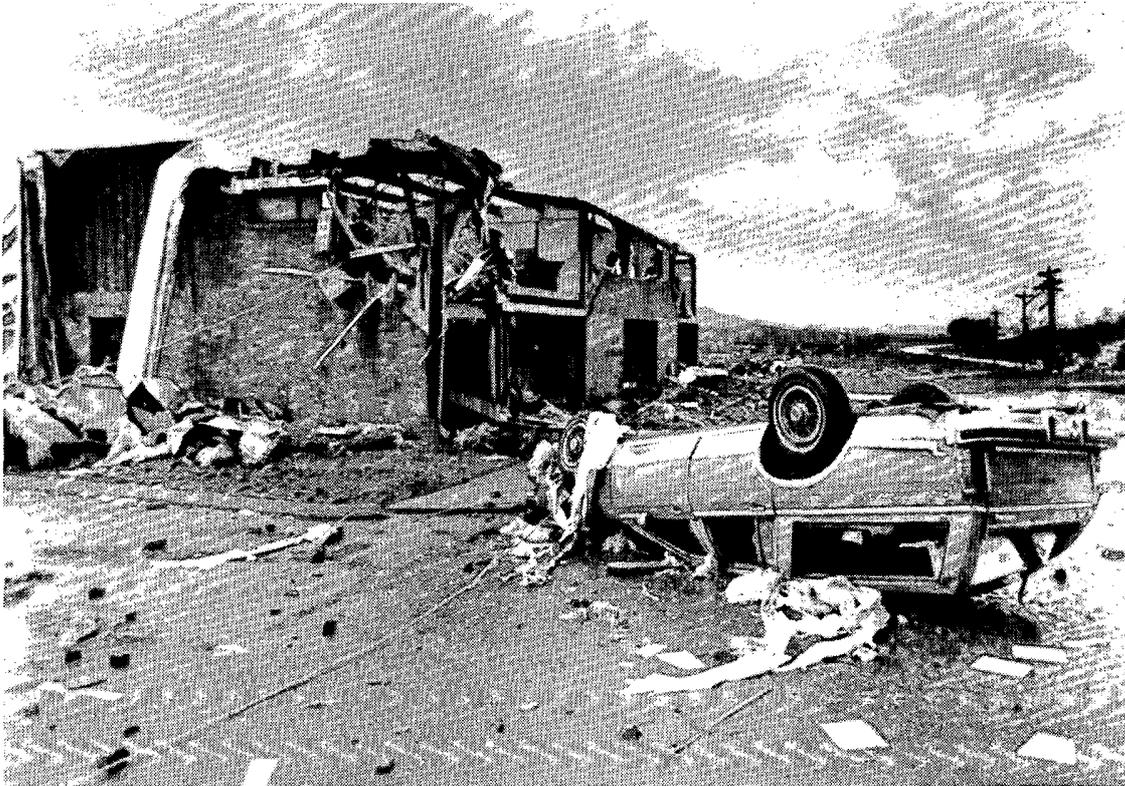


# STORM DATA

## WITH ANNUAL SUMMARIES



"I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND IS COMPILED FROM INFORMATION RECEIVED AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE NORTH CAROLINA" 28801

*Kenneth D. Hadler*

DIRECTOR  
NATIONAL CLIMATIC DATA CENTER

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**noaa** NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE / NATIONAL CLIMATIC DATA CENTER ASHEVILLE, N.C.

## C O N T E N T S

**Cover:** An overturned station wagon and nearby, mangled commercial building bear testimony to the destructive force of a tornado that produced up to F4 intensity damage in the Franklin-Brentwood area south of Nashville, Tennessee on the morning of December 24th, 1988. (See TORNADO at FRANKLIN, TENNESSEE.....pages 6 through 9)  
---Photo by Michael Clancy, The Review Appeal, Franklin, Tennessee.

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### STORM DATA (ISSN 0039-1972)

The section on Outstanding Storms of the Month is prepared by Professor T. Theodore Fujita, editor, and Duane J. Stiegler, associate editor, the University of Chicago, with funding by the U. S. Office of Naval Research. The Storm Data and Unusual Weather Phenomena narratives, and summaries of Hurricanes/Tropical Storms are prepared by the National Weather Service. The National Climatic Data Center compiles statistics on deaths, injuries, damage and prepares the annual summaries of tornadoes and Lightning. This publication contains our best information on storms, but due to the difficulties inherent in collection of this type of data it is not all-inclusive. Late reports and corrections will be carried quarterly. Maps of zones used in the Storm Data and Unusual Weather Phenomena will be published in all editions.

