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U.S. DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration National Weather Service

A Thunderstorm "Warm Wake" at Midland, Texas

RICHARD A. WOOD

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A THUNDERSTORM "WARM WAKE" AT MIDLAND, TEXAS

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EDITOR'S NOTE

In view of the recent occurrence of a thunderstorm wake at Bakersfield, California, described in Western Region Technical Attachment No. 73-29, July 26, 1973, this well-documented case study by Mr. Wood should be of interest to Western Region forecasters, even though the phenomenon took place in Midland, Texas, ten years ago.

A THUNDERSTORM "WARM WAKE" AT MIDLAND, TEXAS

Abstract

A thunderstorm at Midland, Texas, produced a surface temperature rise of about 12°F. on May 25, 1963. This condition has been referred to as a "warm wake". The synoptic events of the period are presented and discussed.

I. INTRODUCTION

During the early morning hours of May 25, 1963, a thunderstorm at Midland, Texas, produced an unusual surface temperature rise of approximately 12°F. (Figure 1). This condition has been referred to as a "warm wake" [1].

The events which occurred in 0045 to 0645 CST, May 25, 1963, are listed in chronological order in Table I. The barogram trace (Figure 2) shows that a fall in pressure occurred at the time the maximum temperature was reached between 0505 and 0523 CST.



Figure I. "Warm Wake" (Arrow) May 25, 1963, at Midland, Texas.

HOUR (CST)	WEATHER CONDITION	TEMPERATURE* (°F.)	DEW POINT (°F.)	RELATIVE HUMIDITY PERCENT	WIND (KNOTS)	WEATHER
0045	Increasing middle and high cloudiness about 13,000 ft.	69	64	84	S 9	- <u>-</u>
0145	Occasional lightning west. Thunderstorm reported at Wink, Texas. (About 50 miles west of Midland with a temperature drop of 7°.)	70	64	82	SSW 12	
0245	Frequent lightning in cloud, and cloud to ground, southwest to west of Midland	71	60	70	WSW 13	
0345	Frequent lightning southwest to north- west as thunderstorms approach Midland. Gusty winds.	72	55	55	WSW 20 with gusts to 28	Very light rain shower
	Thunder begins with light rain and continued gusty westerly winds.					Thunder, light rain shower
0445	Thunderstorm continues with light rain. A trace of rain recorded at Midland, heavier amounts just west of the sta- tion. Thunder ends and maximum tempera- ture is recorded during 0505-0523 period. (81.5°)	77	47	35	SSW 12	Thunder ended Light rain shower ended
0545	Clearing skies and dropping tempera- tures, reaching 68°. Gusty winds for a brief period around 0555.	72	51	47	WSW 15 with gusts to 21	
0645	Scattered to broken cloudiness above four thousand feet. (Mostly cirrus.)	72	[^] 55	55	SW 12	

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TABLE I. EVENTS ASSOCIATED WITH THE "WARM WAKE" OF MAY 25, 1963.

*From Thermogram.

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Figure 2. Barogram, Midland, Texas, 1150 CST, May 24 to 1148 CST May 25, 1963, Showing Pressure of 27.060 to 27.030 (Arrow) during Thunderstorm and "Warm Wake".

II. DISCUSSION

Midland had been under the influence of an unseasonably cool air mass for three days prior to the thunderstorm (Figures 3 and 4). The maximum surface temperature was 59°F. on the 22nd, 66° 23rd, and 80° on the 24th. Normal high temperature for Midland for this period is 88°. The maximum surface temperature on May 25th was 95° which was 15° warmer than on the previous day. The dew point was about 20° to 25° lower on the 25th than on the 24th. Moist southerly winds occurred on the 24th, while dry southwesterly winds occurred on the 25th. Weak frontal action also may have taken place.

The upper-air sounding during the period of the "warm wake" (Figure 5) reveals nearly identical surface temperatures at 0500 CST, May 25 and at the previous upper-air sounding, 1700 CST, May 24. In

comparison, the 0500 CST sounding was warmer between the surface and about 770 mb but was colder from 770 to about 340 mb. It appears that this temperature change may have been caused by compressional heating of air subsiding from near the 850-mb level (Figures 6 and 7). This would involve air descending about 2000 feet.



Figure 4. Surface Analysis, 0600 GMT, May 25, 1963.



Figure 5. Upper-Air Sounding for 0500 CST (1100 GMT) May 25, 1963, and 1700 CST (0000 GMT) May 25, 1963, for Midland, Texas.



Figure 7. 850-mb Analysis, 1200 GMT May 25, 1963.



Figure 6. 850-mb Analysis, 0000 GMT, May 25, 1963.

This may be significant when the density differences in the layer below 850 mb are considered. In addition, cold-air advection in the 700- 500-mb layer (Table 2) between 1700 CST of the 24th and 0500 CST of the 25th contributed to the development of the thunderstorm. Cooler air was noted at 700 mb (Figures 8 and 9) throughout extreme southwest Texas as well as New Mexico and Arizona.

Temperature rises just ahead of a thunderstorm are apparently not uncommon but the large rise of approximately 12°F occurred during the thunderstorm's dissipation, when light rain was falling and supposedly cool downdrafts were occurring. This "warm wake" was characterized by strong, gusty winds, ending of rainfall, dissipation of clouds, substantial rise in temperature, and fall in relative humidity.



Figure 8. 700-mb Analysis, 0000 GMT, May 25, 1963.



Figure 9. 700-mb Analysis, 1200 GMT, May 25, 1963.

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TABLE 2. 850-, 700-, and 500-mb Temperatures and Dew Points for Midland, El Paso, Del Rio, and Abilene, Texas, for 0500 and 1700 GMT, May 24 and 0500 CST, May 25.

			850 TEMP	MB D.P.	700 TEMP	MB D.P.	500 TEMP	MB D.P.
May 24, Midland El Paso Del Rio Abilene	1963,	0500 CST	4 7 5 4	2 3 2	10 8 10 10	-6 -10 0 -9	-9 -13 -10	-35 -23 -16
May 24, Midland El Paso Del Rio Abilene	1963,	1700 CST	20 25 19 17	 - 3 2	 0 9	-12 -4 -1 -2	-9 -12 -10	34 13 20
May 25, Midland El Paso Del Rio Abilene	1963,	0500 CST	23 21 18 18	-4 -2 15 15	8 8 9 10	-8 -5 1 5	-12 -12 -10 -11	-17 -14 -13 -18

Case studies by Williams [1,2] indicate that these factors are usually associated with "warm wakes".

III. REFERENCES

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