meteorology, Melbourne

(Manuscript received February 1965)

ABSTRACT

A description is given of a tornado which occurred in the Tarnagulla-Laanecoorie area, 100 miles north of Melbourne, on 27th September 1964. This was compiled from eyewitness accounts and inspection of damage carried out two days later. The synoptic situation and stability of the atmosphere on the day of occurrence are discussed, in particular the modification which may take place in air mass structure during the six hours after a radiosonde ascent.

1. INTRODUCTION

On the afternoon of Sunday, 27th September 1964, a tornado struck the Tarnagulla-Laanecoorie area of northern Victoria and the damage was inspected two days later, on Tuesday, 29th September. The area lies just north of the Dividing Ranges, the country round Tarnagulla being undulating and varying in elevation from 600 to 800 feet. Towards Laanecoorie, on the Loddon River, the country becomes flat at an elevation of 500 feet. The tornado's path lay through open country, and damage was caused to only two houses and to many trees in such areas as were forested. The number of eyewitnesses was also quite small, and so the descriptive account must necessarily be limited.

2. CHARACTERISTICS AND PATH OF TORNADO

(a) Damage

The first evidence of damage was found at point A on the map (Fig. 1) where the trees along the creek bed were stripped, the width of the tornado's path being about 20 yards. From here it travelled across open country, through a copse of trees at B, then down a gentle slope, across the Tarnagulla-Moliagul road, to the house at C.

This house was badly damaged, being completely unroofed, the front wall pushed inwards, while a brick garage was demolished with the bricks flung outwards. Roofing iron was scattered for over 400 yards along the path of the tornado.

The tornado then travelled throughout timbered country, passing about half a mile south of Tarnagulla township. Figure 2 shows the path of the tornado in this area, where 90 per cent of the trees were felled forward and to the left of the tornado's path.

Moving through forested country for some two or three miles, it approached the township of Laanecoorie, passing it to the north. Damage was caused to the house at point D on the map, where the eastern side was unroofed and the northern wall was pushed out at the bottom. A window on the southern side was blown inwards, showering the kitchen with glass, while a kettle lid went up the chimney, to be found later in the garden. The owner of the house, who stayed in it during the tornado's passage, described how a water tank, lying on its side, was slowly moved, without rolling, to become wedged under a tankstand. A small piece of roofing iron found embedded in a fence post (Fig. 3), gives some indication of the strength of the wind.