Storm Data is published monthly by the National Climatic Data Center.

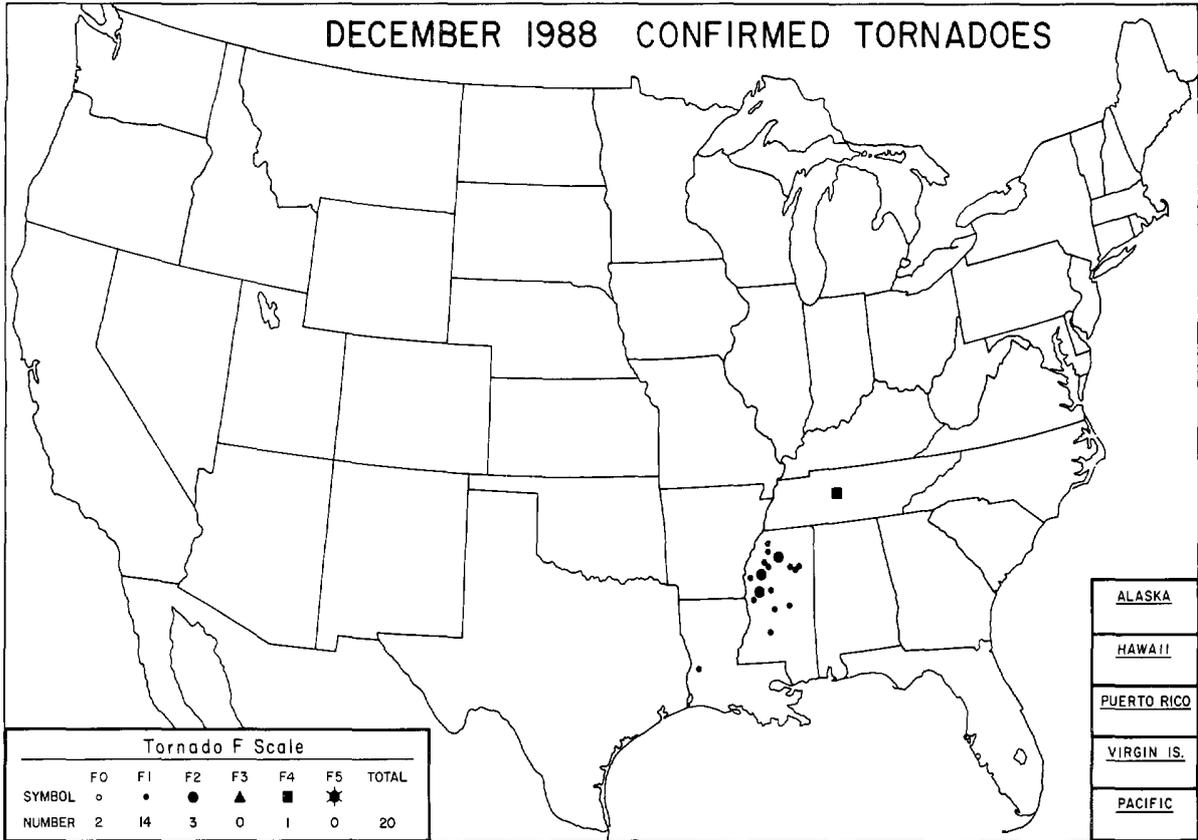
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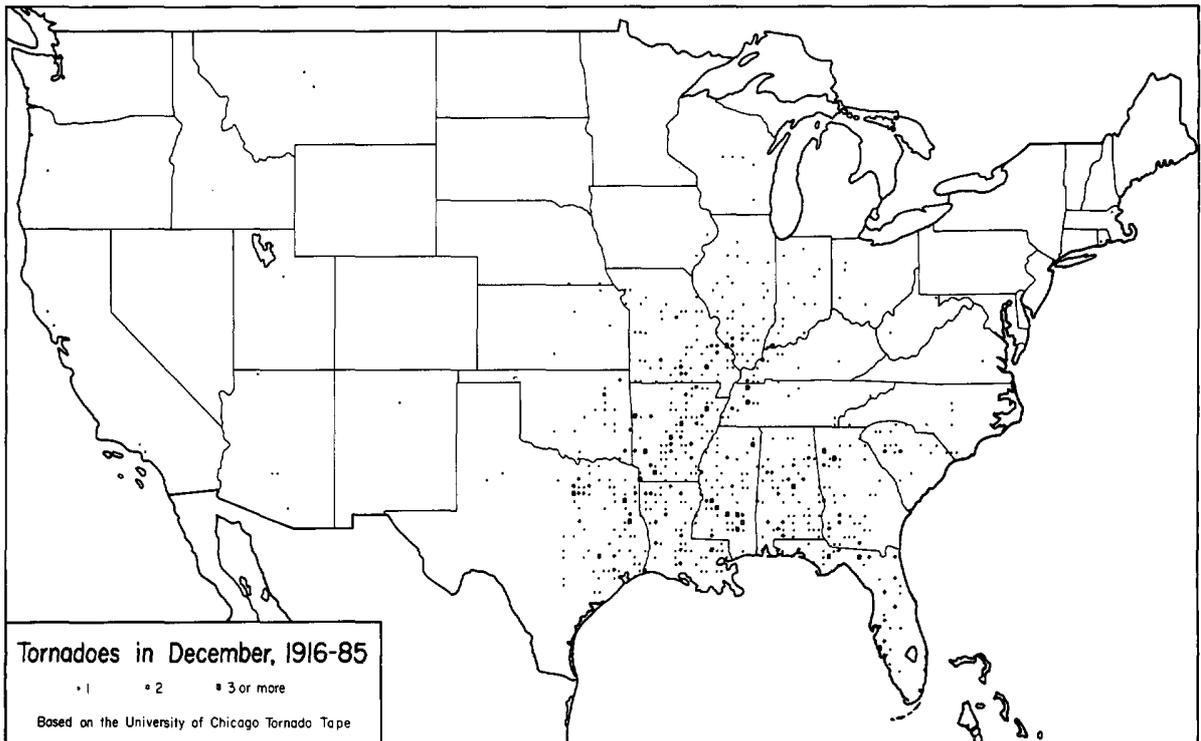
