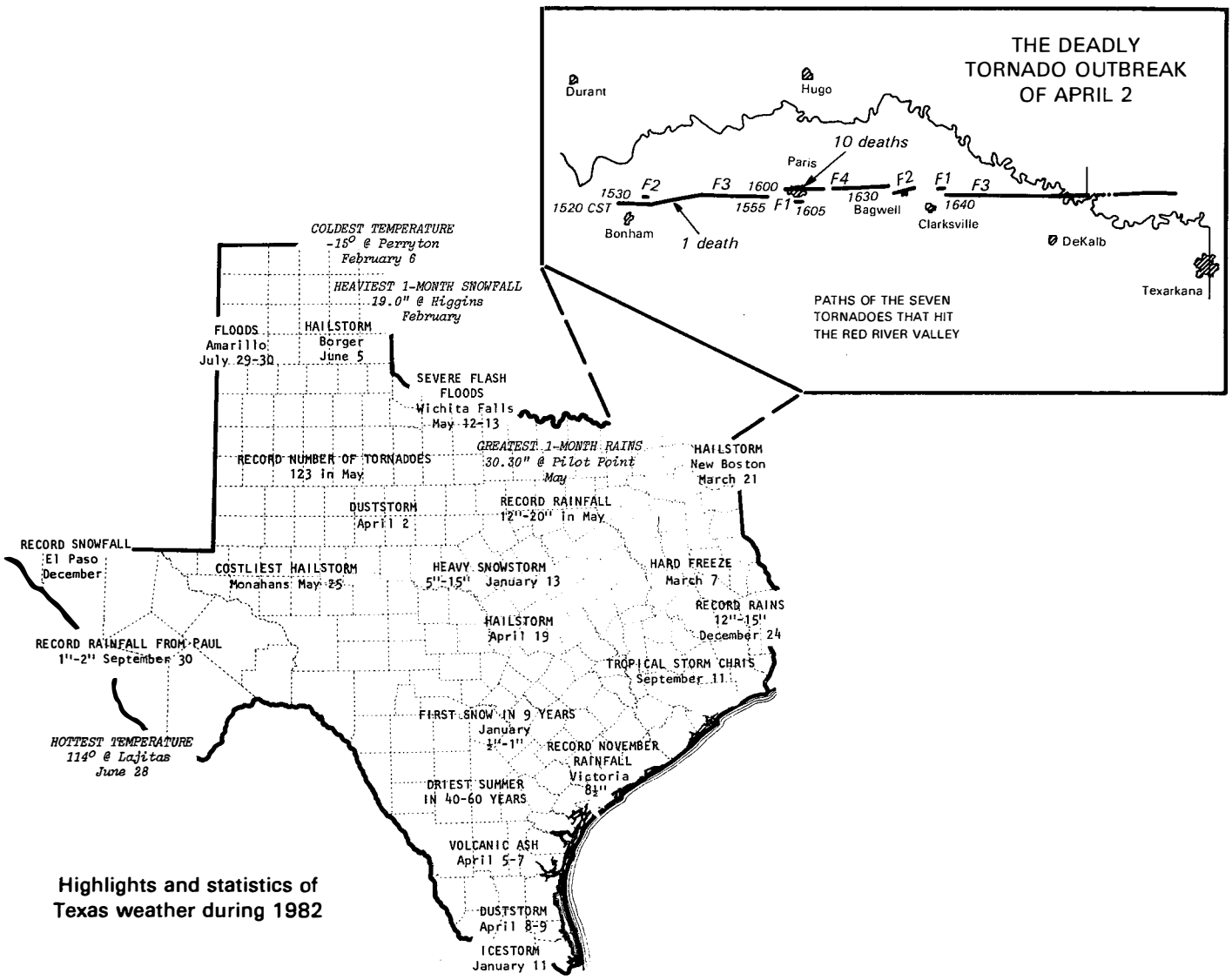
1982: WHEN A TORNADO HIT PARIS

A Review of Texas' Weather During the Year

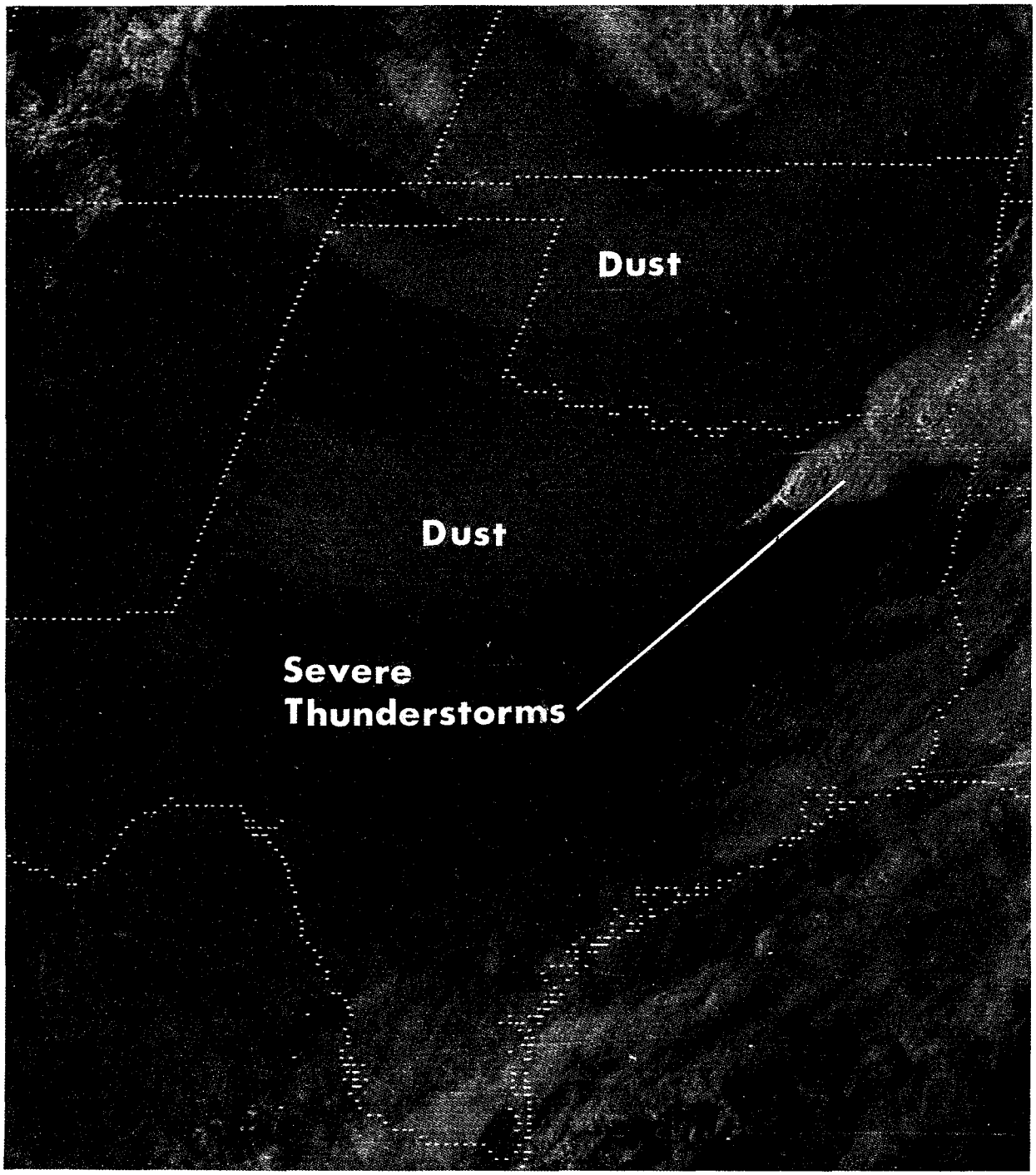


Highlights and statistics of Texas weather during 1982

LP-195

TEXAS DEPARTMENT OF WATER RESOURCES

DECEMBER 1983



With tons of dust swirling into Texas out of the central High Plains states, a line of severe thunderstorms erupted quickly on the afternoon of April 2; the intense cluster of storms shown by this satellite photograph at 5:02 p.m. CST had just spawned the catastrophic Paris tornado.

1982: WHEN A TORNADO HIT PARIS

A Review of Texas' Weather During the Year

by

George W. Bomar
Climatologist

LP-195

Texas Department of Water Resources

December 1983

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Published and distributed
by the
Texas Department of Water Resources
Post Office Box 13087
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PREFACE

Many reels of computer tape and volumes of published records containing meteorological data are made available to the public by the Federal government each year. Data are collected daily—and even hourly at some locales—from more than 600 observing points in Texas by the National Weather Service. Yet, it is often difficult to ascertain from these vast arrays of words and numbers precisely how the vagaries of the weather impacted the people and the economy of the State of Texas. This report is an attempt to categorize, describe, and evaluate the most significant weather developments of the year of 1982 and their impact upon various aspects of life in the Lone Star State.

This report depends largely upon meteorological data supplied by the National Oceanic and Atmospheric Administration (NOAA) of the U. S. Department of Commerce, as provided in the following publications: "Climatological Data: Texas," "Local Climatological Data (for selected cities)," "Storm Data," and "Daily Weather Maps." Some data were obtained from: weather teletype reports (circuits "A" and "C") by the National Weather Service surface and upper-air observing networks; surface and upper-air facsimile charts provided by the National Meteorological Center of NOAA; photographs supplied by NOAA's orbiting weather satellites; and various newspaper accounts.

Maps depicting precipitation data are based upon data from selected cooperative-observer sites in Texas; a list of these stations is given in the appendix. Maps depicting temperature data are based upon all available data from the National Weather Service's first, second, and third-order networks in Texas. Normal values of precipitation, temperature, snowfall, freeze days, and 100^{o}-days are based upon the author's analysis of observations for the period of 1951-1980.

Appreciation is given to the Weather and Climate Section of the Texas Department of Water Resources for helpful review and comment. The author is grateful to the Weather and Climate Section's Bill Hanshaw, who plotted all of the data for the author's analyses, and to Wanda Ferris, who typed the manuscript. Leroy Killough of the Department staff prepared the cover.

ABSTRACT

The most noteworthy aspects of the weather of Texas during 1982 are described, along with accounts of how those various elements impacted the people and the economy of the State. Weather phenomena such as tornadoes, hurricanes, torrential rains and flooding, drought, cold and heat waves, killing freezes, snowstorms, wind and duststorms are described with the help of pictoral, numeric, and graphical data.

The killer tornado that ravaged Paris and surrounding locales on April 2 stands as the most prominent single weather development of 1982. The lethal twister and several companion tornadoes struck the Red River valley in the midst of a particularly tumultuous spring; the family of seven tornadoes took 11 lives, harmed 173 other people, and cost over $500 million in property damage over a 4-county area of North Central and northern East Texas. The month of May supplied an astonishing 123 tornadoes—almost as many as Texas typically experiences in a whole year. Whereas the whole year furnished nearly double (203) the normal number of tornadoes, the number of fatalities in addition to the 11 deaths in Paris totalled only two. Massive thunderheads unleashed damaging hail on numerous occasions, with three hailstorms in particular more prominent than others; property damage of at least $5 million was wrought in each of the cities of Monahans, Borger, and New Boston by large hail. The State was spared from all but two huge duststorms that whipped across the Great Plains of the U. S. The vigorous storm that prompted the April 2 tornado outbreak in the Red River valley also instigated a choking duststorm reminiscient of the Dust Bowl era in the northern half of Texas.

Flooding problems were frequently encountered in Texas because of prodigious cloudbursts both in late spring and again intermittently during the summer and late autumn. Repeated rounds of spring thunderstorms triggered by slow-moving cool fronts dumped torrential rains more appropriately expressed in feet than inches. Much of the Red River valley and scattered areas throughout Texas collected record amounts of rainfall in May; several locales in North Central Texas were drenched with more rain in less than 30 days than often falls in a whole year. More wintry storms set off waves of thunderstorms along the Texas coast that unleashed record amounts of rain in November and December. Few cities suffered from flash flooding to the extent sustained by Wichita Falls in mid-May and Amarillo in late-July. Meaningful snowfall accumulations came to much of the southern half of Texas in January—the first such snow cover in nearly a decade. A prolific winter storm unloaded several feet of snow in a narrow band stretching across the center of the State, and a trio of storms in December buried Texas' western tip with record amounts of snow.

The year was not without its extended dry periods as well. Spring rains

suddenly gave way to a nearly cloudless summer in Texas' southern quarter, where many communities lived through the driest summer in weather history. Except in the portion of Texas within 100 miles or so of the Rio Grande, drought was rarely a concern. Even in the Trans Pecos, Edwards Plateau, Southern Texas, and the Lower Valley, the drought that prevailed in summer and early autumn was seldom worse than "moderate."

The least eventful hurricane season in about 50 years could muster only one tropical cyclone to affect Texas. Tropical Storm Chris entered the State at the mouth of the Sabine River in mid-September but barely generated enough rain to measure in Texas. The eastern North Pacific supplied Hurricane Paul, whose remnants survived a trek across the Mexican desert and triggered record rainfall at El Paso in late September.

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I. INTRODUCTION

A vast swarm of thick dust, whipped into a frenzy by an onrushing norther, agitated thousands of west Texans on a blustery afternoon early in April. Meanwhile residents in southern Texas curiously followed reports that a massive cloud of ash, the offspring of an eruption a fortnight ago of a long-dormant volcano in eastern Mexico, was drifting northward toward them. At the same time, the attention of people living in Texas' Red River valley on that fateful day of April 2 was riveted upon a rapidly-evolving outburst of very severe thunderstorms. As it turned out, the duster that abraded a large portion of Texas was only a short-lived annoyance, while the volcanic dust cloud merely aggravated some folks with respiratory problems and tainted freshly-washed automobiles. Every bit of anxiety summoned for the developing siege of violent weather in North Central Texas, however, was fully warranted. Within 90 minutes a family of seven tornadoes ripped through a narrow avenue of gently-rolling terrain just south of the Red River. Eight communities were victimized by the savage phenomena, but none suffered like the city of Paris. The third, and most potent, member of the tornado family smashed into the northwest and northern sections of that county seat around 4:00 p.m., snuffing out the lives of ten residents and harming 170 others. The victims counted a cumulative property loss of nearly $50 million.

The scenario that unfolded in the Red River valley on the afternoon of April 2 resembled numerous other outbreaks of weather violence that traditionally beleaguer Texans in every spring season. The factor that made the April 2 siege of tornadoes especially infamous was that one of the twisters engendered by its parent cloud happened to dip to the ground and remain there just as the mammoth thunderstorm was swiping a densely-populated area. Studies suggest that over 130 tornadoes customarily strike somewhere in Texas in any year, yet relatively few cut out paths that intersect cities and towns. Almost inevitably, however, the few twisters that do bear down on population centers wreak an indescribable shambles. Until the afternoon of April 2, 1982 the citizenry of Paris had never known tornado-induced decimation of similar magnitude. It is little consolation to note that, with the April 2 tornado that hit Paris knifing through both old and new neighborhoods, the death and injury toll easily could have been much worse. Neither is there any solace in the observation that the Paris tornado ranks 26th in terms of fatalities exacted by tornadoes in Texas over the past 90 years.

The merging of diverse windflow patterns near the surface and high in the atmosphere was the impetus for the eruption of the Paris tornado and its companions. The strong cold front that swept southeastward out of the Rocky Mountains and kicked up tons of soil in the Texas High Plains was directly responsible for the weather violence in the Red River valley. The front encountered mild but, most importantly, very moist and highly unstable air

from the Gulf of Mexico that had overlain the valley for several days. The much drier polar airmass wedged underneath the moist and volatile Gulf air and triggered the eruption of several mammoth and very intense thunderstorms. The two largest attained "severe" intensity not long after noontime; one surged across the Red River near Durant, Oklahoma, while the other moved into Grayson County. Sherman caught hail the size of marbles to golfballs from this gigantic thunderstorm just before 3:00 p.m. Thirty minutes later, even larger hail—many as large as tennis balls and some with diameters of six inches—pounded the community of Ravenna. The first tornado-related fatality of the day occurred near Allen's Chapel (14 miles northeast of Bonham), where a 74-year-old woman died when her home was wrecked by the tornado. A timely warning issued by a local radio station likely saved lives, for two people were known to have left a mobile home after being advised of the approaching tornado; minutes later, the home was destroyed.

The killer tornado that struck Paris was born at 4:00 p.m. on the northwestern fringe of the city. Ample and extensive warning of the weather hazard had been supplied to residents of the city as much as 30 minutes in advance, a factor undoubtedly responsible for keeping the casualty figures relatively low. Moving with a forward speed of 50 miles per hour, the twister attained the status of "devastating," or the second highest possible rating. It walloped objects in its path with wind speeds in excess of 200 miles per hour. A mobile-home park was decimated, and debris from it was cast hundreds of yards away. Luckily, most residents of the park had fled, but one family that did not lost two of its members. Of the other eight fatalitites, six occurred when the victims were caught in the open; the other two died inside a church building. A lumber yard near the mobile-home park was ravaged by a fire that burned out of control for several hours. In all, over 1000 residents were left homeless. More than 25 city blocks of property were either ruined or damaged. The villain was not finished, however. It then plowed into the towns of Reno and Blossom, injuring several inhabitants and destroying or damaging nearly 100 homes and other buildings. Having lived for a seemingly eternal period of 30 minutes, the twister disintegrated near the town of Detroit in Red River County.

Actually, a second tornado touched down in the southern section of Paris just after its lethal relative began its destructive course on the other side of town. It mercifully confined its damage to a lone small building. Of the remainder of the family of seven tornadoes, only the next-to-last was notable. It caused scattered damage in Red River and Bowie Counties, injuring two residents of the Beaver Dams community. Its path (29 miles) was the longest of the seven, surpassing the killer tornado in Paris by six miles, though its width (250 yards) was the same as its counterpart.

The Paris tornado—unquestionably the single most notable weather event in Texas in 1982—and its family of twisters punctuated a spring season that fostered a record number of tornadoes. Whether the April 2 wave of killer tornadoes could be regarded as a harbinger of even more turbulent weather

ahead is debatable, for other years marred by one or several devastating tornadoes were not necessarily characterized by an inordinate number of twisters. Still, within only a few weeks of the April 2 outbreak, numerous other waves of weather violence supplied a record number of tornadoes, including a total of 35 twisters on May 12 alone. The sum of 123 tornadoes sighted in May was not only more than three times the usual number for that last month of spring but was almost equal to the average number of twisters to occur in Texas in a whole year. Moreover, May's total of 123 was the second largest monthly sum of tornadoes ever, surpassed only by the 124 counted in September 1967 largely as a result of Hurricane Beulah. With a total of 203 tornadoes observed in Texas in 1982—or nearly double the usual number—it is undoubtedly a combination of luck and public awareness that held the number of fatalities to a subnormal 13.

Notwithstanding the sinister nature of phenomenon like the Paris tornado, the most bizarre development within the atmosphere over Texas in 1982 was the migration into the State from Mexico of a vast cloud of ash produced by the eruption of the El Chichonal volcano early in April. Many years usually elapse in Texas between occurrences of reduced visibilities due to volcanic ash, yet within a few days of El Chichonal's massive eruption on April's first weekend, a huge plume of ash drifted northward from the volcano's site in southeastern Mexico to enshroud the southern quarter of Texas. More than a score of people were killed and over 500 more were injured in the 2-week period that began when El Chichonal first erupted. More than 60,000 people had to be evacuated from the vicinity of Pichucalco (about 650 miles from Brownsville) when hot ashes, burning lava and debris, mostly hot pebbles and small rocks were spilled by the long-dormant volcano.

Not since 1870, or the beginning date of weather records for Texas' Lower Valley region, had visibilities been markedly reduced because of volcanic debris in Texas' southern extremity. The thick ash cloud that drifted at an altitude of about 8,000 feet into southernmost Texas on April 5 (Figure 1) forced the cancellation of air traffic into and out of the Lower Valley. Later in the week, the volcanic residue eased northward and coated exposed objects with a thin brownish layer of ash in cities such as Austin, San Antonio, and Houston. The residue in the air made for a dull gray appearance of the sky and a dusty smell in daytime as well as brilliant hues around sunset each evening for over a week throughout southern Texas. It irritated an untold number of sufferers from chronic respiratory problems such as emphysema and those plagued by asthma and serious allergies; the ash, however, was never dense enough to pose serious health hazards. A polar air invasion on April 8 brought relief by ushering in northerly winds and propelling the volcanic residue into the Gulf of Mexico.

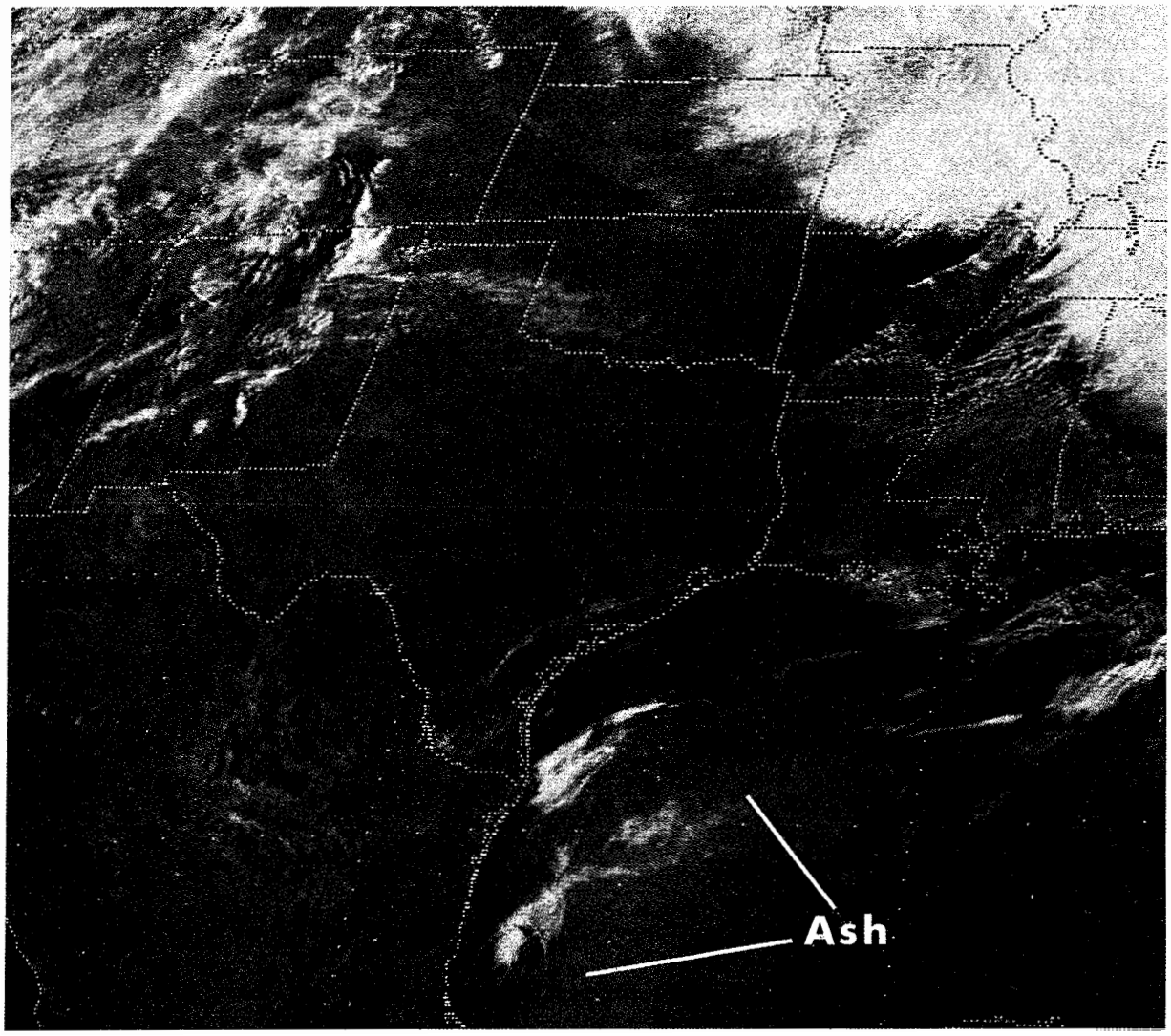


Figure 1. A huge cloud of volcanic ash is seen in this visible satellite photograph to cover much of the western Gulf of Mexico on the afternoon (2031Z) of April 5. The exceedingly rare phenomenon restricted visibilities in the Lower Valley to the extent that airline flights had to be cancelled.

Whereas the El Chichonal ash cloud combined with the wave of killer tornadoes in only a matter of a few days in early April to underscore the vagarious nature of Texas weather in 1982, numerous other extraordinary weather events also marked the year as one of bizarre twists, extremes, and excesses:

- Torrential spring downpours provoked severe flash floods that inundated much of Wichita Falls, causing some $25 million in property damages; and nocturnal rainstorms in the summer forced a playa lake to overflow and cover a heavily-populated section of Amarillo.

- Rainstorms drenched the southern quarter of Texas to a record extent in late winter, but then abandoned the vast area in summer, where meager sums of less than one inch marked the season as the driest ever; yet copious rains returned in autumn, and deluges of ten to sixteen inches in December set records in Texas' eastern fringe.

- Drought was rarely a concern in the northern half of Texas, thanks largely to extraordinarily bountiful rains in late spring and summer; numerous spots in the Red River valley garnered more rain in one week than what usually falls in a whole spring.

- A mid-winter storm piled snow to 15 inches or more in parts of southern North Central Texas and furnished much of Texas' southern quarter with the first significant snow accumulation in nearly a decade; while ice plagued the coastal plain and the Lower Valley, a strip of central Texas remained coated with snow for up to five days after the snow ceased.

- A trio of snowstorms in December hammered the Trans Pecos, disrupting Christmas holiday plans and again encasing the region in a thick blanket of snow and ice as the year expired; resort areas in the mountains were smothered by a half-foot of snow, and El Paso counted a record December snowfall total of 18.2 inches.

- In the most lackluster hurricane season for the U. S. in half a century, only one significant tropical disturbance—Tropical Storm Chris—impacted Texas' weather; rainfall was scanty from Chris, which made landfall near Beaumont at daybreak on September 11, and property damage from the only cyclone to make landfall in the U. S. out of the Atlantic was surprisingly modest.

- A stray tropical cyclone from the eastern North Pacific named Paul survived long enough during its trek across mainland Mexico to fuel the development of thunderstorms that dumped a record amount of rainfall—over 2 inches in a 12-hour period--on El Paso on September 30.

II. PRECIPITATION

Late-spring cloudbursts like those that combined to mete out over 30 inches of rain in one month in North Central Texas overshadowed scanty rainfall later in the year to leave most of the northern half of Texas with precipitation totals modestly higher than normal. The story was not the same in the State's southern half, however, as not enough rain for too long a period of time in the summer and autumn gave many communities there the driest year in at least the last ten. As a result, a modest drought plagued parts of southern Texas, particularly the Trans Pecos and Edwards Plateau, during much of 1982.

An Annual Overview

In a year that featured torrential spring showers and early-winter downpours along with a largely bone-dry summer, remarkably the distribution of annual precipitation across Texas remained very much true to form. The most meager precipitation plagued the usually arid Trans Pecos, while the most bounteous rainfall enriched the always verdant Sabine River valley of far eastern Texas. Specifically, the leanest yearly precipitation total occurred at **Valentine** in Jeff Davis County, where only 7.03 inches was registered, while at the airport in **Port Arthur**, the State's most substantial annual sum of 71.77 inches was received. Characteristically, there were sharp precipitation gradients over short distances in the mountainous Trans Pecos and in less rugged terrain such as the central High Plains. Within 30 miles of Valentine—the State's driest spot in 1982--over 16 inches of precipitation (or more than double **Valentine's** scanty sum) fell at the much higher observation point at **Mount Locke.** Cloudbursts in May and September contributed largely to the 29.15 inches recorded at **Crosbyton** just east of the Caprock, while several hundred feet higher to the northwest at **Plainview**, little more than half that much (16.66 inches) was collected.

The year was not without a significant number of blatant irregularities in its annual rainfall pattern, however. Almost as much rain (60 inches or more) fell in the Red River valley of North Central and East Texas as in the wettest sector of the State along the lower Sabine River. A whole year's worth of rain (30.30 inches) during only the month of May at **Pilot Point** led to an annual sum of 66.69 inches in that city, or just a few inches short of the statewide maximum of 71 inches at **Port Arthur** much farther to the south and east. More precipitation fell in some parts of the Panhandle (such as **Follett, McLean, Miami,** and **Pampa**) than at some locales along the lower Texas coastline (for example, **Corpus Christi, Kingsville,** and **Sinton**). Parts of the Pecos River valley (at **Imperial** and **McCamey**) were drier than areas over 200 miles to the west (at **El Paso** and **Fort Hancock**). Numerous spots in the northern Low Rolling Plains (including **Guthrie, Haskell, Seymour,** and **Wichita Falls**) garnered more rainfall in 1982 than some points along the upper Texas coastline (such as **Matagorda** and **Port O'Connor**).

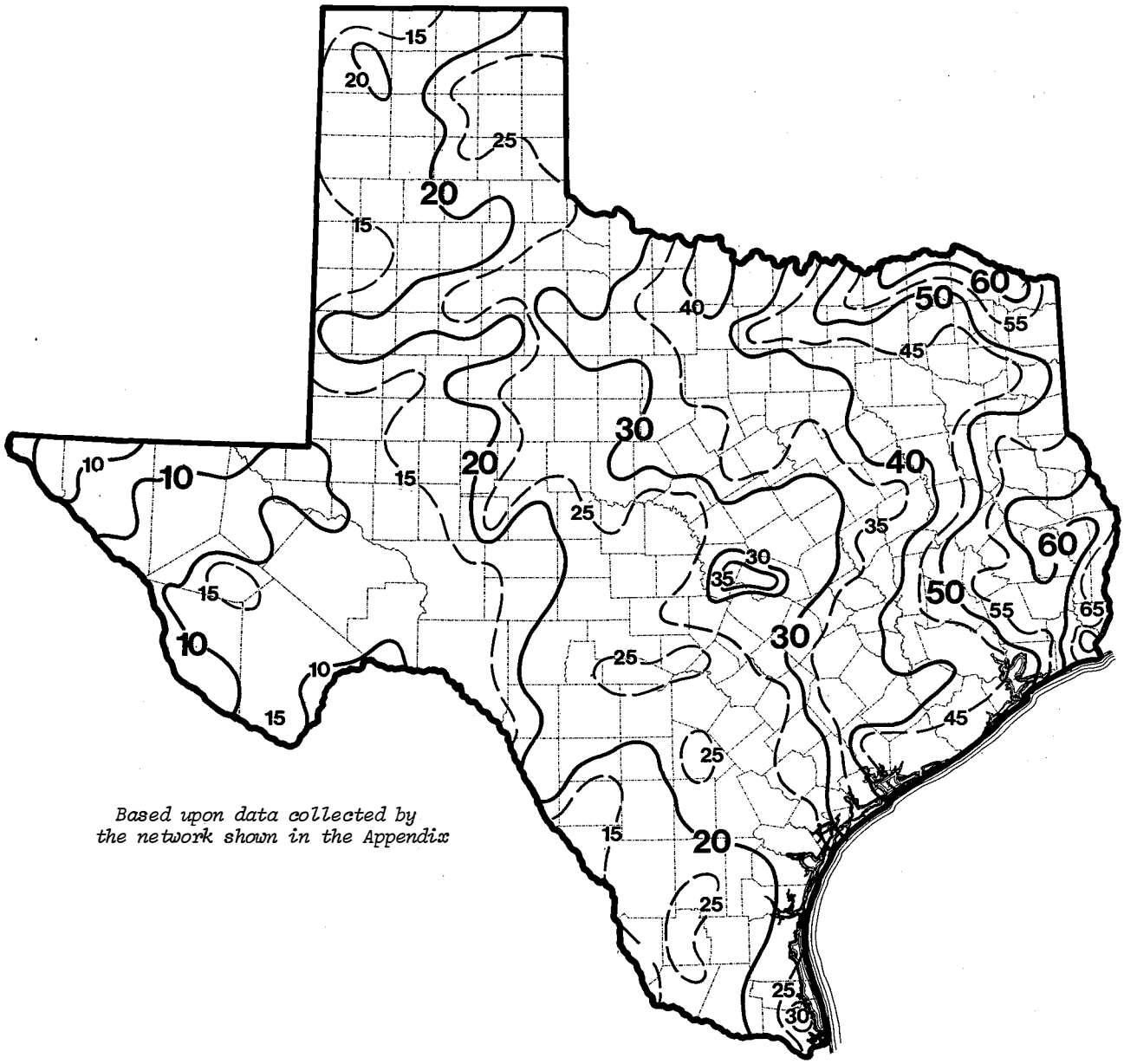


Figure 2. Total precipitation (inches) for 1982.

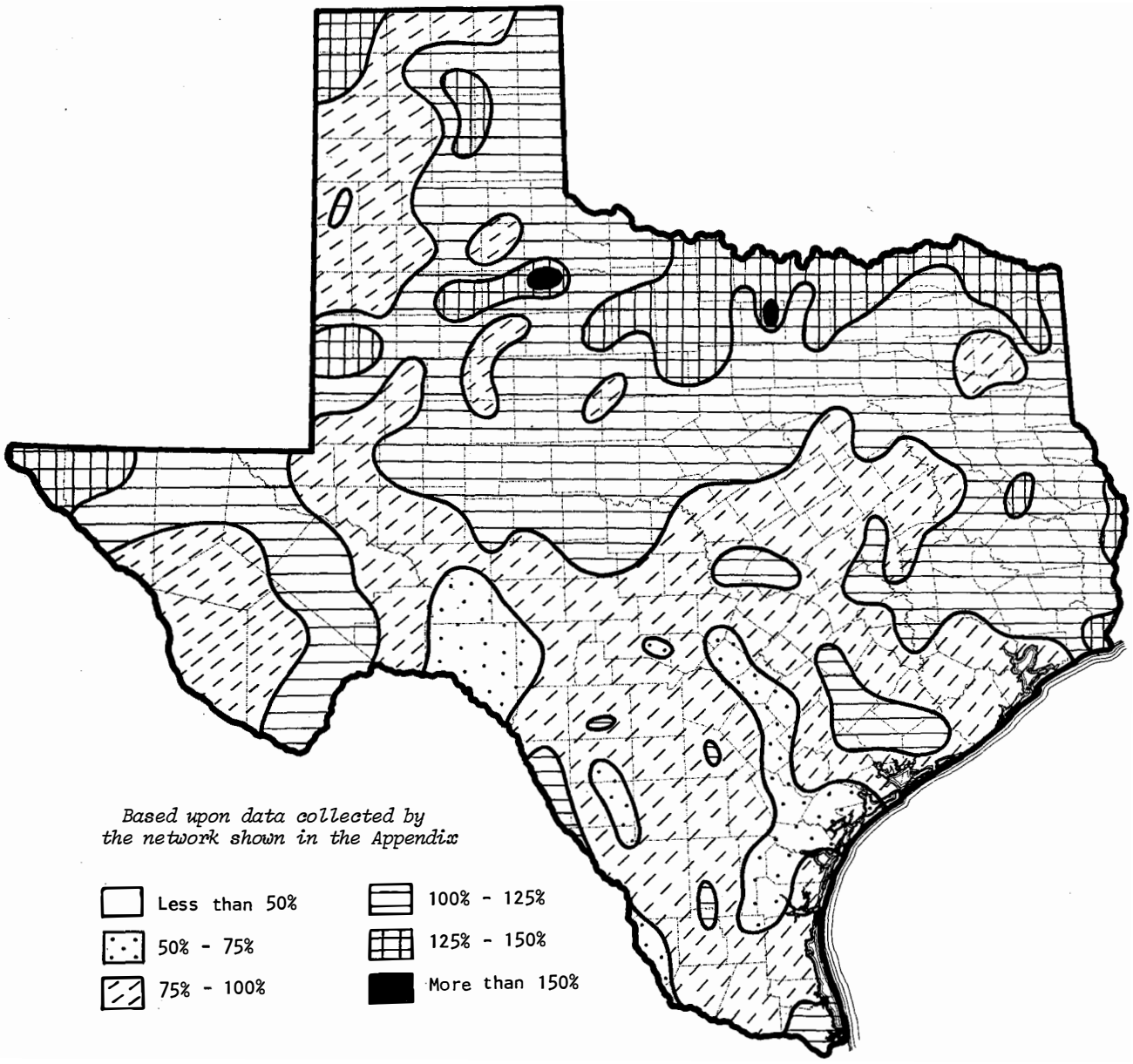


Figure 3. Total precipitation in 1982 as a percentage of the normal amount.

Very few years are as wet as 1982 proved to be in the Red River valley. Totals for the year in the region bounded by **Denison, Dallas-Fort Worth,** and **Clarksville** generally exceeded 45 inches, or the most in at least a decade. In fact, **Sherman's** hefty sum of 51.97 inches was the greatest since 1957, which marked the end of the terrible drought that plagued all of Texas for more than a half-dozen years. In the upper Red River valley, 12-month totals of 33-39 inches were almost 1 1/2 times the normal and were the most substantial in about three decades. The several locations in the High Plains that gaged 25 inches or more marked 1982 as the wettest year in 8 years and the second wettest since World War II. Even in East Texas, where yearly sums around 60 inches were not uncommon, the year supplied the most rain since 1974. Naturally, the greatest positive departure of annual precipitation from normal occurred at **Pilot Point,** whose 1982 sum of 66.69 inches exceeded the normal by nearly 30 inches. Moreover, that community was also distinguished for having the heaviest monthly rainfall—30.30 inches—of any city in Texas. Its 24-hour maximum precipitation amount of 13.00 inches—measured on May 13--was surpassed only by the 1-day sum of 13.02 inches gaged not far away at **Trenton.**

On the other hand, 1982 was exceptionally dry at numerous spots in the southern half of Texas, particularly in South Central Texas. Yearly sums of only 20-25 inches were prevalent in that region, thereby making the year the driest since the severe drought of 1963-64. Indeed, **New Braunfels'** extraordinarily low total of 21.04 inches (more than 12 inches under normal, or merely 63% of normal) was the least since the bad drought of 1956. Parts of the Edwards Plateau (including **Del Rio** and **Blanco**) suffered the driest year in some 20 years, and the 15 to 18 inches common in Southern Texas was the least since 1964. New Braunfels' yearly sum amounting to only 63% of normal was the greatest negative departure of annual precipitation from normal anywhere in Texas during 1982.

None of the four climatic divisions that received above-normal precipitation in 1982 garnered amounts that were eye-catching. The Low Rolling Plains led the way with an annual total that was merely 113% of normal, while regional totals in the High Plains, North Central and East Texas varied between 104% and 110% of normal. These modestly excessive amounts were due in large part to extraordinarily substantial rainfall in May and June. In those two months alone, rainfall in the Low Rolling Plains made up more than half of the annual total of 26 inches, while in the other three divisions the 2-month sum fell just short of constituting half of the yearly total. Rainfall totals were about equal in May and June in the High Plains and East Texas, while in the Low Rolling Plains and North Central Texas, cumulative amounts for May far exceeded those for June. More than 9 inches fell over the region as a whole in North Central Texas in May, while the regional averge for the same month was over 8 inches in the adjacent Low Rolling Plains. In both May and June, rainfall totals in the Low Rolling Plains were more than double the usual amounts. The last two months were also exceptionally wet in these four northernmost regions, though in all but East Texas totals of 1/2 to 3 inches paled in comparison to those collected six months earlier. Strangely, regionwide rainfall of 6 to 8 inches in East Texas in both November and December exceeded totals registered in May and June. The 10 to 15 inches of rain gaged in much of East Texas in December

Table 1. Precipitation totals (inches) for 1982 at selected cities.

DIVISION/City	Total for 1982		Monthly Extremes				# of Months	
		Percent of	Driest		Wettest		Below	Above
	Amount	Normal	Month	Amt	Month	Amt	Normal	Normal
HIGH PLAINS								
Amarillo	18.60	92	Jan	0.15	Jul	6.23	8	4
Dalhart	23.25	134	Jan	0.10	Jul	8.92	7	5
Hereford	17.28	99	Jan	0.05	Jul	5.81	7	5
Lubbock	21.00	114	Jan	0.05	Jun	4.99	7	5
Midland/Odessa	14.65	108	Mar	0.01	Jul	3.24	7	5
Pampa	26.87	133	Jan	0.16	Jul	6.78	5	7
Plainview	16.66	86	Jan	0.03	Jun	6.44	8	4
LOW ROLLING PLAINS								
Abilene	21.31	90	Apr	0.38	May	6.87	7	5
Gail	20.76	111	Feb	0.26	Jun	7.67	8	4
Paducah	26.04	118	Oct	0.10	May	11.30	8	4
Shamrock	26.79	113	Jan	0.10	May	11.14	7	5
Wichita Falls	39.37	145	Aug	0.71	May	13.22	5	7
NORTH CENTRAL								
Brownwood	28.93	106	Aug	0.13	Jun	9.26	6	6
Dallas-Fort Worth	40.75	126	Aug	0.52	May	13.66	5	7
Mineral Wells	42.48	145	Sep	0.32	May	12.68	6	6
Sherman	51.97	130	Mar	1.08	May	15.08	6	6
Waco	29.04	93	Sep	0.15	May	5.54	6	6
EAST								
College Station	36.44	93	Jan	0.86	Oct	6.65	7	5
Lufkin	60.33	140	Aug	0.69	Oct	8.85	5	7
Sulphur Springs	46.98	104	Sep	1.07	Dec	7.81	8	4
Texarkana	52.97	111	Sep	0.84	Dec	10.60	8	4
Tyler	42.94	98	Sep	0.73	Jun	6.23	6	6
TRANS-PECOS								
Alpine	14.87	96	Mar	0.00	May	3.41	7	5
Chisos Basin	18.17	112	Mar	0.00	Jul	4.02	5	7
El Paso	10.97	141	Mar/Oct	0.00	Sep	5.28	9	3
Pecos	10.28	113	Feb	0.00	Jun	2.82	8	4
EDWARDS PLATEAU								
Del Rio	11.94	71	Jan/Aug	0.12	Feb	2.45	8	4
Llano	22.22	85	Aug	0.40	May	4.77	8	4
Ozona	12.77	70	Mar	0.00	May	3.56	4	8
San Angelo	18.18	104	Sep	0.09	Jun	6.01	6	6
SOUTH CENTRAL								
Austin	26.63	82	Jul	0.13	May	5.68	9	3
Columbus	36.21	88	Sep	0.28	Nov	7.73	9	3
Corpus Christi	22.47	79	Jul	0.01	Feb	8.11	9	3
Goliad	26.22	78	Jul	0.00	Feb	5.35	8	4
San Antonio	22.96	83	Jul	0.14	May	6.42	8	4
UPPER COAST								
Beaumont/Pt. Arthur	71.77	130	Sep	1.00	Dec	17.98	5	7
Galveston	34.26	81	Jul	0.24	Nov	6.61	7	5
Houston	42.87	89	Sep	0.98	Nov	8.91	7	5
Victoria	32.53	95	Jun	0.06	Nov	8.68	8	4
SOUTHERN								
Alice	18.55	69	Jun	0.00	May	4.83	8	4
Laredo	15.94	89	Aug	0.02	May	3.77	6	6
Rio Grande City	16.92	90	Jn/Jl/Ag	0.00	Oct	5.57	9	3
LOWER VALLEY								
Brownsville	25.26	101	Jul	0.00	May	9.12	8	4
McAllen	16.82	82	Jul	0.00	May	6.41	7	5

amounted to 2 to 3 times the customary late-in-the year totals. While the majority of months in northern Texas supplied subnormal rainfall, only in September and October were totals substantially smaller than normal.

With the summer being one of the driest ever, the southern half of Texas would have collected considerably subpar precipitation during 1982 had the final months in the winter, spring, and fall seasons not been substanitally wet. Yet, in spite of very meager amounts of rainfall spanning a 4-month stretch in mid-year, yearly sums in each of Texas' six southernmost regions were no less than 80% of normal. Nearly double the normal amount of rain in November and plentiful rain in May prevented South Central Texas from having a disastrous year; that region, with an areal average of 27 inches (or 83% of normal), was the most abnormally dry of Texas' ten climatic divisions. In addition to South Central Texas, Southern Texas and the Lower Valley were notably lacking in yearly precipitation principally because rainfall totals in each of the summer months—and in September as well—were seldom as much as half of normal. Without bountiful rains of 6-8 inches in May, the Lower Valley would have sustained eight straight months—from March through October—in which rainfall totaled only a small fraction of normal. Indeed, a 2-month total of 0.14 inch for the southernmost region as a whole (which translates into less than 4% of normal) was the leanest stretch of any region anytime in 1982. The Trans Pecos, with a regionwide average precipitation total of 11 inches (or 97% of normal), came as close as any to having a normal year rain-wise, although the Upper Coast (with an average of 44 inches, or 95% of normal) was not far behind. Much-above normal rains in late spring and again in the year's final two months had a lot to do with near-normal conditions for the year as a whole in those two regions.