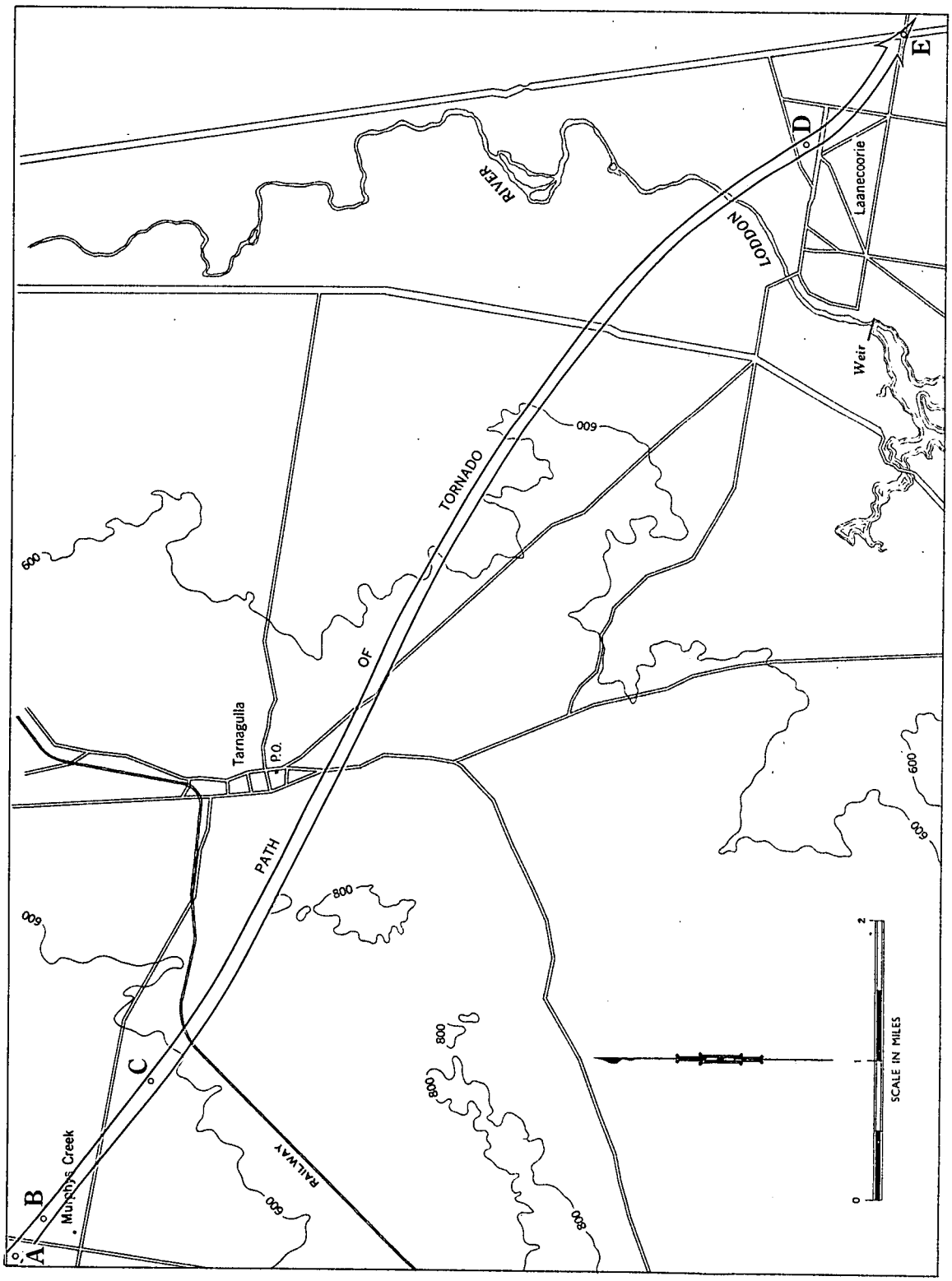

Fig.1 Map showing path of Tornado from Murphys Creek to Laanecoorie

Fig 2. Shows path of Tornado

Fig 3. Shows piece of roofing iron embedded in fence post

The last trace of the tornado was found at the cross-roads (E), where a tree was stripped of some of its branches.

(b) Appearance

Eyewitnesses described dark clouds beforehand, though not extraordinarily dark. The dark funnel cloud was seen, with the whirling debris near the ground, and a couple saw a white streak associated with it.

(c) Rain

Very heavy rain fell during and following the passage of the tornado, lasting five or six minutes at a point on the road near the house at C. Registrations in private gauges showed 0.8 inches within a few chains of the path, to 0.1 inches about a mile and a half away, to 0.01 inches three miles away. At Tarnagulla Post Office, about half a mile from the tornado's path, 0.29 inches was recorded in the Bureau's gauge, and at Laanecoorie Weir 0.46 inches.

(d) Hail

No hail whatsoever was seen.

(e) Thunder and Lightning

Most observers reported thunder and lightning preceding the tornado, but which seemed to have ceased before the tornado struck. Some observed neither phenomenon.

(f) Sound

Again, observers within 500 yards of the path heard no noticeable noise, though this could have been drowned by the heavy rain. Others heard a roar ahead of its approach.

(g) Speed of Translation

The time of occurrence could not be fixed precisely, but estimates centred fairly closely on 4.15 p.m. for the Murphy's Creek area, and about 4.45 p.m. for Laanecoorie. Being a distance of eight miles this would give a speed of sixteen miles per hour.

3. THE TORNADO IN RELATION TO THE THUNDERSTORM

Figure 4 shows the pattern of 24-hour rainfall. ended 9 a.m. on 28th, in the surrounding district, most of which fell during thunderstorms on the afternoon of the 27th. Heavy rain and distant thunder occurred at Moliagul (10 miles west of Tarnagulla) about 2 p.m., but by the time of occurrence of the tornado the thunderstorm activity was concentrated in the Castlemaine-Kyneton area, where intense rainfall flooded streets between 4.00 and 4.30 p.m. Eyewitnesses consistently stated that the thunder and lightning had passed before the time of the tornado and thus it seems that the tornado occurred on the northwestern side of the thunderstorm.

4. THE SYNOPTIC SITUATION

A well-formed depression moved from a position some 300 miles west of Adelaide to another position 250 miles west of Tasmania during the 27th and an associated cold front crossed Central Victoria during the afternoon.