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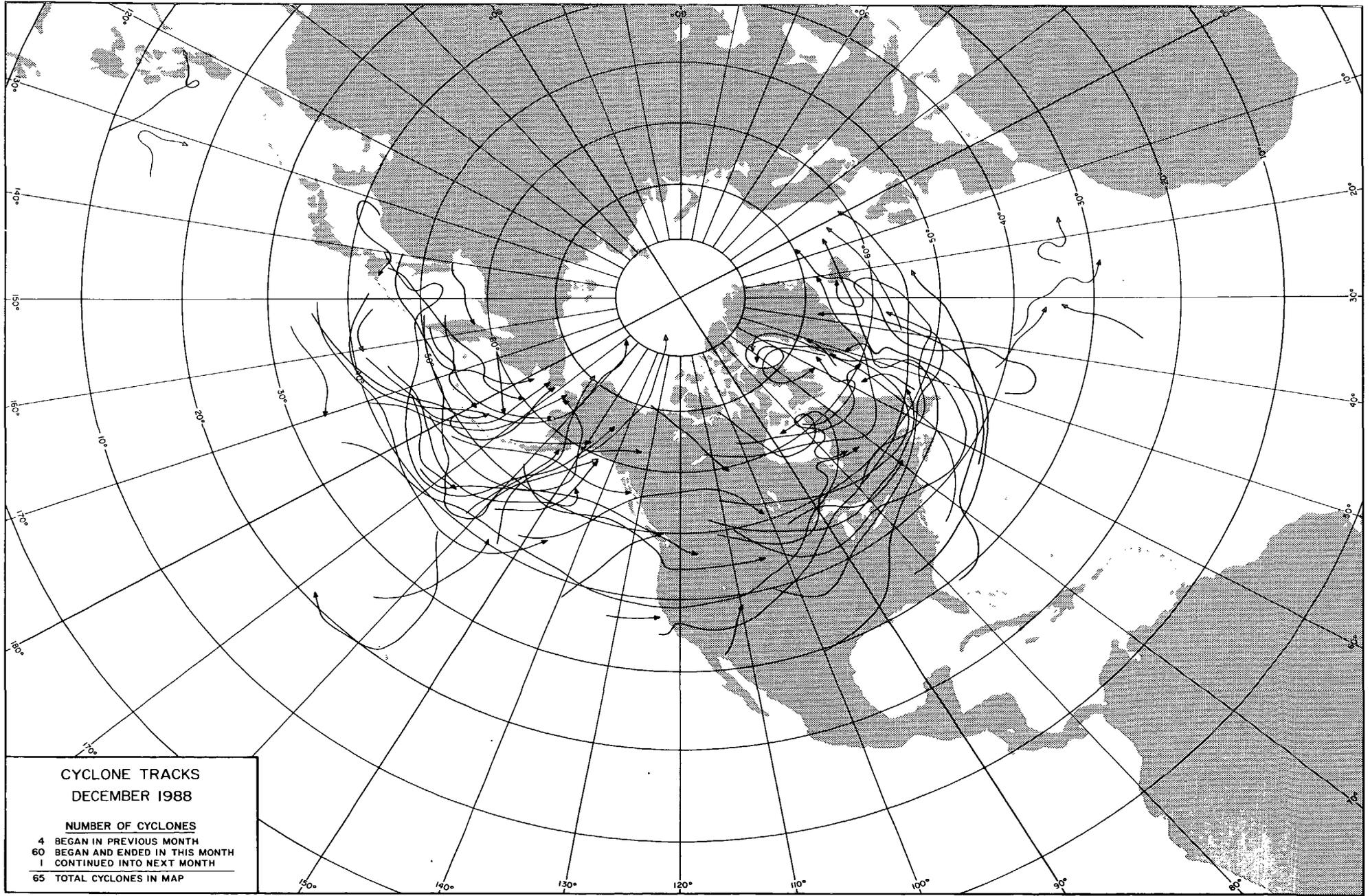
National Climatic Data Center  
Federal Building  
Asheville, NC 28801-2696