Analyses By Month and Season

WINTER

While the coastal bend section and a few scattered areas elsewhere were eventually blessed with appreciable precipitation in February, the remainder of Texas suffered through a protracted stint of woefully meager precipitation that marked the winter of 1981-1982 as one of the driest in modern times. Precipitation totals in each of the three months of winter (December 1981-February 1982 were substantially subpar in large portions of the State, and the result was seasonal sums that were but small fractions of what typically occurs during a Texas winter. The winter was most abnormally dry in the eastern quarter, where numerous locales collected little more than 1 inch over the 3-month period. The aggregate for the winter at **Bryan-College Station** was 3.88 inches, or 43 percent of normal and the leanest sum in any winter since 1902. Only 4.45 inches fell at **Huntsville**, categorizing the winter as the second driest in 64 years. **Longview** (5.23) sustained the driest winter since 1963 and the second driest in 54 years. Almost as substandard were scarce deposits of precipitation in some parts of the High Plains, where melted snow and occasional light rian amounted for the whole winter to merely ½ inch in a lot of communities. The meager sum of 0.12 inch was the smallest winter total in **Big Spring** since 1909.

A virtual absence of meaningful precipitation had already beleagured most of Texas for many weeks by the time the new year of 1982 got underway. In the wake of torrential, record-setting rains fomented by remnants of Hurricane Norma in mid-October 1981, both November and December of that year supplied very little, if any, noteworthy precipitation in at least three-fourths of Texas. Much of North Central Texas, sporadically dampened by only negligible amounts of rain, had just experienced the driest December since the onset in 1951 of the 20th century's worst drought when the new year of 1982 was ushered in.

January: Huge Deficits Down South

In spite of the preponderance of snow and ice spells, January 1982 was typified by meager precipitation statewide. The Low Rolling Plains (1.00 inch) and North Central Texas (1.84) received enough precipitation to approximate normalcy, but huge rainfall deficits occurred in the State's southern quarter. Nearly half of all stations in Southern Texas (0.26 inch) collected no more than 0.10 inch during January, and no part of the Lower Valley (0.06 inch) garnered that much. Most of the coastal bend received precipitation barely substantive enough to gage. **Corpus Christi's** sum of 0.07 inch and **Beeville's** 0.17 inch were the second smallest January precipitation totals in 64 years. By contrast, the invariably arid valleys along the Rio Grande upstream of Big Bend National Park collected far superior—but nonetheless modest—amounts of precipitation, due in part to the first icestorm to reach that normally-sheltered area in nine

years. **Presidio's** monthly gross of 1.14 inches was nearly three times the normal early-in-the-year amount for that isolated community.

February: Shortages Become Excesses Along the Coast

It was not until late in the month of February that the only substantial rainfall of the winter arrived, and even that was confined largely to the southeastern quarter of Texas. Still, rainfall in some parts of the coastal bend and elsewhere in southern portions of the State was plentiful enough to establish new precipitation marks for the year's shortest month, as indicated below:

Most Precipitation Ever Observed in February	Feb Total	Previous Wettest February
SOUTH CENTRAL		
Corpus Christi	8.11	1903 (5.81)
Sinton	8.87	1969 (8.43)
UPPER COAST		
Port Lavaca	9.29	1959 (6.58)
SOUTHERN		
Falfurrias	6.23	1923 (5.27)
LOWER VALLEY		
Raymondville	5.51	1923 (5.39)

The 9.50 inches gaged at **Harlingen** was the heaviest February total in 59 years. **Refugio** and **Palacios** collected 7.57 and 6.90 inches, respectively, or the most in February in over 20 years. Communities situated along virtually the entire length of the coastline were drenched with the heaviest rainfall amounts; many port cities collected 6-8 inches over a span of 8 days ending on February 26.

The ample rainfall stemmed from the development of "wave" on each of two fronts that pushed through Texas and into the Gulf of Mexico during that time. When the first of the pair of fronts moved through the Lower Valley and then retreated back over the region on February 19, a narrow band of intense rainstorms dumped nearly 6 inches of precipitation in less than 3 hours at **Harlingen.** For the entire evening, 7.76 inches (or nearly 7 times as much as what normally occurs in the whole month of February) fell in that city, while 7.42 inches was gaged nearby at **Adams Garden.** Damages to property amounted to one-quarter of a million dollars in Cameron County. Concentrations of heavy thunderstorms dumped 3 to 4-inch rains the next morning in Karnes and Atascosa Counties, and rainfall totals for the 72-hour period ending on February 21 were in excess of 2 inches in much of southern South Central Texas and the western Upper Coast (Figure 4).

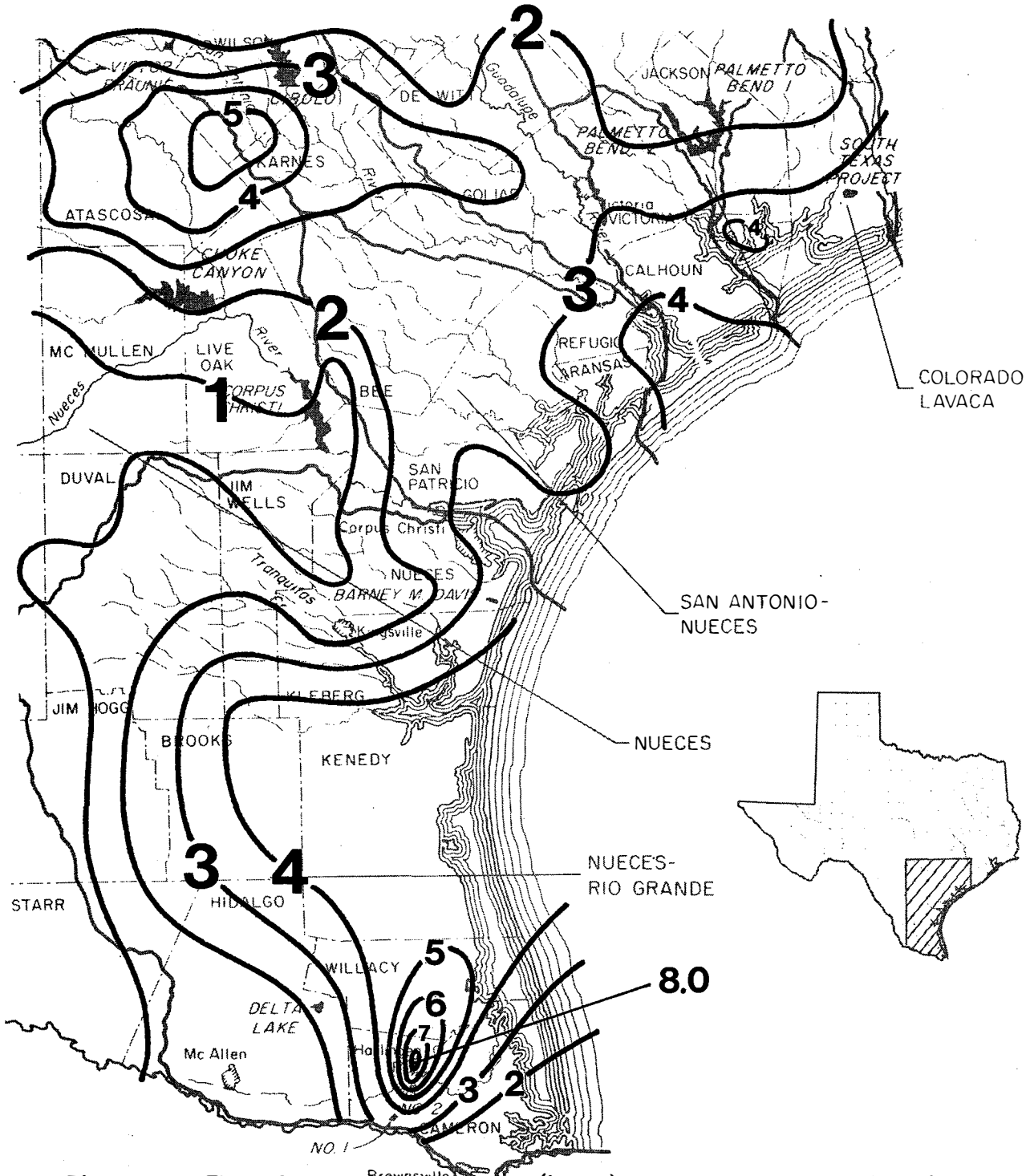


Figure 4. Three-day precipitation totals (inches) caused by the stagnation of a cold front that led to record February rainfall at numerous spots along the coastline, as reported by the cooperative-observer network of the National Weather Service for the period beginning about 7 a.m. (CST), February 18 and ending at about the same time on February 21, 1982.

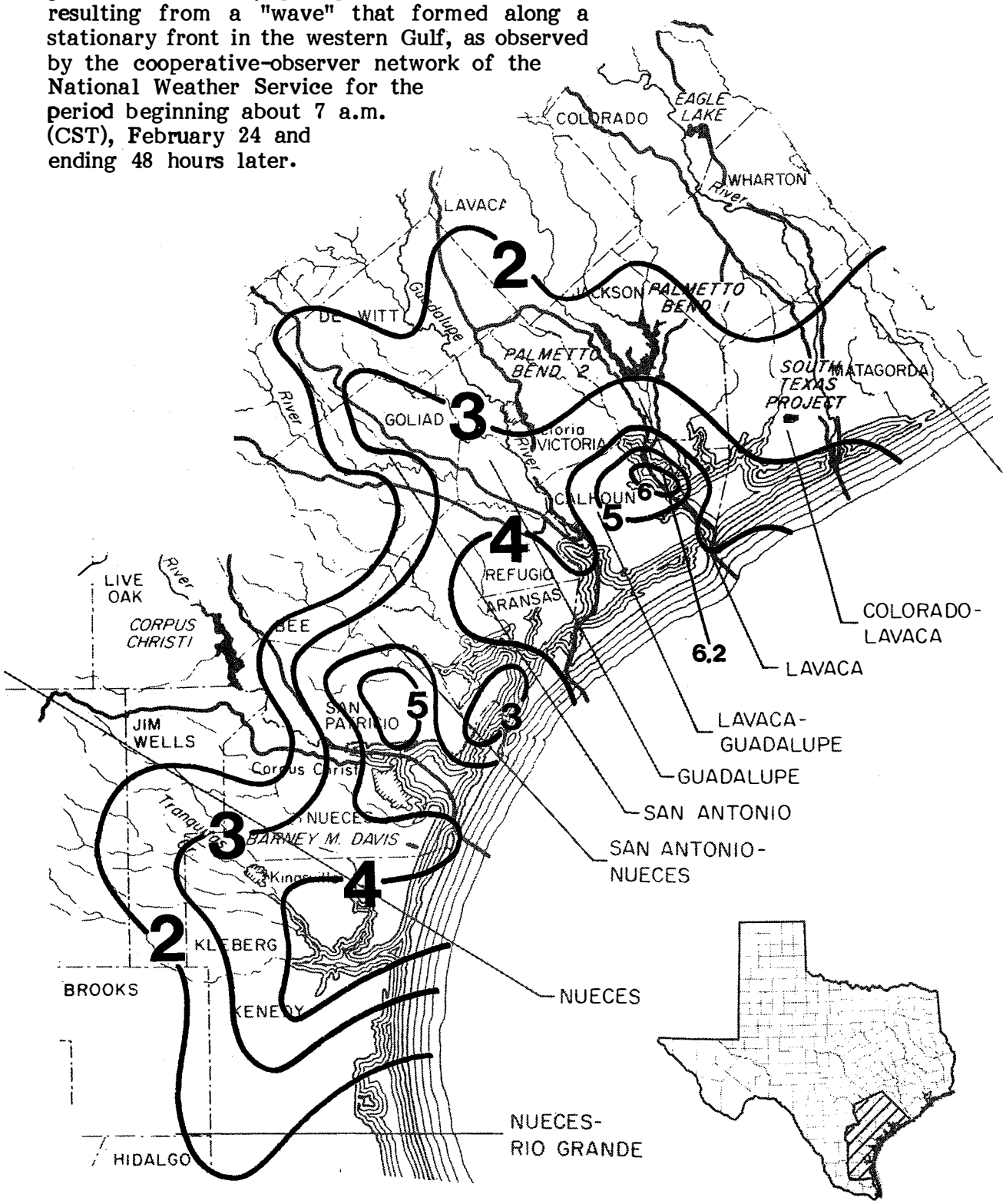
An intense low-pressure center that grew on a stagnant front in the western Gulf on February 25 unleased rains that proved to be more harmful and widespread than those that developed five days earlier. Cloudbursts during the afternoon washed numerous locales between **Corpus Christi** and **Matagorda** with 3-5 inches of rain (Figure 5). Floodwaters led to the first severe-storm fatality of 1982 when a worker at a flooded oil rig near **Fannin** (Goliad County) drowned while trying to foard swift water to get to higher ground. The most substantial short-term rainfall that stemmed from either or both of the inclement spells in late February are tabulated below:

	Feb 19	Feb 20	Feb 21	Feb 25	Feb 26	8-day total
SOUTH CENTRAL						
Sinton		1.33	1.66		5.31	8.30
Aransas WL Refuge	.35	3.60	.03	3.40	.63	8.01
Corpus Christi	.49	2.49		4.70	.15	7.83
Robstown	1.10	.97	.19	1.58	3.63	7.47
Refugio	.97	1.90		3.72	.65	7.24
Yorktown		3.09	.22		2.89	6.20
Falls City 4 WSW		4.76	.52	.08	.76	6.12
UPPER COAST						
Point Comfort	.60	3.36		5.01	1.16	10.13
Port Lavaca		3.50		5.30		8.82
Port O'Connor		.32	3.48	.01	3.98	7.81
Matagorda	.10	3.42		1.50	1.46	6.48
Palacios	.25	3.05		2.25	.81	10.13
SOUTHERN						
Sarita	3.15	1.05		3.50	.80	8.50
Falfurrias	3.78	.84	.05		1.41	4.67
LOWER VALLEY						
Harlingen		7.95			1.32	9.36

SPRING

For large portions of Texas, whether the spring was extraordinarily dry or excessively wet hinged upon the location of several outbreaks of heavy thunderstorms in May. Spring was much like the preceding winter in that the first two months of the season offered little in the way of appreciable rainfall, then compensated for the lack of precipitation by unleashing torrential rainfall as the season drew to a close. While the rains of late February were rather localized in the coastal bend section of the State, May's deluges were almost

Figure 5. Two-day precipitation totals (inches) resulting from a "wave" that formed along a stationary front in the western Gulf, as observed by the cooperative-observer network of the National Weather Service for the period beginning about 7 a.m. (CST), February 24 and ending 48 hours later.



statewide, and in many instances, easily exceeded quantitatively those that fell three months earlier. Not all sections prospered with near or above-normal precipitation during the spring, however. A few scattered pockets in the Edwards Plateau and Trans Pecos experienced rainfall deficits in May as acute as those in March and April. Consequently, some spots tolerated the driest spring since the final year of the terrible drought of the 1950s. For instance, **Del Rio's** 3-month total of 2.19 was the leanest sum for any spring since 1956. Though it has seen more than a few spring seasons equally as dry, **El Paso** was given but 0.24 inch of precipitation (or merely one-fourth of normal) during the March-May period.

Especially in parts of the Low Rolling Plains and North Central Texas, rainfall totals in May were larger than those of spring's first two months by a factor of ten. Indeed, with such bountiful amounts of rain in May, had the earlier half of spring not been so inordinately dry, the spring likely would have been the wettest in many years. In much of the Red River valley, the spring as a whole was the wettest since exceptionally heavy spring rains abolished the century's worst drought in Texas in 1957. **Wichita Falls'** spring sum of 18.64 inches--of which 71 percent fell in May—was not only the greatest in 25 years but was the second highest since 1915. **Dallas-Fort Worth's** 3-month total of 18.08 inches—or 160 percent of normal—was the second largest amount in spring since 1942. Spring was extraordinarily wet in the Lower Valley also. Though **Brownsville** experienced the wettest spring only since 1976, the 3-month sum of 9.32 inches was more than twice the normal. Moreover, while they were not nearly substantive enough to establish new records, such disparate locales as **Lubbock** (7.51) and **Beaumont-Port Arthur** (18.11) nonetheless received almost 1½ times the normal amount of rain in spring.

March: Characteristic Shortfalls Almost Everywhere

Notwithstanding the fact that March customarily is either the driest or one of the three driest months anywhere in Texas, rainfall during March 1982 was uncommonly scanty, particularly in the southwestern half of the State. Only one-seventh of all observing stations in the Trans Pecos recorded measurable precipitation during the month. That westernmost region collected less than two percent of normal precipitation for the first month of spring, and the Lower Valley garnered less than one-quarter of normal. **Victoria's** meager sum of 0.23 inch was the second leanest March total in over 40 years. Amounts in excess of 4 inches were confined to parts of southern East Texas and at **Hamilton** (North Central), whose 5.10 inches was the greatest March total anywhere in Texas.

April: More Shortages Despite Belated Spring Showers

The long-awaited spring downpours were not only late in coming in April but

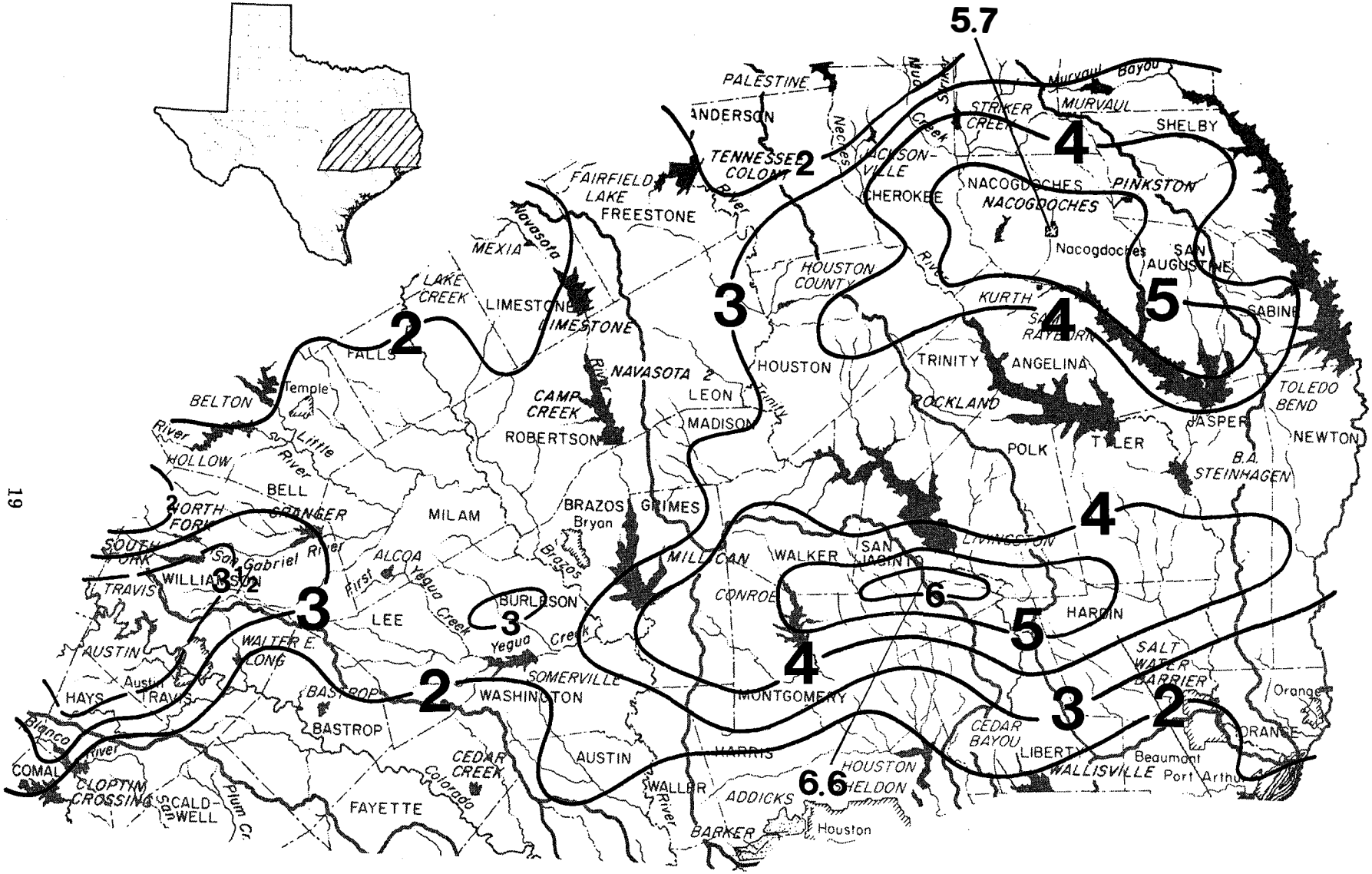


Figure 6. Three-day rainfall totals (inches) from spring thunderstorms that gave much of East Texas the wettest April in 16 years, as reported by the cooperative-observer network for the period beginning at about 7 a.m. (CST), April 19 and ending at about the same time on April 22, 1982.

were also highly selective in terms of location. By almost any standard, the spates of spring thunderstorms dished out appreciable amounts of rainfall, even in the western third of the State. Still, except in East Texas, April precipitation totals were subpar at most points in all of the other regions. That meant that, in spite of a weeklong spell of unsettled weather just after mid-month that provided 1 to 3-inch rains in at least half of Texas, a huge segment of the State sustained the sixth consecutive month of below-normal precipitation. Due mostly to two 2-day periods of intense, heavy thunderstorms at mid-month and on April 20-21 (Figure 6), half of all stations in East Texas registered over 5 inches of rainfall. A few stations, namely **Nacogdoches** (10.78), **Pineland** (10.17), **Reklaw** (10.03), and **Rusk** (10.37), received in excess of 10 inches, or more than double the normal for spring's middle month. For most sections of East Texas, it was the rainiest April in at least 16 years, and for some the wettest April since torrents of rain helped erase in 1957 the century's worst drought. Even the Trans Pecos (with a regionwide average of 0.69 inch) experienced a slight rainfall "excess," though that aberration was due largely to the fact that a trio of stations (including **Fort Stockton**, with 3.01 inches, or the most in April in 33 years) collected more than 1½ inches of rainfall.

May: Records Shattered in Many Places by Deluges

Nearly every community and county in Texas shared in May's super-abundant rains. Only a smattering of locales in the High Plains and a few spots in the Trans Pecos were robbed of all but a fraction of an inch. However, rainfall elsewhere generally amounted to 3 to 8 inches, with some sections of the Low Rolling Plains and North Central Texas collecting over 12 inches. Truly, for those two regions affronting the Red River, the month on a regionwide basis was the wettest since 1957. More than 8 inches fell in over half of the Low Rolling Plains, whose regionwide total of 8.37 inches was more than double the normal. Two out of every five sites gaged over 10 inches in North Central Texas, where the region as a whole measured 9.33 inches, or precisely twice the normal. A series of outbreaks of very heavy thunderstorms spaced about one week apart and lasting until the beginning of May's last week inundated some areas of the Red River valley with record rainfall, as shown below:

Most Rainfall Ever Observed in May	May Total	Previous Wettest May
LOW ROLLING PLAINS		
Seymour	14.88	1941 (11.52)
Wichita Falls	13.22	1901 (12.79)
Anson	12.28	1965 (9.22)
Electra	11.07	1975 (10.60)
Roscoe	10.92	1957 (7.85)
Haskell	10.38	1969 (9.26)

Most Rainfall Ever Observed in May	May Total	Previous Wettest May
NORTH CENTRAL		
Bonham	21.83	1957 (15.10)
Denton	20.92	1957 (16.75)
McKinney	16.70	1905 (14.93)
Decatur	15.92	1957 (10.95)
Paris	15.15	1920 (14.20)
Graham	14.62	1957 (12.54)
Dallas-Fort Worth	13.66	1957 (12.64)
Cooper	12.86	1946 (10.53)
Archer City	12.44	1975 (11.73)
Jacksboro	12.32	1957 (10.02)
Henrietta	12.15	1933 (12.09)
Albany	10.53	1957 (9.93)
HIGH PLAINS		
Claude	12.37	1951 (11.71)
EAST		
Clarksville	14.53	1935 (13.24)
EDWARDS PLATEAU		
Robert Lee	8.91	1954 (5.81)
UPPER COAST		
Angleton	12.55	1966 (11.99)
SOUTHERN		
Hebronville	15.25	1914 (8.82)
LOWER VALLEY		
Harlingen	11.96	1914 (9.63)
McCook	9.24	1968 (9.02)
Brownsville	9.12	1914 (9.03)

The May total of 30.30 inches measured at **Pilot Point** (North Central) was just a few inches less than what that city collects during an average year. Moreover, some spots, like **Trenton** (13.02 on May 13), were struck by more rain in one day than what normally is given in the whole spring season.

Equally astonishing were the extraordinarily sharp gradients in observed rainfall over short distances. For instance, **Amarillo's** May sum of 1.96 inches paled in comparison to the 12.37 inches garnered less than 30 miles away at **Claude;** indeed, on the day (May 27) that **Claude** was bathed with over 10 inches of rain, **Amarillo** was dampened with merely one-quarter of an inch. At the other end of the State, a 3-day rainy siege deposited nearly 11½ inches at **Hebronville,**

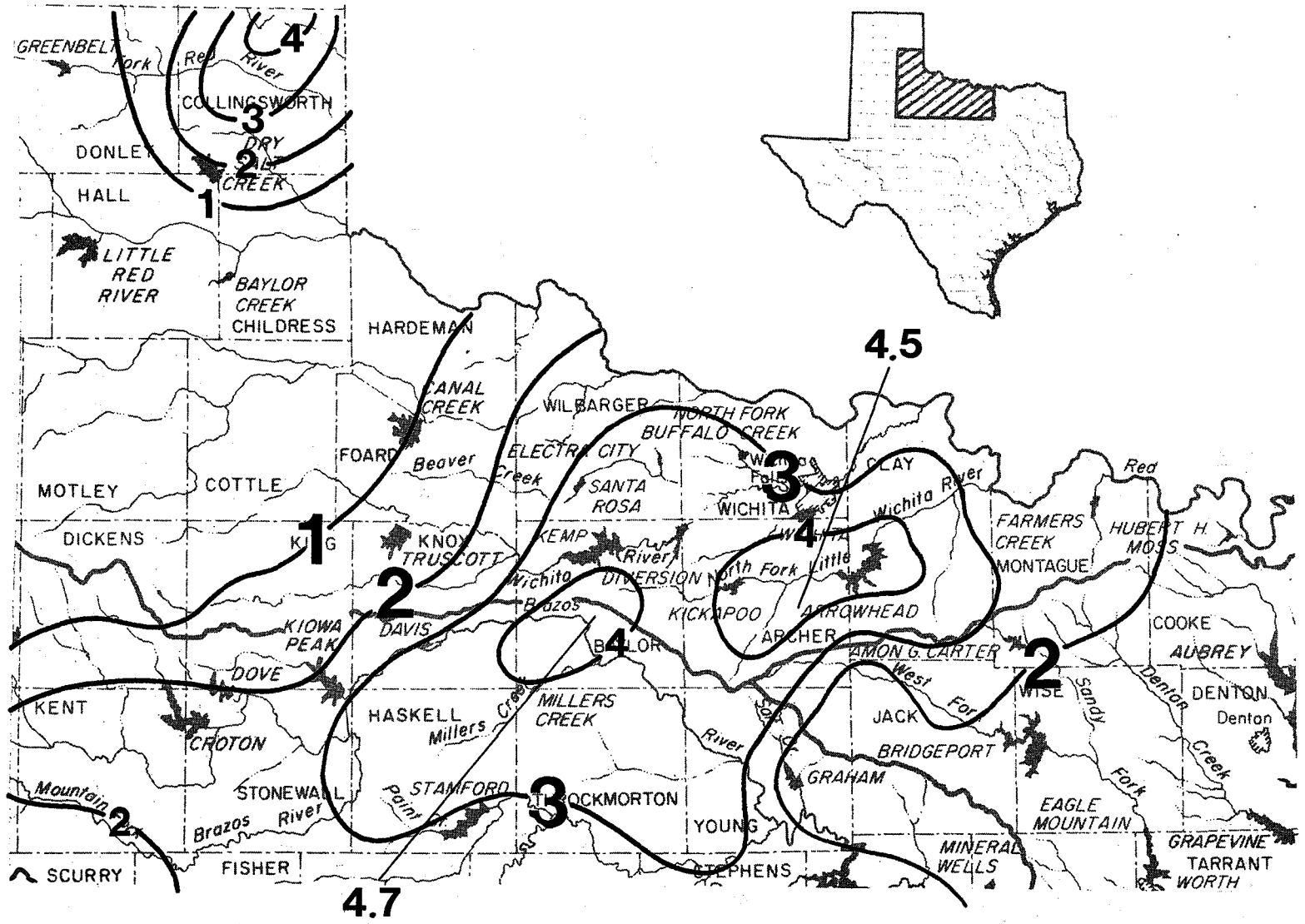


Figure 7. Three-day rainfall totals (inches) from the first of a trio of rainstorm outbreaks in May that made the month the wettest ever in many locales, as reported by the cooperative-observer network for the period beginning at about 7 a.m. (CDT), May 4 and ending at about the same time on May 7, 1982.

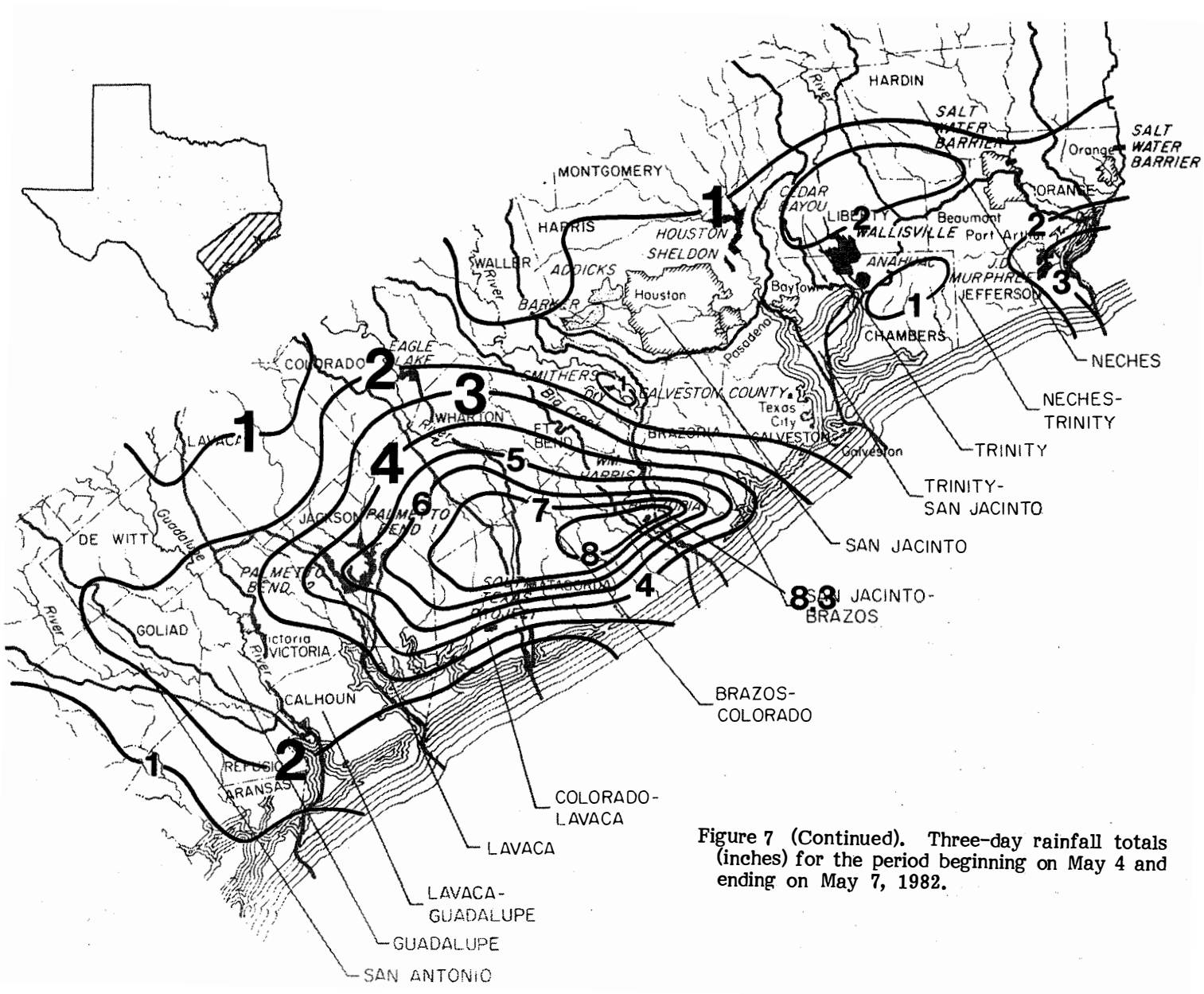


Figure 7 (Continued). Three-day rainfall totals (inches) for the period beginning on May 4 and ending on May 7, 1982.

or a large share of that city's May total of 15.25 inches; meanwhile, 50 miles to the east at **Falfurrias,** the same 3-day period furnished that city with less than 1 inch and, accordingly, its monthly total (2.59) amounted to less than one-fifth of its neighbor.

The first of May's trio of rainy sieges was the shortest-lived of the three. Yet, it contributed to a large share of the monthly aggregate of 6-10 inches of rain observed in the Upper Coast. Rainfall in less than 24 hours exceeded 7 inches at **Angleton, Bay City,** and **Danevang** (Figure 7), where some residents had to evacuate flooded homes and businesses. Early on May 6, rains of 3-6 inches caused flooding in **San Antonio,** where at least a half-dozen residents had to be rescued from trees and the tops of automobiles and a mudslide trapped several others. Rainfall over a 3-day period ending on May 7 totalled more than 3 inches in sections of the Low Rolling Plains and North Central Texas (Figure 7). A breakdown of some of the most substantial rainfall during May's first week is provided below:

	May 5	May 6	May 7	3-day total	% of May total
UPPER COAST					
Angleton		8.30		8.30	66
Bay City		.02	7.18	7.20	63
Danevang		7.20	.10	7.30	64
Pierce			6.80	6.80	63
Wharton		5.10		5.10	51
NORTH CENTRAL					
Pilot Point		6.80		6.80	22

Most of the 2-4 inches of rain that fell during May in the Trans Pecos, whose regionwide sum was almost double the normal, occurred during the first few days of the month.

Amounts given by a second spell of heavy rain a week later were even more substantial and farflung. Rains over three days of 3 inches or more in the northeastern quarter of the State (Figure 8) were almost as much as what customarily occurs in an entire month of spring. Totals in one 24-hour period ending on May 13 were especially prodigious in a large portion of North Central Texas between the Dallas-Fort Worth area and the Red River. Many of the whopping 1-day sums, such as those registered at **Trenton** (13.02), **Pilot Point** (13.00), and **Bonham** (12.60) are reflected in the following tabulation of daily rainfall totals for the 3-day period ending on May 14:

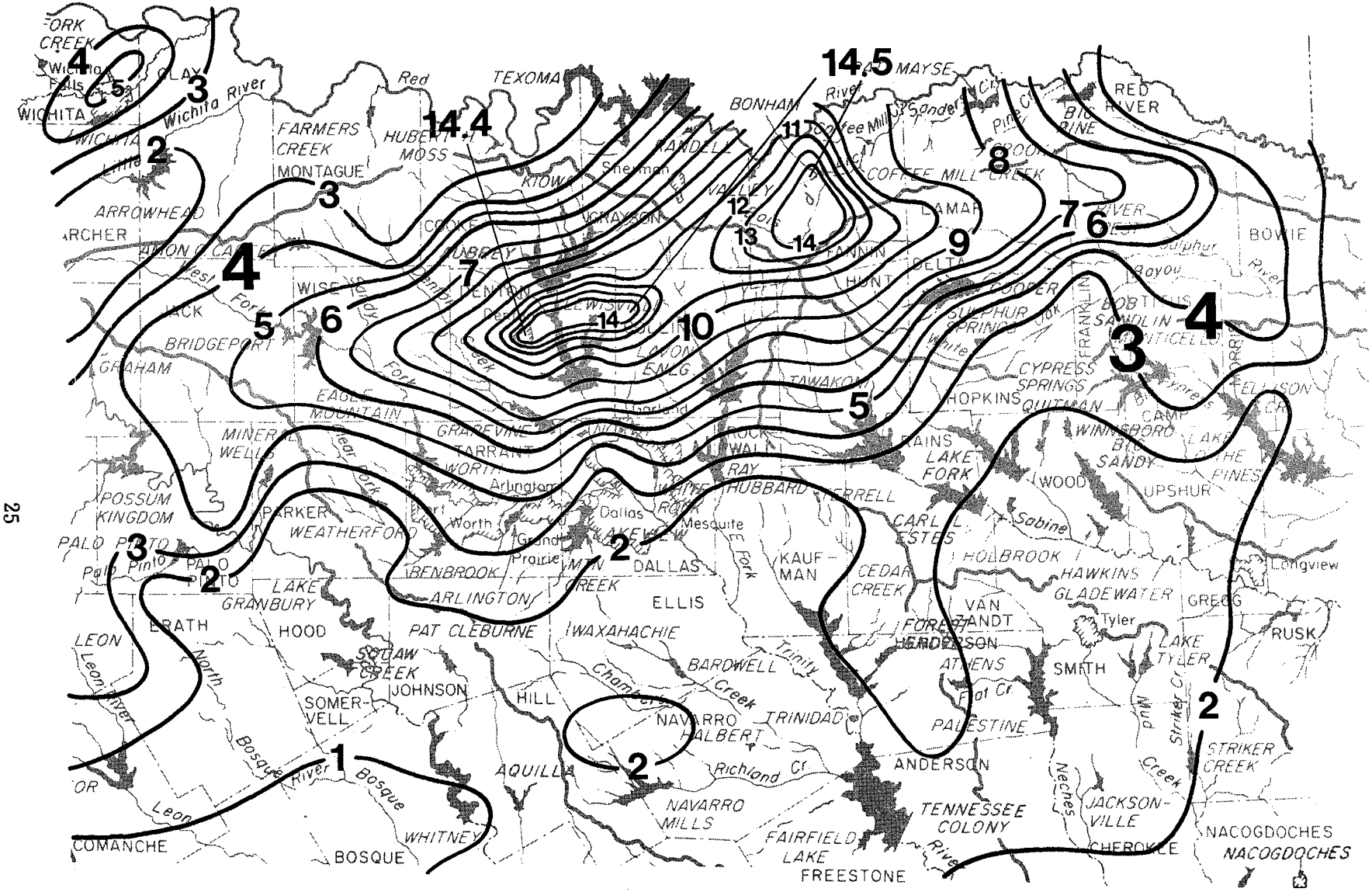


Figure 8. Three-day rainfall totals (inches) generated from some of the most prodigious rainstorms ever to occur in Texas in spring, as reported by the cooperative-observer network for the period beginning at about 7 a.m. (CDT), May 11 and ending at about the same time on May 14, 1982.

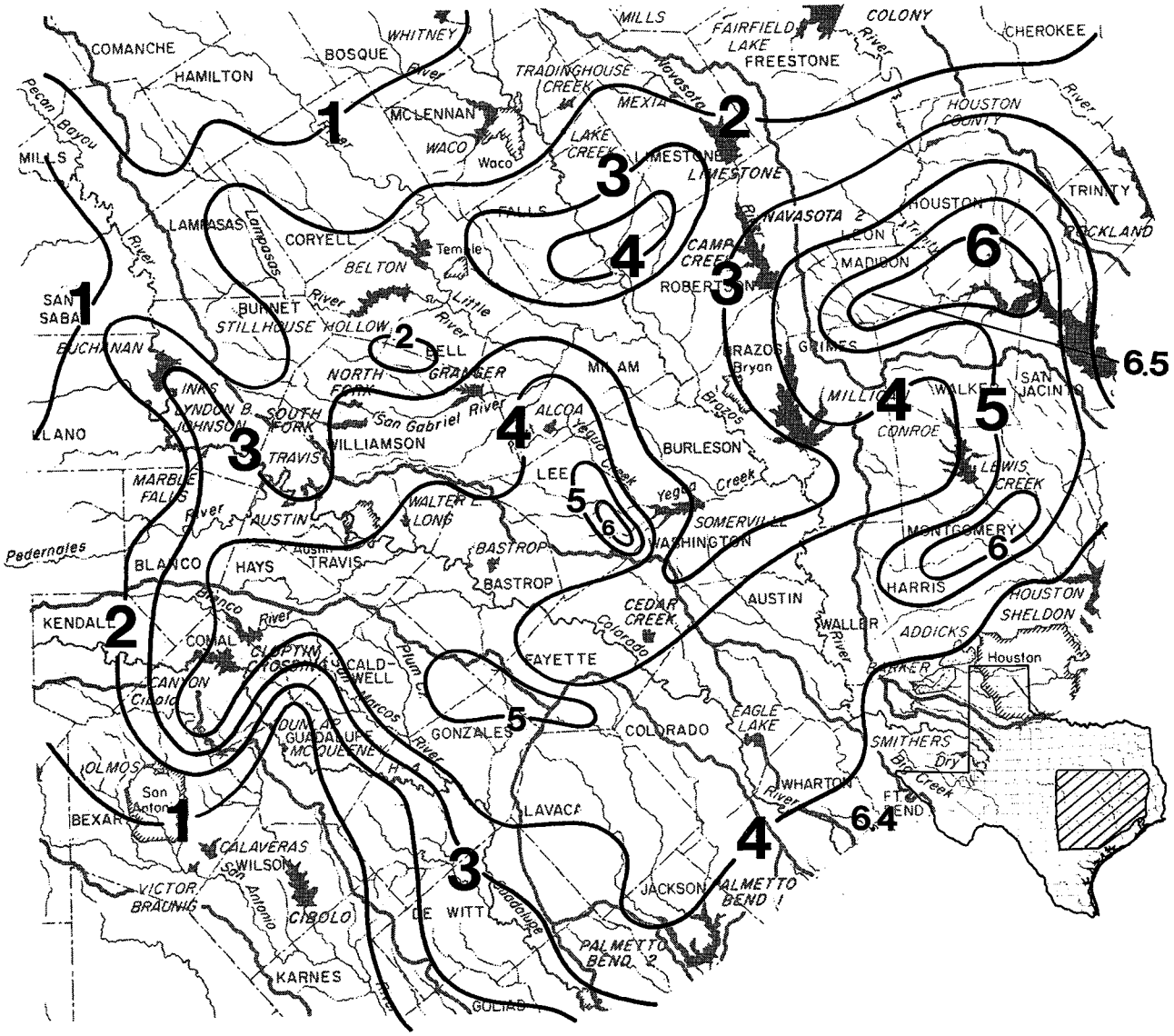


Figure 8 (Continued). Three-day rainfall totals (inches) for the period beginning May 11 and ending May 14, 1982.

	May 12	May 13	May 14	3-day total	% of May total
NORTH CENTRAL					
Bonham	.02	12.60	1.90	14.52	66
Denton 2 SE	7.30	7.14		14.44	69
Celina	8.32	6.00		14.32	67
Trenton		13.02	.56	13.58	70
Pilot Point	.30	13.00		13.30	44
Gunter 5 S	.25	11.03	.25	11.53	61
Anna	.03	10.56	.74	11.33	64
Wolfe City		10.16	.62	10.78	60
Frisco	.91	9.02	.33	10.26	58
Cooper		8.46	.51	8.97	70
Lewisville Dam	1.42	6.11	1.25	8.78	60
McKinney 3 S	.11	7.75	.63	8.49	51
Sherman	.01	8.00	.47	8.48	56
Honey Grove	5.77	2.60		8.37	44
Paris		6.91	1.15	8.06	53
Decatur		7.90		7.90	50
Greenville 7 NW	.01	6.32	1.02	7.35	63
Grapevine Dam	1.37	5.51	.43	7.31	65
Farmersville		6.28	1.00	7.28	62
Mid City		6.35	.86	7.21	42
Roanoke	.25	6.26	.39	6.90	51
Carrollton		6.40	.43	6.83	51
Slidell		6.76		6.76	47
Lavon Dam	.01	6.08	.65	6.74	53
Valley View	.12	6.20		6.32	43
Boyd	2.61	3.50		6.11	44
EAST					
Clarksville 2 NE		6.06	.84	6.90	47
Conroe	.32		6.20	6.52	76
Madisonville		4.50	2.00	6.50	72
Lovelady		1.60	4.60	6.20	83
SOUTH CENTRAL					
Dime Box		6.42		6.42	75

For a description of the repercussions stemming from these torrential rains, the reader should consult the section entitled "Flash Flooding" in Chapter 5.