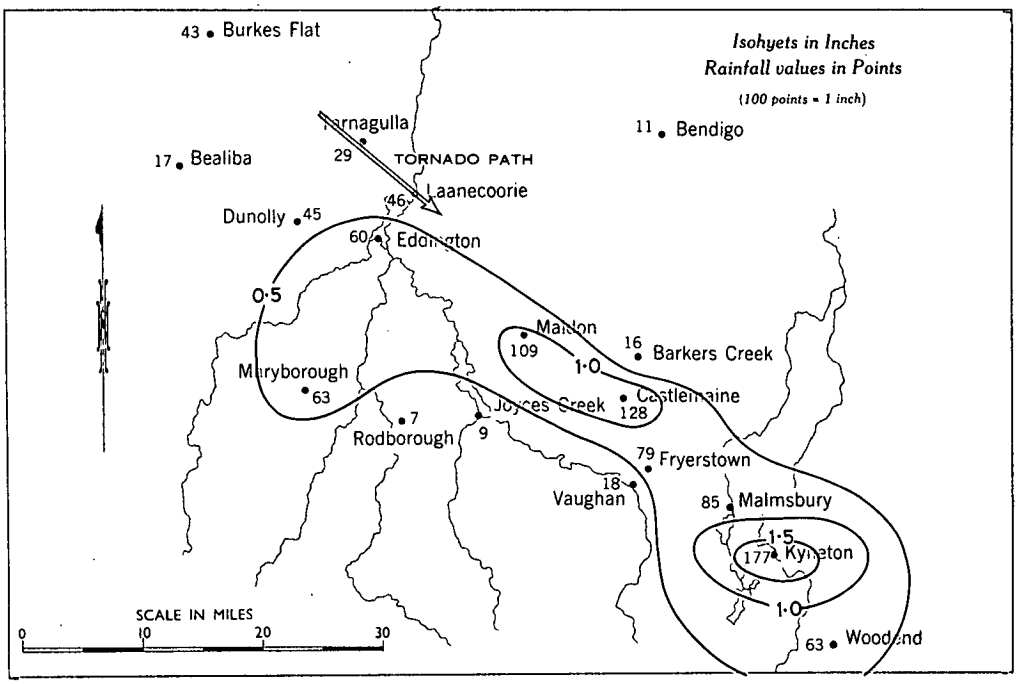

Fig.4 Isohyets of 24-hour rainfall to 0900 EST, 28 September, 1964.

The radiosonde at Laverton at 9 a.m. on the 27th (Fig. 5) indicates a deep, very moist layer to 600 mb and the air does not become dry till 300 mb. The static Showalter Index is +4. However, the sounding is too stable for convection to occur by surface heating to 16°C (61°F, the temperature reached at Bendigo); and the potential pseudo wet bulb temperature increases with height, indicating lack of convective instability, and convective clouds would not be expected even with frontal lifting. In contrast to conditions prior to Western Australia tornadoes described by Southern (1960), the upper air temperatures were higher than the normals of Phillpot and Reid (1953).

The radiosonde ascent at Mt. Gambier at 9 a.m. on the 27th (Fig. 6) shows somewhat different characteristics from that at Laverton. The lower atmosphere is again very moist, drying slowly up to 400 mb. Surface heating to only 17 degrees C would be sufficient to start convective activity, while the potential pseudo wet-bulb temperature decreases slowly with height to 700 mb, indicating convective instability in this layer.