Many rain-weary Texans endured yet another protracted spell of nearly incessant and super-abundant rainfall as May neared an end. A cold front drifted into the State's midsection on May 21, then stalled and stimulated repeated rounds of thunderstorms that unleashed widespread rains of 2-3 inches in more than half of the State. Most of the southern half of the State was spared from rains of more than 2 inches, although a few isolated locales such as **McCook** (7.89) and **Edna** (5.74), in addition to **Hebronville** (11.40), were soaked by far more than a whole month's worth of rain (Figure 9). The front shifted back and forth for the better part of a week, triggering rains that were heaviest in the Low Rolling Plains, where 4-6 inches was a common measurement (Figure 10). The following tabulation quantifies the daily distribution of some of the heaviest rainfall during the latter third of May:

	May 22-23	May 24	May 25	May 26	May 27	May 28	1-week total
LOW ROLLING PLAINS							
Rotan	3.50	2.12	.94	.68		1.37	8.61
Dickens	1.23	.10	.41	1.41		3.10	6.25
Roscoe	3.35		1.58	.48	.55		5.96
Guthrie	1.92		1.40	.74		1.24	5.30
Haskell	1.17	1.53	.76	.79		.94	5.19
NORTH CENTRAL							
Honey Grove	2.22	2.40	3.20	.10		.06	7.98
Mid City	1.07	2.17	2.70		1.76	.20	7.90
Graham	3.05	1.50	.55	.56	.12	.80	6.58
Chalk Mountain	4.60	.34	.53	.19		.10	5.76
Paris	.74	1.86	2.19	.01	.61	.05	5.46
EDWARDS PLATEAU							
Robert Lee	4.00	1.36	.41	.05		.23	6.05
SOUTHERN							
Hebronville	4.90	6.50		.02			11.42
LOWER VALLEY							
McCook	7.12	.75	.02				7.89

With much of the State having seen measurable rain on at least half of the month's days, the sky finally and mercifully cleared on May 29.

SUMMER

The onset of summer saw the inevitable migration northward out of the tropics

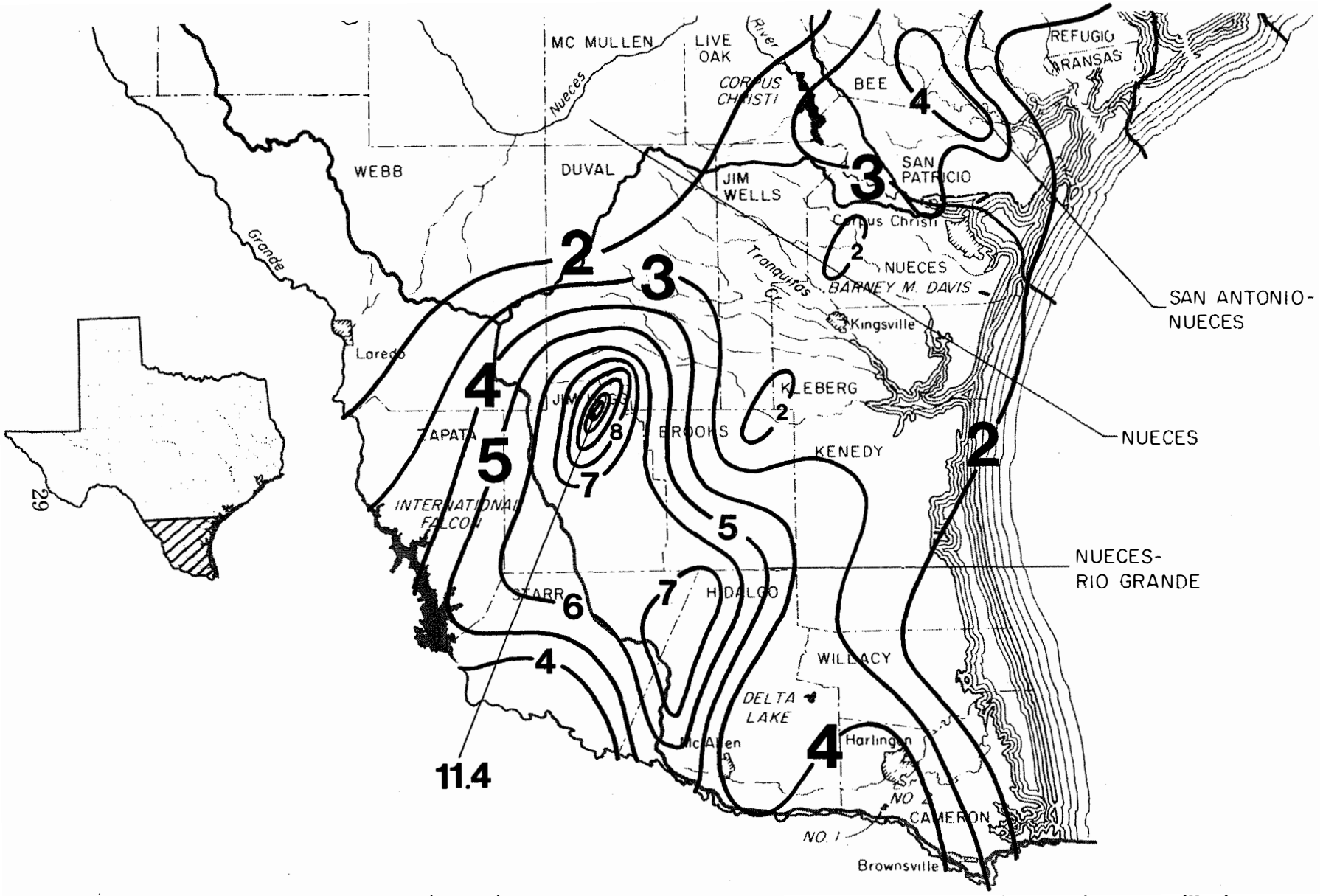


Figure 9. Four-day rainfall totals (inches) yielded by repeated rounds of thunderstorms triggered by an oscillating front, as reported by the cooperative-observer network for the period beginning at about 7 a.m. (CDT), May 21 and ending at the same time on May 25, 1982.

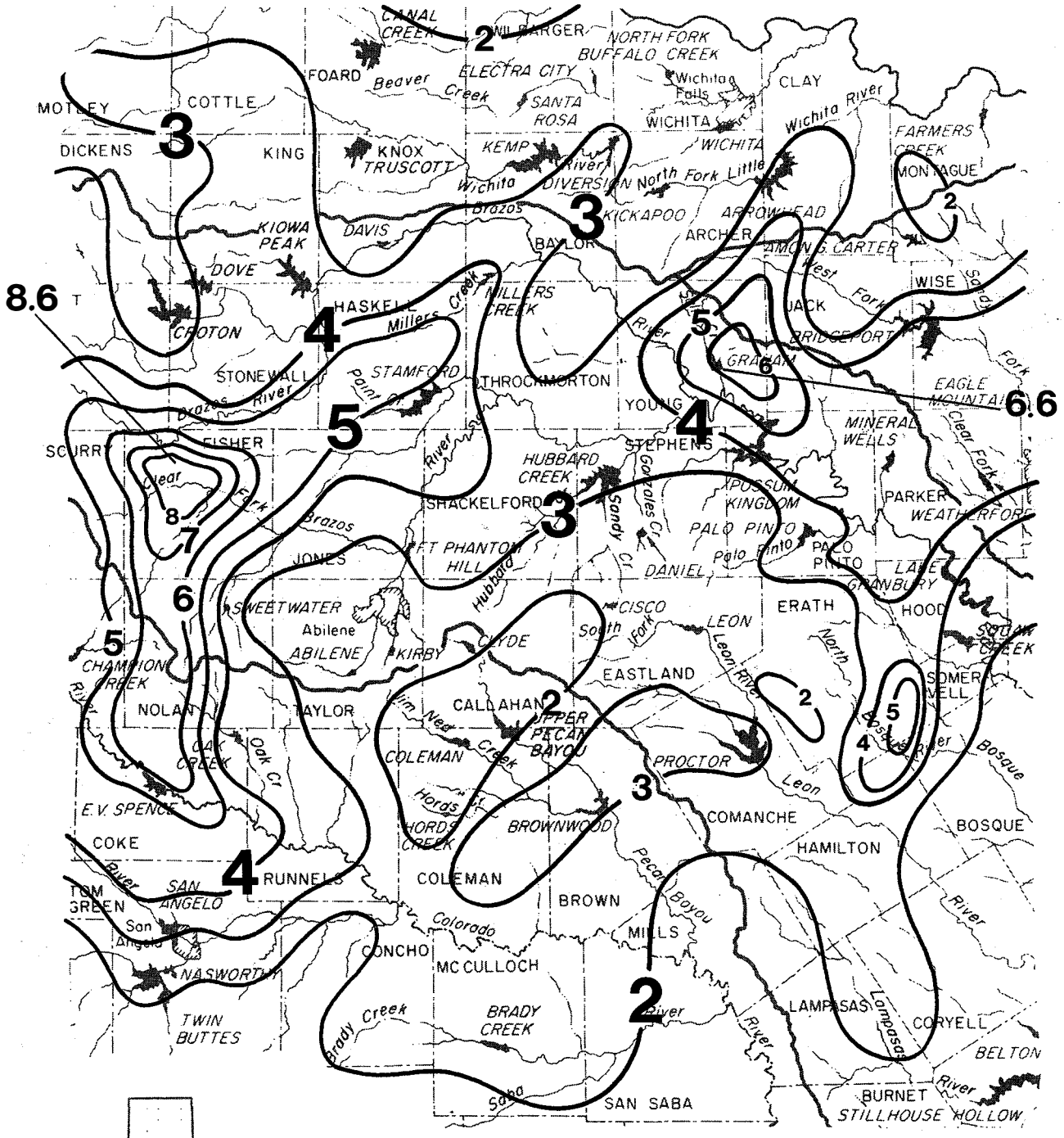


Figure 10. One-week rainfall totals (inches) produced by a stalled cold front that boosted sums for the month of May to the highest levels ever for numerous locales, as reported by the cooperative-observer network for the period beginning at about 7 a.m. (CDT), May 21 and ending at about the same time on May 28, 1982.

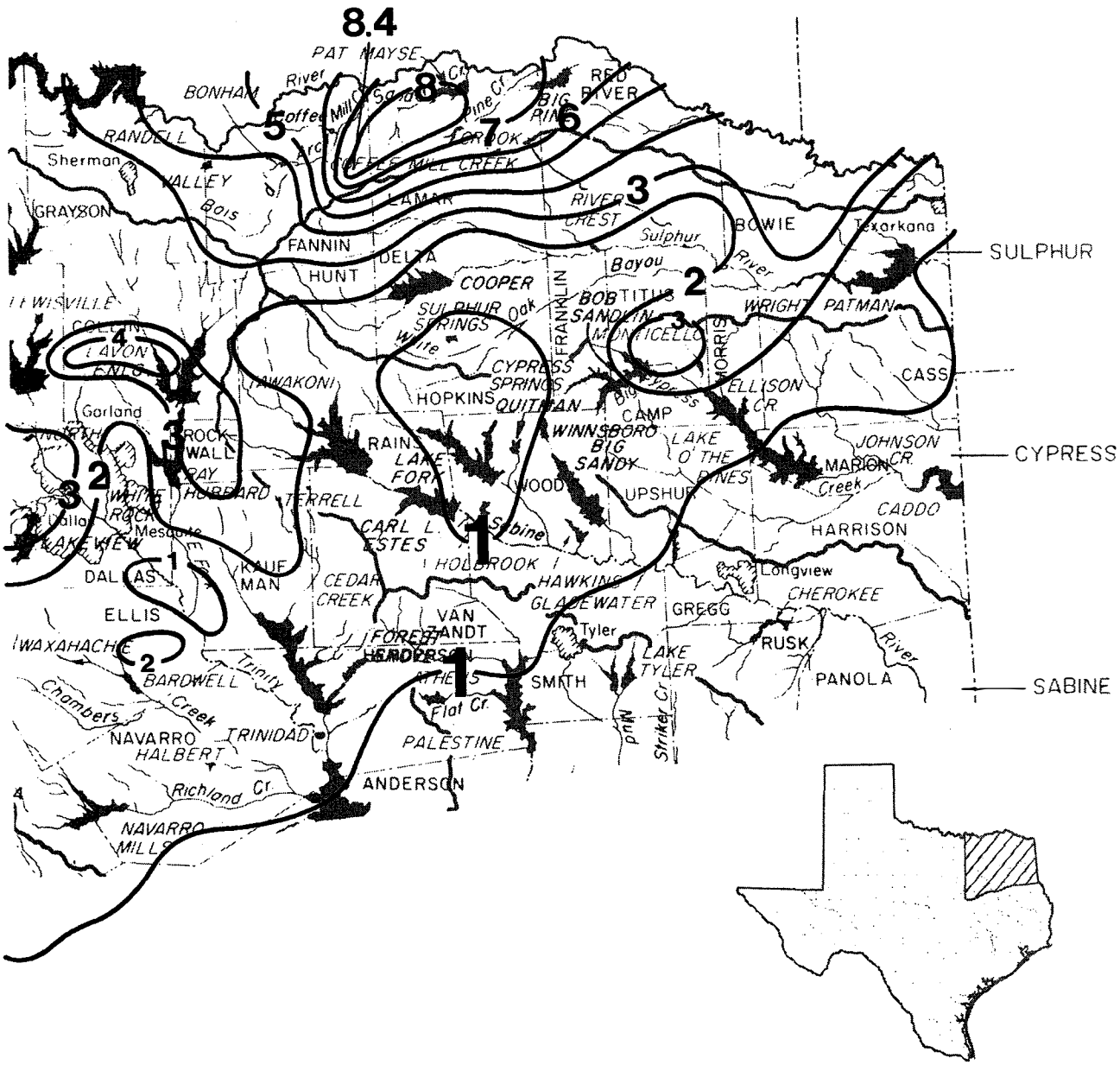


Figure 10 (Continued). One week rainfall totals (inches) for the period beginning May 21 and ending May 28, 1982.

of the vast upper-atmospheric ridge of high pressure that often dominates Texas' weather for extended periods during the year's warmest season. However, the fact that, after it enveloped the State's southern sector early in June, the subtropical ridge seldom relaxed its enervating grip meant that most of the coastal plain had to withstand far too many days of rainless skies. Noteworthy tropical disturbances were scarce, and the few that did drift westward out of the Gulf of Mexico were not potent enough to disrupt for long the monotonous pattern of warm, muggy nights and sunny, very hot days. Moreover, the stance assumed by the ridge was such that upper-atmospheric disturbances scooting around the poleward fringe of the ridge abetted the formation of numerous outbreaks of thunderstorms that poured out bountiful rains in much of the northern half of Texas during the first two months of summer. Though the rain-producing troughs almost became extinct in August, enough rain already had fallen in June and July to mark the season as an uncommonly wet one especially in the west central portion of the State.

Few summers in Texas history have been as barren as the one that left the southern quarter of Texas with 3-month totals of less than 2 inches. Barely measurable rainfall in coastal sections of South Central and Southern Texas during June and July contributed to summer precipitation totals that were little more than 10 percent of normal. Those locales in the southern quadrant of Texas that experienced the driest summer on record are listed below:

Driest Summer Ever	Summer Total	Previous Driest Summer
SOUTHERN		
Freer	0.39	1952 (0.58)
George West	0.44	1965 (1.51)
Hebronville	0.47	1921 (0.66)
Alice	0.50	1915 (1.14)
LOWER VALLEY		
Raymondville	0.52	1914 (1.10)
McCook	0.60	1964 (1.62)
SOUTH CENTRAL		
Cuero	0.97	1954 (1.34)
Nixon	1.76	1958 (1.86)
UPPER COAST		
Edna	2.98	1956 (3.50)

A puny 3-month sum of 1.91 inches at **Victoria** characterized the summer as the driest since 1917—and the second driest of the 20th century. With 2.06 inches gaged in June-August, **San Antonio** sustained the least rainfall for a summer season since 1938. Even less at **Corpus Christi** (1.37) marked the summer as the driest since 1943. The summer was the driest 18 years at

Brownsville (1.22) and 17 years at **Houston** (7.32). On the other hand, **San Angelo's** summer total of 6.82 inches—88 percent of which fell during June—was the highest in 11 years.

June: Record Rains Up North, Record Dryness Down South

A pattern of unsettled weather that gave much of Texas generous rains belatedly in the spring persisted well into June, drenching most of the northern half of Texas with rainfall far in excess of typical early-summer amounts. Numerous outbreaks of showers and thunderstorms on practically every day during the latter two-thirds of June dished out the heaviest June rainfall in 20 years in the Low Rolling Plains, whose regionwide total of nearly 6½ inches was more than double the normal. A single-day sum of 7.68 inches boosted **Winters'** June total rainfall to 14.56 inches—or more than 12 inches above normal. As shown below, some parts of the Low Rolling Plains and adjacent western section of North Central Texas witnessed the wettest June in weather history:

Wettest June Ever Observed	June Total	Previous Wettest June
HIGH PLAINS		
Claude	23.14	1921 (11.34)
LOW ROLLING PLAINS		
Coleman	8.22	1962 (7.78)
NORTH CENTRAL		
Mineral Wells	9.58	1962 (8.67)
Stephenville	8.24	1927 (7.18)
Breckenridge	8.06	1940 (7.12)

The protracted spell of showery, stormy weather in mid and late-June was largely responsible for more than half of North Central Texas collecting in excess of 5 inches of rainfall. Monthly sums of 8-10 inches were not uncommon in northern East Texas either, and most of the northern Edwards Plateau collected 4 inches or more.

While northern Texas was being doused, the southern half of the State grew increasingly thirsty. No region hungered more for rain than the Lower Valley, whose regionwide total of 0.08 inch was a mere 3 percent of normal. Scattered areas in Southern and South Central Texas collected no measurable rainfall during the month; for the regions as a whole, South Central's scanty total of 1.43 inches was but 44 percent of normal, and Southern's 1.17 inches was only

half of normal. For some points in these regions, June 1982 was the driest first month of summer in history, as shown below:

Driest June Ever Observed	June Total	Previous Record
CENTRAL		
Beeville	0.00	1980 (0.00)
Sinton	0.00	1967 (Trace)
SOUTHERN		
Alice	0.00	1916 (0.02)
Freer	0.00	1967 (0.00)
George West	0.00	1972 (0.00)
LOWER VALLEY		
Harlingen	0.00	1955 (0.00)
Mercedes	0.00	1955 (Trace)
Weslaco	0.00	1980 (0.00)

While the eastern edge of the Upper Coast caught 6-9 inches of rain during June, the western portion of that region received barely measurable amounts. Rainfall sums at **Edna** (0.03), **Victoria** (0.06), and **Matagorda** (0.15) were no more than 2 percent of normal.

July: Another Historically Dry Month for the South

The absence of both tropical waves from the Gulf of Mexico and subtropical upper-air disturbances from the Pacific again marked the southern quadrant of Texas as the most rain-starved region during July. Less than half of all observing sites in the Lower Valley measured rain at all, and the regionwide sum of 0.06 inch was only 5 percent of normal. A few locales in South Central and Southern Texas were fortunate enough to lie in the paths of infrequent and brief thunderstorms that meted out up to 1 inch of rain, but the two regions as a whole collected 20 and 32 percent of normal July rainfall, respectively.

In much of the southern quarter of the State, monthly rainfall totals were the smallest in July in 20 years. Indeed, more than a few spots had the scantiest July rainfall in half a century; **Victoria's** meager total of 0.07 inch was the least since 1912. Still other locations witnessed the driest July on record, as indicated on the next page:

Driest July Ever Observed	July Total	Previous Record
SOUTH CENTRAL		
Corpus Christi	.01	1962 (Trace)
Cuero	.00	1971 (0.03)
Goliad	.00	1962 (0.00)
New Braunfels	.00	1924 (Trace)
San Marcos	.00	1913 (0.00)
SOUTHERN		
Cotula	.00	1980 (0.00)
Encinal	.00	1966 (0.00)
Hebronville	0.00	1978 (0.00)
Rio Grande City	0.00	1962 (0.00)
Zapata	0.00	1962 (0.00)
LOWER VALLEY		
Brownsville	0.00	1962 (0.00)
McAllen	0.00	1969 (0.00)
Raymondville	0.00	1962 (0.00)

The meager amounts of rain that did occur were the result of a weak cool front that drifted through eastern Texas during July 22-25.

A trio of weak, slow-moving cool fronts, each of which stalled after pushing through the Panhandle, instigated numerous cloudbursts that drenched the High Plains—and northern Low Rolling Plains—during July. Most of the Panhandle collected at least 4 inches, with the bulk of that coming during a 4-day period at month's end. The northwestern corner of the Panhandle was the most blessed, with **Dalhart** (8.92), **Bravo** (8.32), **Gruver** (7.59), **Coldwater** (7.55), **Borger** (7.41), and **Morse** (7.10) measuring 2½ to 3 times the normal July amount. The 7.51 inches at **Amarillo**, parts of which were devastated by flash floods from a 4½-inch deluge on July 30, was the most substantial rainfall for that Panhandle city since 1962. A few points in the Red River valley of the Low Rolling Plains and North Central Texas picked up in excess of 5 inches.

August: Meager Rainfall All Over

August saw the High Plains succumb to the oppressive mound of moisture-depleted air that dominated the rest of the State for most of summer. The reversal in fortunes for some Panhandle cities was most abrupt; for instance, after two months of very heavy rainfall, **Amarillo** received a paltry total of 0.55 inch—or the least in August in 35 years. Very few locations scattered at random around the State received substantial rainfall yielded by occasional and isolated thunderstorms. The High Plains as a whole was given 0.92 inch, or only about 42 percent of normal. Only the Lower Valley (36 percent) and Southern Texas (41 percent) were less fortunate. One-half to two-thirds of all

locales in every region except East Texas and the Upper Coast collected no more than 1 inch during August. A sprinkling of places in northernmost East Texas—such as **Negley** (6.82) and a point near **Clarksville** (5.48)—measured over 5 inches, with much of that coming on the first day of the month. A couple of other spots—at **Gold** in the Edwards Plateau (5.01) and **Tomball** in the Upper Coast (5.12)—reported substantially above-normal rainfall.

AUTUMN

Slow, soaking rains in November rescued the autumn of 1982 from being the driest in recent memory in large portions of Texas. After two months of highly scant rainfall in much of the State, two wintry storms unleashed inordinately large amounts of precipitation—and even record totals in portions of the coastal plain—as the fall season drew to a close. Nonetheless, the autumn as a whole proved to be the latest in a series of abnormally dry fall seasons extending through much of the latter half of the decade of the 1970s and into the early 1980s. **Corpus Christi's** 3-month sum of 6.58 inches was the smallest for any autumn in 16 years. The autumn was most uncommonly dry in a broad swath of central Texas extending through much of the Edwards Plateau into southern portions of the High and Low Rolling Plains. In much of this area, precipitation amounts for the period September-November were little more than half of normal, and in spots like **San Angelo**, diminutive 3-month sums of barely 2 inches were less than half of normal. Still, in these areas the autumn of 1982 was not as dry as the fall seasons of 1977 and 1979. Only in the extreme westernmost sector of Texas, and in a few scattered spots in the Upper Coast, was the autumn uncommonly wet. The year's only tropical cyclone from the Pacific to affect Texas weather helped boost **El Paso's** autumnal total to almost 6 inches—or nearly 2½ times the normal fall amount.

September: A Thirst for Rain Goes Unquenched

The early autumn perpetuated the largely rainless weather of summer, with virtually every portion of Texas receiving in September mostly meager amounts of rain on a considerably subpar number of rain days. All but a few spots in the northwestern quarter of the State suffered from less than half of normal precipitation. Rainfall deficits were most notable in North Central Texas, whose regionwide total of 0.79 inch was only 23 percent of normal. At least two of every three locales in that region were given no more than 1 inch of rain. Texas' four southernmost regions collected only about one-third of normal rainfall for autumn's first month. So minute were some rainfall sums in the southern portion of North Central Texas—and a few spots elsewhere—that all-time records were established, as provided on the next page:

Driest September Ever Observed	Sep Total	Previous Record
NORTH CENTRAL		
Goldthwaite	.00	1956 (Trace)
Hamilton	.02	1977 (0.02)
Cameron	.04	1939 (0.10)
Corsicana	.04	1933 (0.08)
EAST		
Atlanta	Trace	1952 (0.07)
SOUTHERN		
Freer	.20	1960 (1.00)

In much of the eastern two-thirds of the State, the month was the driest September since at least the waning months of the disastrous drought of the mid 1950s. A mere 0.55 inch at **Corpus Christi** marked the month as the driest September in 62 years and the second driest September since weather records were begun there in 1887. A meager sum of 0.15 inch qualified the month as the fourth driest September of this century at **Waco.** Monthly totals of hardly a half-inch at **Dallas-Fort Worth** and exactly 1 inch at **Beaumont-Port Arthur** made September the driest first month of autumn since the infamous drought of the mid-1950's.

Except for a very few locales that happened to benefit from widely scattered or isolated heavy thunderstorms, only the extreme western tip of Texas was blessed with ample rainfall during September. The fact that the western limit of the Trans Pecos caught 2 or more inches at month's end was due in part to the influence of the year's lone Pacific tropical cyclone to affect Texas' weather. Showers and thunderstorms from Hurricane Paul gave more than 2 inches to **El Paso** on September's last day, and some of that heavy rain broke an all-time intensity record. (See the section, "From the eastern North Pacific," in Chapter 4 for further details on the high-intensity rains that occurred in **El Paso.**) Yet, a rash of thunderstorms ten days earlier was even more responsible for that city's third largest September total (5.28 inches) since the Civil War. Unfortunately, Paul's remnants remained too far west and were too quickly extinguished to affect appreciably the weather elsewhere in Texas.

October: Still More Subpar Rainfall

In the absence of noteworthy tropical disturbances, it was up to cold fronts and upper-air storm centers migrating eastward out of the Rockies to generate rainfall during October. However, because of a fewer-than-normal number of fronts and upper-air lows, much of Texas endured yet another abnormally dry month—the fifth in a row for much of the southern half of the State.

The two most notable "northers" failed to produce appreciable rainfall in the latter half of the month except in the eastern quarter of the State. Approximately half of all communities in the High and Low Rolling Plains, as well as the Trans Pecos, received no more than ½ inch during the month. Those three regions on the whole were given only about one-fourth of normal October precipitation. More than a score of stations in the High Plains and Trans Pecos did not receive any measurable precipitation.

Much of the month's precipitation consisted of fairly general rains associated with the passage, shortly before mid-month, of a cool front that later stalled in the Gulf of Mexico. A new low-pressure center that formed on the stagnating front caused considerable overrunning of Gulf moisture that was converted into rains of 2-4 inches in much of East Texas and parts of the Upper Coast and South Central Texas. Weeklong rainfall of 5 inches or more was concentrated in scattered sections of southern East Texas, northern South Central Texas, and Southern Texas (Figure 11). All but about 2 inches of **San Augustine's** prodigious sum of 11.91 inches came from that weeklong rainy spell. Just about all of the 4-8 inches of rain common in Southern Texas was furnished by the overrunning situation early in October. A thunderstorm outbreak triggered by the month's last cold front spawned general one to 2-inch rains in East Texas, where the regionwide precipitation total for the month of 4.47 inches exceeded the October normal by more than 1 inch. Indeed, **Lufkin's** monthly aggregate of 8.85 inches—the most in October in 33 years—was almost 3 times greater than normal.

November: The Return of Super-Abundant Cloudbursts

A single cold front at the beginning of the month and an early winter storm during the week of Thanksgiving were almost solely responsible for the inordinately large amounts of precipitation that fell in November in virtually every corner of Texas. For the first time in 1982 every one of Texas' ten climatic divisions registered, on a regionwide basis, precipitation amounts that were notably above normal. In the eastern third of the State, rain occurred on almost every day during the latter half of November, and the result was precipitation sums nearly double the normal for late-autumn. In fact, rainfall was so substantial in a few areas of the Upper Coast that some all-time precipitation records were established:

Wettest November Ever Observed	Nov Total	Previous Wettest November
UPPER COAST		
Edna	10.25	1952 (8.82)
Palacios	8.78	1977 (7.97)
Victoria	8.68	1905 (7.47)

The bulk of the extraordinarily heavy downpours that drenched the eastern

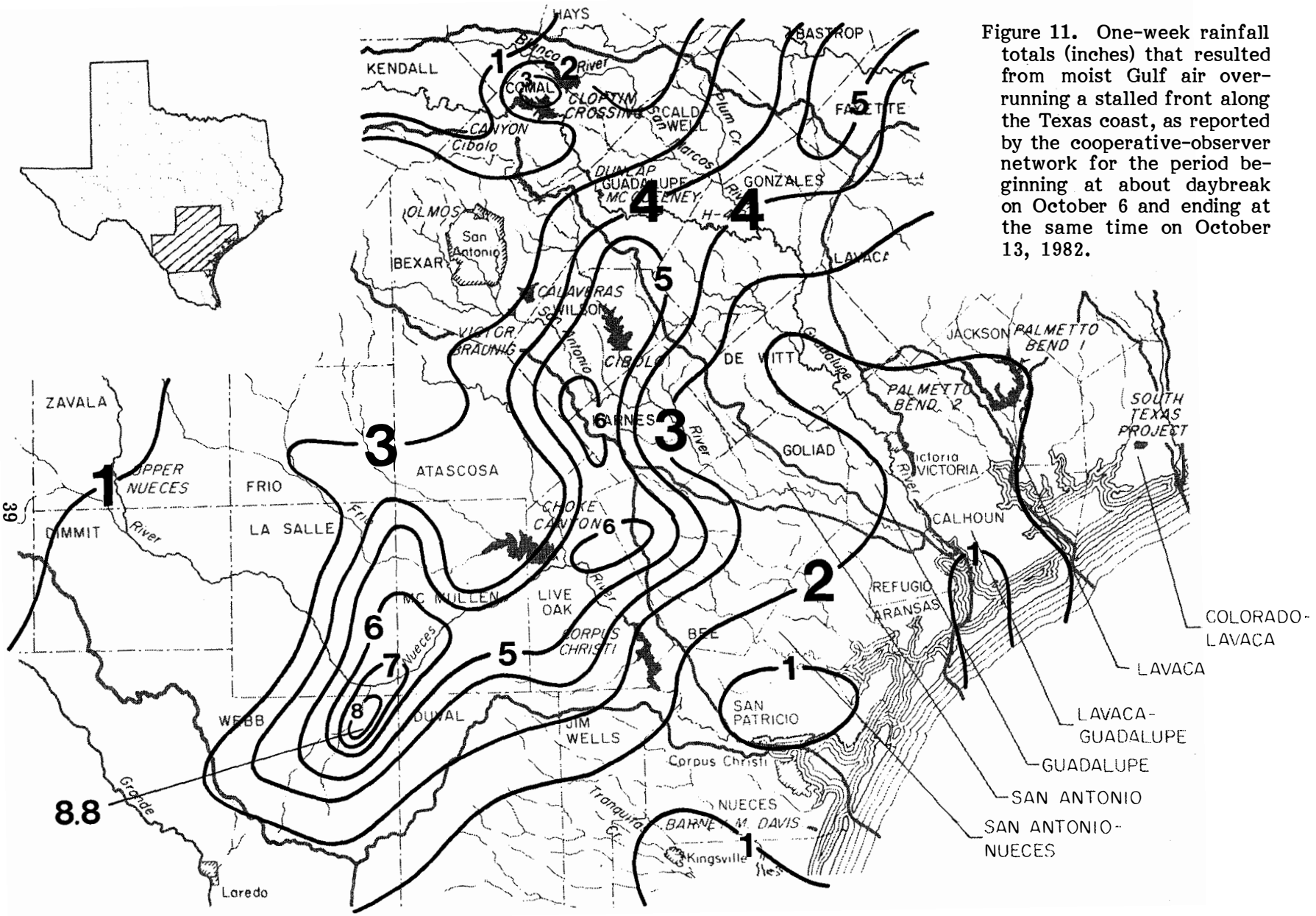


Figure 11. One-week rainfall totals (inches) that resulted from moist Gulf air overrunning a stalled front along the Texas coast, as reported by the cooperative-observer network for the period beginning at about daybreak on October 6 and ending at the same time on October 13, 1982.

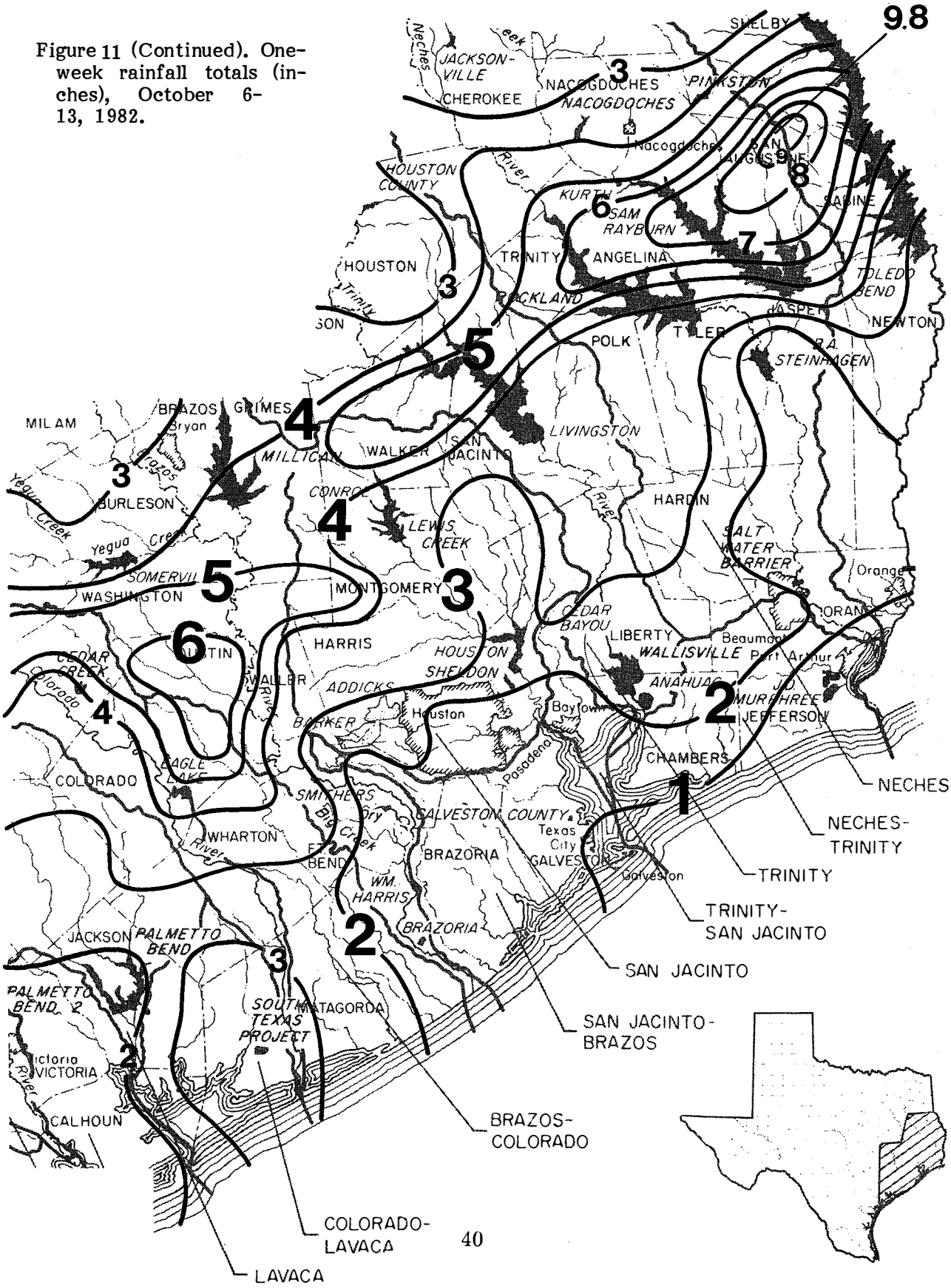


Figure 11 (Continued). One-week rainfall totals (inches), October 6-13, 1982.

third of Texas in November stemmed from frontal "wave" activity offshore in the western Gulf of Mexico just after mid-month or a few days following Thanksgiving. Numerous very heavy thunderstorms that formed in the vicinity of an old front unleashed deluges on many cities in South Central Texas and the Upper Coast during a 5-day period ending on November 20 (Figure 12). As shown in the following tabulation, single-day rainfall totals of 3-6 inches were not uncommon during that rainy spell:

	Nov 16	Nov 17	Nov 18	Nov 19	Nov 20	5-day total	% of Nov total
UPPER COAST							
Tomball	3.40			5.00		8.40	60
Edna	.70			6.98		7.68	75
Victoria	.22			6.63		6.85	79
Matagorda	.30	1.85		3.92	.51	6.58	72
Palacios	.86	.68	.01	4.10	.25	5.90	67
Wharton	1.29			4.46		5.75	64
Pierce		1.40			4.30	5.70	69
Katy Wolf Hill		3.40		.01	2.02	5.43	51
Cypress		3.33			2.00	5.33	63
Danevang	.90	.60		3.45	.30	5.25	70
Port Lavaca	.80	.46		3.90		5.16	62
Port O'Connor		1.93	.02	.03	3.04	5.02	67
SOUTH CENTRAL							
Hallettsville	.41			5.67		6.08	69
Sealy	2.35	1.54		2.00	.11	6.00	58
Goliad 1SE	.50			4.50		5.00	68
EAST							
Bon Wier		1.50	.32	2.70	.78	5.30	45
Waller		4.12			1.10	5.22	58

Less than one week later, after an early-winter storm left Texas encased in an Arctic chill over Thanksgiving, a low-pressure center formed on the decaying front in the western Gulf and moved up the coastline, dumping more heavy rains throughout the coastal plain and into East Texas. Heaviest rainstorm totals were logged in southern East Texas, where 3-day sums surpassed 6 inches.

Helped largely by rains of 3-5 inches when turbulent weather roamed the area on the first two or three days of November, some locales in the Red River valley of North Central Texas collected the most rain for autumn's last month in at least 14 years. Though they contributed proportionately less to the exorbitant monthly sums, high-intensity rains of 1½-3 inches in less than 48 hours at the same time were very common in East Texas. One nocturnal outbreak of very heavy thunderstorms dumped 6.70 inches of rain at **Denison Dam** on November 2 (Figure 13).

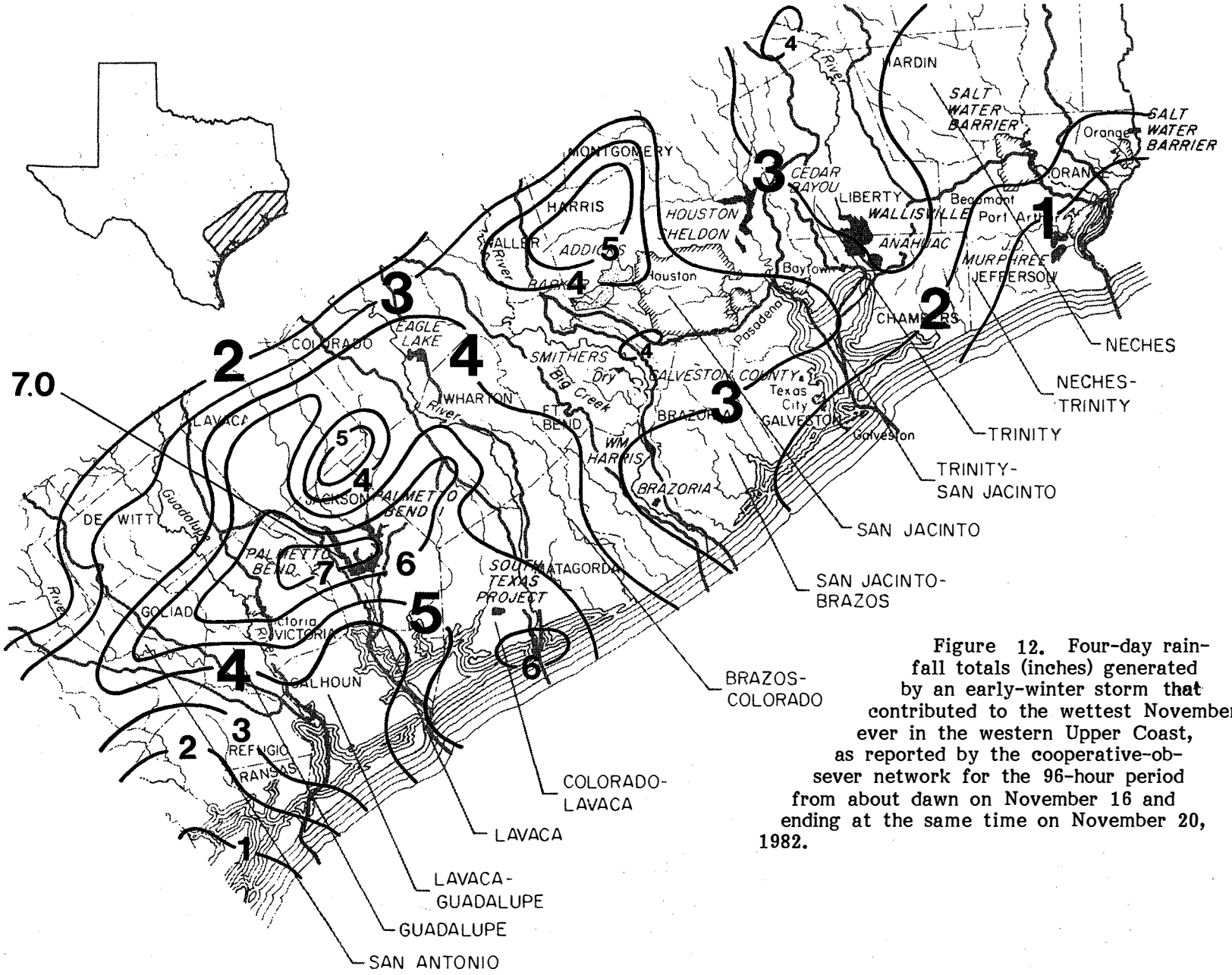
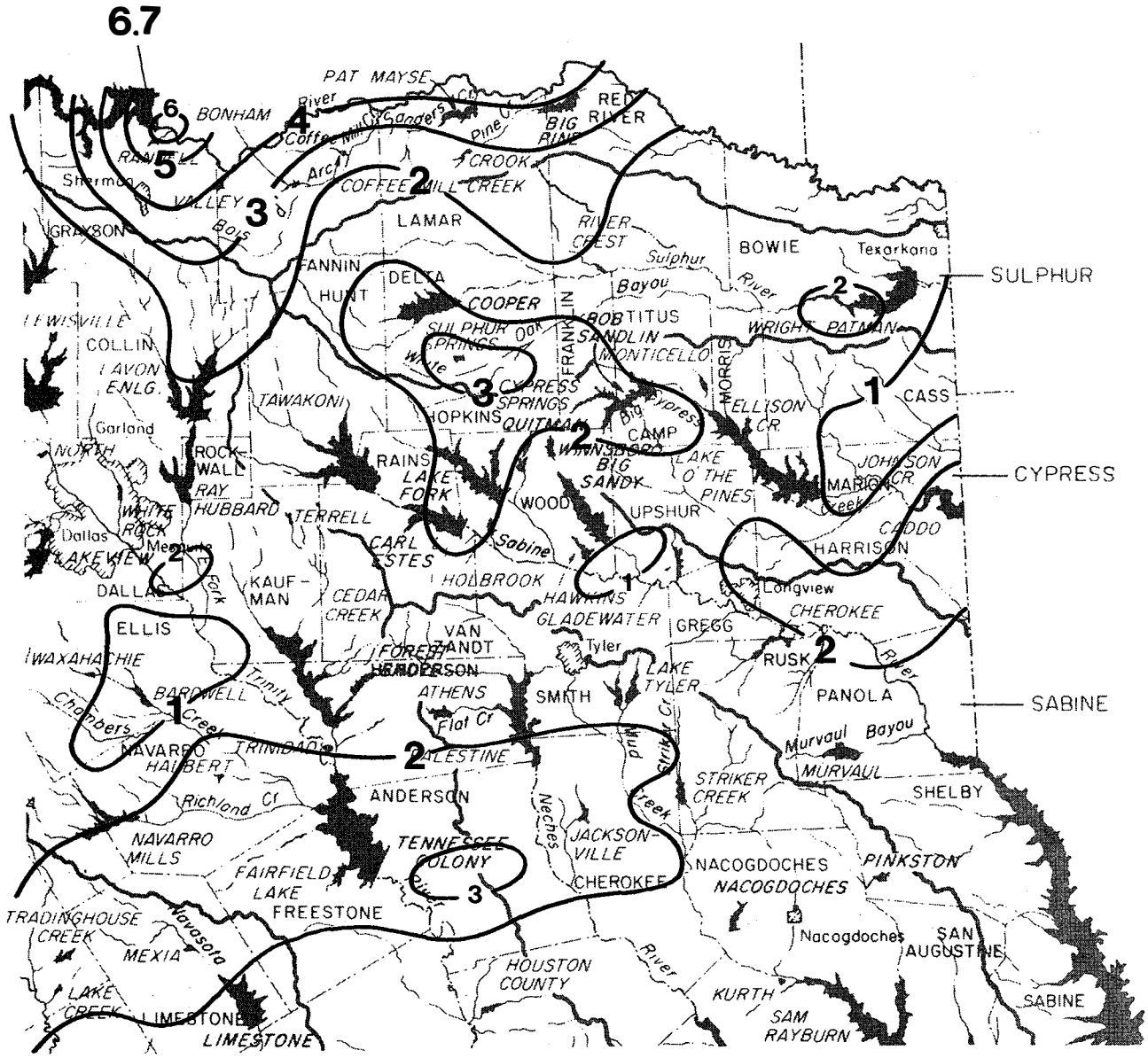


Figure 12. Four-day rainfall totals (inches) generated by an early-winter storm that contributed to the wettest November ever in the western Upper Coast, as reported by the cooperative-observer network for the 96-hour period from about dawn on November 16 and ending at the same time on November 20, 1982.



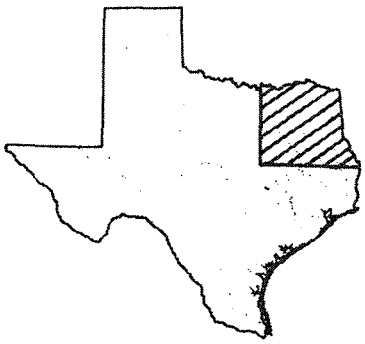


Figure 13. Two-day rainfall totals (inches) furnished by a nocturnal outbreak of turbulent weather that helped make the month of November the wettest in 14 years in some parts of North Central Texas, as observed by the cooperative-observer network for the 48-hour period beginning at about 7 a.m. (CST), November 1 and ending at the same time on November 3, 1982.

December: Record Rainstorms in Deep East Texas

The pair of very intense winter storms that dealt exraordinarily torrential rains in the eastern quarter of Texas in December also supplied much of the rest of the State with above-normal precipitation—largely in the form of a thick snow cover in the far north and a cold rain elsewhere. The second of the duo of wintry blasts contributed the most to December rainfall totals in excess of 10 inches at almost a score of locations in East Texas and more than a half-dozen sites in the Upper Coast. For some points in these two easternmost regions, the precipitation was plentiful enough to mark the month as the wettest December in history:

Wettest December Ever Observed	Dec Total	Previous Wettest December
UPPER COAST		
Port Arthur	17.98	1911 (13.45)
Orange	15.81	1956 (15.06)
EAST		
Marshall	16.68	1931 (12.74)
Warren	13.84	1971 (11.16)
Jasper	13.24	1940 (10.09)
Evadale	12.54	1945 (9.24)
Mount Pleasant	10.98	1971 (9.85)
Center	10.05	1961 (9.86)

In addition, the sum of 12.89 inches at **Liberty** was the most in December in that Upper Coast city since 1923 and the third heaviest ever in the year's last month.

The cold front that ripped across western Texas on Christmas Eve slowed almost to a stall in eastern Texas on Christmas Day, setting off repeated rounds of rainstorms interspersed with scattered thunderstorms that left 7.54 inches of rain in **Port Arthur** during an 8-hour period on the night of December 26-27. A wave formed on the front in the northwestern Gulf late on the following day, thereby fomenting even more widespread and very heavy rains that persisted until about midday of December 27. Rainfall for the 3-day period totaled more than 6 inches in a large portion of East Texas and the Upper Coast (Figure 14), with some locales, as shown below, collecting that much rain in a single 24-hour period:

	Dec 25	Dec 26	Dec 27	3-day total	% of Dec total
EAST TEXAS					
Bon Wier		3.25	7.20	10.45	66
Newton 6SE	.40	2.26	6.48	9.14	53
Evadale	2.44	3.15	1.62	7.21	57
Toledo Bend Dam	.04	2.88	3.55	6.47	41

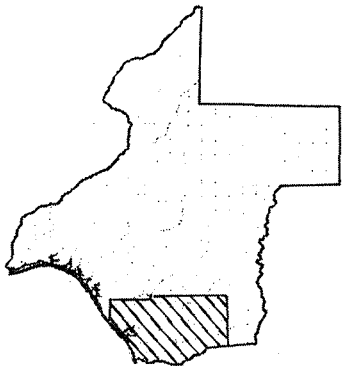


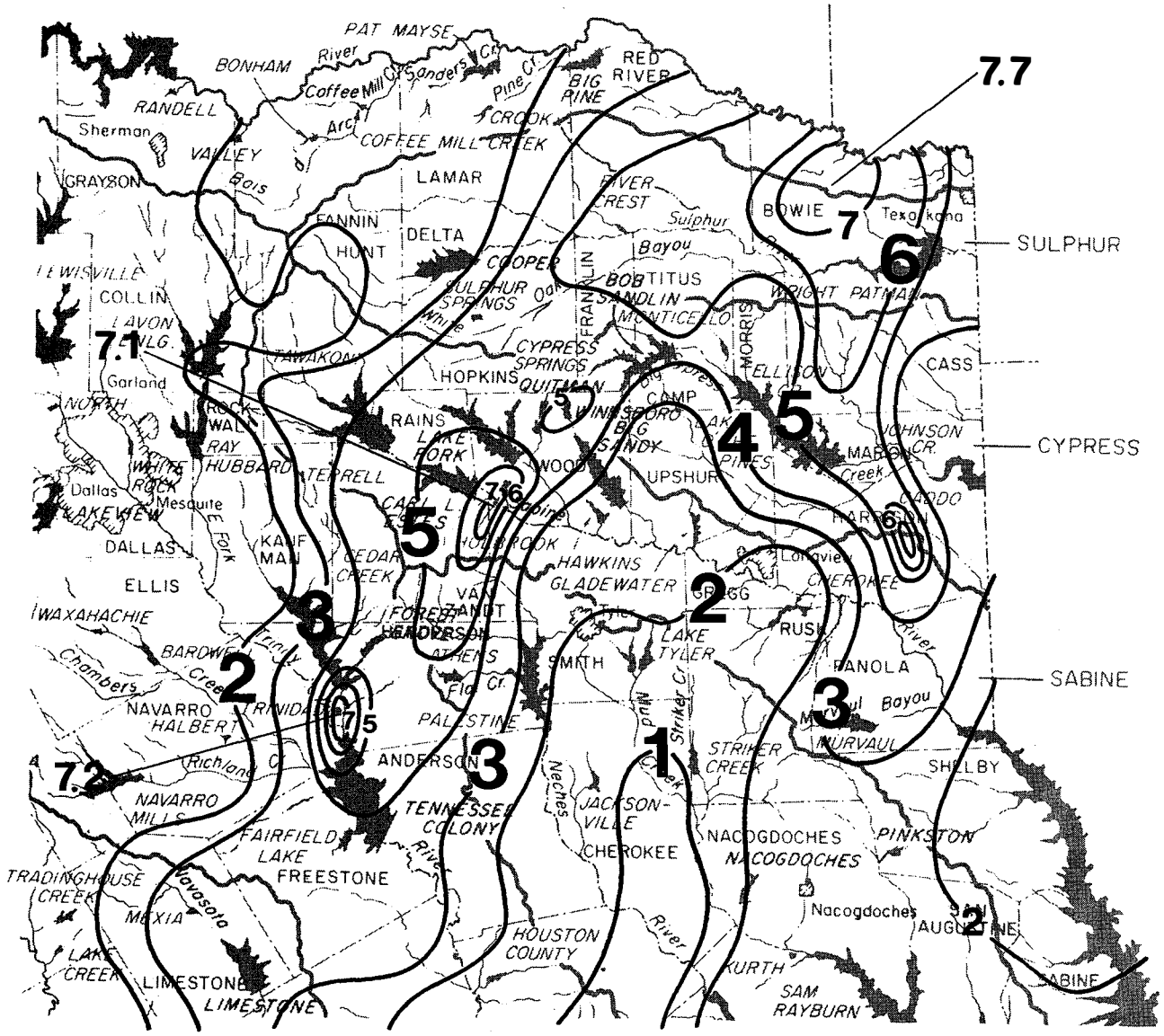
Figure 14. Three-day rainfall totals (inches) triggered by a Christmas coldfront that contributed largely to the wettest December ever in much of Texas' eastern extremity, as reported by the cooperative-observer network for the 72-hour period beginning around dawn on December 24 and ending at the same time on December 27, 1982.

	Dec 25	Dec 26	Dec 27	3-day total	% of Dec total
UPPER COAST (continued)					
Sam Rayburn Dam	.83	2.11	3.15	6.09	48
Town Bluff Dam	.51	2.40	2.97	5.88	42
Jasper	.31	2.57	2.92	5.80	44
Warren	1.26	2.68	1.81	5.75	42
Marshall	2.00	2.00	1.20	5.20	31
Pineland		2.39	2.61	5.00	50
Port Arthur AP	2.65	8.04	3.25	13.94	78
Orange		3.65	6.80	10.45	66
Deweyville 5 S	.03	3.45	6.91	10.39	68
Liberty	3.30	4.10	1.43	8.83	69
Port Arthur City		3.50	5.12	8.62	63
Beaumont	.05	3.33	5.20	8.58	68
Beaumont (Res Ctr)	.02	3.46	3.48	6.96	59
Anahuac	.07	3.20	1.96	5.23	39

Very substantial rains early in the month almost had as much to do with December's record precipitation totals as the inclement spell that plagued East Texas during Christmas week. Again, it was a stalled front that fostered the formation of a low-pressure center in northeast Texas and was responsible for 3-day rains totaling over 6 inches in a large portion of East Texas (Figure 15). Numerous communities received more than a normal December's worth of rainfall in one day during this spell, as shown below:

	Dec 2	Dec 3	Dec 4	3-day total	% of Dec total
EAST TEXAS					
Marshall		6.95	.95	7.90	47
De Kalb	.29	7.45	.07	7.81	62
Trinidad	1.30	5.90		7.20	70
Mineola 7SSW	2.33	4.80		7.13	69
Maud		6.10	.40	6.50	54
Mineola 8ENE		6.42		6.42	66
Winnsboro 6SW	.05	5.70	.07	5.82	62
Hagansport	2.65	2.90		5.55	70
Franklin	.90	4.62		5.52	69
Mount Pleasant	.10	5.35		5.45	50
Boxelder	.09	5.11	.02	5.22	55

The two exceptionally wet spells at month's beginning and near month's end provided East Texas with a regionwide monthly total of 8.11 inches of precipitation—or precisely twice what normally occurs in the final month of the year.



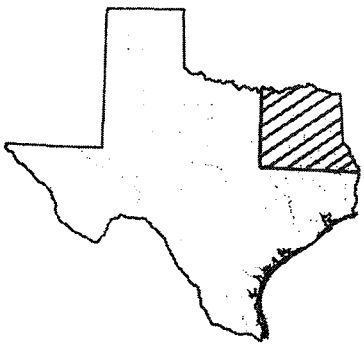


Figure 15. Three-day rainfall totals (inches) produced by an intense low-pressure center that formed on a stalled front in northeast Texas, as reported by the cooperative-observer network for the 72-hour period beginning around daybreak on November 30 and ending at the same time on December 3, 1982.

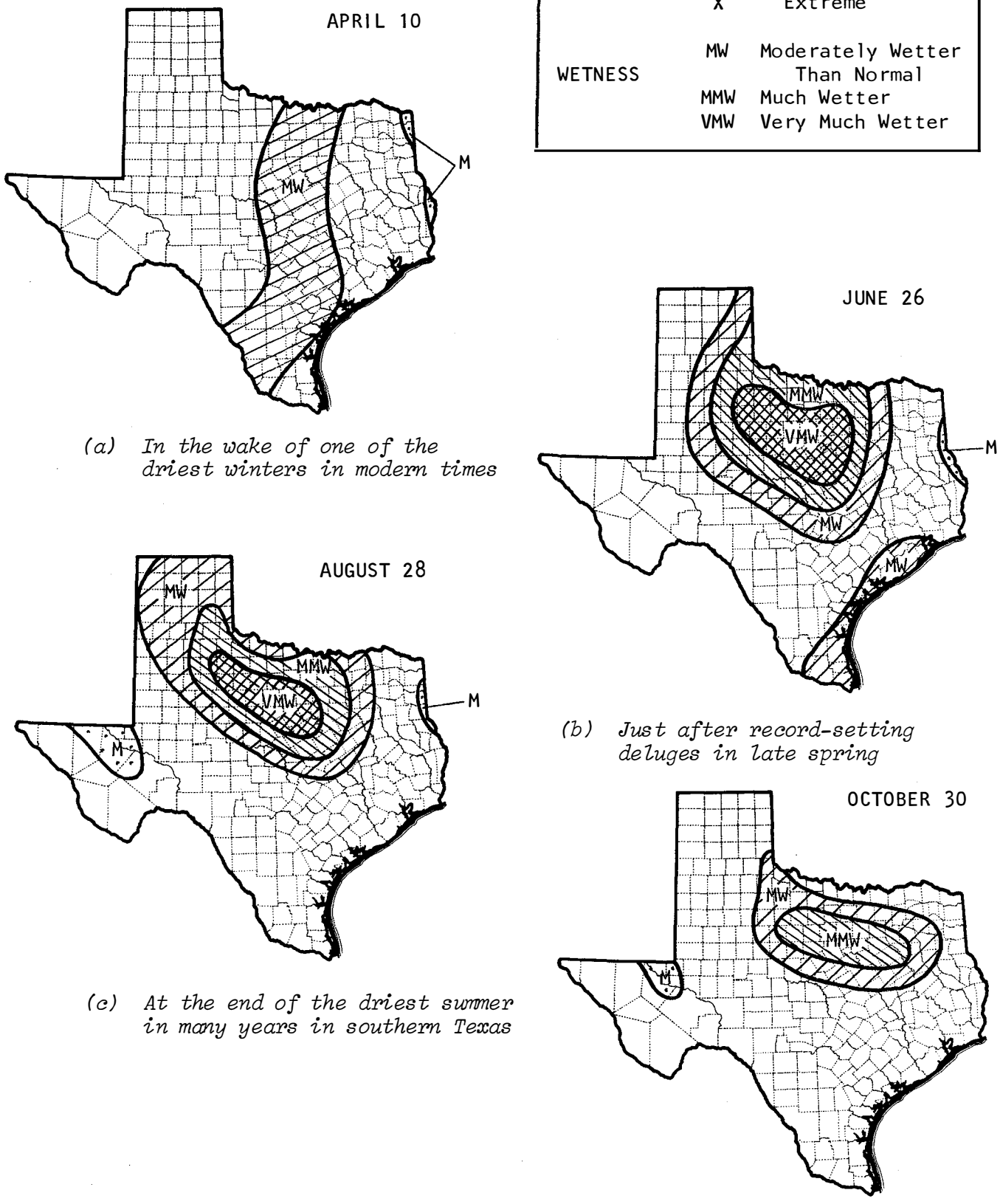
The Impact of Precipitation on Drought

Lavish rainfall spread over a 2-month period near mid-year ensured that most of the northern half of Texas had an ample amount of soil moisture for much of 1982, and copious rains in late autumn either mitigated or expunged a mild drought that enveloped southern Texas for most of the year's warm season. Generally, that segment of Texas to the north of the 31st latitude--or a line connecting points near Pecos, Temple, and Lufkin—sustained an above-normal amount of moisture in the soil for nearly all of 1982, with only the Low Rolling Plains experiencing slightly drier than normal conditions early in the year and the High Plains enduring a mild drought at the end of the summer. By contrast, drought was more widespread, intense, and longer-lasting in most of that portion of Texas south of the 31st latitude. Still, drought was rarely worse than "moderate," and in those areas (viz., the Trans Pecos and Edwards Plateau) where some degree of drought was prevalent for nearly all of 1982, conditions more often than not were barely drier than usual.

The drought that afflicted a broad expanse of Texas soon after mid-year attained its peak in early autumn—or not long after one of the driest summers in Texas' history ended. Southern Texas saw the moderate drought eased somewhat by 3-5 inches of rain during the period of October 7-10. Other areas like the Trans Pecos and Edwards Plateau, however, failed to witness any significant abatement in the drought until modest rains fell during No-vember's first week. The drought was lessened perceptibly at the same time in the Lower Valley, whose Palmer Index reading of -2.37 during October was the highest measure of drought of any region of Texas during 1982. The drought in all of these regions was the worst for the early half of autumn since a drought of similar magnitude occurred in 1964. Far to the north, in the High Plains, a drought that almost reached "moderate" intensity in October was the most acute early-autumnal dry spell in 12 years.

The wettest soil-moisture conditions anywhere in Texas in 1982 occurred in much of northern Texas in the wake of record rains in May (Figure 16b). Indeed, thanks to much above-normal rainfall persisting through June, the Low Rolling Plains and North Central Texas sustained "very much wetter than normal" moisture conditions as late as July. The whole summer was the wettest—in terms of soil-moisture—for those two regions in seven years, and a Palmer Index of 4.29 was the highest July measure of wetness for that region since 1968. The winter of 1981-82 in North Central Texas also happened to be the most moisture-rich in seven years.

North Central Texas was the only one of the State's ten climatic divisions to avoid altogether the scourge of even a modest drought in 1982. Soil-moisture conditions grew no worse than "moderately wetter than normal" in this region at any time during the year. It was the first time in 13 years, in fact, that conditions no worse than "moderately wetter than normal" persisted for the entire year. Without a fairly short-lived modest drought in late summer and



(a) In the wake of one of the driest winters in modern times

(b) Just after record-setting deluges in late spring

(c) At the end of the driest summer in many years in southern Texas

(d) Following back-to-back months of meager rainfall in autumn

Figure 16. Drought and moist soil conditions in Texas at various times during 1982.

early autumn, the High Plains also would have had a whole year devoid of any drought. Except for the year's first four months, when conditions barely in the drier-than-normal category prevailed, the Low Rolling Plains would have shared with its two neighbors in the year-long spell of "wet" soil conditions.

By contrast, the Edwards Plateau bore the ignominy of suffering drier-than-normal soil conditions throughout 1982. Yet, except for a relatively brief period in early autumn, the drought there never worsened to a "moderate" status. For six of the year's first seven months, the Palmer Index for the Edwards Plateau remained under -1.00, or within the near-normal range. Its neighbor to the west—the Trans Pecos—tolerated a "mild" drought for much of the first three-quarter of 1982, then saw slightly wetter-than-normal soil conditions take over near year's end.

The most abrupt alteration in soil-moisture conditions was effected by the record-setting deluges that spilled from the skies in late spring and late autumn. The Low Rolling Plains had an incipient drought erased in only a matter of a few days when general two to 4-inch rains hit in May's first six days. Three-day rains of 3-5 inches in East Texas in late April quickly eliminated a moderate drought. The sudden reversal in the Trans Pecos was even more dramatic. Very modest rainfall there of ½ to 1 inch in November was nonetheless sufficient to vanquish a moderate drought that measured -2.31 on the Palmer Index scale in October.

While the onset of drought is most often much more subtle than its cessation, there were several notable instances of wetness rapidly giving way to dry soil conditions. For example, less than half of normal rainfall in August turned moderately wetter-than-normal soil conditions into an incipient drought in the High Plains. Subpar rainfall in June and July transformed modestly wetter than normal conditions in Southern Texas and the Upper Coast, respectively, into incipient drought. These instances paled in comparison to what transpired in the Lower Valley, however. An almost total lack of rainfall in June in that southernmost region dropped the Palmer Index from a reading of 2.75 (much wetter than normal) to -0.60 in only 30 days.

Snowstorms and Snowfall

Intense winter storms unleashed inordinate amounts of snow not long after the year got underway and again on several occasions as the year drew to a close. Except for a swath of central Texas smothered by at least a half-foot of snow in mid-January, only the western third of Texas was touched at any time in 1982 by extraordinarily heavy snowfall. Snowfall was the most abnormally abundant in both the first and fourth quarters of 1982 in the extreme southern sector of the High Plains, where **Seminole's** 14.5 inches of snow during winter and 9.0 inches more in 1982's last two months meant that city received more than 2½ times the normal annual amount of snow. While the western tip of the State was barely nipped by several icy blasts early in the year, a trio of snowstorms in December left more than 1½ feet of snow—easily the heaviest

snowfall ever for the year's final month. As in most years, snowflakes were rare—if not altogether nonexistent—in much of the southern half of Texas

WINTER

Few winter seasons ever pass without one or a few eccentricities in the distribution of snowfall. After all, a subtle alteration in the movement of a winter storm can lead to one area getting nothing but a thin layer of snow while an adjacent region is buried underneath a snow cover of many inches. The most peculiar aspect of the "snow season" in the winter of 1982 was not that much of the Panhandle, which almost invariably receives more snow than any other section of the State, was blanketed with nearly double the normal amount of snow. Rather, the most curious development was the occurrence of extraordinarily heavy amounts of snow—almost as sizeable as in the Panhandle—in spots confined to a small area of the southern High Plains and along a narrow strip of countryside extending latitudinally through the heart of the State (Figure 17). Some of the most substantial snowfall in February in nearly 20 years ensured that the Panhandle would retain that distinction in 1982. While they were not hefty enough to crack all-time records for the winter, the 14.5 inches gaged at **Seminole** and 12.3 inches at **Navarro Mills Dam** were eye-catching totals nonetheless.

A single snowstorm in mid-January was almost solely responsible for the inordinately large snowfall amounts measured in the southern High Plains and in the strip of terrain across the center of Texas from **Mason** to **Tyler.** On the other hand, a series of snow spells in the first two weeks of February contributed largely to the excessive snow cover in the eastern Panhandle. Snowfall totals for the whole season exceeded easily the normal in these areas, while in nearly all of the remainder of the State, winter snowfall sums were subpar (Table 2). A total of ten snowstorms, four each in January and February, led to measurable accumulations of snow somewhere in Texas during the winter (December 1981-February 1982).

Table 2. Snowfall totals (inches) for the Winter (December 1981-February 1982) at selected points in Texas.

REGION/City	Winter '81-82 Total	Average for Winter	Historical Record: Greatest Total Amount	Historical Record: Greatest Total Year	Historical Record: Length of Record
HIGH PLAINS					
Amarillo	6.1	9.7	35.5	1904-05	1905-82
Canadian	0.0	3.7	22.0	1939-40	1919-82
Dalhart	7.5	9.5	26.0	1959-60	1919-82
Lubbock	3.2	7.1	27.5	1960-61	1919-82
Midland-Odessa	3.8	2.6	12.8	1928-29	1919-82

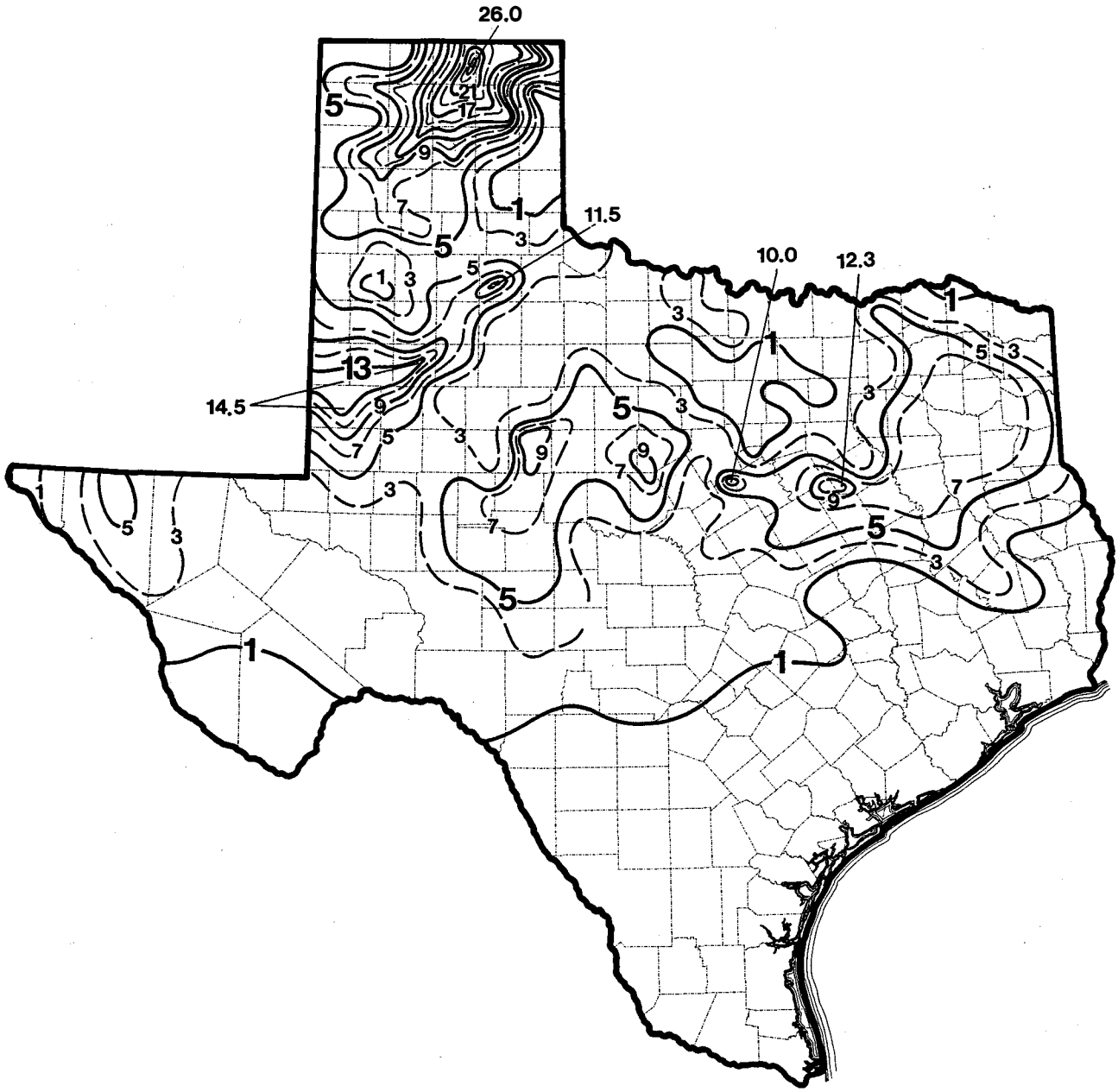


Figure 17. Cumulative snowfall totals (at 2-inch intervals) for January-April 1982.

REGION/City	Winter '81-82 Total	Average for Winter[a]	Historical Record: Greatest Total Amount	Year	Length of Record
HIGH PLAINS (continued)					
Muleshoe	3.5	7.8	21.6	1977-78	1923-82
Plainview	3.7	8.2	31.8	1955-56	1919-82
Seminole	14.5	6.1	25.7	1972-73	1923-82
Spearman	19.5	10.9	39.0	1939-40	1921-82
LOW ROLLING PLAINS					
Abilene	6.2	4.0	16.5	1972-73	1904-82
Childress	2.9	6.7	24.7	1942-43	1925-82
Clarendon	1.0	5.6	28.0	1931-32	1919-82
Wichita Falls	4.5	4.8	13.7	1977-78	1931-82
NORTH CENTRAL					
Dallas-Ft. Worth	0.8	3.0	17.6	1977-78	1919-82
TRANS-PECOS					
Alpine	0.0	2.1	26.3	1945-46	1929-82
El Paso	Trace	3.1	12.3	1905-06	1904-82

[a] Based upon observations for the period 1951-80

For the whole winter, the snowline—or the line connecting the southernmost points where measurable snowfall was observed--extended as far as **Floresville** (South Central) and **Danevang** (Upper Coast). The highest winter snowfall totals were registered at **Spearman** (19.5) and at **Darouzett** and **Higgins** (both with 19.0). The most substantial depth of snow on the ground on any single day was 12 inches at **Whitney Dam** (North Central) on January 14.

January: A Swath of Very Heavy Snow in central Texas

Two other very modest outbreaks of snow had already touched the northwestern corner of Texas by the time winter's most massive and prolific snowstorm gripped the State in mid-January. One minor wintry siege offered scattered snow accumulations of 1/2 to 1 inch in the northern Panhandle on January 2-3, and a second dusted the three northernmost tiers of Panhandle counties four days later with equally minute layers of snow. These were dwarfed, however, by the severe winter storm that first manifested itself as a far-reaching blitzkrieg of freezing rain and sleet that made movement treacherous in nearly all sections of the State. Within 48 hours after the coldest surge of Artic air to penetrate Texas all winter enveloped the State, heavy amounts of freezing rain and sleet swept north and eastward on the evening of January 11 and the

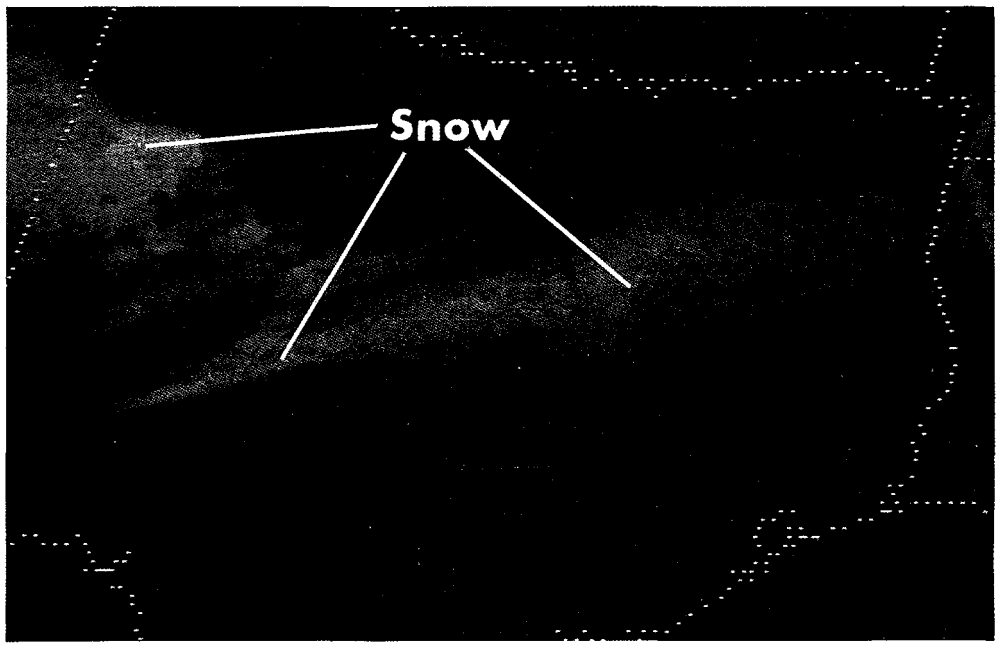
morning of the following day. While thick layers of ice coated the southern Edwards Plateau on the morning of January 11, icing of roadways was reported as far south as the Lower Valley. Ice on bridges contributed to a 20-car pileup in Brownsville that led to the death of a motorist. Power outages were common throughout the State but were especially serious in the southeastern sector, where 3/4 to 1 inch of freezing rain felled trees in heavily-forested areas that in turn snapped utility lines.

The heavy snow that followed within 24 hours the rash of freezing rain and sleet was felt most acutely in the center of the State. Whereas at least one-half foot of snow occurred in scattered areas in the southern High Plains (at **Seminole**) and Low Rolling Plains (at **Roscoe**), snow depths of at least that magnitude were observed within a swath of territory extending from near **Brownwood** and **Mason** northeastward through **Waco** into East Texas near **Tyler** and **Longview.** In fact, 9 to 10 inches of snow was detected in a narrow band 10-15 miles wide within this broader swath, extending from Brown County eastward for nearly 200 miles. At **West** and **Valley Mills,** snow depths of about 15 inches were recorded. So deep was the snow cover across southern North Central Texas that snow could be seen from weather satellites on January 18 or 5 days after the snow fell (Figure 18b).

While snowfall accumulations elsewhere were not nearly so gradiose, they were appreciable nonetheless. Moveover, significant coatings were noted deep in the southern half of the State. **San Antonio** had not been given a measurable blanket of snow since 1973 until 0.5 inch of snow fell on the Alamo City on January 13, 1982. **Austin** recorded 2.0 inches the same day, and in the Upper Coast, **Port Arthur** gaged 0.2 inch while **Galveston** and **Corpus Christi** noted traces of snow. Several locales in the northern Edwards Plateau, including **San Angelo,** collected over 6 inches, and most of the northern Trans Pecos was given 1 to 3 inches. In addition to **Seminole's** 2-day total of 13.0 inches, most of the rest of the southern third of the High Plains received notable amounts, including **Midland-Odessa** 3.4 inches. Oddly, the Panhandle was not covered with snow, and much of the Low Rolling Plains, North Central and East Texas to the north of the swath of heavy snow spanning the central portion of the State collected very modest amounts of 2-3 inches or less.

Some parts of the Panhandle and the Red River valley practically missed by the mid-January snowstorm were dusted with snow on January's last two days. Though much of this area received less than 2 inches, a few widely scattered spots caught a great deal more. **Tulia,** for instance, dug out from under 6 inches of snow as January ended, while much farther east at **Muenster** and **Gunter** (North Central), snow depths of 2-3 inches were reported. The end-of-the-month snow, however, was not nearly so widespread or substantial to appreciably augment some phenominally large January snowfall totals registered earlier in the month in the State's mid-section. Cities and locales receiving record or near-record January snowfall totals included: in North Central Texas, **Navarro Mills Dam** (12.3), **Hurst Springs** and **Meridian State Park** (11.0), **Hico**

(a)



(b)

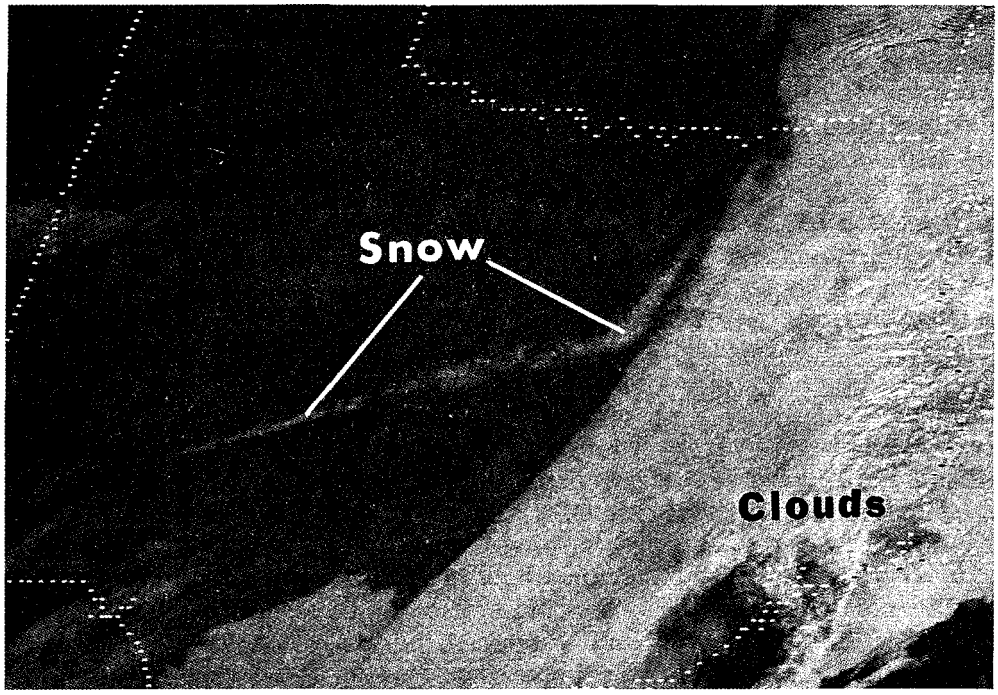


Figure 18. A severe mid-winter storm deposited extraordinarily heavy amounts of snow—some of which remained on the ground for five days—in a swath across the State's midsection on January 13. (a) Numerous reservoirs and streams in central Texas are delineated by the snow cover in this visible satellite photo taken 24 hours (2132Z) after the snowstrom ended; snow depths included 15 inches at West and Valley Mills. (b) Traces of snow are still visible on the morning (1532Z) of January 18 in a thin band from near San Angelo east-northeastward to Hillsboro.

(10.0), **Frost** (8.5), **Rising Star** and **Center City** (8.0), and **Evant** (7.1); in East Texas, **Tyler** (8.1), **Athens, Longview,** and **Dialville** (all with 8.0), and **Reklaw** (7.5). Though they were not of record dimensions, January snowfall totals were nonetheless abnormal in the following locales: in the Edwards Plateau, at a point 10 miles north-northeast of **Water Valley** (8.0), and at**Sterling City** (7.0), **San Angelo** (6.8), and **Mertzon** (6.6); in the Trans Pecos, at **Cornudas Station** (6.1); in the High Plains, at **Seminole** (13.0) and **Tahoka** (10.0); in the Low Rolling Plains, at **Roscoe** (9.0); and in South Central Texas, at **Floresville** (5.5).

February: A Deep Snow Cover in the Far North

The inclement and frequently treacherous weather that plagued Texas during February's first two weeks could be traced to the influence of a major, long-wave trough that persisted high in the atmosphere over mid-America. Gyrations in the behavior of this expansive and deep low-pressure system aloft alternately channeled new masses of frigid Arctic air and surges of moisture from the eastern Pacific and Gulf of Mexico, thereby causing a series of snow and ice spells that beleagured every corner of the State and produced excessive snowfall accumulations in the Panhandle. The first wintry wave left typically substantial snowfall in parts of the Panhandle, while most of the remainder of the northern half of the State was pestered by light amounts of snow mixed with sleet and freezing rain. After snowing lightly and intermittently for four straight days, most places in the northern High Plains counted snowfall totals of 2 to 5 inches. To the south and east, freezing rain and sleet was much more prevalent, though the icestorm that hit the northern half of the State on February 4-5 was not a major one. The modest icestorm was far-reaching, however, for frozen precipitation was felt deep in South Central and the Upper Coast on February 5.

Another round of snow and ice lashed the northern third of the State on February 8-9 after a fresh mound of subfreezing polar air invaded Texas. Snowfall amounts were less substantial than that supplied by the month's initial cold wave, as much of the Panhandle and the upper Red River valley garnered 1 to 2 inches of snow. A third batch of snow followed barely two days later, leaving most of the Panhandle again blanketed by a snow layer of 1 to 2 inches. In fact, the northern High Plains remained snow-covered for practically all of the first half of February, and repeated bursts of cold air prevented the temperature from rising much above the freeze level during any sustained period of time.

Springlike temperatures in the 70s for much of the latter half of February meant that any trace of snow had long since disappeared when a short-lived cold wave brought one more rash of snow just before the month ended. While the February 25-26 snowstorm served only a few inches of snow to the northwestern quarter of Texas, it supplied somewhat more substantial snowfall amounts farther east and south in much of North Central and East Texas. Snow measuring 1 to 3

inches fell in such disparate locales in these regions as **Throckmorton** and **Muenster** in the west to **Terrell** and **Atlanta** in the east. Much of the Trans Pecos and Edwards Plateau received traces of snow from this relatively minor storm.

The fact that most of the snowstorms that struck Texas in February followed courses that took them over the northernmost portion of the State is demonstrated by February snowfall totals. The few inches of snow registered at most locales in the Low Rolling Plains, North Central and East Texas were dwarfed by the highly appreciable sums seen in the Panhandle. Still, a few spots outside of the Panhandle, especially in North Central Texas, received abnormally large sums; these included **Mid City** (9.0), **Anna** and **Honey Grove** (6.0), and **Bonham** (5.0). More than a half-dozen places, all in the northeastern corner of the Panhandle, totalled over a foot of snow during the year's shortest month. Heading the list was **Higgins,** where a total of 19.0 inches was gaged, while **Spearman** (17.0), **Darrouzett** (15.5), **Perryton** (14.5), **Gruver** (14.2), and **Borger** (14.1) were not far behind.

SPRING

There was hardly anything unusual about the trio of modest snowstorms that brushed parts of northern Texas during the early half of Spring. Only the first of the trio managed to deposit snow on the ground outside of the High Plains. The March 5-6 wintry outburst delivered a snow cover of 1 to 3 inches in the northern High Plains. Somewhat surprisingly, that storm skipped over areas immediately to the south and east to place minor amounts of snow in a few scattered spots in North Central and East Texas. Even then, the snow cover was only a small fraction of an inch at locales such as **Temple** and **Benbrook Dam** (North Central) and **Athens, Emory,** and **Tyler** (East); only **Negley,** in the Red River valley, received as much as 1 inch.

The spring furnished uncommonly substantial snowfall only in the eastern half of the Panhandle. The combination of 1 to 3 inches of snow provided by the March 5-6 storm and a subsequent snowfall of at least that much more late in the month of March meant that some locales northeast and east of **Amarillo** collected at least twice as much as usual for the whole season. The brief snowstorm of March 27 left 5.0 inches of snow on the ground at **Follett,** whose spring total of 8.0 inches was second only to nearby **Spearman's** seasonal sum of 8.5 inches (Table 3). Other spots in the eastern Panhandle with abnormally large spring snowfall totals included: **Miami** (8.0 inches), **Lipscomb** (7.0), and **Perryton** (6.0).

While snow was substantial enough to stick on the ground one last time in the spring—on April 10 in the northernmost reaches of the Panhandle—the depth

of the snow was hardly measurable. A few points between **Amarillo** and the Texas-Oklahoma border to the north received "traces" of snow on the ground, while the only measurable amount of snow fell in the northeastern corner of the Panhandle at **Follett,** where 1.0 inch was registered. The last trace of snow in the spring was seen much farther south in the high elevations of the Trans Pecos at **Marfa** on April 22.

Table 3. Snowfall totals (inches) for the Spring (March-May) of 1982 at selected points in Texas.

REGION/City	Spring 1982 Totals[a]	Average for Spring[b]	Historical Record: Greatest Total Amount	Year	Length of Record
HIGH PLAINS					
Amarillo	1.7	2.9	21.5	1934	1904-82
Dalhart	2.9	3.3	16.0	1958	1919-82
Lubbock	Trace	2.0	14.3	1958	1919-82
Midland-Odessa	0.0	0.4	5.9	1970	1919-82
Muleshoe	Trace	1.6	11.5	1969	1924-82
Plainview	Trace	1.5	14.0	1947	1919-82
Seminole	0.0	1.4	12.0	1969	1923-82
Spearman	8.5	3.5	19.0	1922	1921-82

[a] All measurable snowfall occurred in the month of March
[b] Based upon observations for the period 1951-80
[c] Also in the Spring of 1941

AUTUMN-EARLY WINTER

Were it not for a lone wintry blast that chilled Texas during the week of Thanksgiving, the autumn (September-November) of 1982 would have been snowless and ice-free. Temperatures in October were seldom near or below the freeze mark, so any forms of frozen precipitation were either negligible or altogether nonexistent. The complex and rather protracted wintry siege in late November, however, supplied portions of the High Plains with a snow cover 2 to 3 times the usual accumulation in autumn (Table 4). Nonetheless, even those depths paled in comparison to the hugh amounts of snow deposited by a succession of winter storms during December. A total snow cover for that year's final month of 5 to 8 inches in much of the southern half of the High Plains marked the beginning of a winter season (December 1982-February 1983)

Table 4. Snowfall totals (inches) for the last two months of 1980.