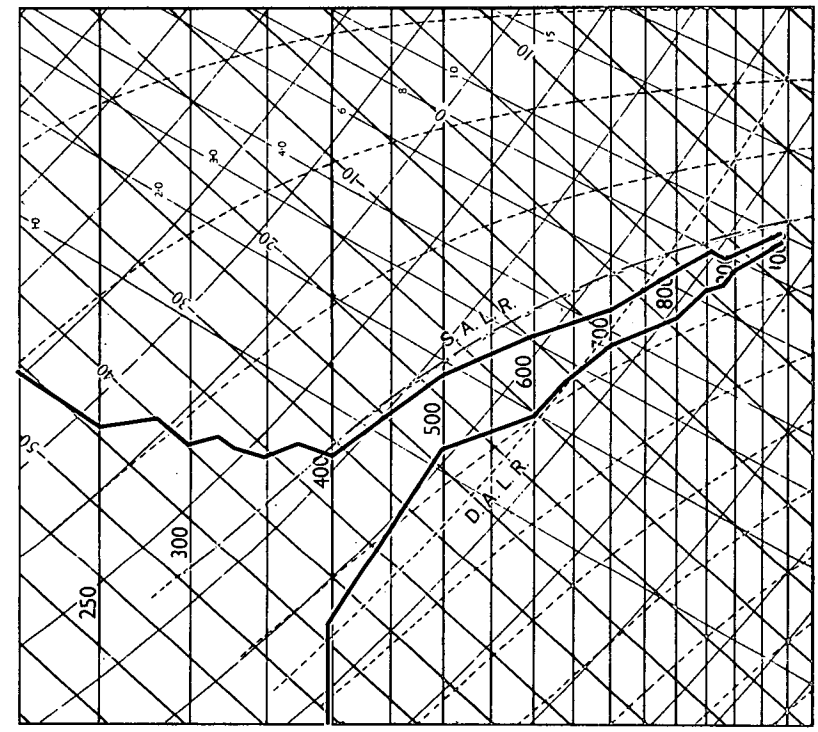

Fig.6 Mt.Gambier aerological sounding for 0900EST, 27 September, 1964.

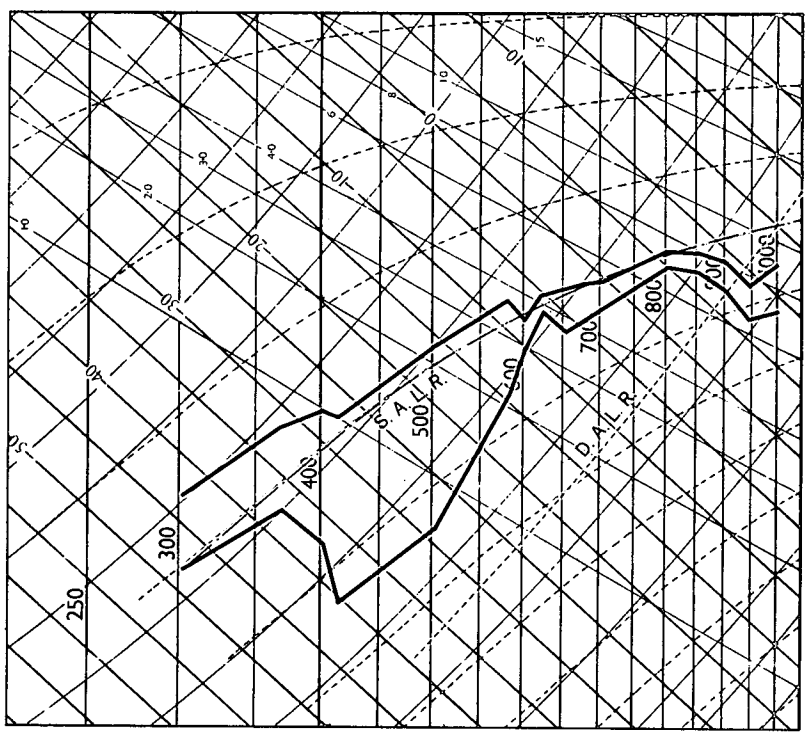

Fig.5 Laverton aerological sounding for 0900EST, 27 September, 1964.