Region/City	Nov-Dec 1982 Total	Historical Record: Mean Nov-Dec	Greatest Total: Amount	Greatest Total: Year	Length of Record
HIGH PLAINS					
Amarillo	6.4	3.0	31.3	1918	1904-82
Dalhart	8.3	2.3	20.0	1923	1919-82
Lubbock	7.2	1.2=	21.4	1980	1919-82
Midland-Odessa	6.5	0.4@	7.2	1980	1919-82
Plainview	8.0	1.6&	18.0	1931	1919-82
LOW ROLLING PLAINS					
Abilene	1.4	0.5+	9.3	1918	1904-82
Childress	0.4	1.3+	24.0	1931	1925-82
Clarendon	2.5	1.2+	25.0	1931	1919-82
Wichita Falls	1.1	0.6+	8.0	1942	1931-82
TRANS PECOS					
El Paso	18.5	0.9+	14.7	1976	1904-82

\+ One measurable snowfall every two years.
@ One measurable snowfall every three years.
= Two measurable snowfalls every three years.
& Three measurable snowfalls every four years.

that eventually would be identified in weather annals as the snowiest ever. Moreover, the 1½ feet of snow gaged at **El Paso** in December contributed largely to the most snow that westernmost metropolis would ever observe during a whole winter. The aggregate snow cover in December in some locations in the Trans Pecos and southern High Plains was sufficient to set new marks for the year's final month, as shown below:

Most Snowfall Ever in December	Dec 82 total	Previous Snowiest December
TRANS PECOS		
El Paso	18.2	1960 (10.1)
Chisos Basin	4.0	1960 (3.8)
HIGH PLAINS		
Midland-Odessa	6.4	1943 (6.3)

Not surprisingly, the snowline—or the southernmost limit of measurable snow accumulations—extended much deeper into Texas during December than at any time in autumn, as **Bakers Crossing** (in Val Verde County) and **Putnam** (in

Callahan County) registered at least 1.0 inch of snow. Traces of snow on the ground were observed as far equatorward as **Junction** (Edwards Plateau) and **Mount Vernon** (East). The maximum depth of snow measured on any one day was 7 inches—shared by **Hereford** and **Levelland,** on the morning of December 27.

November: A Lone Snowy Siege at Thanksgiving

The first genuine dose of wintry weather in the autumn of 1982 hit the northwestern quarter of Texas just one day before Thanksgiving. Polar air that had enveloped the region late on November 22 remained sufficiently chilled to foment sleet in the southrn High Plains and snow showers in the northern Trans Pecos as early as on the morning of November 24. With intermittent snow persisting in the High Plains until daybreak of November 25, heaviest snowfall accumulations—ranging from 1 to 3 inches—lay in the area between **Lubbock** and **Amarillo.** Following a respite that lasted for most of Thanksgiving Day, light snow returned to the Panhandle on the morning of November 26. More light snow fell late that day and until dawn on November 27 in much of the High Plains. The two-pronged winter storm left snowfall totals of at least one-half foot in portions of the western High Plains and in the northern fringe of the Panhandle. The most substantial accumulations measured 7.0 inches at **Friona** and 6.0 inches at **Muleshoe** and **Stratford.** A few points in the northern Low Rolling Plains were blanketed by modest snow covers of 1 to 2 inches, and some locales as far south and east as **Albany** and **Bowie** registered trace amounts. The 1 to 2½ inches common in the northern half of the Trans Pecos was the most in November in that area in 6 years.

December: Record Snows in the Far West

It was fitting that a month noted for a record snowfall should begin and end with a snowstorm in progress somewhere in western Texas. The snowy siege that blanketed the northern Trans Pecos and southern High Plains on one or more of December's first three days was nearly as prolific as the snowstorm that ushered out the year of 1982. In less than 6 hours the month's first winter storm dumped 5.2 inches of snow on **El Paso** on the morning of December 1, closing businesses and schools and snarling traffic. That single-day snow total easily exceeded the normal for the whole month and put the city well on its way to establishing a new snowfall mark for the last month of the year. Snowfall of 4 inches was observed elsewhere in the Trans Pecos in the Sierra Vieja Mountains, while a rather isolated patch of appreciable snowfall enveloped Lubbock, where 3.2 inches of snow was gaged.

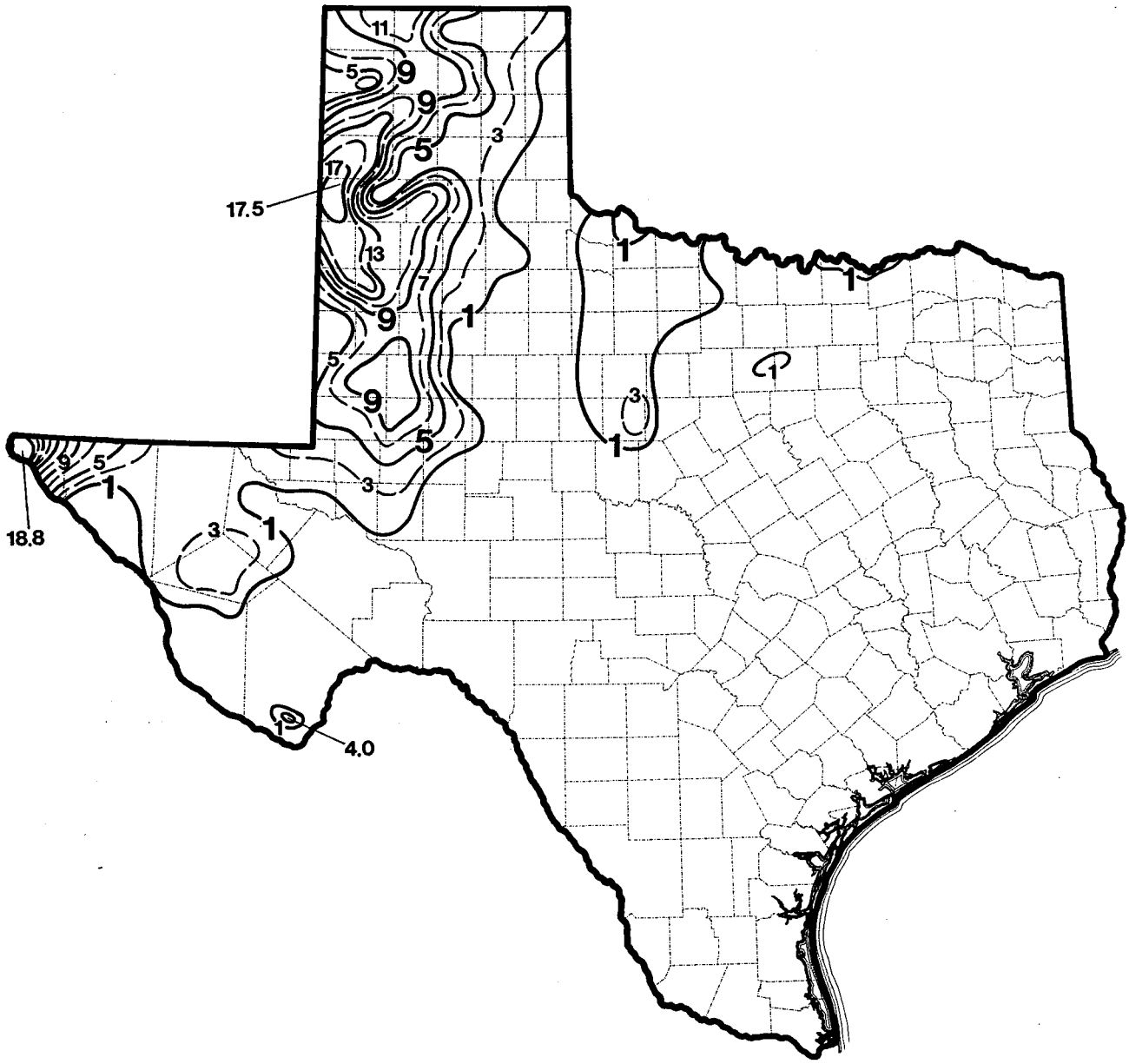
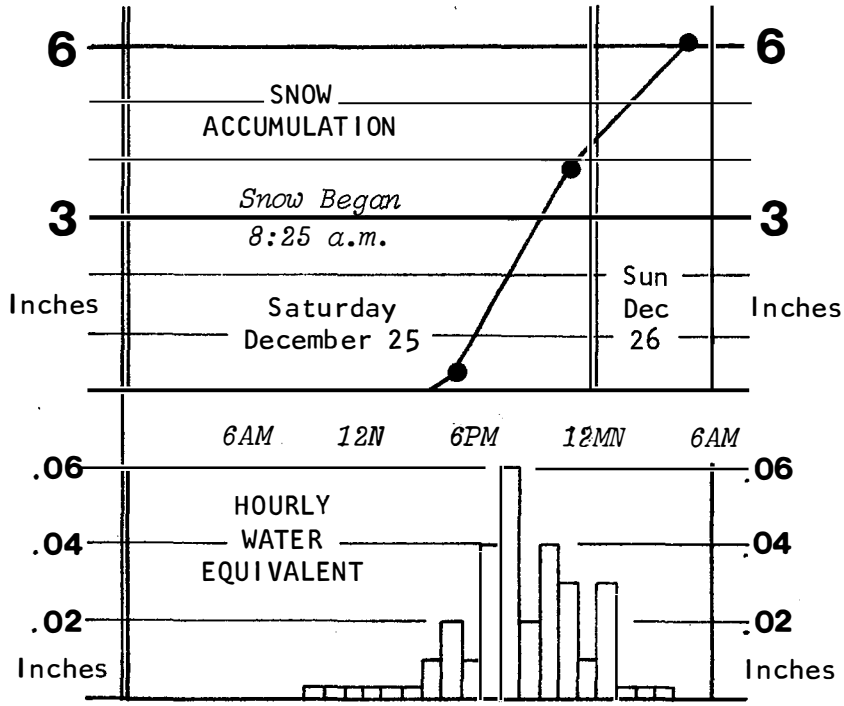


Figure 19. Cumulative snowfall totals (at 2-inch intervals) for November-December 1982.

A second December snowstorm that hit on Christmas weekend out-distanced the early-in-the-month storm in that it dumped sizeable snowfall accumulations in much of the western third of Texas. Snow began falling in **El Paso** around noon on Christmas Day, severely disrupting holiday traffic and festivities. By daybreak of the following day, enough snow had fallen—6 inches, that is (Figure 20)—to shatter the all-time December snowfall record for that westernmost city. A combination of snow, freezing rain, and sleet fell for much of the day on December 26 throughout the Trans Pecos, High and Low Rolling Plains. Four to 6 inches of snow was common in the Guadalupe Mountains and in Big Bend National Park, and at least a half-foot of snow covered the ground in much of the High Plains. Nearly 200 motorists were stranded by the snow-clogged roads in Dallam County. A snow cover of 2 inches was noted as far south and east as **Throckmorton.**

Other outbreaks of snow during December included a storm that deposited 4 inches of snow or more in parts of North Central Texas a few days before mid-month. Whereas it furnished the High and Low Rolling Plains with most negligible amounts of snow, the storm left several inches of snow in locales such as **Forestburg, Muenster,** and **Putnam.** One outburst lasting no more than 2 hours on December 11 left accumulations of 2-4 inches in Montague County. A short-lived snowy spell nipped the High and Low Rolling Plains on December 28-29, leaving mostly minor accumulations of snow and ice.

The final winter storm of 1982 rushed eastward out of the southern Rockies on December 30 and began coating the Trans Pecos and southern High and Low Rolling Plains with snow and ice early on New Year's Eve. Actually, snow started falling as early as nightfall of December 30 in the northern Trans Pecos and southern High Plains. With 7 inches of new snow on the ground, snow was still falling when the last few seconds of 1982 were being counted off. Two to 5 inches of snow was common in most of the High Plains on 1982's last day.



(a) Snowfall accumulation and water equivalent for the snowstorm of December 25-26, 1982.

(b) Snowfall accumulation and water equivalent for the snowstorm of December 30-31, 1982.

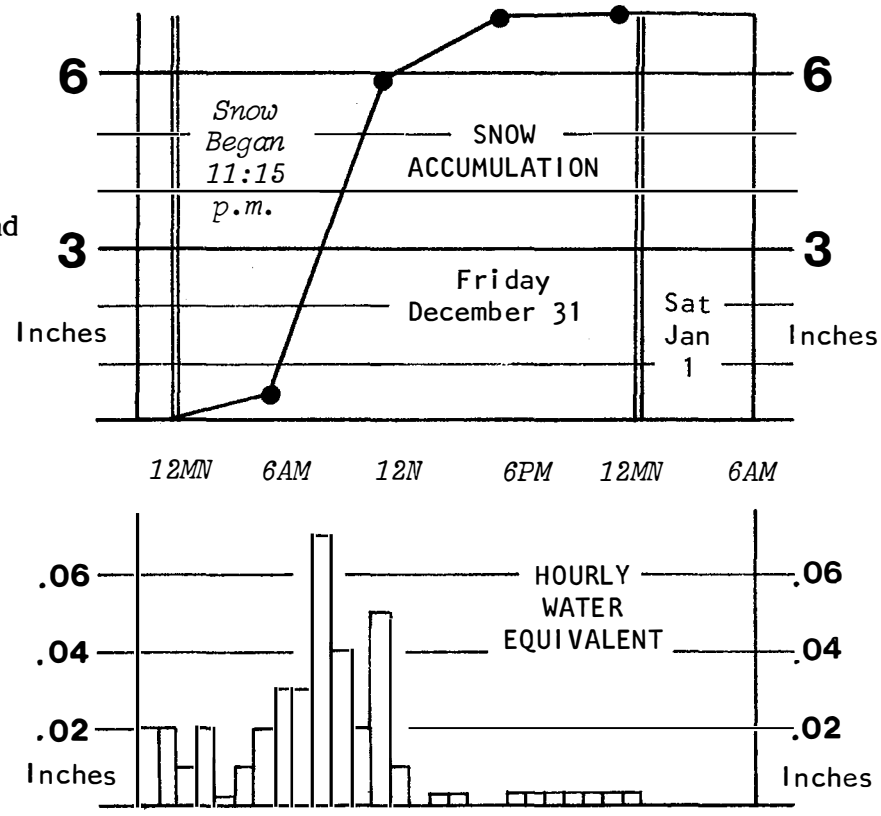


Figure 20. Accumulation of snowfall at El Paso's International Airport and the hourly amounts of melted precipitation at that location during two separate snowstorms in December 1982 that contributed to the heftiest monthly snowfall (18.2 inches) ever in December in that westernmost city.

III. TEMPERATURE

Marked by a winter that was not unduly harsh or a summer that was only infrequently hot, the year of 1982 seldom featured weather that was much out of the ordinary. Unusually frigid weather occurred only sporadically in winter—a season highlighted by a pair of Arctic-air outbreaks, one of which plunged temperatures below 0^{o} in scattered portions of North Central and East Texas in mid-January and a second that shoved readings to an 8-year low far below 0^{o}F in the Panhandle a month later. Nature was most perplexing during the spring, for extraordinarily mild weather in March was replaced by protracted sieges of winterlike chill in April and May. The summer got underway with a record chill nearly statewide but then heated up to astounding levels just as the season ended. Punctuated by an infusion of polar air in mid-September that dropped temperatures to record depths near freezing in North Central Texas, Autumn was best remembered for the premature arrival of frost in much of the State.

An Annual Overview

With none of 1982's four seasons having been extraordinarily warmer or cooler than usual, it is not surprising that temperatures averaged for the whole year were near normal throughout the State. Three-fourths of Texas experienced mean annual temperatures that were within 1^{o} of normal, and only a couple of locales in North Central Texas (**Bridgeport**, -2.3^{o} and **Bonham**, -2.6^{o}) and one each in the High Plains (**Vega**, -2.3^{o}) and Trans Pecos (**Ysleta**, 4.1^{o}) measured mean yearly readings more than 2^{o} above or below normal. In general, the northern third of Texas experienced slightly cooler than normal weather on a year-long basis, while the remainder of the State registered mean readings only a fraction of a degree above or below normal (Figure 21). In fact, on a regionwide basis, the five climatic divisions constituting the southern half of Texas each had a mean regional temperature within 0.1^{o} of normal. In the north, the Low Rolling Plains sustained the greatest negative departure from normal (-1.0^{o}F) while the westernmost Trans Pecos had the greatest positive departure (+0.9). As one would expect, the northern extremity of Texas felt the mildest weather on a year-round basis. **Dalhart** (54.7^{o}) and **Vega** (54.0^{o}) recorded the lowest mean temperatures for 1982 anywhere in Texas, while at the other end of the State, warmest average annual temperatures were gaged at **Zapata** (75.6^{o}), **Brownsville** (75.1^{o}), **McAllen** (75.0^{o}), and near **Mission** (74.7^{o}). Yearly extremes were -13^{o}F at **Gruver** (High Plains) on February 6 and 114^{o}F at **Lajitas** (Trans Pecos) on June 28.

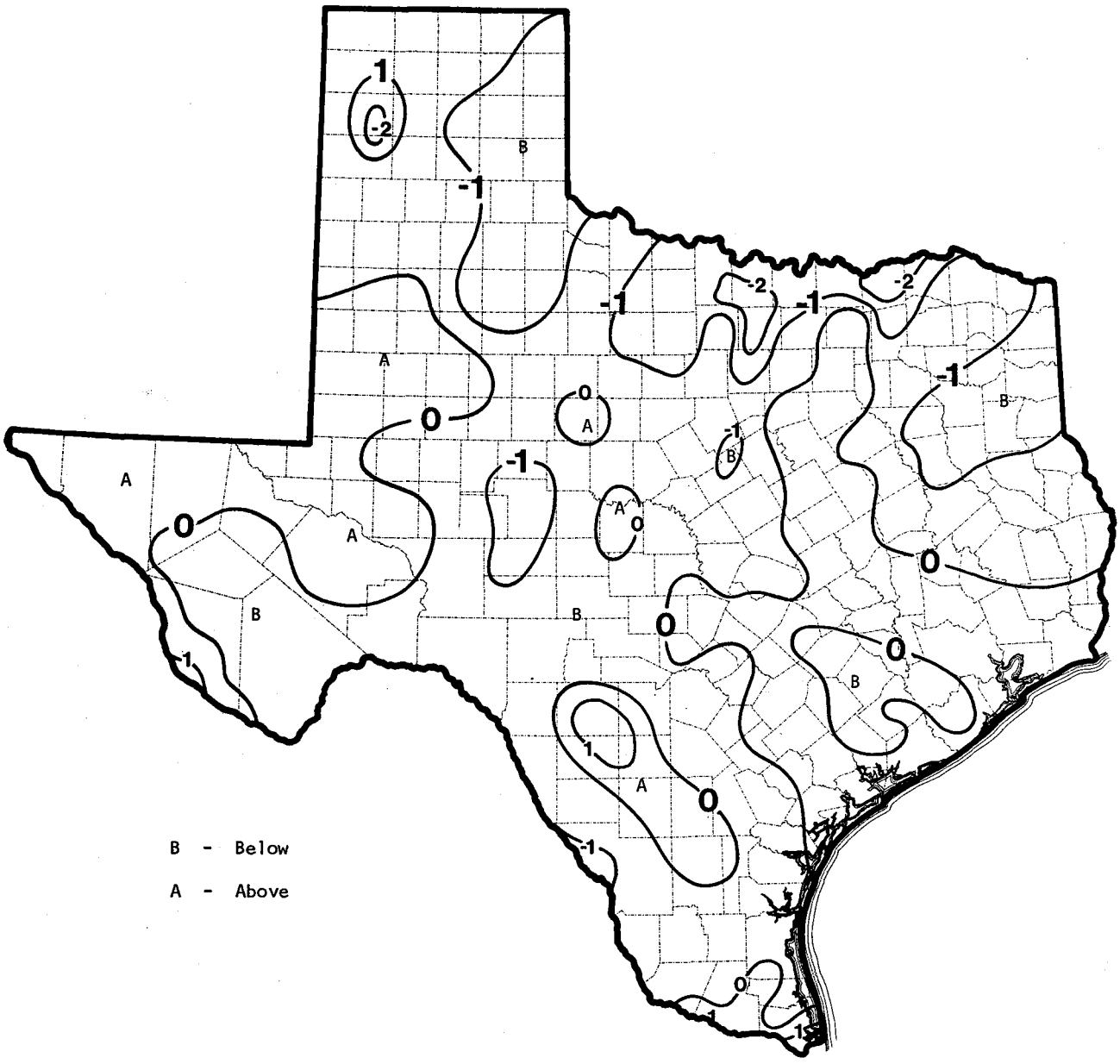


Figure 21. Departure (^{o}F) of average annual temperature from normal in 1982.

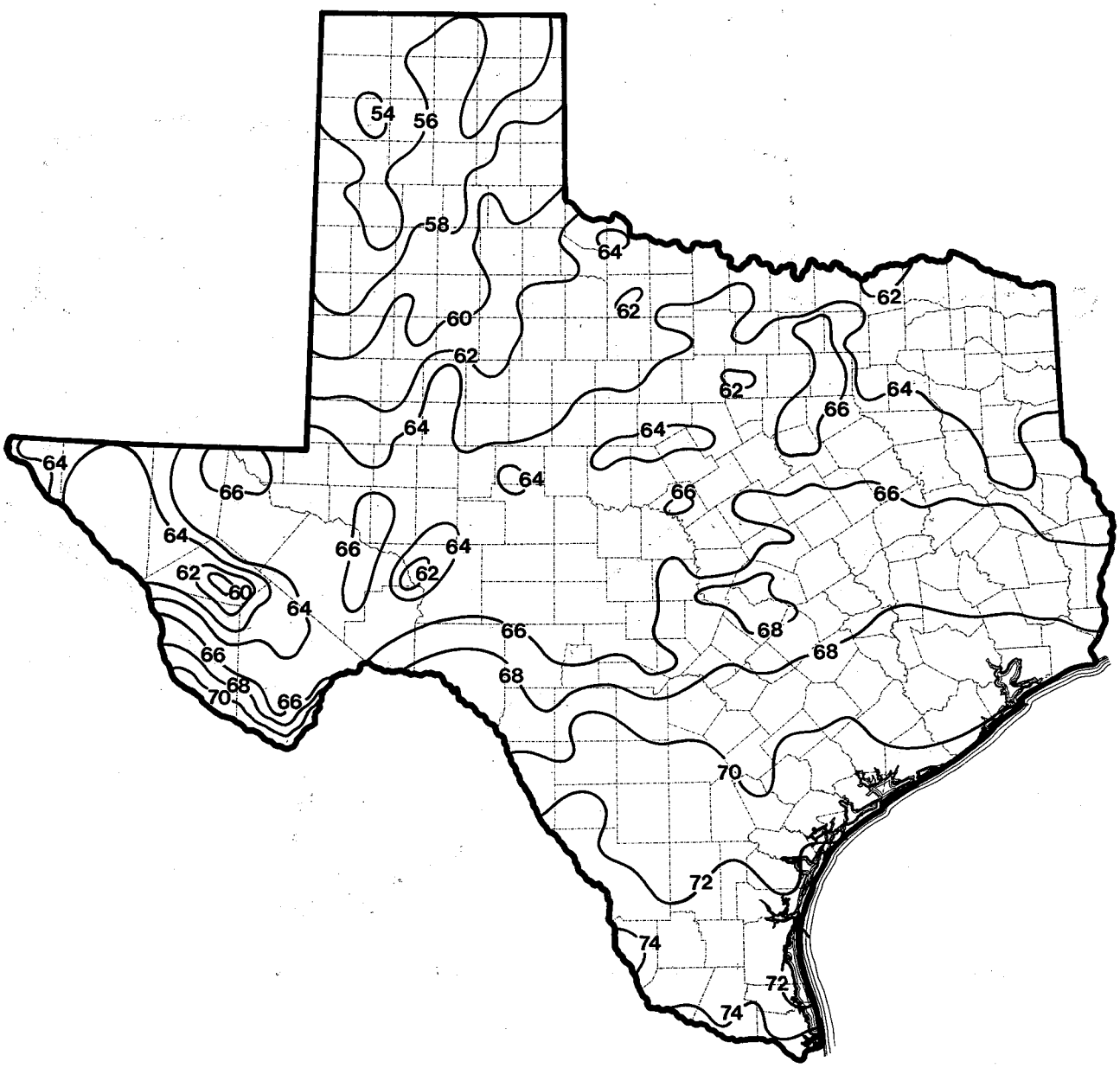


Figure 22. Average annual temperature (^{o}F) of 1982.

Table 5. Mean and extreme temperatures (°F) for selected cities in Texas during 1982

CLIMATIC DIVISION/City	Annual Average	Departure from Normal (1941-70)	Extremes		Number of Months		Freeze Occurrences	
			Low	High	Below Normal	Above Normal	Last in Spring	First in Fall
HIGH PLAINS								
Amarillo	56.5	-0.9	-5 Feb 5	102 Aug 15	7	5	Apr 22	Oct 20
Dalhart	54.7	-0.5	-7 Feb 6	97 Aug 14	8	4	Apr 23	Oct 11
Hereford	56.1	-0.7	-6 Dec 30	100 Aug 16	8	4	Apr 21	Oct 20
Lipscomb	55.6		-11 Feb 6	107 Aug 15			Apr 22	Oct 11
Lubbock	60.0	0.2	0 Dec 29	103 Aug 15	7	5	May 22	Oct 20
Midland-Odessa	63.6	-0.3	5 Jan 11	102 Aug 24	8	3	Mar 08	Nov 04
Pampa	55.6		-3 Feb 6	101 Aug 16			Apr 07	Oct 20
Plainview	58.8	-0.1	2 Dec 29	102 Aug 16	7	5	Apr 06	Oct 20
LOW ROLLING PLAINS								
Abilene	64.6	0.1	5 Jan 11	101 Aug 16	6	6	Mar 07	Nov 03
Gail	64.3		4 Jan 11	103 Aug 15			Mar 07	Nov 13
Paducah	60.8		4 Jan 12	105 Aug 16			Mar 08	Nov 04
Wichita Falls	62.6	-1.5	3 Jan 11	107 Aug 27	9	3	Apr 06	Nov 05
NORTH CENTRAL								
Brownwood	65.1	-0.3	2 Jan 14	105 Aug 17	8	4	Mar 07	Nov 04
Dallas-Ft. Worth	65.4	-0.1	7 Jan 11	103 Aug 6	7	4	Mar 06	Nov 13
Gainesville	62.2	-1.5	3 Jan 11	103 Aug 16	10	2	Mar 08	Nov 04
Waco	67.3	0.2	6 Jan 14	105 Aug 6	5	7	Mar 07	Nov 13
EAST								
Athens	65.6		-5 Jan 14	103 Aug 27			Mar 08	Nov 04
College Station	68.9	0.6	9 Jan 11	102 Aug 17	4	8	Mar 07	Dec 12
Lufkin	66.5	-0.2	8 Jan 11	99 Aug 17	6	5	Mar 08	Nov 13
Sulphur Springs	62.6		4 Jan 11	104 Aug 27	7	5	Apr 06	Oct 25
Texarkana	62.9		3 Jan 11	101 Aug 27			Mar 07	Oct 24
TRANS-PECOS								
Alpine	61.9	-0.7	10 Feb 3	98 Jun 26	8	4	Apr 23	Oct 29
Chisos Basin	62.0	-0.4	19 Jan 11	94 Jun 7	7	5	Mar 08	Nov 03
El Paso	64.1	0.8	10 Jan 4	105 Jun 28	3	9	Mar 08	Nov 12
Pecos	65.5	0.3	13 Jan 12	108 Aug 15	5	6	Mar 09	Nov 04
EDWARDS PLATEAU								
Del Rio	69.8	-0.1	15 Jan 11	105 Aug 7	5	6	Mar 07	Nov 04
Llano	66.7	0.0	7 Jan 12	107 Aug 8	6	6	Mar 08	Nov 04
Ozona	64.3		1 Jan 11	101 Jul 21			Mar 08	Nov 04
San Angelo	64.3		1 Jan 11	101 Jul 21			Mar 08	Nov 04
SOUTH CENTRAL								
Austin	69.1	1.0	11 Jan 11	104 Aug 17	3	7	Feb 10	Dec 12
Columbus	69.1		10 Jan 12	105 Sep 4			Mar 08	Oct 26
Corpus Christi	71.6	-0.3	19 Jan 14	100 Sep 11	7	4	Mar 07	None
Goliad	71.4	0.1	15 Jan 11	104 Aug 5	5	7	Mar 07	Nov 05
San Antonio	68.3	-0.6	13 Jan 11	102 Aug 17	7	5	Mar 07	Nov 04
UPPER COAST								
Beau-Pt. Arthur	69.1	0.6	15 Jan 11	94 Aug 17	5	7	Mar 07	Dec 13
Galveston	70.0	0.2	20 Jan 11	93 Sep 3	5	7	Feb 06	None
Houston	69.2	0.3	12 Jan 11	99 Jul 11	5	7	Mar 07	Dec 12
Victoria	70.5	0.4	14 Jan 11	100 Aug 17	4	7	Mar 07	Dec 12
SOUTHERN								
Alice	72.2	0.1	19 Jan 12	103 Aug 18	4	8	Feb 07	None
Eagle Pass	70.5	-0.5	19 Jan 12	105 Aug 28	6	5	Mar 07	None
Laredo	72.9	-1.0	22 Jan 14	105 Jul 30	6	6	Mar 07	None
LOWER VALLEY								
Brownsville	75.1	1.4	25 Jan 14	99 Sep 1	2	10	Feb 06	None
McAllen	73.9	0.2	27 Jan 12	100 Aug 6	3	9	Feb 07	None

*Same temperature also occurred on earlier dates

Analyses by Month and Season

WINTER

Though highlighted by a mid-January Arctic-air outbreak that frosted Texas' southern extremity and an early-February cold wave that produced the coldest temperatures in the Panhandle in eight years, the winter of 1981-1982 (December 1981-February 1982) could be characterized at worst as only modestly harsh. Without the infusion of very frigid Arctic air as February got underway, the winter likely would have been either near-normal or even a shade milder than usual. Still, the two severe cold waves plummeted temperatures to levels seldom seen in Texas. The Arctic blast in early February sent temperatures far below 0^{o} in the Panhandle, while the mid-January surge of uncommonly frigid air caused some of the worst discomfort in the southeastern portion of the State in many years. Amazingly, subzero readings were felt in such unlikely locales as **Athens** (-5^{o}) and **Glen Rose** (-1^{o}) on January 14. Although it remained in the grip of the bitter cold wave for four days, the Lower Valley somehow escaped substantial crop losses.

Temperatures in East Texas were colder than normal in each of winter's three months, so that region sustained the greatest negative departures of average winter temperature from normal of any of Texas' ten climatic divisions. Readings for the whole of winter were 2.5^{o} under normal in East Texas. The Upper Coast was the only other region to have negative departures from normal in each of winter's three months, though in December 1981 and January 1982 mean monthly temperatures were barely in the minus category. Due largely to an uncommonly cold February, average winter temperatures in nearly all of the remainder of Texas were from 1/2 to 1^{o} below normal. The lone exception was the Trans Pecos, where an unusually warm December more than counteracted a modestly cold February to leave that westernmost region with an average winter temperature of 1.3^{o} above normal.

Winter's harshest blast of Arctic air in early February shoved temperatures in northwestern Texas below freezing and kept them there for a spell lasting six days. Readings in the Panhandle dipped under 32^{o} on the evening of February 1 and remained subfreezing until midday on February 7. In fact, much of the Panhandle suffered subzero temperatures for a nine to 12-hour period on the night of February 4-5. The coldest temperatures of the winter were recorded on the morning of February 6, when minimums of -15^{o} and -13^{o} were observed near **Perryton** (Figure 23) and at **Gruver**, respectively. Not since January 5, 1974 had temperatures dropped so low anywhere in Texas. Moreover, it was only the third time since 1960 that temperatures plunged to -15^{o} or lower in the Lone Star State.

Due largely to an uncharacteristically cold February, much of Texas endured a greater than normal number of freeze days during the winter of 1981-82. Days with temperatures dipping to 32^{o} were especially more numerous than usual in the Red River valley and in the mountainous areas of the Trans Pecos, as well as in Southern Texas and the Lower Valley (Table 6). The inordinately large number of freeze days—from 4 to 6—that occurred in the State's southern

Table 6. Number of freeze days during January-May 1982 as compared with the recent past (1949-1979)

REGION/ Locale	Number of Freeze Days			Greatest Number of Consecutive Freeze Days in 1982
	Jan-May 1982	Mean (1949-78)	Greatest in Any Jan-May	
HIGH PLAINS				
Amarillo	68	67	80 (1959/64)	16 Jan 30-Feb 14
Dalhart	76	83	97 (1964)	19 Jan 28-Feb 15
Lubbock	45	58	72 (1964)	16 Jan 30-Feb 14
Muleshoe	74	77	93 (1951)	30 Jan 23-Feb 21
Seminole	48	58	75 (1955)	23 Dec 23-Jan 18
Spearman	65	74	88 (1964)	13 Jan 6-18
LOW ROLLING PLAINS				
Abilene	34	34	54 (1978)	12 Feb 2-13
Wichita Falls	48	42	63 (1978)	16 Jan 30-Feb 14
NORTH CENTRAL				
Dallas-Ft. Worth	34	27	51 (1978)	13 Jan 6-18
Paris	41	37	58 (1978)	12 Jan 7-18
Waco	27	21	39 (1978)	11 Jan 7-17
EAST				
Longview	29	26	50 (1978)	10 Jan 8-17
Lufkin	20	22	49 (1978)	7 Jan 8-14
TRANS-PECOS				
Alpine	50	32	56 (1980)	15 Jan 28-Feb 11
El Paso	37	33	51 (1964)	12 Jan 7-18
Wink	37	44	56 (1964)	11 Jan 7-17
EDWARDS PLATEAU				
Del Rio	19	10	20 (1964)	10 Jan 9-18
San Angelo	37	31	43 (1978)	10 Feb 2-11
SOUTH CENTRAL				
Austin	15	14	32 (1978)	7 Jan 8-14
UPPER COAST				
Houston	12	10	34 (1978)	9 Jan 9-17
Victoria	12	7	17 (1963)	5 Jan 10-14
SOUTHERN				
Laredo	10	5	14 (1973)	4 Jan 11-14
LOWER VALLEY				
Brownsville	5	2	08 (1973)	4 Jan 11-14

[+]includes last 8 days in December 1981

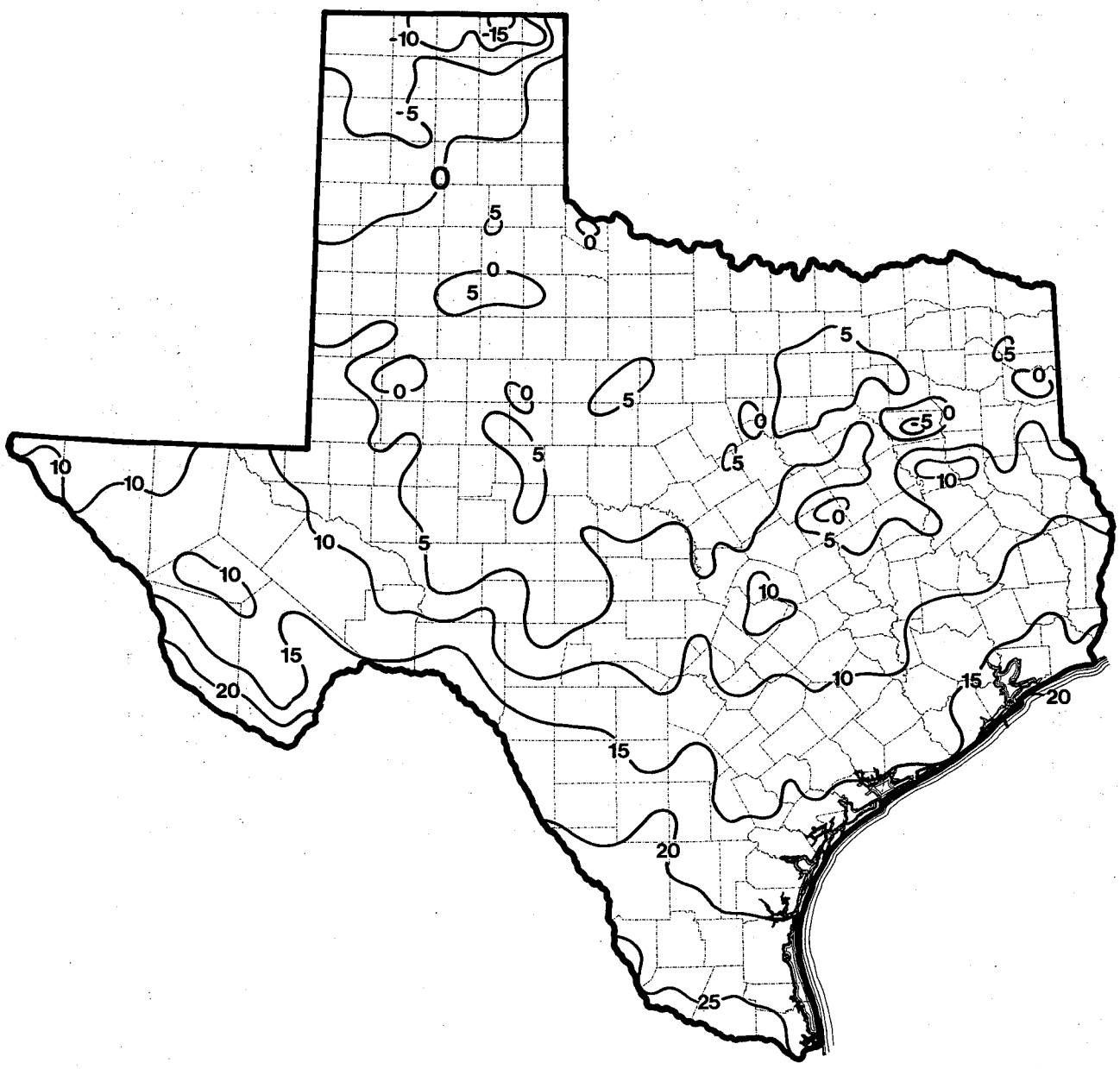


Figure 23. Extreme minimum temperatures (^{O}F) of 1982.

extremity was due almost exclusively to the mid-January cold-air outbreak that nearly caused extensive crop losses in that region. **Brownsville's** string of four consecutive days with temperatures dropping to 32° was the longest in 32 years. Yet, in the Panhandle where winter's coldest temperatures occurred, the number of freeze days was not subpar. The lengthiest spell of freezing weather regionwide took place from mid-December 1981 through the middle of January 1982; a second prolonged spell of chilly weather with temperatures dipping to the freezing level each day spanned the period from late January to mid-February 1982. The cities of **Lipscomb** and **Perryton** garnered the greatest number—82—of freeze days of any locale in Texas during the winter of 1981-82. **Lipscomb** also led with the most number of days—17—when the temperature never got above 32°. Strangely, the longest spell of consecutive freeze days belonged to a community far removed from the Texas Panhandle, as **Plains** witnessed minimum readings of 32° or below on 49 straight days beginning on December 27 and ending on February 13.

Whereas the vast majority of Texas cities saw the freeze (non-growing) season extend into early spring, scattered sections of the State's southeastern quarter witnessed the start of the growing season as early as the first week in February. Austin's last freeze on February 10 was about three weeks earlier than normal, while along the upper coastline at points like **Matagorda, Freeport,** and **Galveston,** the last freeze on February 6 or 7 was virtually on schedule. The Arctic cold wave that forced temperatures below 0° in the far north concluded the freeze season in parts of Southern Texas and all of the Lower Valley. Indeed, the light freeze that hit all of the Lower Valley on February 6-8 was nearly a week later than normal.

December: An Absence of Severe Cold

Partially offsetting the inordinately chilly weather of February to give near-normal conditions for the winter season as a whole were temperatures in December 1981 that were seldom subnormal. While the number of cold-air infusions (6) was normal for winter's first month, only a pair produced readings substantially below early-winter levels. These two cold spells caused hard freezes in all but the southern quarter of Texas, the first coming just after mid-month and the second on or about Christmas. The lone single-digit temperature registered in the State occurred in the northernmost fringe of the Panhandle at **Stratford,** where a low of 6° was measured on Christmas morning. Nearly all of the Lower Valley, with minimums of 34-37° on December 18-19, escaped a freeze, as did a few spots along and farther up the coastline. Average December temperatures in the Trans Pecos were markedly above normal. The western half of that region, especially, sustained readings that were in excess of 4° higher than normal and was led by **Ysleta's** mean December temperature of 7.4° above normal.

January: The Most Bitter Cold Wave in Three Decades

The bitterly cold Arctic airmass shoved into Texas by the year's first major winter storm on January 10 not only generated a record chill in the southern half of the State but also forced temperatures below freezing for inordinately long periods of time. When the huge mound of frigid Canadian air settled in over Texas on the morning of January 11, temperatures plummeted to record levels from the Edwards Plateau to the upper and lower coastline. Readings of 11° at **Austin** and 12° at **Houston** were the coldest at any time in at least the past 30 years. The minimum of 9° at **Bryan-College Station** was only the ninth time in this century that the temperature dipped into the single digits in that twin-city area. Lows in the single digits were noted as far south as **New Braunfels** and **Sealy.** Power outages were widespread as a result of lines contracting and then snapping, and numerous businesses and schools had to be closed on account of insufficient heating. In northern South Central Texas considerable damage was done to plumbing when pipes froze and then bursted. An elderly woman in Austin was burned to death when her clothing caught fire after she had huddled too close to a space heater. Once temperatures fell below the freeze mark on the evening of January 10, sub-freezing readings persisted for more than 36 continuous hours. Shipping along the upper coastline was disrupted because of extraordinarily low tides produced by gale-force northerly winds.

Fortuitously, temperatures neither dived low enough or remained below freezing long enough to cause a disastrous freeze in the Lower Valley. Minimum readings on both January 11 and 12 were equally frigid, with mid and upper 20s commonly observed. Citrus escaped serious damage. However, about half of the sugar cane was hurt, and farther north in the Winter Gardens area—where temperatures bottomed out in the upper teens--appreciable damage was done to spinach and cabbage.

Temperatures not far above 0° in North Central and East Texas matched those observed in the usually colder High and Low Rolling Plains because the center of the massive dome of Arctic air had migrated into the heart of the State by the time dawn occurred on January 11. Indeed, near the center of the mammoth high-pressure cell—at **Gatesville, Georgetown,** and **Evant**—temperatures plunged to 1°F. Readings in the single digits were prevalent throughout North Central and East Texas at that time. However, a reinforcement of Arctic air two days later sent temperatures at a few spots even lower. Readings below 0° were registered at **Glen Rose** (-1°) and **Marlin** (-1°), while deep in East Texas at **Athens,** a minimum of -5° was reported. No locations in the High and Low Rolling Plains could match that unthinkable reading so far south and east; only a half dozen points in the far north saw temperatures dip under 0°, with Follett (-3°) in the extreme northeastern corner of the Panhandle heading the list. The fresh dose of Arctic air sent temperatures to record levels again in the southern portion of Texas on January 14, when readings in the teens were recorded at Houston (19°) and **Corpus Christi** (19°) and deep into the 20s in the Lower Valley at **Brownsville** (25°). Again, however, the duration of subfreezing temperatures was not lengthy enough to cause serious damage to citrus.

Still more Arctic air just after mid-month sent temperatures again below 10° in the Red River valley of North Central Texas. Yet due to numerous spells of springlike weather that sent temperatures soaring into the low 80s, the month as a whole was not uncommonly cold anywhere in the State. On a regionwide basis, only East Texas (-1.3°), the Low Rolling Plains (-0.3°), and the Upper Coast (-0.1°) sustained negative departures of mean January temperature from normal. Near summerlike weather on or about January 3 and again around January 23 that sent temperatures into the 90s in the Lower Valley (1.4°) helped mark the month as a slightly warmer-than-normal first month of the year in that region as well as in Southern Texas (1.5°) and the Trans Pecos (1.2°).

February: Readings Far Below Zero in the Panhandle

The Arctic airmass that encased Texas in early February was every bit as immense as the one that invaded the State in early-January. In fact, February's dose of frigid air plunged temperatures in the Panhandle considerably lower than those observed one month earlier largely because the center of the mound of Arctic air found its way into the Panhandle and because the huge dome drifted away more slowly than its early January counterpart. As a result, readings nosedived below 0° in the northern High Plains on February 5-6, or from 5 to 15° lower than minimums attained in January. The low of -15° at **Perryton** was the coldest temperature anywhere in Texas since 1974. Other extraordinarily low temperatures measured on February 6 included: -13° at **Gruver**, -11° at **Lipscomb**, -9° at **Spearman**, and -8° at **Stratford**. Lows in the single positive digits were common in the Low Rolling Plains. Elsewhere in Texas, however, monthly minimums were not nearly as low as those recorded in January, since the mound of Arctic air in early February followed a more easterly trajectory that ushered it toward the Mississippi River and not the Rio Grande. Still, a light freeze nipped all of the Lower Valley on either or both the mornings of February 6 and 7, even though lows dipped no more than a degree or two below the freeze mark. A supplemental infusion of Arctic air on February 8 forced temperatures again to uncommon depths in the Panhandle, although lows were not nearly as extreme as those registered a few days earlier.

Due in part to another cold-air outbreak near the end of February, but largely to the two-pronged Arctic siege early in the month, temperatures averaged over the whole of February were colder than normal statewide. Mean readings in three-fourths of the State were at least 4° under normal, with a few scattered locales in North and South Central Texas observing means of more than 6° cooler than usual. Temperatures were most abnormally cold at **Hico** (-7.0°), **New Braunfels** (-6.3°), and **Gainesville** (-6.2°). In North Central Texas freezes occurred on at least half of the month's days, and the total number of freeze days was at least double the normal. Only portions of the Trans Pecos experienced warmer-than-usual weather during the shortest month of the year.

SPRING

As one of the year's two transitional seasons, the spring in Texas is not only characterized by sharp fluctuations in temperature on a day-to-day basis but by a fairly steady pattern of increasing temperatures from week to week. Almost always May is notably warmer than April, which invariably is substantially milder than its predecessor. Yet, because springlike temperatures in the 70s and 80s were established almost routinely during much of the month of March, and due to several outbreaks of uncommonly chilly weather during April, average temperatures for the first two months of spring were barely dissimilar in much of Texas. Winterlike weather was nested in the early days of March but recurred several times over many days in April. The same anomalous circulation pattern that made April unusually cool kept an abundance of cold fronts coming in May, a month that was just as abnormally cool as its immediate predecessor.

The latter two months of spring were sufficiently cool to negate a substantially warmer-than-normal month of March in most of Texas. The result was near-normal seasonal average temperatures in all but the southwestern quarter of the State. In the Trans Pecos and Edwards Plateau, March was so mild that mean readings for the whole season were 1/2 to 2° above normal. Except for the Trans Pecos' average spring temperature of 1.3° above normal and, at the other extreme, the Low Rolling Plains' average seasonal reading of 0.6° below normal, mean spring temperatures elsewhere were within 1/2° of normal.

Because spring's last widespread freeze struck during the first week of March, the growing (or freeze-free) season got underway uncommonly early in much of Texas. The last day with freezing temperatures occurred one to two weeks earlier than normal in North Central and East Texas and as much as two to three weeks earlier than usual in much of the Edwards Plateau and southern portions of the High and Low Rolling Plains. The March 7 freeze was belated only in Texas' southeastern quarter, where normally freezing temperatures occur for the last time during the latter half of February. A light freeze in the Davis Mountains on April 23 prolonged the non-growing season in the central Trans Pecos by nearly three weeks, while a harder freeze in the Panhandle on the same morning meant the freeze season lasted a few days longer than usual in that region (Figure 24). True to form, the northern tier of Panhandle counties sustained the greatest number of freeze occurrences during the spring. **Perryton** headed the list with a spring total of 34 days with temperatures dropping to 32° or below and was followed by **Boys Ranch** (33 days) and **Stratford** (32). **Perryton** also held the distinction of having the longest string of consecutive freeze days (12 days, or March 1-12) and the longest spell of subfreezing temperatures (almost 72 hours, or from the evening of March 4 until about noon on March 7). **Pampa** tied Perryton in having the most (2) days in which the temperature failed to get above freezing.

While temperatures rebounded quickly from the farflung freeze of March 7 to approach summerlike levels within two weeks, the few modest heat waves that

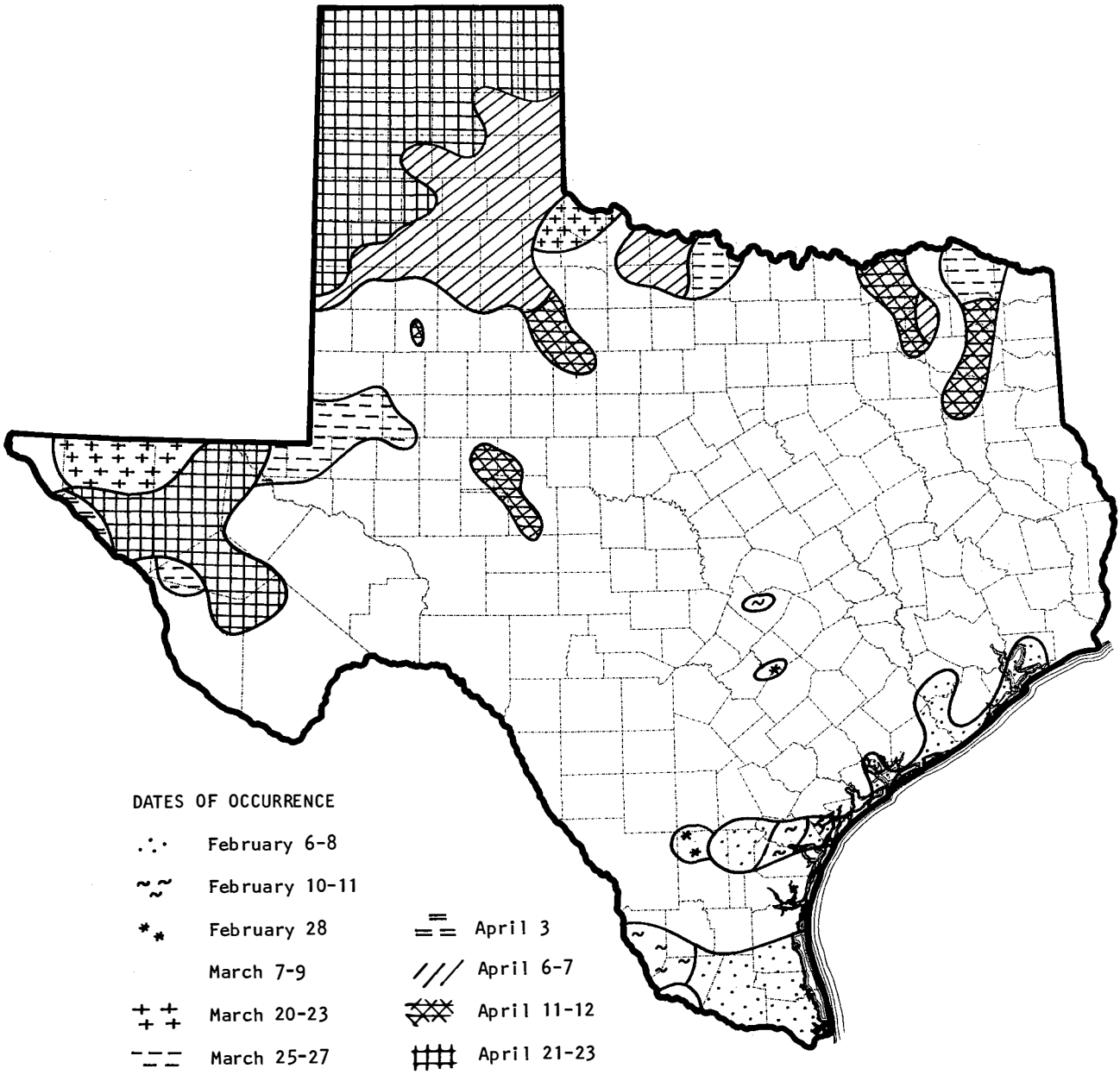


Figure 24. Time of occurrence of the last freeze in the winter-spring period of 1982.

characterized the spring of 1982 in Texas were nothing extraordinary. The first 100-degree temperature was observed uncommonly early—on March 13 at **Castolon** near Big Bend National Park, and numerous locales in southern and western Texas felt 100-degree warmth during a brief heat wave in mid-April. Yet, genuinely hot weather in much of Texas was most infrequent, even during the month of May. Cities along and near the Rio Grande that normally endure temperatures of 100° or more on a half-dozen occasions in May saw readings climb that high only about half as often as usual. Temperatures did get progressively hotter as spring elapsed, as attested by statewide monthly maximums of 106° at **Carrizo Springs** and **Catarina** in April and 112° at **Lajitas** on the last day of May. **Castolon** gained the notoriety of having sustained the greatest number (19) of days with temperatures of 100° or hotter during the spring, while nearby **Lajitas** was noted for having the most consecutive number of such days (7, or from May 25 to May 31).

March: A Hard Freeze, Then Balmy Weather

Winterlike weather, in the form of a widespread hard freeze, made one last appearance in Texas before giving way to a lengthy spell of uncommon warmth early in March. Extraordinarily chilly temperatures were confined to March's first week, when subfreezing conditions bit deep into the Texas Hill Country and East Texas and even knifed far into Southern Texas. Almost abruptly, however, temperatures moderated and within a few days had climbed to near-summerlike levels, where they remained for most of the rest of the month. In some portion of every one of Texas' ten climatic divisions, mean temperatures for March were more than 4° above normal; a few scattered locales in North Central and East Texas even encountered temperatures of 6° above normal. All of the State's temperature-reporting stations registered temperatures that, over the whole of March, were warmer than normal.

A modified Arctic airmass that gushed into Texas on March 3-4 sent temperatures almost to 0° in much of the Panhandle, where 32° readings or colder were noted on at least five consecutive mornings. Not since 1962 had the temperature in March chilled to the level of 3° measured at **Stratford** and 4° at **Spearman.** Lows in the 20s were prevalent as far south as **Refugio** in South Central Texas and **Falfurrias** in Southern Texas. In the Lower Valley temperatures on March 7 and 8 dipped to within a few degrees of freezing; **Brownsville's** low of 37° on that morning tied a 62-year-old record for the date. While it was not nearly as profound as the early-March outbreak of Arctic air, a polar airmass that swarmed over Texas a few days before month's end gave a light freeze to northern East Texas. Subfreezing readings were noted as far south as **Mineola** and at **Gilmer** on March 26-27.

Sandwiched between the early-in-the-month influx of Arctic air and the late-month surge of polar air, however, was a 10-day spell of very mild or even uncharacteristically warm weather. Summerlike heat in the 90s gripped the Low Rolling Plains on March 12-13, whereas even hotter weather—with highs near 100°—engulfed Southern Texas a few days later at mid-month. Summer got underway early in parts of the Trans Pecos as well, for several locales—

mostly in the valleys within or near the Big Bend—registered afternoon maximums over 100°. True to form, the air in the arid Trans Pecos was exceedingly dry throughout the month, as attested by the large disparity in nighttime low and afternoon high temperatures. On the day (March 19) that **Pecos** measured a maximum of 101°, just nine hours earlier the temperature had bottomed out there at 47°.

April: A Time of Drastic Temperature Gyrations

Rarely do temperatures fluctuate as rapidly or as drastically as during the early half of spring, and the middle month of spring 1982 afforded some of the most spectacular shifts in temperature seen in Texas in many months. Brief spells of frosty weather gave way suddenly to equally terse periods of heat reminiscient of summer, following which more wintry chill set in for a few days. Over the course of the whole month of April, however, the sieges of cool Canadian air outnumbered and outlasted the stints of torrid weather. The result was notably cooler-than-normal average temperatures statewide in April. Readings were most unusually cool in the northeastern quarter of the State, where some parts of North Central and East Texas registered mean April temperatures of 4-5° below normal. Only in parts of the Trans Pecos and at a few scattered locations elsewhere near the Rio Grande were readings warmer than normal.

A weeklong spell of near-freezing temperatures early in April had much to do with the subpar temperatures noted statewide. An initial wave of polar air poured into Texas on April 6, forcing temperatures below freezing in some sections of northern North Central and East Texas. Subsequent infusions of dry Canadian air kept minimum readings in these areas around or just above the freeze level for about seven days. A pair of freeze days occurred at **Emory**, while temperatures dipped at least once to 32° or below **Gilmer, Mount Pleasant, Sulphur Springs,** and **Tyler.** Another pair of cold fronts pushed through Texas shortly after mid-month and produced several freeze occurrences at many spots in the northern High Plains. The latter of the pair was more pervasive and intense, causing temperatures to plummet into the 20s in the Davis Mountains of the central Trans Pecos.

Sandwiched between the rather protracted spells of uncommon chill was a short-lived heat wave that shot temperatures to summertime levels. Indeed, just three days after the early-April cold snap climaxed with near-freezing temperatures in much of northern Texas, readings in the low 90s were registered virtually statewide. Parts of all four divisions of the State affronting the Rio Grande even encountered temperatures of 100° or hotter. Heading the list were maximums of 106° at both **Catarina** and **Carrizo Springs** in Southern Texas on April 13 and 14, respectively; these torrid readings came little more than 48 hours after temperatures stood in the 40s. One of the more extreme examples of the abrupt turnabout in weather fortunes was the range in temperature at **Coleman** in the Low Rolling Plains: from a low of 36° around daybreak

of April 11 to a high of 97° on the afternoon of the following day. The weather was also extraordinarily hot earlier in the month in the southern portion of Texas, where highs of 104° at **Rio Grande City** and 103° at **Carrizo Springs** and near **Mission** were registered.

May: More Widespread, Uncommonly Chilly Weather

Like its immediate predecessor, May sponsored some unordinary—and even record-breaking—chilly weather early in the month that more than counterbalanced a siege of sweltering heat at month's end. Readings averaged over the whole of the month were subpar statewide, although the magnitude of the negative departures from normal was not as large as that experienced in April in most sections. Conditions were the most abnormally cool in Southern Texas (-2.2°), where daytime temperatures at no time reached as high as peak values attained in April. In some locales in this region, monthly mean readings were more than 3° below normal. Only in North Central and East Texas were temperatures near normal.

The large mass of polar air that infiltrated Texas on May 5-6 and prompted the month's first outbreak of weather violence delivered a record chill to central portions of the State. Lows on either or both the mornings of May 7 and May 8 dipped into the low and mid 40s in large portions of the Edwards Plateau and North Central and East Texas. In fact, minimums in the low 40s were noted as far south as **Point Comfort** (Upper Coast) and **Kerrville** and **Medina** (Edwards Plateau). Temperatures nosed into the upper 30s as far into North Central Texas as **Graham** and as deep into the Edwards Plateau as **Menard.** The same airmass sent temperatures into the middle 30s in the Panhandle and was responsible for providing the coolest weather of the month in all but the southwestern quarter of Texas. A second near-freezing dose of polar air flowed into western sectors of the State one week later, giving much of the Trans Pecos its chilliest temperatures of the month. Points as far south as **Marfa** and **Marathon** recorded lows in the upper 30s on the morning of May 14.

Temperatures did not climb to summerlike levels until after mid-May and did not reach their monthly peaks until just before the month ended. All but a few locales scattered in the High Plains and in the coastal plain saw readings extend into the 90s on one or several occasions during May's last week. Days with temperatures of 90° or higher were no more numerous than normal in most sections of Texas, and readings of 100° or more were confined to the Trans Pecos and a few isolated communities in the Edwards Plateau and Southern Texas. Yet, as the month closed, temperatures had shot beyond 110° in the arid valleys of the southern Trans Pecos. After six straight days with maximum readings above 100°, **Lajitas** (just west of Big Bend National Park) witnessed the hottest temperature of the month anywhere in Texas on May 31: a scorching 112°.

SUMMER

The record chill of an extraordinarily late cold spell in June's first week was quickly dissipated by a broiling sun that baked most of Texas almost continually for the duration of the summer. The polar air that infiltrated the State at the end of May was felt most keenly in the northern half of Texas where substantially subnormal temperatures averaged for the whole month of June reflected the influence of the uncommon cold-air outbreak. In fact, more influxes of polar air later in June and even in early July left this territory with subnormal temperatures for the whole of the summer. In the High Plains and upper Red River valley, June's weather was some of the coolest of the century. In the remainder of Texas, however, the story read differently. While the early June cool spell did produce exceptionally low tempertures deep into the State, most of the other northers entering Texas lost their impact before reaching the State's midsection. Consequently, an abundance of sunshine penetrating virtually ever-present moist tropical air caused very warm and sultry conditions to prevail almost incessantly. Each of summer's three months was warmer than usual in South Central Texas, the Upper Coast, and Lower Valley. Along with the Trans Pecos, the Upper Coast and Lower Valley endured a summer that was, on the whole, more than 1^{o} hotter than usual. Oddly, those same three regions were the only ones in which average July temperatures exceeded those of August; elsewhere, mean August readings were the highest of any of the months of summer.

The intense heat of summer reached its peak later than usual throughout Texas. Two moderate heat waves, each lasting at least a week, seized the State early in August and again around the middle of that month to force temperatures to their highest levels of the season in virtually every area. Even in the Trans Pecos, where the summer heat typically climaxes in late June or early July, readings in mid-August were as hot as those felt four to six weeks earlier. Due to its belatedness, the torrid weather in August broke records in the northern Panhandle, where afternoon maximums of 105^{o} or higher were commonplace (Figure 25). As is often the case, the hottest weather occurred in or near Big Bend National Park. **Lajitas** sweltered in heat that was gaged at 114^{o} on June 28 and 112^{o} on July 21.

Genuinely hot weather was more plentiful than usual in most of the southwestern half of Texas, whereas the State's four northernmost regions in general were spared much of the excessive heat that usually afflicts them intermittently during summer. The number of days with temperatures of 100^{o} or hotter was about double the normal in Southern Texas, the Lower Valley, and parts of South Central Texas and the Trans Pecos. Conversely, the number of days with triple-digit heat in the High Plains numbered less than a half-dozen, or about half of normal, and throughout the Low Rolling Plains and the Red River valley, the number of 100-degree days was less than half of the usual. At normally torrid **Wichita Falls**, for instance, summer furnished only 17 days (15 of them in August) with readings of 100^{o} or higher, or 15 fewer than normal. As

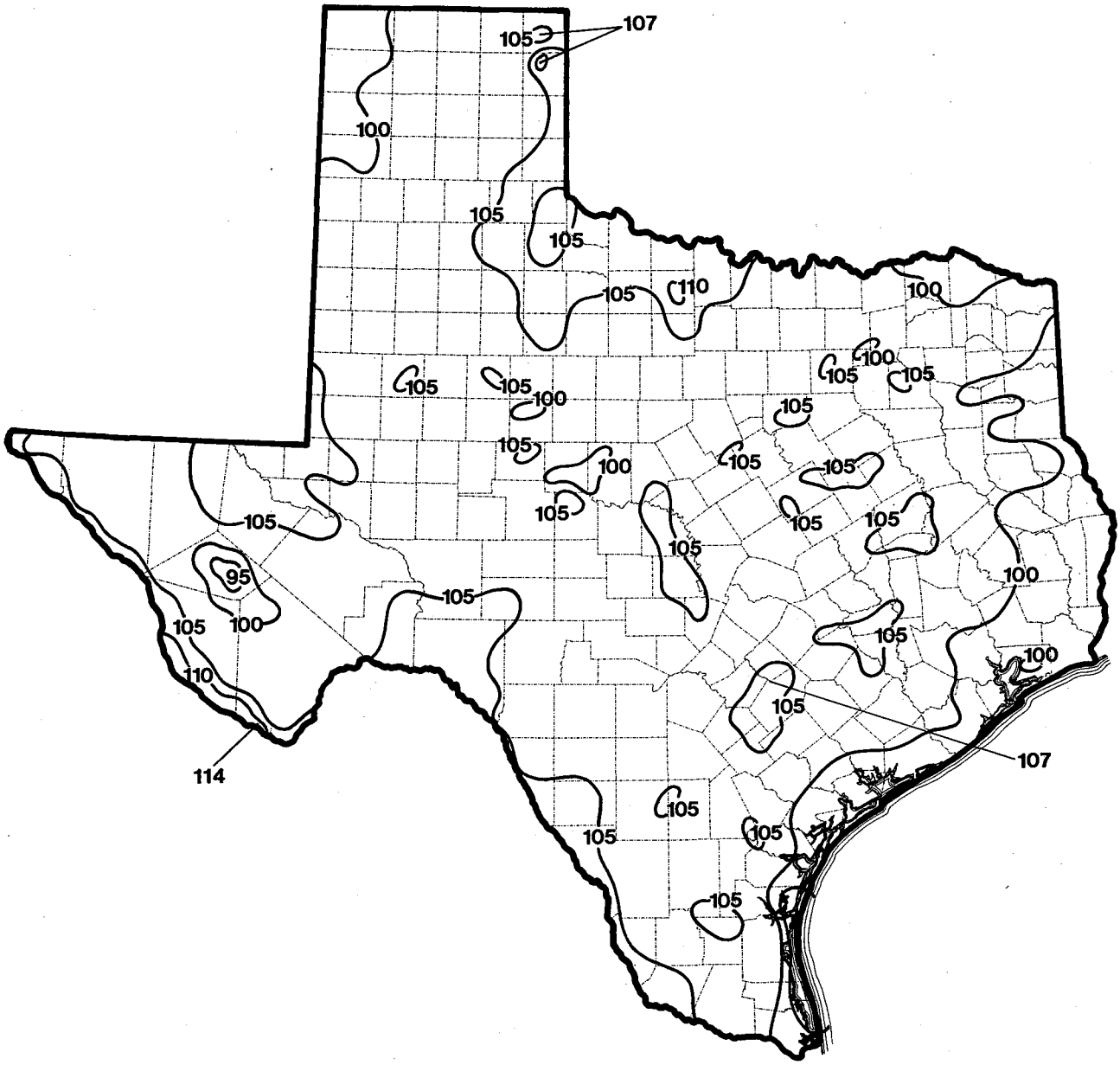


Figure 25.. Extreme maximum temperatures (^{o}F) of 1982.

expected, the greatest abundance of very hot temperatures could be found in Southern Texas. **Zapata** suffered through 59 straight days in which afternoon temperatures soared to or beyond 100°; the spell began on June 11 and finally ended August 8.

Aside from the record cool spell that greeted the arrival of summer, temperatures seldom dropped much below seasonal levels. In the wake of the June 1 chill, a trio of cool fronts forced temperatures considerably under normal in northern sections on an intermittent basis during June. However, the three cool fronts in each of the months of July and August that penetrated at least part of Texas failed to deliver any fresh polar air that was markedly cooler than usual. With almost no exceptions, the June 1 cool spell provided all areas of Texas with the lowest temperatures of summer. Temperatures dropped into the 50s in the higher elevations of the Trans Pecos on about half the total number of days in each of summer's three months, but that is typical for the arid climate of that region. The only record low temperatures established during summer were associated with the polar air outbreak of June 1, when lows in the 40s were common in the High Plains and even at a few spots farther south in North Central Texas and the Edwards Plateau.

June: A Phenomenal Early-Summer Chill

An inordinate amount of cloud cover associated with the preponderance of rainstorms teamed with several notable cool-air invasions to maintain temperatures over the whole of June at below normal early-summer levels in most of Texas. Only in the southern quarter of the State—where the vast subtropical ridge finally asserted itself late in the amount by supplying ample sunshine--were readings near or slightly above normal. Mean monthly temperatures were especially milder than usual in the High and Low Rolling Plains, within which some locales recorded readings of as much as 4 or 5° below normal. **Lubbock's** average June temperature of 73.5° was the lowest since 1922, and Wichita Falls experienced the second coolest June in 41 years. Many communities in these two northernmost regions saw temperatures of 90° or hotter on only 10 or 15 days during the month--or nearly half of the usual early-summer number.

Unmistakably the coolest spell in all of Texas in June occurred just as the month got underway. An exceptional chilly mass of polar air that poured into the State on May 31 produced readings on the morning of June's first day that were 10 to 20° cooler than normal. Temperatures in the 40s were felt as far south as **Glen Rose** and **Hamilton** in North Central Texas and **Menard** in the Edwards Plateau. The temperature even dipped into the high 30s in the central Trans Pecos; the low of 39° at **Mount Locke** was merely 7° above the all-time lowest temperature ever registered in Texas in June. Low readings in the 50s were commonplace in North Central and East Texas. Subsequent infusions of dry and cool polar air around mid-month and at the time of the summer solstice caused temperatures to dip near 50° at some locales in the Panhandle and the Trans Pecos.

The belated appearance of the subtropical ridge had much to do with the lack of hot weather during June in most of Texas. The upper-air high asserted itself just enough early in the month to cause record warmth in far western Texas, where the area between El Paso and the Big Bend sustained daytime temperatures of 105-110° for more than one week. It returned to cause similarly torrid readings in that region in June's last week and seasonally hot temperatures in the mid and upper 90s elsewhere in Texas; it was during the hot streak near month's end that the temperature hit 114° at **Lajitas** for June's hottest reading anywhere in the State. Temperatures of 100° or higher were unknown in North and South Central Texas, as well as East Texas and the Upper Coast. Even in the High and Low Rolling Plains triple-digit temperatures were few and far between, and in the State's southern quarter 100-degree days were prevalent only on a few days during June. Yet, an uncommonly large amount of sunshine maintained the temperature at consistently high levels in Southern Texas and the Lower Valley to the extent that the month was one of the hottest on record. For instance, in only one other month of June, since the turn of the century, had the average temperature for the month exceeded the mean value of 85.7° registered at **Brownsville** during June 1982.

July: A Typically Hot and Sultry Spell

The mid-month of summer was modestly hotter than usual in the southern and western quarters of Texas. Daytime temperatures in the four climatic divisions bordered by the Rio Grande were persistently very warm or even hot but rarely—if at all--did they climb to exceptional levels. Days with readings of 100° or more were at least double the normal sum in much of the Trans Pecos, Southern Texas, and parts of the Lower Valley. The Trans Pecos—where the State's hottest reading (112°) occurred at **Lajitas** on July 21--was the most unusually hot of any of Texas' ten divisions; the mean regionwide temperature of 82.7° was 1.9° higher than mid-summer levels for the State's westernmost sector. Actually, several other regions—led by Southern Texas with a mean regionwide temperature of 87.1°--sustained hotter weather over the whole of the month, but negative departures of those average readings from normal were less substantial. In those regions bounded or traversed by the Red River, temperatures averaged for all of July were slightly milder than normal. A thick cloud cover was prevalent so much of the month that readings of 100° or higher were uncommon. In most of the High and Low Rolling Plains and North Central and East Texas, maximum daily readings of 100° or hotter numbered, if not at all, merely one or a few.

By and large, hottest temperatures in July in most Texas cities took place near the end of the month. Except for a few locales situated along the coastline—where maximum July readings rose no higher than the low or mid 90s—every section of the State observed extreme temperatures near or slightly above 100°. In the northern half of Texas monthly maximums for the most part were noted during the period of July 21-27, while in most other sections hottest readings occurred on one of July's last three or four days. Even in parts of Southern Texas and the Lower Valley where highs of 100° or more were recorded on a dozen or more consecutive days—if not the whole month—hottest temperatures

were felt near the end of July. The temperature soared to or beyond the 100° level on each day of the month at four cities in Southern Texas: **Falcon Dam** (with a July high of 105°), **Fowlerton** (105°), near **Rio Grande City** (105°), and **Zapata** (105°). However, the heat was most intense in the southern Trans **Pecos,** where several cities, in addition to Lajitas, registered Texas' hottest temperatures in July: **Boquillas** and **Grandfalls** (108°), and **Castolon,** Pecos, and **Ysleta** (107°).

Of the three cool fronts, that edged into Texas during July, only two of them managed to reach the State's midsection, and none of them ever made it to the coastline. The second of the trio of fronts, having crossed the Red River before evaporating in central Texas around July 12, ushered in the coolest weather of all. Temperatures dipped into the mid 50s in some sections of the High Plains, while low and mid 60s were common in the Low Rolling Plains on one or several mornings just before midmonth. Lows in the mid 50s were noted at a few places in the higher elevations of the Trans Pecos at this time—and on several other occasions—during July. Temperatures rarely dropped under 70° at any time in July in practically all of the southeastern half of the State.

August: A Brief Dose of Record Heat

Diluted polar air eased into northern Texas on five separate occasions during August, but hardly any of the shallow pools of Canadian air led to substantial drops in temperature. In fact, the drier air, while allowing readings to drop a few degrees lower than the typical late-summer levels in the Panhandle and Red River valley, negated that very modest chill by abetting even sharper rises in temperature in daytime often to or beyond 100°. Still, afternoon maximums rarely soared far above the 100-degree plateau, and it was not so much excessively high daytime readings that contributed to above-normal average August temperatures in all sections of Texas. Rather, it was the persistency of modestly above-normal warmth--with very few, if any, interruptions—that gave mean monthly readings 1-2° above seasonal norms.

Only a smattering of locales in the northern half of Texas had temperatures over the whole of August that were subnormal. Even in those places, negative departures of mean August temperatures from normal were but a few tenths of a degree. On the other hand, sizeable parts of the High Plains, North and South Central Texas, and the Trans Pecos sustained readings of 2 to 3° above normal. True to form, the late-summer heat was most consistently intense in the southern quarter of Texas, where all locales in Southern Texas registered mean August temperatures in the upper 80s. Temperatures at **Brownsville** were the warmest for any August in 40 years; in fact, the average daytime maximum temperature there—influenced by 22 days of temperatures of 96° or hotter—was the highest since 1920. The average monthly readings at **Lubbock** and **Waco,** though only 2 1/2° above normal, were the warmest in August since the beginning of the unforgettable drought of the early 1950s. Greatest deviations in average temperature from normal occurred in the Trans Pecos, however; that westernmost region as a whole measured temperatures over the whole of August that were 2.6° than normal.

The late-summer heat did reach extraordinary levels on at least two occasions somewhere in Texas during August. The Panhandle and western Trans **Pecos** saw new record temperatures set around mid-month when afternoon temperatures skyrocketed well beyond 100° in most communities. Maximums of 105° or more were common on both August 14 and 15 in the High Plains and included highs of 107° suffered at **Canadian** and **Lipscomb.** The heat was equally torrid farther south in the Low Rolling Plains at **Guthrie** and **Memphis.** In some spots in the Trans Pecos, temperatures climbed a bit higher during the same period: the mercury ascended to 109° in the thermometer at **Boquillas Ranger Station** in the Big Bend National Park and to 108° at Pecos. Then, a few days before the month ended, temperatures escalated again much above 100° in large portions of the State. **Archer City** gaged August's hottest temperature (110°) on the 27th, while **Castolon** (in Big Bend National Park) came in second with a high of 109° on the following day. Most cities in the State recorded highest temperatures during either the mid-month or end-of-the-month torrid spells, although some parts of North Central Texas and the Edwards Plateau sustained their hottest spell at the end of August's first week.

Temperatures in the mornings rarely cooled much below typical summer levels. One of the month's five cool fronts supplied enough polar air to drop the temperature into the upper 50s in the northern Panhandle on or about August 25. True to form, minimums in the mid and upper 50s were not uncommon in the higher elevations of the Trans Pecos on many days during August.

AUTUMN

In spite of a harsh norther in mid-September and subsequent cold snaps that delivered premature freezes in East Texas and deep into South Central Texas, the autumn as a whole was hardly any chillier than usual. The winterlike sieges were countered by occasional stints of torrid weather reminiscent of summer. As a result, only in the Trans Pecos did average seasonal temperatures deviate prominently from normal. In that far western region, an especially hot September coupled with a warmer-than-normal October more than offset slightly subpar readings in November; autumn temperatures in the Trans Pecos averaged 1.2° above normal. In fact, all four Texas regions bounded by the Rio Grande experienced warmer-than-usual weather, although in the other three regions, departures amounted to only a few tenths of a degree below normal. Almost universally across Texas, Septemer was warmer than normal, while the last two months of autumn furnished near or modestly cooler than normal weather.

Though the initial freeze of the season struck at least one week early, the number of freeze occurrences during the autumn of 1982 was not unusually large. A gush of polar air that enveloped the State on October 8 produced the first noteworthy freeze in the Panhandle on the following morning, or about ten days ahead of schedule. Autumn's first freeze occurrence was not only felt at **Bootleg Corner** (with a low of 32°), **Olton** (32°), and **Vega** (30°) but also in far western Texas at **Fort Hancock** (32°) (Figure 26). A more extensive freeze followed ten days later, encompassing nearly all of the High Plains. However,

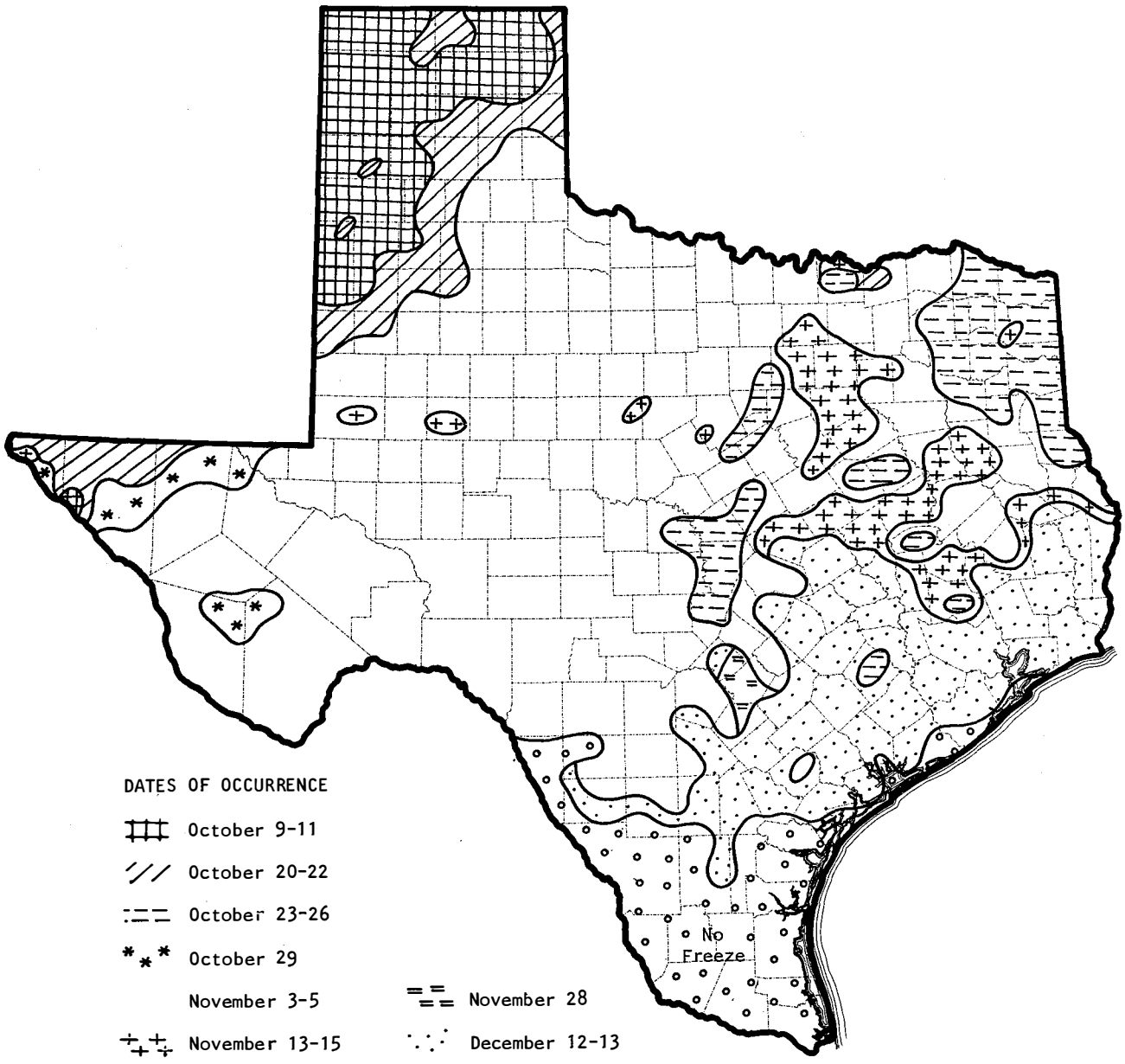


Figure 26. Time of occurrence of the first freeze in the autumn-winter period of 1982.

the first truly large-scale freeze hit on November 3-4, when freezing temperatures cut deep into the heart of Texas. The minimums of 32° that were registered as far south as **Del Rio, Fowlerton** (Southern), and **Goliad** (South Central) came about four weeks earlier than usual! Aside from a few locales in South Central and Southern Texas, the State's four southernmost regions escaped freezing temperatures altogether during the fall (September-November). The freeze-line in autumn reached as deep into Texas as **Crystal City** and **Fowlerton** (Southern) and **Goliad** (South Central).

Temperatures dipped to the freeze level on at least a score of days in most of the Panhandle during the autumn, but that is customary for that coolest of regions. Some portions of the Red River valley experienced a few more freezes than normal, while a few less freeze occurrences were witnessed in most of East Texas. The lengthiest spell of freezing weather spanned at least one week at the end of November in the northwestern Panhandle; **Boys Ranch** measured the most consecutive mornings (11) with freezing temperatures. At least a half-dozen locales in the northern High Plains, led by **Boys Ranch** with 34, recorded 30 or more freezes during the fall season.

A pair of cold polar-air outbreaks in the early half of November were responsible for the coldest readings of the autumn in most of Texas. The fast-moving norther of November 14 swept in the coldest weather of the season in much of the Panhandle, where **Lipscomb** gaged the lowest daily minimum (8°) of any Texas city during the fall. It dropped morning readings into the teens at scattered locations in the Low Rolling Plains and North Central Texas. Most of the southern half of Texas felt the most intense chill of the season in the wake of a frontal invasion on November 2.

At the other extreme, hottest temperatures of the autumn not surprisingly were endured during the first few days of September at the majority of Texas cities. Many stations saw temperatures ascend to or above 100° on one or more days during September's first week. Yet, in almost every instance where highs of 100° or more were recorded, the number of such days was either near or under normal. Seasonal highs near or above 100° occurred in much of Texas' southern quarter in mid-September, at which time the season's latest, hottest temperature was registered: 108° at **Falcon Dam,** on September 11. Earlier in the month, the same maximum had been attained at **Ysleta** (on Septemer 2) and at **Centerville** (September 4).

September: A Near-Freeze in northern Texas

Autumn's initial surge of invigoratingly cool polar air to envelope all of Texas arrived just about on schedule. The first bonafide "norther" of the season eased—rather than blasted—its way through the State just before the fall season officially arrived on the morning of September 22. Only a pair of rather feeble cool fronts that slowly drifted across much of Texas on September's first three days and again at mid-month had preceded it in the early stage of autumn. The decrepit mass of drier and only slightly cooler air at September's beginning

produced a notable cooling off in the northern half of Texas but effected no discernible change in temperature farther south. The second of the pair of weak fronts failed to cause significant changes in temperature anywhere in Texas. But the mound of polar air that gradually encased the Lone Star State around the autumnal equinox was so refreshingly cool that temperatures plunged to record levels in the upper 40s and low 50s along the Red River and even in parts of the Upper Coast. Moreover, a reinforcement of the uncommonly chilly polar airmass four days later again led to some of the coolest weather ever seen so early in autumn in the same regions.

A startling aspect of the two-pronged invasion of inordinately cool Canadian air just after the middle of September was that it sent temperatures to record depths. Indeed, residents of numerous communities in northern North Central Texas awoke on the morning of September 22 to find temperatures hovering not many degrees above the freeze mark! Unheard of for so early in the autumn were low readings of 35° at **Bonham**, 36° at **Glen Rose**, and 37° at **Bridgeport.** Equally peculiar about the season's first real norther was that its course through Texas was such that the northeastern quarter was chilled to a extent unmatched by the normally cooler High and Low Rolling Plains. The same airmass generated minimums only in the upper 40s in much of the State's two northernmost regions, while aside from the scattered instances of temperatures in the 30s, much of North Central and East Texas felt a chill in the low 40s on one or several mornings. The rare, premature chill was felt almost as acutely in portions of the Upper Coast after a fresh, reinforcing surge of polar air encased the State on September 24-25. Yet another amazing feature of the phenomenal chill was its heartiness. In the eastern two-thirds of Texas, the rare chill reappeared repeatedly, lasting almost one whole week. **Orange** saw morning readings dip into the upper 40s on two successive mornings, followed by a low of 54° on September 25 and minimums back in the 40s again on September 26 and 27. Not surprisingly, the two-phased polar air outbreak of September 22-26 forced temperatures to their extreme lowest points of the month in virtually every Texas locale.

Prior to the late-September chill, temperatures were uncommonly hot much of the time. Not surprisingly, the heat was most intense during the first 3 or 4 days of September in most areas. Just ahead of the month's first norther, temperatures in the daytime shot to near or above 100° in all but a few spots along the upper Texas coast. On September 1 **El Paso** recorded a maximum of 104°, marking the heat as the most severe ever so late in the year in the 95-year weather history of that far western metropolis. On the following day nearby **Ysleta** registered a monthly extreme of 108°. Atypically warm weather recurred on numerous occasions later in September. A short heat wave on September 11-12 sent temperatures to 100° or beyond in a number of locales in East Texas, where heat of that magnitude as late as mid-September is most unusual. Highs between 102° and 105° were commonplace in the southern quarter of Texas during the same spell. More torrid weather gripped the Trans Pecos as the month drew to a close. Highs well above 100° were dominant for several days in this region, whose average monthly temperature exceeded the norm by 3.6°.

October: A Premature Hard Freeze in East Texas

Summerlike heat persisted in most of Texas until the second of October, when the first of a trio of cold fronts pushed through the State and produced temperatures substantially below seasonal levels. Two more northers followed within ten days, including one that "backed" into the State from the Mississippi River valley and another that shoved temperatures far below the freeze level in the Panhandle. In spite of the fact that October both began and ended on an unusually warm note, the several surges of Canadian air in the middle portion of the month led to a slightly cooler than normal October in all but the southwestern quarter. Average readings were the most subpar in East Texas, where a hard freeze bit more than two weeks ahead of schedule. While East Texas as a whole measured a mean October temperature of 2.3° below normal, some places near the Red and Sabine Rivers gaged readings of 6 to 8° below normal.

Concentrated Arctic air poured into Texas shortly after mid-month, sending temperatures to within a few degrees of record levels in nearly every section of the State. The initial surge of phenominally cool air gave the Panhandle a hard freeze on October 20. The temperature bottomed out at 26° at **Amarillo** on that morning, shattering a record that had stood for 84 years. Many other locations in the northern High Plains felt the coldest temperatures ever for so early in the autumn. Once the broad and massive mound of Arctic air settled over the State's midsection a few days later, freezing temperatures occurred at numerous scattered locations in the Edwards Plateau and North Central and East Texas. In fact, hard freezes struck deep into the coastal plain at **Conroe** (26°) and **Columbus** (29°). More cold air poured into Texas near October's end and produced another hard freeze in the Panhandle. Still, the number of freeze days in Texas' northernmost region was no more numerous than usual.

The first week of October furnished some late-summer heat, but otherwise temperatures in daytime were rarely much above normal. The most abnormally warm weather took place on a few days early in the month, when maximums in the low and mid 90s were recorded almost everywhere. After the first major cold front of the month whipped through the State on October 8-10, temperatures that high rarely recurred. One exception was a short-lived heat wave that gripped the southern quarter of Texas on October's last three days, forcing daytime high temperatures into the low 90s and matching all-time records for the Trans Pecos and the southern quadrant of Texas.

November: An Extraordinarily Early Freeze in south Texas

Scattered portions of central Texas were nipped by an extraordinarily early freeze when cold polar air poured into Texas just as November got underway. On three consecutive mornings a hard freeze bit into western North Central Texas, where the first freeze of autumn normally takes place two weeks later.

More astonishing, however, was the light freeze that nipped locales such as **San Antonio, Fowlerton, Goliad,** and **Floresville,** where temperatures ordinarily do not dip to 32° until late in the month. Strangely, the northeastern quarter of Texas escaped a freeze altogether until a second major surge of polar air engulfed Texas around the middle of the month. That two-phased cold wave was responsible for generating the lowest readings of the month in much of the State. The northeastern corner of the Panhandle endured lows in the single-digit category on November 15, and minimums in the teens struck as far south as Ozona (Edwards Plateau) and western North Central Texas in locales such as **Breckenridge** and **Eastland.** None of the four cold fronts to enter Texas in November were potent enough to force temperatures to the freeze level in the Upper Coast and Lower Valley, as well as nearly all of Southern Texas.

The early-November cold front that ushered freezing temperatures deep into Texas snapped the month's most intense heat wave. Almost universally around the State temperatures peaked for the month in the mid 80s—or higher—on November 1 and 2. Highs in the low 90s were noted as far north as **Denison Dam** and throughout the southern extremity of the State, while extremes at a few spots on the lower Rio Grande neared 100° just before the initial front of the month arrived.

In spite of the phenominally early freezing spell in central Texas, temperatures averaged over the whole of November were neither notably colder nor warmer than usual. A few communities in the northern half of Texas as disparate as **Vega, Childress, Bonham,** and **Palestine** measured temperatures more than 2° under normal, but then a smattering of locales in southern Texas such as **Liberty** and **McAllen** recorded mean November temperatures of 2° or more above normal.