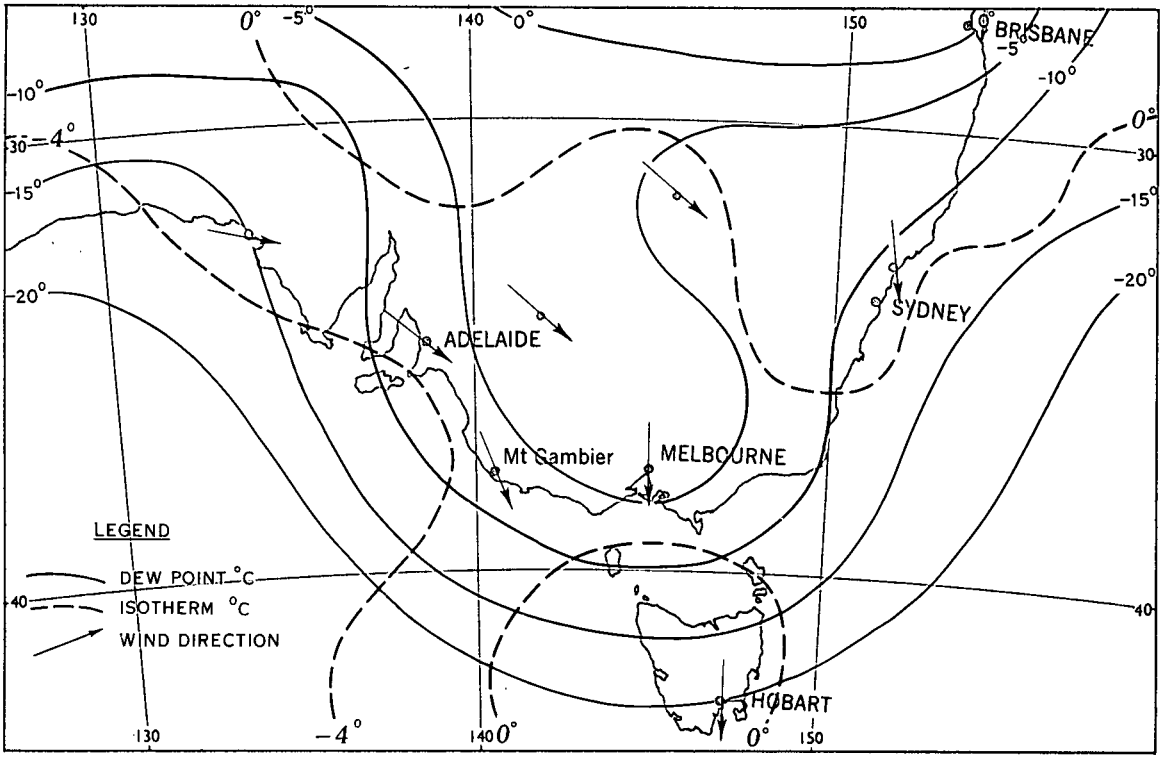

Fig. 7 Isotherm-Isohume Chart, 700mb; 0900EST, 27 September, 1964.

A study of the charts at 700 mb and 500 mb at 9 a.m. on the 27th shows the way in which the air mass described by the Laverton ascent was modified. Fig. 7 shows the temperature and moisture pattern at 700 mb, from which can be seen the advection of moist air over Victoria. The northerly wind was stronger at lower levels, being 60 knots at 850 mb at Laverton. The isotherm pattern at 700 mb, however, shows the warmest air at Hobart, and the air advected over Victoria would be slightly colder.

At 500 mb there was little advection of cold air, but at 300 mb a westerly jet maximum had been steadily advancing towards northwestern Victoria since the morning of Saturday, 26th, and at 9 a.m. on the 27th the wind speed at Mildura had reached 130 knots at this level.

These conditions are those described by Petterssen (1956) in which a high level jet with advection of dry cold air becomes superimposed on a strong low-level advection of moist air, and it was on this basis that a forecast of local severe squalls had been included in the Victorian forecast issued at 11.15 a.m. on the 26th and repeated till 11.15 a.m. on the 27th, and was particularly included in the forecasts for Mallee, Wimmera and Northern Victoria.

Thus the air mass over North Central Victoria became modified to provide a great amount of convective instability, which was realized by the arrival of the cold front.

5. CONCLUSION

This tornado shows the importance of considering not only an aerological sounding at a given time, but also the ways in which the air mass may become modified over the succeeding six to twelve hours. In this case, the air mass at Laverton, though moist, was stable. However, a hundred miles to the north, seven hours later, differential thermal advection had produced sufficient convective instability, which when realized by frontal lifting caused a weather phenomenon long to be remembered by residents of Murphy's Creek and Laanecoorie.

ACKNOWLEDGEMENTS

The co-operation and assistance of the people of Murphy's Creek, Tarnagulla and Laanecoorie are gratefully acknowledged. The author is also indebted to Mr. A.K. Hannay, Regional Director, Victoria Regional Office, Bureau of Meteorology, for helpful suggestions and general oversight of the manuscript.

REFERENCES

Petterssen, S. 1956 Weather Analysis and Forecasting, Vol. II, McGraw-Hill p. 187.

Phillpot, H.R. and Reid, D.G. 1953 Bulletin No. 42, Bureau of Met.

Southern, R.L. 1960 Aust. Met. Mag. No. 29, June 1960, p. 63.