December: Snow-Induced, Record-Setting Temperatures at Year's End

Although it was punctuated by a bitter cold wave that produced the lowest temperatures of the winter of 1982-83 in the Panhandle, the month of December as a whole was not unusually chilly. Only a pair of the five cold fronts that traversed Texas in 1982's final month forced temperatures substantially below normal, so mean readings for the month in much of the State were near or slightly above normal. Only the High Plains and Trans Pecos sustained regionwide temperatures over the whole of December that were 3° or more below normal. Such anomalies were due in part to the massive surge of Arctic air that precipitated a heavy snowfall just a few days before the year ended. Abetted by a thick snow cover, morning temperatures plummetted below 0° in large portions of the Panhandle. Highlighted by minimums of -7° at **Friona** and -6° at **Dimmitt, Hereford,** and **Muleshoe,** subzero readings were felt as far south as **Morton,** whereas **Lubbock** recorded a near-record low of 0° on December 29. Lows in the teens were registered as far south as **Fairfield** (East) and **Floresville** (South Central) a day later. A second Arctic air invasion shortly before mid-December caused the most widespread hard freeze of the month; all sections

except the Lower Valley saw morning readings dip below 32° on or about December 13 and 14. In all, the number of freeze days during December was subpar, except in the High Plains and Trans Pecos. Much of North Central and East Texas experienced little more than half the usual number of freeze days.

Spells of record warmth struck sections of Texas on three separate occasions, the most notable being just as December got underway. Afternoon readings soared into the 80s in nearly all of the southern half of Texas on either or both December 1 and 2. Even highs in the 90s were noted in the State's southernmost extremity at that time.

IV. HURRICANES AND OTHER TROPICAL DISTURBANCES

Rare is the year when the arid westernmost portion of Texas receives substantially more rainfall from tropical weather disturbances than the sector of Texas' coastal plain that affronts the Gulf of Mexico. Even more unthinkable is a summer devoid of cyclone-inspired drenching rains along the Texas coastline. Yet, the only tropical organism capable of interrupting an otherwise monotonously hot and uncommonly dry summer along Texas' coastal flank was a lone tropical storm dubbed "Chris," and it fell woefully short of furnishing notable rainfall. The only noteworthy rains stemming from a tropical cyclone fell in far western Texas, and only after a dying hurricane hiked several hundred miles across the Chihuahan desert in late September. Even then the highly intense, short-term rains that measured over 2 inches were confined to a small corner of the western Trans Pecos in and around El Paso.

Out of the Atlantic Ocean/Gulf of Mexico

The fact that only one major tropical cyclone out of the Gulf of Mexico impacted Texas' weather in 1982 only partially explains why the "hurricane season" of 1982 was more than a little exceptional.[1/] While it is not uncommon for a summer-autumn period to elapse without a tropical storm or hurricane making landfall somewhere along the Texas coastline (a happenstance that occurred in 6 of the last 10 years), it is unusual for a year to pass without one or a few lesser tropical disturbances migrating westward out of the Gulf to provide appreciable rain in Texas' coastal plain. Still, with the exception of

1/ The 1982 hurricane season was the most uneventful in half a century for the whole nation. During the past 50 years only one year (1972) had fewer (4) named tropical cyclones than the year 1982. Of the five named cyclones in 1982, three were tropical storms (**Beryl**, August 28-September 6; **Chris**, September 9-12; **Ernesto**, September 30-October 2) and two attained hurricane stattus (**Alberto**, June 2-6; and **Debby**, September 13-20). The most recent year prior to 1982 to have only two recorded hurricanes was 1931. Moreover, the U. S. mainland was spared a hurricane making landfall for the second year in a row—or only the second time this century that two consecutive years elapsed without a hurricane hitting this nation's coastline. Yet one more oddity about the 1982 hurricane season was the fact that none of the storm tracks ever crossed each other—the first time that has happened since 1929.

When the only major tropical cyclone to make landfall anywhere in the U. S. in 1982 evolved in the west central Gulf of Mexico on September 9, the potential for heavy rains appeared considerable, particularly when the infant storm headed westward toward the lower Texas coastline. After drawing to within 225 miles of Corpus Christi on September 10, Chris abruptly swung poleward and steered toward the Texas-Louisiana border (Figure 27). The slowly intensifying cyclone—while yet a depression—never got close enough to dampen the lower two-thirds of the Texas coastal plain. Both Brownsville and Corpus Christi gaged wind gusts of only 16 mph and 15 mph, respectively, before the maturing storm altered its course. In fact, it was not until the storm's course changed from westerly to northerly that Chris attained tropical storm status—just after the noon hour on September 10 while 135 miles southeast of Galveston (Figure 28a and b). From that moment until it roared ashore 20 hours later, Chris steadily grew stronger.

When it reached the coastline just east of Beaumont at daybreak on September 11, Tropical Storm Chris was mustering sustained winds of 55 mph with gusts near hurricane strength in some of its squalls. It had assumed a mostly northerly course at a speed of 9 mph and was emitting gale-force winds as far as 150 miles to the east but only about 50 miles to the west—or not quite as far west as Galveston. Its central pressure was measured at 994 millibars (29.36 inches of Hg). Showers and some thunderstorms had preceded the main storm body by several hours; rain began falling just after midnight on September 11 at Port Arthur, where highest sustained winds reached 28 mph. At nearby Sea Rim State Park, wind gusts of 51 mph were reported, and highest tides reached 5-6 feet.

Because its course took the tropical storm over the mouth of the Sabine River, property damage in Texas was only very modest. No beach erosion could be detected along the Texas coastline, and only minor flooding occurred—that at Sabine Pass. Chris caused no human casualties in Texas, although three crew members of a 65-foot utility boat sunk nine miles out at sea had to be rescued. Moreover, damages to a restaurant on Pleasure Island in Port Arthur amounted to $200 thousand, and an offshore crewboat was washed ashore near Sabine.

Surprisingly, rainfall generated in Texas by Chris was scanty. Only four out of 44 weather stations in the Upper Coast collected as much as ½ inch during the 72-hour period leading up to and following Chris's invasion, while only three out of 86 rainfall-observing points in East Texas gaged ½ inch or more. The heaviest rainfall provided by Chris and its remnants in Texas merely amounted to 0.96 inch at **Evadale,** which is less than 30 miles from the point where Chris made landfall! Other locales receiving appreciable rains included: **Orange** (0.89 inch), Hobby Airport in **Houston** (0.87), Deweyville (0.82), **San Jacinto** Dam in Houston and **Toledo Bend Dam** (0.69), and **Bon Wier** (0.57). Rainfall in the Sabine River valley ended as early as nightfall of September 11, and scattered pockets of clouds—the last vestige of the storm's remains—exited the State less than 48 hours after Chris made landfall. Chris's residue tracked north-northeastward through northern Louisiana into the lower Mississippi River valley on September 11 and 12 and produced nine tornadoes and heavy rains that provoked widespread flooding in a 4-state area.

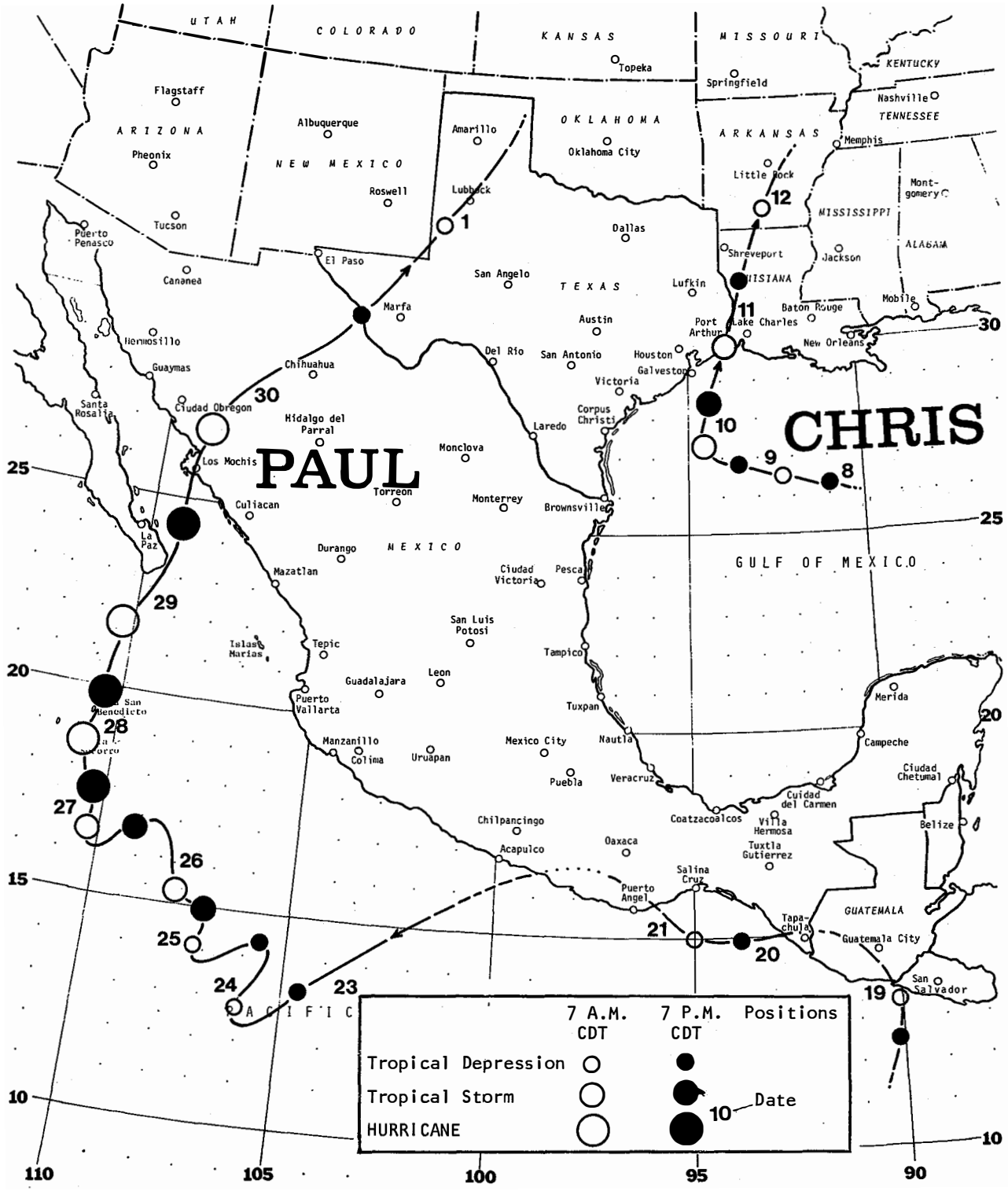
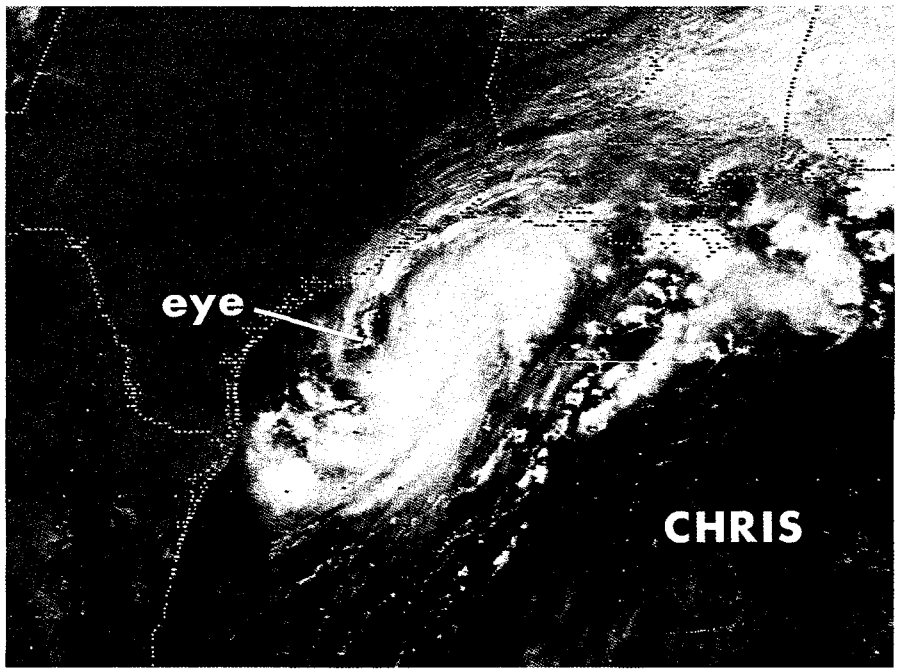


Figure 27. Plots of the paths of two tropical cyclones that had a discernible impact on Texas weather during 1982: Tropical Storm Chris (September 8-12); and Hurricane Paul (September 19-October 1).

(a)



(b)

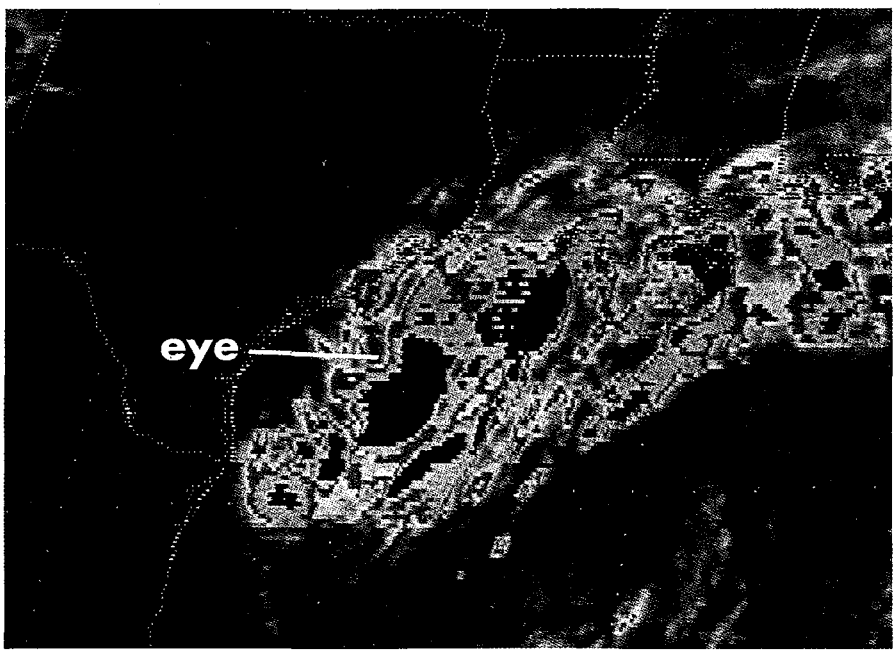
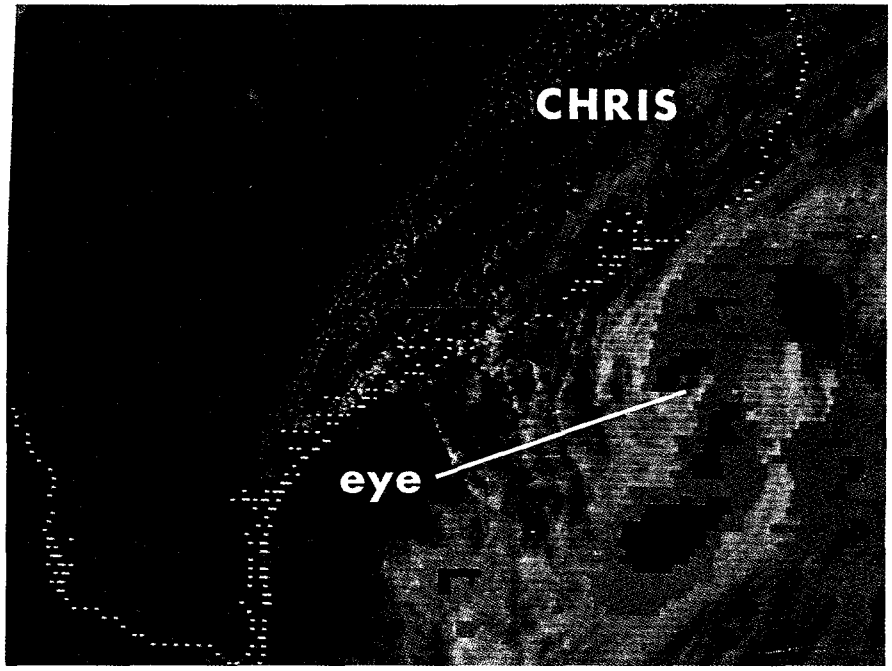


Figure 28. Tropical Storm Chris, the only one of five tropical cyclones from the north Atlantic to affect Texas in 1982, had surprisingly little adverse impact on the State when it moved ashore around daybreak on September 11. (a) After aiming initially for the lower Texas coast, Chris attained tropical storm strength early on September 10 and was headed northward when this visible satellite photo was taken late on the same morning (1631Z); (b) infrared imagery at about the same time (1701Z) showed the bulk of the storm was east of the eye and more than 100 miles off the Texas coastline.

(c)



(d)

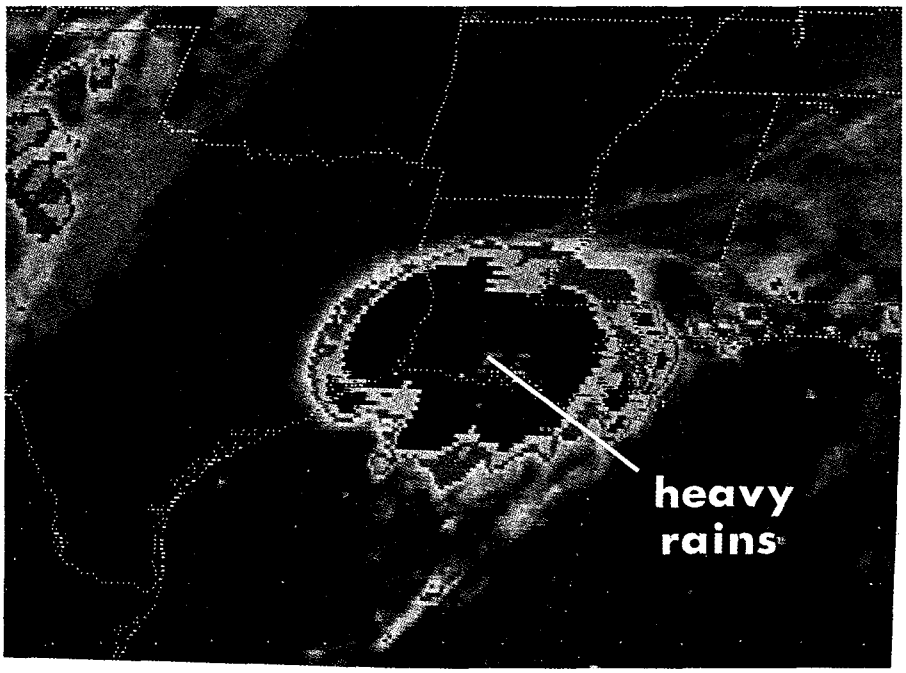
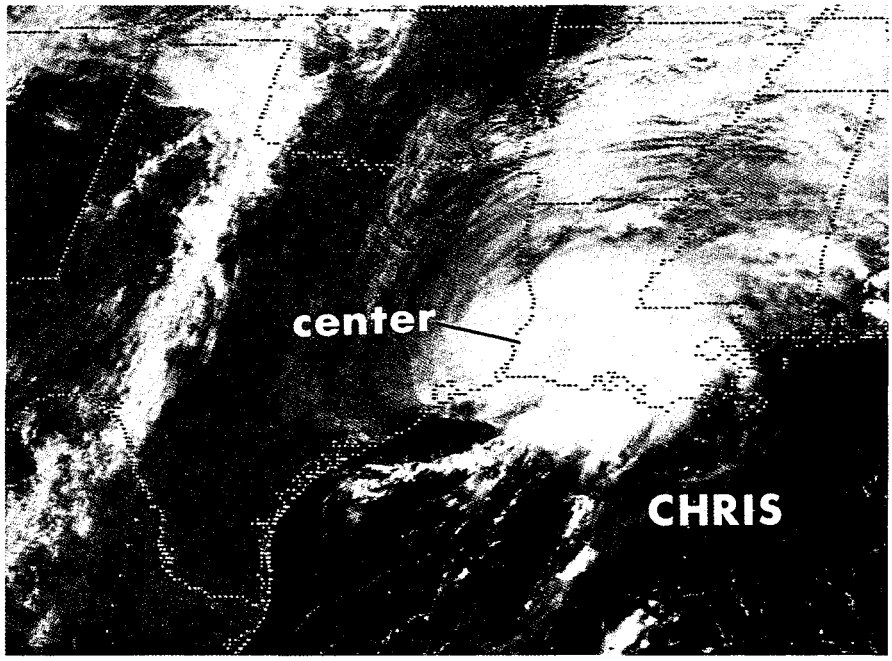


Figure 28 (Continued). (c) Within three hours after reaching tropical storm status, Chris had highest sustained winds of 50 miles per hour with gales extending 150 miles to the east; the infrared photo taken at 5:02 p.m. CDT showed intense thunderstorms well distributed around the eye of the storm. (d) At the precise moment (1231Z) that the center of Chris pushed ashore near Port Arthur around dawn on September 11, most of the heavy rain associated with the storm spread over Louisiana or remained at sea.

(e)



(f)

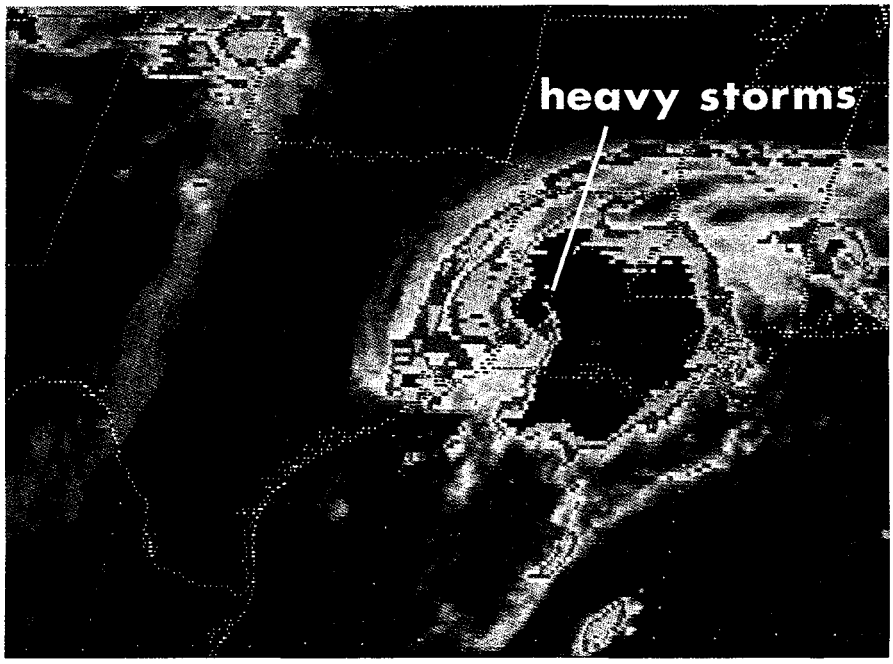


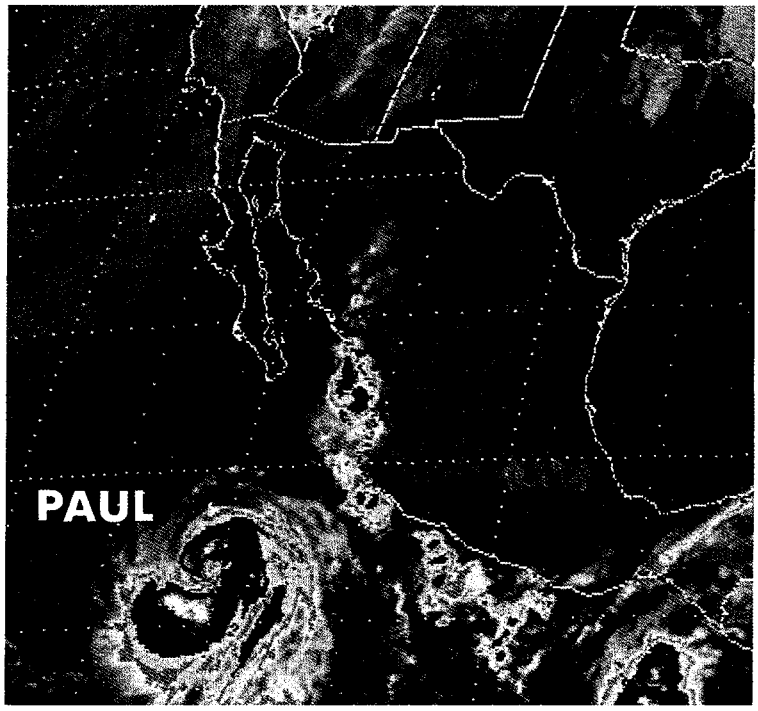
Figure 28 (Continued). (e) The remains of Chris (1631Z) drifted north-northeastward through western Louisiana, leaving behind very modest property damage and minor flooding in and around Sabine Pass. (f) Texas' eastern extremity captured rains of only 1 inch or less from the dying storm, whose remnants, as shown by infrared imagery at about noon (1701Z) on September 11, mostly were concentrations of heavy thunderstorms over Louisiana.

From the eastern North Pacific

Much less publicized than storms moving through the Caribbean Sea and Gulf of Mexico are the tropical storms and hurricanes so prevalent in the eastern North Pacific off the western coast of Mexico in summer and autumn. After all, 400 miles of Mexican desert and plateau serves as a buffer between these cyclones and the land north of the Rio Grande. Besides, nearly all of the average number of 14 tropical cyclones that traverse the warm waters of the eastern North Pacific near Mexico each year follow a northwestward trajectory that avoids the Mexican coastline and inevitably leads the storms to their deaths in the colder waters of the central Pacific Ocean. Still, hardly a year passes that one or a few of these tropical cyclones do not stray off the customary path and crash into the western Mexican coast. When this happens, copious amounts of Pacific moisture are propelled northward across the Mexican continent, oftentimes spilling over into western and southern portions of Texas. Occasionally, enough cloud cover is transported into Texas that meaningful rainfall results, or the dying remains of the Pacific storm unsettles the atmosphere to the extent that numerous showers and thunderstorms are triggered on the Texas side of the Rio Grande. The latter scenario took place once in 1982 and was responsible for the record-setting intense rainfall that drenched the far western tip of Texas in late September. The instigator of the substantial rains in the Trans Pecos was Hurricane Paul.

Paul had a most unorthodox beginning. It first evolved as a depression less than 100 miles southwest of El Salvador, moved inland through Guatemala, exited into the Gulf of Tehuantepec, then moved inland again into the Mexican state of Oaxaca, only to exit once more on September 22 into the eastern North Pacific, where it almost disintegrated. Feeding again off of the energy supplied by the very warm ocean, however, Paul revived the next day and began a meandering, 5-day journey northward toward Baja California as it steadily grew to hurricane status (Figure 27). Finally, on the morning of September 28 while centered more than 300 miles west of Manzanillo, Mexico, Paul became a hurricane. After veering slightly and nipping the southernmost part of Baja California (Figure 29 b), Hurricane Paul smashed ashore near Los Mochis, Mexico before dawn on September 30. Paul's vicious winds and flood-waters killed eight people, left 24,000 homeless and destroyed an estimated $70 million in crops in western Mexico; high water cut off a coastal highway between Culiacan and Los Mochis, stranding more than 3,000 travelers, including some American tourists.

With huge amounts of moisture spewing across Mexico, showers first developed in the northern Trans Pecos just after midnight on September 30 at the time Paul's center rushed ashore about 450 miles away. Though Paul weakened quickly after making landfall, a massive concentration of moderate to heavy rain moved northeastward across central Mexico toward the upper Rio Grande. Light rain mixed with heavier showers peppered much of the Trans Pecos during the morning, and by midday much more substantial thunderstorms boomed as the still-evident center of the dissolving cyclone drew to within 200 miles of El Paso (Figure 29 d). Scattered showers persisted in the Trans Pecos for the



(a)

(b)

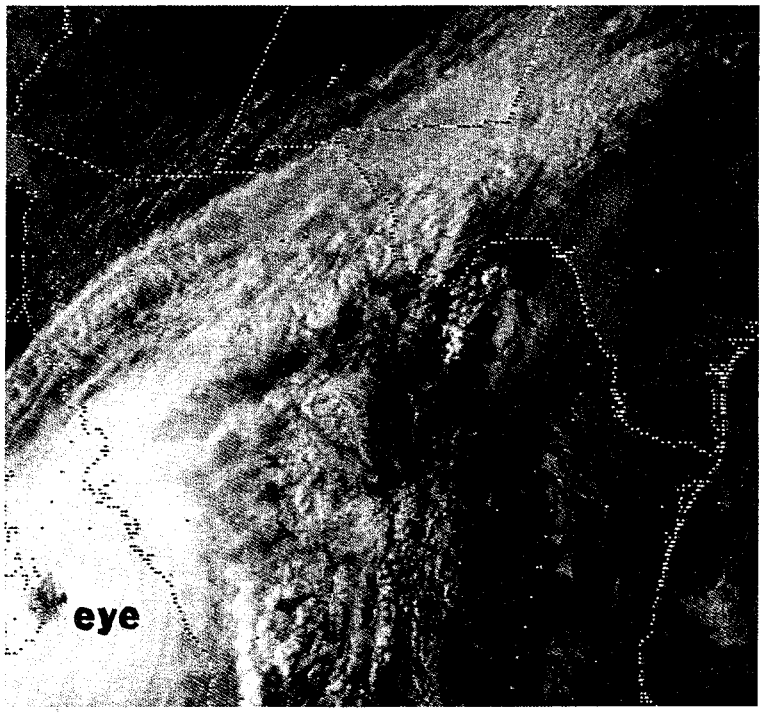
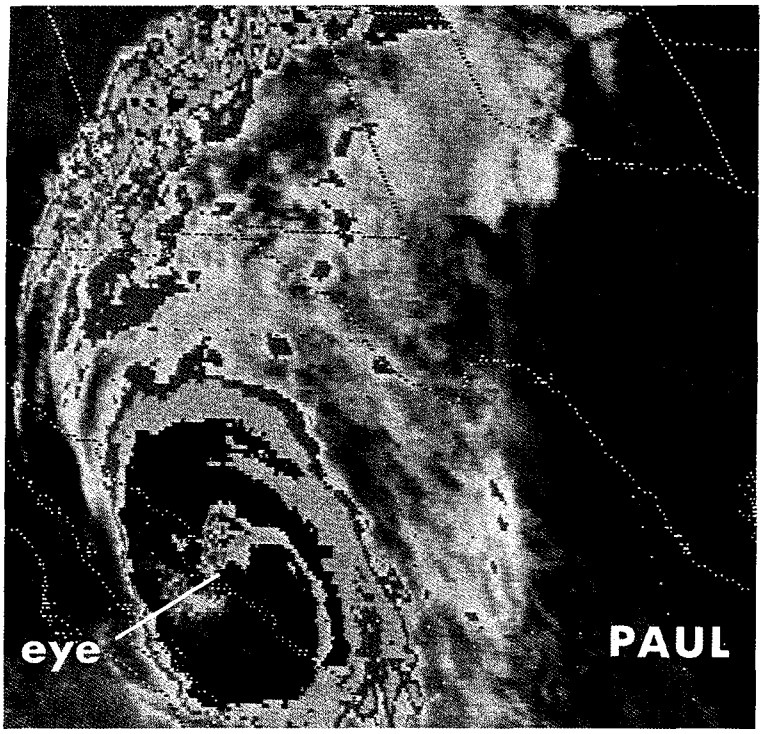


Figure 29. Hurricane Paul, one of 18 tropical cyclones to develop in the eastern North Pacific during 1982, struck the western coast of Mexico on September 29-30 and later produced record rainfall in the westernmost tip of Texas. (a) As shown by an infrared satellite photo taken around dawn (1331Z) on September 27, Paul was on the verge of becoming a full-fledged hurricane while centered nearly 400 miles off the western Mexican coastline. (b) The eye of Paul grazed the southern tip of Baja California late on the afternoon (2230Z) of September 29 while hurricane-force winds battered Mazatlan and Culiacan; the cloud cover over western Texas at this point was due to the slow, southeastward movement of a cold front.



(c)

(d)

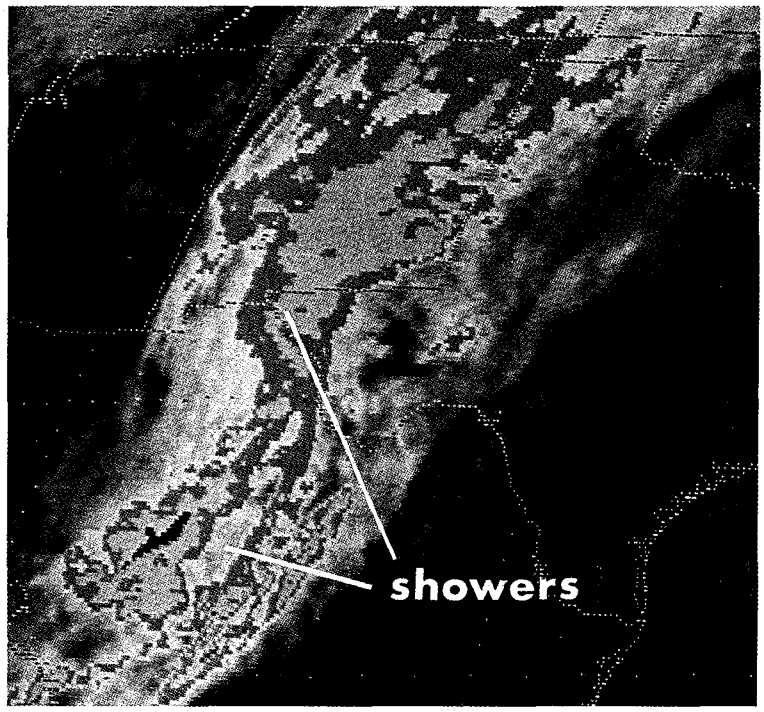


Figure 29 (Continued). (c) Infrared imagery taken early (0645Z) on September 30 depicts copious moisture streaming far inland over Mexico just after Hurricane Paul roared ashore at Los Mochis; the mammoth cyclone killed 8, left 24,000 homeless, and destroyed an estimated $70 million worth of crops in Mexico. (d) With Paul's residue centered near Chihuahua at midday on September 30, one remnant of the dying storm was dumping a record short-term rainstorm on El Paso at the time (1801Z) of this infrared photo.

remainder of the day, and rain and showers formed farther north in the western High Plains and continued off and on throughout the night and up until midday of October 1.

Over a half-dozen points in the Panhandle, and a few locales in the western Trans Pecos, collected more than 1 inch of rain from Paul's residue (Figure 30). Indeed, El Paso was beseiged by a downpour of record intensity just before noon on September 30; the metropolis gaged more than 2 inches from Paul's remnants over a 12-period ending that afternoon. (More specific information about the record rainfall rate observed in El Paso is given in the section, "Flash Floods," in Chapter V.) The heaviest rainfall attributed to Paul was observed at nearby Ysleta, where 2.26 inches was measured during the 24-hour period ending at daybreak on October 1. Meanwhile, instability aided by the approach of Paul's residue led to as much as 1.74 inches in the northwestern corner of the Panhandle at Dalhart, while locales such as Channing, Hartley, Tascosa, and Stratford received about 1 $\frac{1}{4}$ inches from the dying storm. In fact, Paul's residue contributed almost all of the precipitation collected at these Panhandle locations during October 1982.

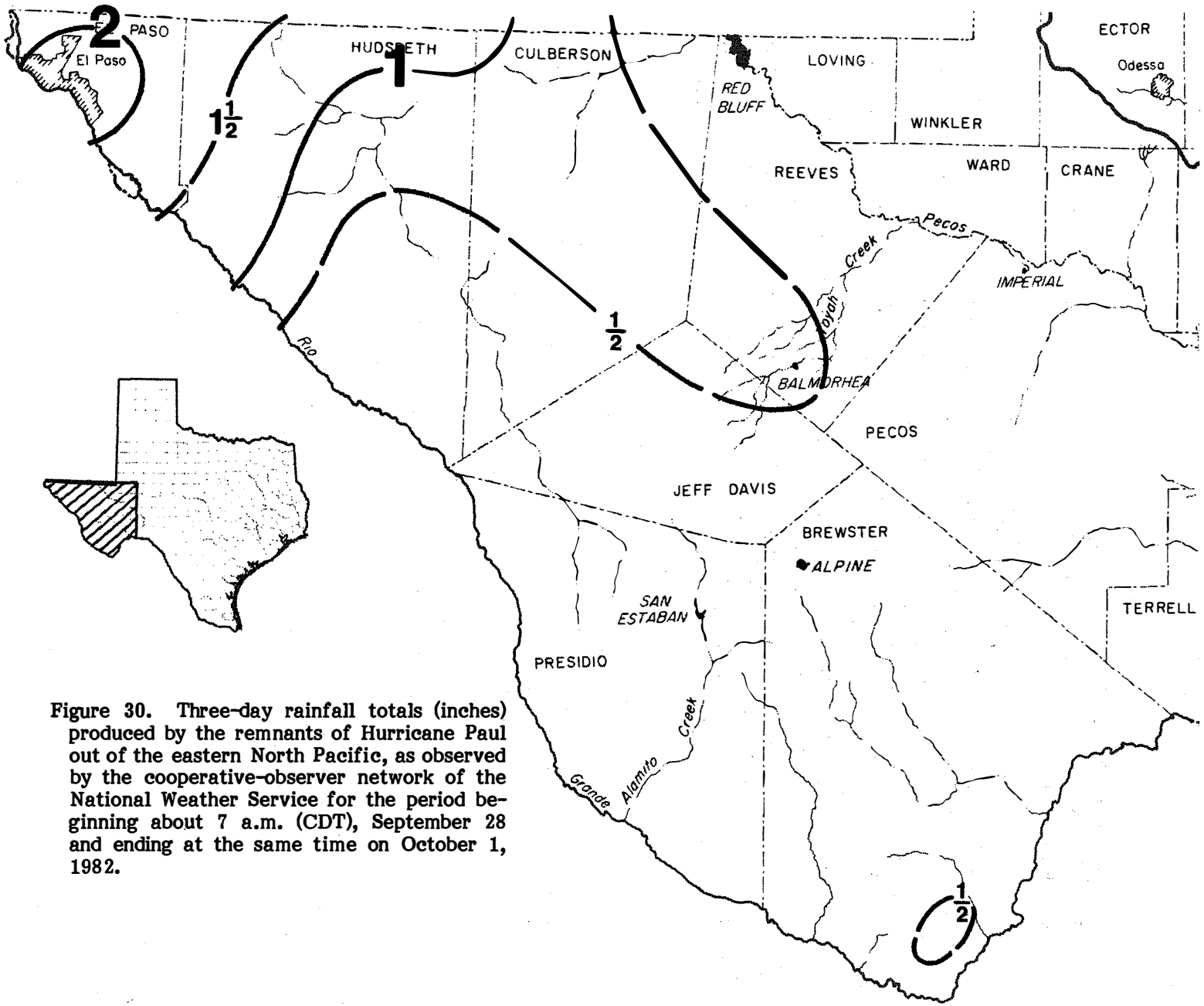
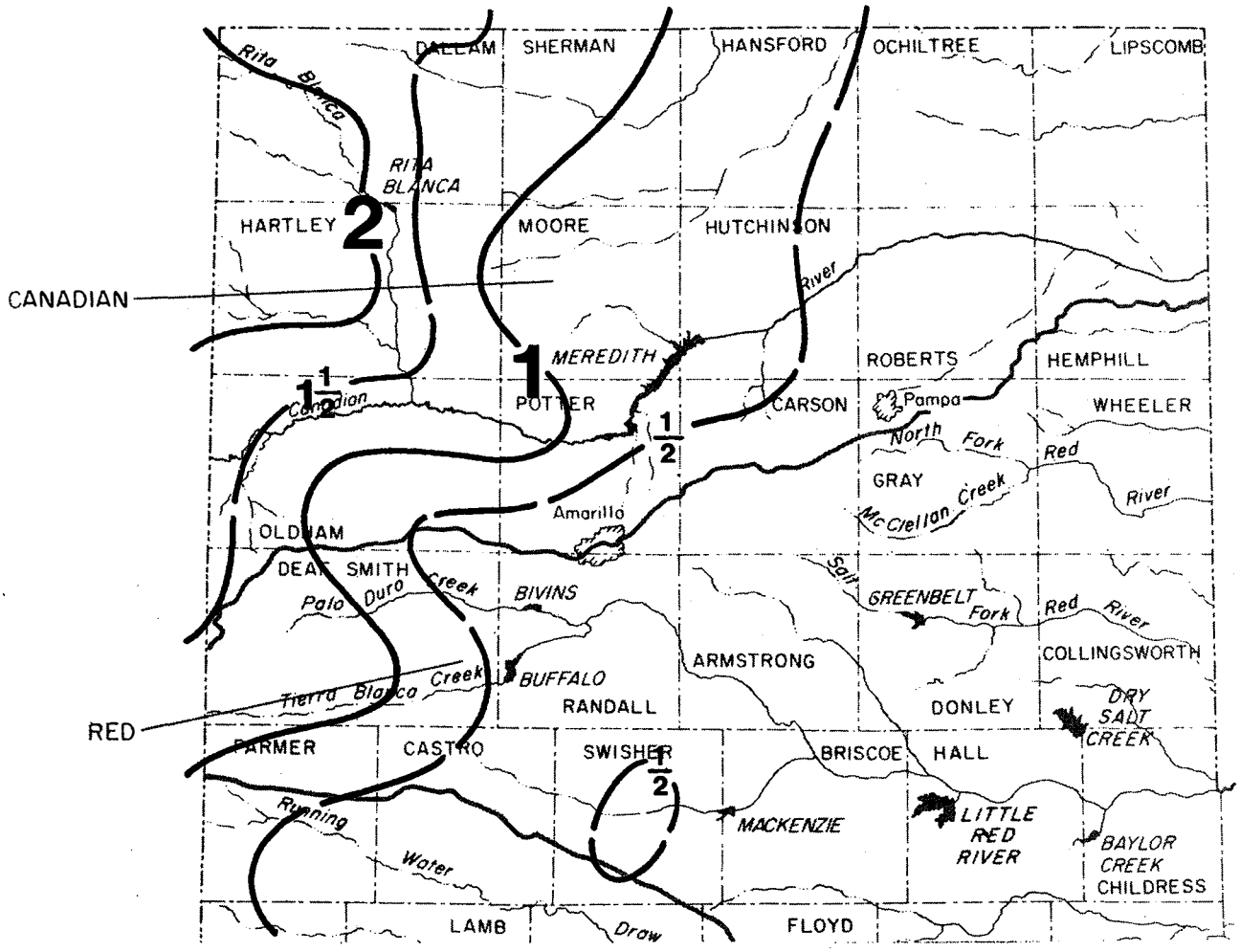


Figure 30. Three-day rainfall totals (inches) produced by the remnants of Hurricane Paul out of the eastern North Pacific, as observed by the cooperative-observer network of the National Weather Service for the period beginning about 7 a.m. (CDT), September 28 and ending at the same time on October 1, 1982.



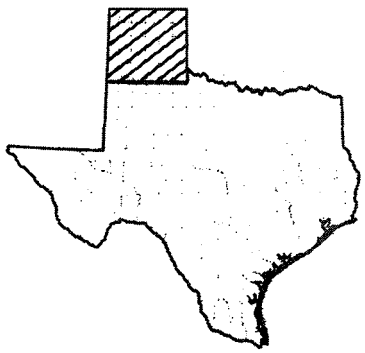


Figure 30 (Continued). Three-day rainfall totals (inches) produced by the remnants of Hurricane Paul, as observed for the period beginning about 7 a.m. (CDT), September 28 and ending at the same time on October 1, 1982.

LOCAL SEVERE-STORM PHENOMENA

While the Paris tornado was unquestionably the pre-eminent feature of a typically tumultuous spring, there were legions of other localized severe storms that wrought havoc on virtually every community throughout the length and breadth of the Lone Star State. With the month of May alone supplying about as many tornadoes as are ordinarily witnessed in Texas in an entire year, 1982 was noted not only for its inordinately high number of twisters but for an abnormally large number of tornado-related injuries. Cloudbursts, scattered seemingly at random around the State at various times during the year, dumped far too much water in too little time, and the inevitable result was calamitous floods that brought monumental misfortune to cities as large as Amarillo and Wichita Falls. Not many locales went unscathed from one or more showers of hail during the year, and several cities paid dearly by being in the paths of severe thunderstorms bearing uncommonly large and plentiful hailstones. Lightning was a typical menace, striking all too suddenly and, in a relatively few instances, claiming a life or triggering a fateful fire. Though it fell short of being as vexatious as some of the more notable "dusters" of the previous decade, a duststorm in April bedeviled much of the State for a couple of days, and several other outbreaks of blowing dust reminded the citizenry of Nature's proclivity for transplanting precious topsoil from a region having none to spare.

Tornadoes

Given the fact that the number of tornadoes observed during 1982 far exceeded the normal population of the dreaded phenomenon, it was fortuitous that—aside from the multitudinal casualties stemming from the Paris tornado—relatively few of the remainder scored direct hits on densely populated areas. Only two tornadoes not associated with the April 2 outbreak in and around Paris led to fatalities, and in those instances the number of deaths totalled only two (Table 7). Moreover, barely more than a half-dozen tornadoes not occurring on April 2 led to injuries. Yet, the 174 injuries caused by the rash of twisters of April in and around Paris inflated the year's cumulative tornado-related statistics to the extent that the casualty total of 246 for 1982 was uncommonly numerous (Table 8).

The tornado season got underway a bit belatedly, with the first sighted twister occurring early on the morning of March 14 in Taylor County south of Abilene (Table 7). The inaugural tornado, as one of four twisters that combined to cause major destruction early that day in Taylor and four nearby counties, produced heavy damage to a restaurant in **Buffalo Gap**, a community 12 miles south of Abilene.

Table 7. Tornadoes of significance in Texas during 1982.

Significance	Location	Date	Time (CST)	Casualties		Path	
				Deaths	Injuries	Length (mi)	Width (ft)
First Observed Tornado	at Buffalo Gap (Taylor County)	Mar 14	1:00 a.m.	0	0	-	-
First Tornado Causing Major Destruction and/or Injury	in vicinity of Winters (Runnels County)	Mar 14	1:40 a.m.	0	9	40 1/2	525
First Killer Tornado	near Bohnam (Fannin County)	Apr 2	3:20 p.m.	1	1	32	450
First Large Outbreak (8)	Taylor and adjacent counties	Mar 14	12:30 a.m.	0	9	-	-
Other Large Outbreaks	Lamar, Bowie, and Red River counties	Apr 2	3:20 p.m.	11	174	-	-
	High Plains and western/northern North Central Texas (31)	May 12	most of the day	0	12	-	-
Most Destructive	Paris and vicinity	Apr 2	4:00 p.m.	10	170	23	750
Day with the Greatest Number (35)	High Plains and western/northern North Central Texas	May 12	most of the day	0	14	-	-
Last Tornado Causing Death	Humble	Sep 3	3:30 p.m.	1	2	1	600
Last Observed Tornado	near Bonham	Nov 22	7:50 p.m.	0	0	5	150

Source: "Storm Data," U. S. Department of Commerce, 1982.

Table 8. Number of fatalities and injuries resulting from localized severe-storm phenomena in 1982.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
TORNADOES													
No. Observed			6	27	123	36	4		3		3	1	203
Days with			2	8	17	17	4		3		1	1	53
Deaths				11	1				1				13
Injuries			14	174	23	16			11			1	246
HAILSTORMS													
Deaths													
Injuries						16							16
LIGHTNING													
Deaths				2		2			1	2			7
Injuries				1		2	1						4
WINDSTORMS													
Deaths						1							1
Injuries			3			3		1			28		35
FLOODING													
Deaths	1				8								9
Injuries	1				34								35

Source: "Storm Data," U. S. Department of Commerce

Another tornado in that foursome caused the first injuries of the year when it tore through **Winters,** where one home and three industrial buildings were leveled. That tornado stayed on the ground for over 40 miles, injured nine people, and produced more than 3 million dollars worth of damage in four counties. The only other round of tornado-producing turbulence in March led to a single tornado on March 18 that cut across a swath of Hansford and Moore Counties (in the Panhandle) and caused more than $1 million in damage to farm buildings and equipment near **Sunray.**

All but a few of the 27 tornadoes witnessed in April touched down in either North Central or East Texas. Only the eight tornadoes that dipped out of the sky on April 2 near the Red River caused death or injury. Only two of the remainder engendered appreciable property damage; four homes and numerous barns and sheds were either destroyed or damaged in the communities of **Fulbright** and **McCoy** (near **Clarksville** in Red River County) when an early-evening twister touched down on April 25, while $100 thousand worth in damage was wrought by a tornado that hit **Hurst** (in Tarrant County) three days later.

Table 9. Number of tornadoes, tornado days, and tornado related casualties observed in Texas' ten climatic regions in 1982.

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1982
HIGH PLAINS													
Tornadoes			1		44	18		1					64
Tornado Days			1		14	8		1					24
Injuries			5		2	16		9					32
LOW ROLLING PLAINS													
Tornadoes			3	1	24	6							34
Tornado Days			1	1	9	4							15
Injuries			9										9
NORTH CENTRAL													
Tornadoes			2	9	29	5	1				3		49
Tornado Days			1	5	4	3	1				1		15
Deaths				11									11
Injuries				171	13								184
EAST													
Tornadoes			14	5	1			1				1	22
Tornado Days			4	1	1			1				1	8
Deaths				1									1
Injuries				3	6							1	10
TRANS PECOS													
Tornadoes					1	1	1						3
Tornado Days					1	1	1						3
Injuries													
EDWARDS PLATEAU													
Tornadoes				3	9	3							15
Tornado Days				2	4	3							9
Injuries					2								2
SOUTH CENTRAL													
Tornadoes					2	1							3
Tornado Days					2	1							3
Injuries													
UPPER COAST													
Tornadoes					8	1	2		1				12
Tornado Days					2	1	2		1				6
Deaths										1			1
Injuries										2			2
SOUTHERN/LOWER													
Tornadoes					1								1
Tornado Days					1								1
Injuries													
TOTALS													
Tornadoes			**6**	**27**	**123**	**36**	**4**		**3**		**3**	**1**	**203**
Tornado Days			**2**	**8**	**17**	**17**	**4**		**3**		**1**	**1**	**53**
Deaths				**11**	**1**				**1**				**13**
Injuries			**14**	**174**	**30**	**16**			**11**			**1**	**246**

Source: "Storm Data," U.S. Department of Commerce.

Table 10. Distribution by region and month of tornadoes of varying intensities in Texas in 1982.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
HIGH PLAINS	FO					28	11							40
	F1					10	5				1			16
	F2					3	2							5
	F3					4								4
	F4			1										1
LOW ROLLING PLAINS	FO					15	4							19
	F1			1	1	5	1							8
	F2			1		2	1							4
	F3			1		1								2
NORTH CENTRAL	FO				3	7	3	1						14
	F1			2	2	16	2					3		25
	F2				2	4								6
	F3				1	2								3
	F4				1									1
EAST	FO									1				1
	F1				10	3	1							14
	F2				2	1							1	4
	F3				1	1								2
TRANS PECOS	FO					1								1
	F1							1						1
	F2						1							1
EDWARDS PLATEAU	FO					2	2							4
	F1				4	5	1							10
	F2					2								2
SOUTH CENTRAL	FO						1							1
	F1					2								2
UPPER COAST	FO							1						1
	F1					7	1	1		1				10
	F2					1								1
SOUTHERN	F1					1								1
Totals	**FO**				**3**	**53**	**21**	**2**		**1**				**80**
	F1			**3**	**17**	**49**	**11**	**2**		**2**		**3**		**87**
	F2			**1**	**4**	**13**	**4**						**1**	**23**
	F3			**1**	**2**	**8**								**11**
	F4			**1**	**1**									**2**

"F" SCALE DEFINITIONS

Rating	Maximum Wind Speeds (mph)	Characteristics
FO	40-72	Breaks branches off trees; signboards damaged.
F1	73-112	Peels surface off roofs, trailer houses pushed or damaged.
F2	113-157	Tears roofs off frame houses and outbuildings; cars blown off highways.
F3	158-206	Windows of skyscrapers smashed; frame houses destroyed; cars lifted off ground.
F4	207-260	Skyscrapers twisted; frame house leveled; cars blown some distance.
F5	over 260	

Source: "Storm Data," U. S. Department of Commerce.

Not surprisingly, the month with the overwhelmingly largest total of tornadoes also featured the greatest single-day outbreak of the feared phenomena. Thirty-five tornadoes dropped out of the sky on May 12, and several of them induced injuries and notable property damage. Six residents of the Western Lakes community in southern Parker County were injured when an early-afternoon tornado cut through a mobile-home park, while at about the same time a mother and her infant daughter were injured in a rural area near **Patillo** in southern Palo Pinto County. Four hours later, in nearby Comanche County, three people were hurt when a tornado ripped through homes and farm buildings, turning two trucks upside-down and hurling a third some 25 yards. On the following day twelve more tornadoes struck in the southeastern sector of the State. One of the dozen hit a rural section of Jasper County early in the afternoon, shattering a farm house and killing its inhabitant. An elderly man was injured nearby when the same twister caused his mobile home to tumble for 200 yards across open fields. Nearly half of the month's 123 observed tornadoes occurred in the High and Low Rolling Plains, but only a few were responsible for appreciable damage.[1/] A May 9 tornado caused more than $2 million in damages to property near **Bushland**, and a second struck **Seminole** on May 12, slightly injuring 17 people and causing about $1.6 million in damages. A tornado with a clearly defined loop path hit an industrial park near **Pampa** on May 19, producing property losses of $3-4 million.

Characteristically, most of the near-normal number of 37 tornadoes appearing during summer came in June, or just prior to the establishment of stable atmospheric conditions so prevalent in July and August in Texas. All but a few of June's 20 tornadoes cropped up in the western third of the State; only three of those caused injury or major damage. One of them teamed up with a vicious hailstorm on June 5 to cause nearly $5 millioin in damages to property near **Borger** (Hutchinson County), as well as injury to six people. Ten people were harmed by flying glass and hail when a tornado-producing thunderstorm rumbled across farmland near **Spearman.** One of only four tornadoes observed in July dipped down into the community of **Stowell** on July 14, destroyed a barn, then lifted the frame of a building and placed it between two homes that were not damaged at all. Marked by an absence of significant tropical disturbances, August furnished no tornadoes.

The season's lone tropical storm failed to generate any tornadoes, so the autumn of 1982 was notably lacking in numbers of twisters. While the three tornadoes sighted in September was substantially subpar, one of them was a killer. It dipped down at **Humble** on the afternoon of September 3 and collapsed a garage under construction, killing one worker and injuring two others. Much later in the month, a tornado touched down in **Seminole,** demolishing four mobile homes and hurting nine residents. The year's final spate of weather violence occurred

1/ The total of 123 tornadoes in May far exceeded the previous May record of 71 established in 1981 and was the highest ever reported for any month with the lone exception of September 1967, when 124 tornadoes were observed, many in association with Hurricane Beulah.

just prior to Thanksgiving, when a trio of tornadoes dipped down in Grayson and Fannin Counties and caused only modest damage to outbuildings and trees.

Flash Flooding

While **Wichita Falls** suffered more than any other community from the severe flash floods of May 12-13, scores of other locales throughout North Central East and South Central Texas and the Upper Coast were beleagured by excessive amounts of water during what was the most rampant, unsettled spell of weather during 1982. Within 24 hours after much of the region had been buffeted by brief, heavy rains, violent winds, and numerous scattered instances of hail and tornadoes, subsequent squalls triggered by a slow-moving cool front and very strong upper-atmospheric storm center unleashed mostly nocturnal torrents of rain that totalled from 6 to 10 inches overnight in many places. Rainfall of 5-8 inches within a 10-hour period created havoc in Wichita County. While water rose to as much as 8 feet in homes in Wichita Falls, one man was swept away and drowned. Raging currents of floodwater entered more than 2100 homes in and near Wichita Falls, forcing more than 5000 residents to flee and causing property damage of approximately $25 million in the county alone. Roads, bridges, and crops were damaged extensively in numerous counties to the north and northeast of the **Dallas-Fort Worth** area on May 12-13; general rains of 10-12 inches in Denton County, more than 12 inches in **Bonham**, and at least 8 inches in **Sherman** and **Paris** caused widespread flooding of urban property and forced the closing of numerous streets and roads. About 30 homes had to be evacuated in **Greenville**, while at least 16 residents of **McKinney** had to be rescued from their flooded homes. About 30,000 acres of farmland were inundated by floodwaters in Hopkins County when the Sulphur River and its tributaries spilled out of their banks. In central Texas thunderstorm deluges forced scores of creeks out of their banks before dawn on May 13. Overflow from Shoal Creek was largely responsible for property damages totalling $2 million in **Austin**, while about half that much damage occurred nearby in **Round Rock** and vicinity. One man, after being swept downstream off of a flooded bridge on which his pickup truck had stood, was rescued by a second man who dived into the swollen creek after him. Property losses from flash floodwaters in a 6-county to the north and east of Austin amounted to at least $3.1 million. On May 16 a flood-producing thunderstorm unleashed torrential rains lasting 3 hours that caused 4 drownings and 15 injuries in **San Antonio.** One woman, and a young man who attempted to rescue her, were swept away by floodwaters at a low-water crossing. Barely an hour later, more heavy rain near **Uvalde** flooded a highway crossing, where the driver of a pickup truck lost control of his vehicle and two occupants were drowned.

Flood damages were equally as severe and almost as widespread in much of the Texas Panhandle in late July. Deluges generated by rounds of nocturnal thunderstorms unleashed overnight rainfall amounts of 3-5 inches in most of the western two-thirds of the Panhandle. **Amarillo** sustained the costliest damage when a playa lake in the southwestern portion of the city—Lawrence

Lake—overflowed and inundated about 3/4 of a square mile of densely-developed real estate. The overflow from the lake, one of the largest in the Panhandle that drains about 5700 acres and that has had a tendency to overflow rather frequently in the recent past, damaged about 65 businesses, 49 multi-family dwellings, and 82 homes.

Some of the most intense but unquestionably isolated short-term rains of 1982 struck in Kendall County (Edwards Plateau) late in the afternoon of September 15. The migration into the region of a cool front spawned a small but long-lived thunderstorm that unleashed a 2-hour rainfall of 10-12 inches over a 10-mile-wide area near **Sisterdale.** The cloudburst quickly forced Wasp Creek out of its banks, and this then caused the Guadalupe River to rise enough to cut off two farm-to-market roads. Elsewhere in Kendall County, at points only 8-10 miles north, east, and south of the Sisterdale area, no more than one inch of rainfall was measured by weather observers.

Two outbreaks of thunderstorms that produced serious flooding in **El Paso** during the latter half of September were responsible for almost half of the total amount of rainfall collected in that westernmost city during 1982. Rising water damaged numerous homes in El Paso (as well as in Juarez, its sister city in Mexico) on the evening of September 20 when a massive thunderstorm dumped 2.18 inches of rain in only one hour. While such rainfall rates are not extraordinary for most other regions of Texas, in the arid Trans Pecos they were sufficient to establish new records: 0.60 inch in only 5 minues, 1.44 inches in 1/2 hour, 2.18 inches in 1 hour, and 2.20 inches in 2 hours. Moreover, ten days later, on September 30, the same area was drenched again by a 2-inch rainfall that led to destructive floods. The uncommonly heavy rain, served up by the remnants of Hurricane Paul out of the eastern North Pacific Ocean, left rocks and debris on streets and highways and caused widespread damage to residential property.

Hailstorms

Ruinous outbreaks of hail afflicted scattered locations from the plains of the Panhandle and Permian Basin to the Red River valley of East Texas during 1982. A trio of hailstorms that pounded such disparate locales as **Borger, Monahans,** and **New Boston** were the most prominent among scores of hail occurrences in that each of the three caused property damage worth more than a few million dollars. The most costly hailstorm of all pummeled **Monahans** late on the afternoon of May 25 as cool Canadian air eased southward out of the plains of eastern New Mexico. Though most of the hail was no larger than golfballs, the force with which the frozen precipitation pounded exposed objects led to $8 million worth of shattered windows, damaged roofs and storm fronts of businesses and residences and disfigured autos. Much the same type of damage was done with similar-sized hail in **New Boston** earlier in the spring, although some of the most ruinous hail was reported to be as large as baseballs.

Extensive damage to mobile homes contributed to an estimated total cost of $5.4 in New Boston and nearby **Hooks** just after midnight on March 21. Hail ranging in size from golfballs to baseballs teamed with a tornado to cause nearly $5 million in property losses on the early evening of June 5 in **Borger.** While six people were injured either by the short-lived tornado or the large hail, nearly all of the damage sustained was attributed to the bursts of hail.

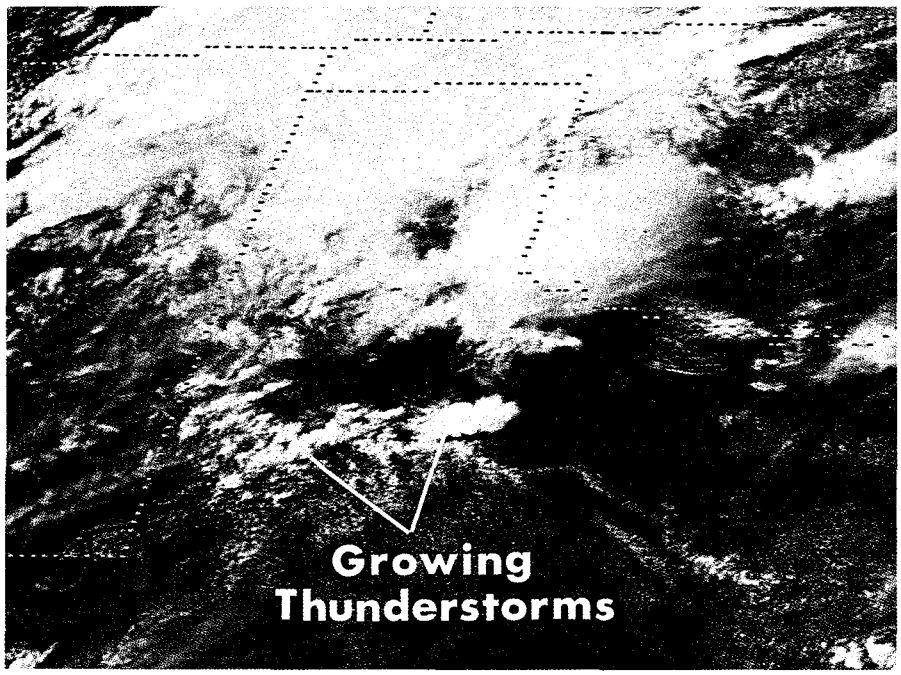
Numerous other hailstorms produced enough damage to pose problems for the economies of cities and communities scattered throughout the State. An evening of rampant weather violence was highlighted by a hailstorm that wracked **Liberty Hill, Leander,** and **Cedar Park** (all near Austin) on April 19. Hail driven by fierce winds broke glass in thousands of homes, businesses, and autos and also beat garden produce into oblivion and stripped many trees and shrubs of all of their leaves. The siege of hail lasting only 5-10 minutes caused damages estimated between 3/4 and $1 million. On the next morning a pair of severe thunderstorms generated barrages of hail that destroyed $100 thousand worth of peaches in Gillespie County.

Hailstones varied in size from peas and marbles to golfballs in most instances, but occasionally stones much larger were sighted. Moreover, particularly in the spring and early summer, hail in a few widely scattered places was plentiful enough to stack up to depths of one-half foot or more. The largest reported hailstones occurred in conjunction with the rash of tornadoes that ripped through **Paris** and other nearby locales on April 2. Within one hour before the mammoth tornado tore through Paris, a severe thunderstorm unleashed hailstones near Ravenna as large as 6 inches in diameter. On April 19 considerable damage was done in **Burnet** when 2 1/2-inch diameter hail pelted that city; residents found some stones, shaped in oblong fashion, with a circumference as much as 8 inches. One of the deepest accumulations of hail on the ground was measured at **Pecos** on June 20, when golfball-size hail ruined 5000 acres of cotton and downed power lines; the stones stacked up 8-10 inches deep on some roads around Pecos. Hail ranging in size from peas to baseballs covered the ground at **Tulia** (High Plains) to a depth of 7-8 inches on May 17, while at **Mabank** (East) thunderstorm winds were sufficient to stack hail on the windward sides of houses as much as 6 inches high.

Lightning

Out of an inestimable number of lightning bolts that struck the earth during 1982, more than a dozen struck at a time and at a point in Texas sufficient to cause death or injury to humanity or to exact a sizeable amount of damage to personal and public property. The vast majority of lightning strokes that produced casualties hit during the spring or summer, and most of their victims were outdoors and freely exposed to the elements. All but one of the five fatalities linked to lightning, and all but one lightning-induced injury, occurred in either April or June—months that mark the beginning and end of the peak thunderstorm season in much of Texas (Table 8).

(a)



(b)

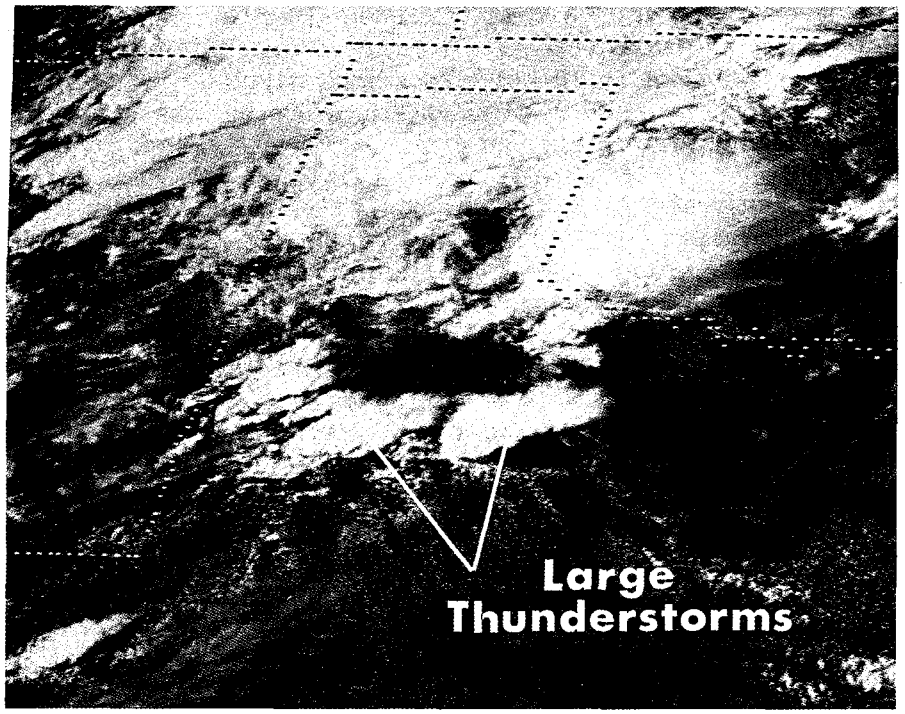


Figure 31. Booming thunderstorms that sustained phenomenal growth in less than one hour on the afternoon of June 18 unleashed a barrage of hail that helped wipe out nearly half of the 4 million dollar cotton crop in the Lubbock area. (a) A slow-moving cold front triggered a rash of rapidly-growing thunderstorms around 3 p.m. CDT to the west, south, and east of Lubbock. (b) Thirty minutes later (2102Z) the storms, whose tops are shown to be sheared off by strong, upper-level winds, dumped golfball to egg-size hail in much of the South Plains area.

A look at the circumstances surrounding the deaths and injuries caused by lightning serves as a reminder of the locations and activities that should be avoided when turbulent weather is happening. The year's first reported lightning fatality took place near **San Angelo**, where a 17-year-old farmworker was hit early one evening in mid-April while working on his father's farm. The father, working alongside his son, suffered singed hair from the lightning bolt that felled the lad. A few days later a rapidly-evolving thunderstorm unleashed a torrent of electricity that hit a 10-year-old girl and her softball coach one evening in April in **Arlington**. Both had been attempting to secure shelter in an automobile parked under a tree when the lightning struck. The young girl did not survive; the coach recovered from her injuries. Another outdoorsman, a 43-year-old ranch foreman, was killed by lightning one afternoon near the end of June as he rode his horse away from where he had been working cattle on a ranch near **Frankston** in Anderson County. Although they were also on horseback near him at the time he was struck, the man's wife and children were not harmed. Just two days later, shortly after noon on June 30, a National Guard soldier stationed at Fort Sam Houston in **San Antonio** was hit by lightning as he emptied trash into a large metal container near his barracks. He died the next day. A small boy was merely standing outside his home near **Hearne** on the afternoon of September 16 when he was struck by lightning. The 4-year-old child was killed instantly.

Lightning frequently strikes in the absence of rain, as one resident of **Garland** learned late one afternoon in late June. The woman was outside her home cleaning up after a garage sale when lightning hit her, yet the rain from a thunderstorm was some distance away. Though she was critically injured by the bolt, the woman did survive. Even being confined inside the home is not always a foolproof method for avoiding the hazards posed by lightning. A **Bridge City** woman, while holding a curling iron one evening in late July, was knocked to the floor when lightning struck her home. At a nearby residence, several appliances, including a television set, a stereo, and a microwave oven, were burned out by a lightning hit. Widespread power outages resulting from an early-morning electrical storm contributed to a monumental traffic jam in **Baytown** on April 21; the LaPorte-Baytown tunnel, which had to be closed for two hours, was filled with toxic automobile fumes when exhaust fans in the tunnel were deprived of electrical energy.

Much more often than instances in which lightning inflicted loss of or injury to human life were occasions when lightning produced major damage to property. Grass fires, like the one induced by lightning that raged an entire day in Kerr County not far from **Ingram**, were commonplace. The April 14 fire destroyed two summer homes west of Ingram, disrupted utility lines, and erased several hundred acres of brush and timber. Along the Houston ship channel in Pasadena late in the day of June 26, a 2-story tank of compressed hydrogen at a chemical plant was hit by lightning. A large fire with numerous subsequent explosions ensued. Lightning indirectly caused damage to homes in **Killeen** on May 12 when the shock wave of thunder—a product of a lightning stroke—shattered windows.

Perhaps the most bizarre lightning-related incident of the year involved a flock of wild geese. Residents of the community of **Cedar Bayou** in eastern Harris County reported having observed scores of dead and dying geese scattered over a 5-acre area of pine and hardwood forest. Subsequent investigation by Texas Parks and Wildlife Department officials revealed that the geese apparently were struck by lightning while in flight—a most extraordinary happenstance, particularly in such large numbers. The force of the lightning bolt neatly sheared off the heads of several of the 129 snow and Ross geese found by investigators; numerous other geese were injured, including several who appeared dazed but still able to fly. While the precise time of the incident was unknown, it was believed the storm struck within a few days of the end of the year.

Dust and Windstorms

Meager amounts of precipitation during the winter and early spring helped set the stage for the early-April duststorm that proved to be the most pervasive as well as costliest of all such storms in 1982. Winds of hurricane force raked across the western third of the State on April 2, whipping tons of topsoil into the air that plummeted visibilities to a few miles in such disparate sections as the High Plains, East and South Central Texas. Although the destruction of crops and other property in the western portion of the State attributable to the potent wind added up to one or two million dollars worth, the widespread storm could not be regarded as one of the worst choking duststorms of the past decade. Visibilities at points like Lubbock and Abilene did plunge to a fraction of a mile, but such reduced vision persisted for only about six hours or less. Nonetheless, the "duster" was about as farflung as any in recent years, for dust residue drifted east and southward to fill the air in all but the extreme southern tip of the State. Visibilities dipped to two miles or less for at least a few hours later that day or early on April 3 at Dallas-Fort Worth, Waco, San Antonio, and Corpus Christi.

It was one of only two duststorms in 1982 to appreciably reduce visibilities in parts of the southern half of the State. The other duststorm was felt most acutely in the Lower Valley, when visibilities dropped to a fraction of a mile on the night of April 8-9. Brownsville experienced visibilities of no better than 4 miles for a 30-hour period ending after dusk on April 9. Indeed, that day brought dust-clogged air that held the visibility to 1/4 mile in that far southern city. Much of the dust emanated from northern Mexico, for most sections of western Texas observed very little, if any, dust in the air on that day or the one preceding it.

Extensive duststorms as early as January are uncommon anywhere in Texas, but one that reduced visibilities in such disparate locales as Abilene and Austin materialized during 1982's first week. Abilene sustained visibilities of only 1/2 mile for a while on the afternoon of January 3, while enough of the

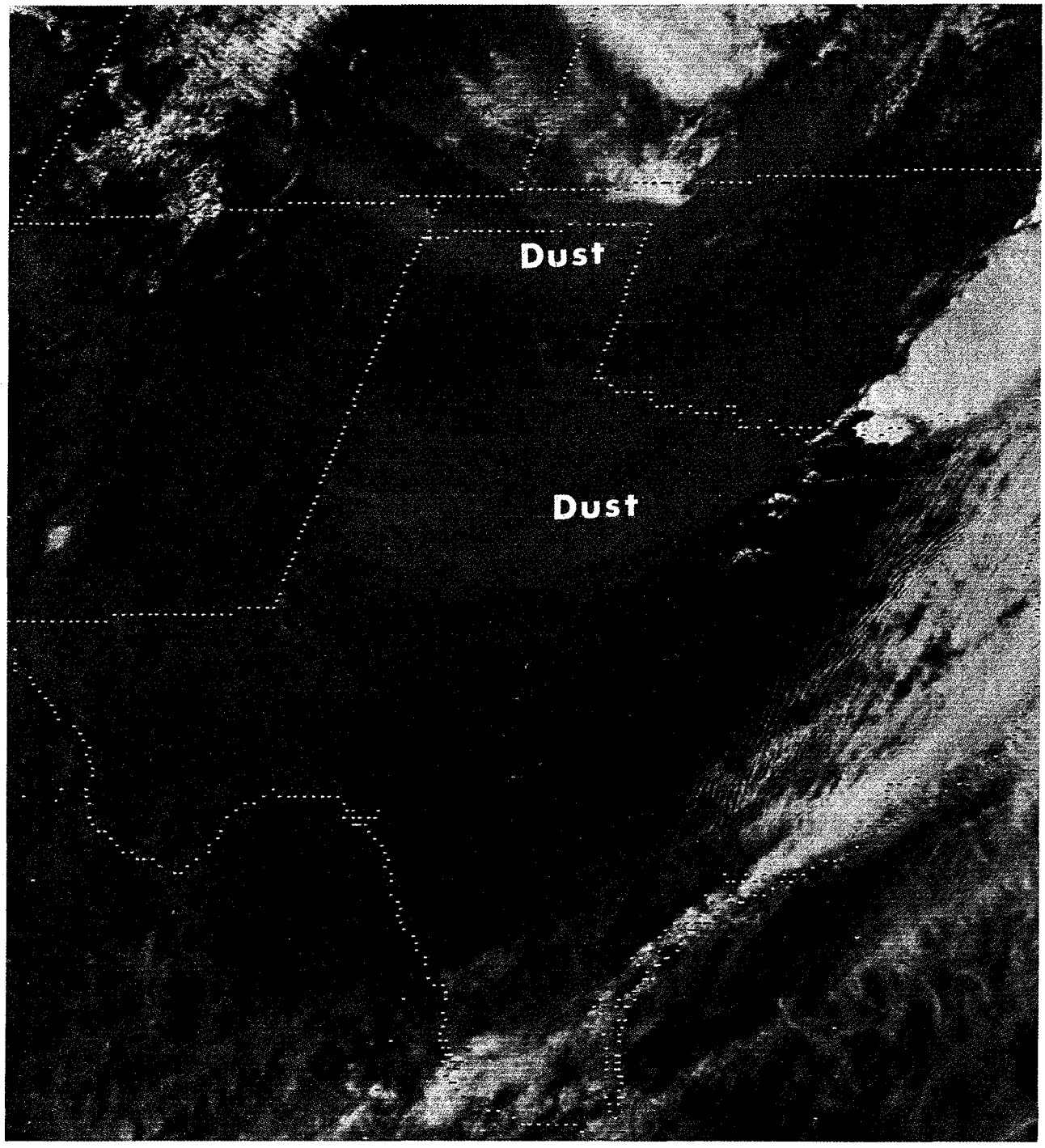


Figure 32. The year's most pervasive and pernicious duststorm hit Texas on April 2, dropping visibilities to less than 2 miles from Lubbock and Dallas to San Antonio and Corpus Christi; a visible satellite photo taken one hour (2102Z) before the Paris tornado was spawned shows the familiar arc-shaped mass of dust moving southeastward out of northwestern Texas.

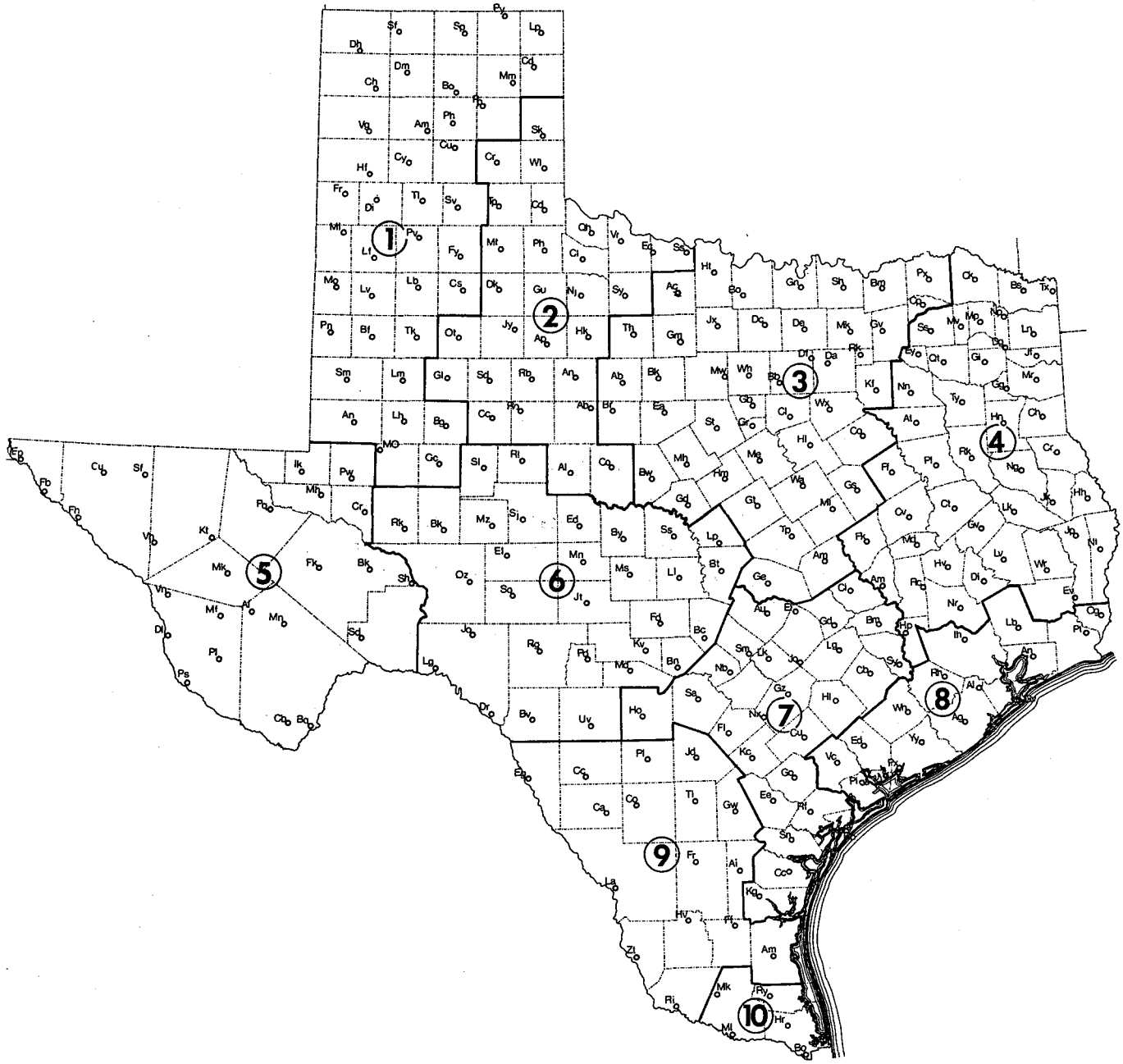
particulates migrated eastward to drop the visibility at Austin that night to three miles. Blowing dust lowered visibilities substantially in the southern High Plains on at least four other occasions during January, with the most significant spell of dust occurring on January 12. For a few hours late in the morning of that day, dust restricted the visibility at Midland-Odessa to 1 1/2 miles. The uncommon prevalence of dust so early in the year reflected the fact that the winter of 1981-82 brought only small fractions of an inch of precipitation to much of the western half of the State.

One very typical aspect of the "dust season" in Texas was that, in terms of cumulative number of hours of visibility reduced by fog, the southern High Plains was the dustiest sector of the State in 1982. The visibility dipped to 5 miles or less on at least a dozen days in the period January-April in locations like Lubbock and Midland-Odessa. January almost matched April in number of dusty days in that section, while considerable dust was confined to only a few days in early February and late March. The only major duststorm affecting the western Trans Pecos came on March 29, when the visibility at El Paso slumped to only one mile for a few hours around midday. At the same time the Panhandle was experiencing its worst case of dust; Amarillo saw its visibility drop to 2 1/2 miles around sunset.

In the absence of dust, very strong winds—most often accompanying heavy or severe thunderstorms—produced on occasion notable damage to property or injury to humanity. A severe thunderstorm that yielded 3/4-inch hail also unleashed winds with speeds of as much as 70 miles per hour that caused considerable property damage and human injury on May 26 in Bowie County. One tree toppled by the wind fell on a car in **DeKalb**, critically injuring the 18-year-old driver of the vehicle, while another felled tree crushed a house in **New Boston**, hurting four occupants. Areas adjacent to **Lake Texhoma** were particularly victimized by high winds during the spring. Potent winds in the wake of a thunderstorm produced several millions of dollars in damages to boats and boat docks on the lake on May 28; then three days later, winds with speeds near 100 mph wracked the same area again, causing extensive damage to boats, docks, trees, and utility lines. The same area was picked on again barely two weeks later when winds estimated at 80 mph once more caused major property damage. High seas and very vigorous winds prompted by a thunderstorm sank four boats near **Galveston** on June 22. One boater drowned when his 18-foot pleasure boat began taking on water and sank some 200 yards off the south jetty. A second person in the boat, whose anchor line became entangled in the propeller, was pulled to safety two hours later.

APPENDIX

A display and tabulation of stations whose data were analyzed to determine monthly precipitation on a Statewide basis


1
2
3
4
5
6
7
8
9
10

1 HIGH PLAINS

Am Amarillo
An Andrews
Bf Brownfield
Bg Big Spring
Bo Borger
Cd Canadian
Ch Channing
Cs Crosbyton
Cu Claude
Cy Canyon
Dh Dalhart
Di Dimmitt
Dm Dumas
Fr Friona
Fy Floydada
Gc Garden City
Hf Hereford
Lb Lubbock
Lf Littlefield
Lh Lenorah
Lm Lamesa
Lp Lipscomb
Lv Levelland
Ml Muleshoe
Mm Miami
Mo Morton
MO Midland-Odessa
Ph Panhandle
Pn Plains
Pp Pampa
Pv Plainview
Py Perryton
Sf Stratford
Sm Seminole
Sp Spearman
Sv Silverton
Tl Tulia
Tk Tahoka
Vg Vega

2 LOW ROLLING PLAINS

Ab Abilene
Al Ballinger
An Anson
Ap Aspermont
Cc Lake Colorado City
Cd Childress
Cl Crowell
Co Coleman
Cr Clarendon
Dk Dickens
Ec Electra
Gl Gail
Gu Guthrie
Hk Haskell
Jy Jayton
Mt Matador
Nj Benjamin
Ot Post
Ph Paducah
Qh Quanah
Rb Roby
Ro Roscoe
Sd Snyder
Sk Shamrock
Ss Wichita Falls
Sy Seymour
Tp Tampico
Vr Vernon
Wl Wellington

3 NORTH CENTRAL

Ab Albany
Ac Archer City
Am Cameron
Bb Benbrook Dam
Bk Breckenridge
Bm Bonham
Bo Bowie
Br Baird
Bw Brownwood
Cl Cleburne
Co Corsicana
Cp Cooper
Da Dallas
Dc Decatur
De Denton
Df Dallas-Fort Worth
Ea Eastland
Gb Granbury
Gd Goldthwaite
Ge Georgetown
Gm Graham
Gn Gainesville
Gr Glen Rose
Gs Groesbeck
Gt Gatesville
Gv Greenville
Hl Hillsboro
Hm Hamilton
Ht Henrietta
Jx Jacksboro
Kf Kaufman
Me Meridian State Park
Mh Comanche
Mk McKinney
Ml Marlin
Mw Mineral Wells
Px Paris
Rk Rockwall
Sh Sherman
St Stephenville
Th Throckmorton
Tp Temple
Wa Waco
Wh Weatherford
Wx Waxahachie

4 EAST

Am College Station
At Athens
Bs New Boston
Ch Carthage
Ck Clarksville
Cr Center
Ct Crockett
Cv Centerville
Dg Daingerfield
Dl Coldspring
Ev Evadale
Ey Emory
Ff Fairfield
Fk Franklin
Gg Longview
Gl Gilmer
Gv Groveton
Hh Hemphill
Hn Henderson
Hp Hempstead
Hv Huntsville
Jf Jefferson
Jk Jackson Hill
Jp Jasper
Lk Lufkin
Ln Linden
Lv Livingston
Md Madisonville
Mp Mount Pleasant
Mr Marshall
Mv Mount Vernon
Ng Nacogdoches
Nn Canton
Np Naples
Nr Conroe
Nt Newton
Pl Palestine
Qt Quitman
Rc Richards
Rk Rusk
Ss Sulphur Springs
Tx Texarkana
Ty Tyler
Wr Warren

5 TRANS-PECOS

Al Alpine
Bk Bakersfield
Bq Boquillas
Cb Chisos Basin
Cr Crane
Cu Cornudas
Dl Candelaria
Ep El Paso
Fb Fabens
Fh Fort Hancock
Fk Fort Stockton
Ik Wink
Kt Kent
Mf Marfa
Mh Monahans
Mk Mount Locke
Mn Marathon
Pl Plata
Pq Pecos
Ps Presidio
Pw Penwell
Sd Sanderson
Sf Salt Flat
Sh Sheffield
Vh Van Horn
Vn Valentine

6 EDWARDS PLATEAU

Bc Blanco
Bk Big Lake
Bn Boerne
Bt Burnet
Bv Brackettville
By Brady
Dr Del Rio
Ed Eden
El Eldorado
Fd Fredericksburg
Jt Junction
Jo Juno
Kv Kerrville

Lg Langtry
Ll Llano
Lp Lampasas
Md Medina
Mn Menard
Ms Mason
Mz Mertzon
Oz Ozona
Pd Prade Ranch
Rg Rocksprings
Rk Rankin
Rl Robert Lee
Sj San Angelo
Sl Sterling City
So Sonora
Ss San Saba
Uv Uvalde

7 SOUTH CENTRAL

Au Austin
Bm Brenham
Cb Columbus
Cc Corpus Christi
Cl Caldwell
Cu Cuero
Ee Beeville
El Elgin
Fl Floresville
Gd Giddings
Go Goliad
Gz Conzales
Hl Hallettsville
Ho Hondo
Jo Jeddo
Kc Karnes City
Kg Kingsville
Lg La Grange
Lk Lockhart
Nb New Braunfels
Nx Nixon
Rf Refugio
Rp Rockport
Sa San Antonio
Sm San Marcos
Sn Sinton
Sy Sealy

8 UPPER COAST

Ag Angleton
Al Alvin
An Anahuac
Ed Edna
Gv Galveston
Ih Houston
Lb Liberty
Og Orange
Pl Port Lavaca
Pt Port Arthur
Px Palacios
Rh Richmond
Vc Victoria
Wh Wharton
Yy Bay City

9 SOUTHERN

Al Alice
Am Armstrong
Ca Catarina
Cc Crystal City
Co Cotulla
Eg Eagle Pass
Ff Falfurrias
Fr Freer
Gw George West
Hv Hebronville
Jd Jourdanton
La Laredo
Pl Pearsall
Ri Rio Grande City
Tl Tilden
Zt Zapata

10 LOWER VALLEY

Bo Brownsville
Hr Harlingen
Mk McCook
Ml McAllen
Ry Raymondville