# OUTSTANDING STORMS OF THE MONTH



<ul style="list-style-type: none"> <li>● COMPLETE REPORT RECEIVED</li> <li>◐ PRELIMINARY REPORT RECEIVED</li> <li>○ REPORT NOT RECEIVED</li> </ul> <p>(N) northern (W) western                  (S) southern (C) central                  (E) eastern (O) coastal                  (SE) southeastern</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td>● 1AL</td><td>● 7DE</td><td>● 14KS</td><td>● 21MN</td><td>● 28NJ</td><td>● 33OH</td><td>● 39SD</td><td>● 44VA</td><td>● 49AK(SE)</td> </tr> <tr> <td>● 2AZ</td><td>● 8FL</td><td>● 15KY</td><td>● 22MS</td><td>● 29NM</td><td>● 34OK</td><td>● 40TN</td><td>● 45WA</td><td>● 50HI</td> </tr> <tr> <td>● 3AR</td><td>● 9GA</td><td>● 16LA</td><td>● 23MO</td><td>● 30NY(O)</td><td>● 35OR</td><td>● 41TX(N)</td><td>● 46WV</td><td>● 51PR</td> </tr> <tr> <td>● 4CA(N)</td><td>● 10ID</td><td>● 17ME</td><td>● 24MT</td><td>● 30NY(C)</td><td>● 36PA(E)</td><td>● 41TX(S)</td><td>● 47WI</td><td>● 52VI</td> </tr> <tr> <td>● 4CA(S)</td><td>● 11IL</td><td>● 18MD</td><td>● 25NE</td><td>● 30NY(W)</td><td>● 36PA(W)</td><td>● 41TX(W)</td><td>● 48WY</td><td>● 53PC</td> </tr> <tr> <td>● 5CO</td><td>● 12IN</td><td>● 19MA</td><td>● 26NV</td><td>● 31NC</td><td>● 37RI</td><td>○ 49AK(N)</td><td></td><td></td> </tr> <tr> <td>● 6CT</td><td>● 13IA</td><td>● 20MI</td><td>● 27NH</td><td>● 32ND</td><td>● 38SC</td><td>● 43VT</td><td>● 49AK(S)</td><td></td> </tr> </table>	● 1AL	● 7DE	● 14KS	● 21MN	● 28NJ	● 33OH	● 39SD	● 44VA	● 49AK(SE)	● 2AZ	● 8FL	● 15KY	● 22MS	● 29NM	● 34OK	● 40TN	● 45WA	● 50HI	● 3AR	● 9GA	● 16LA	● 23MO	● 30NY(O)	● 35OR	● 41TX(N)	● 46WV	● 51PR	● 4CA(N)	● 10ID	● 17ME	● 24MT	● 30NY(C)	● 36PA(E)	● 41TX(S)	● 47WI	● 52VI	● 4CA(S)	● 11IL	● 18MD	● 25NE	● 30NY(W)	● 36PA(W)	● 41TX(W)	● 48WY	● 53PC	● 5CO	● 12IN	● 19MA	● 26NV	● 31NC	● 37RI	○ 49AK(N)			● 6CT	● 13IA	● 20MI	● 27NH	● 32ND	● 38SC	● 43VT	● 49AK(S)	
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**CYCLONE TRACKS  
DECEMBER 1988**

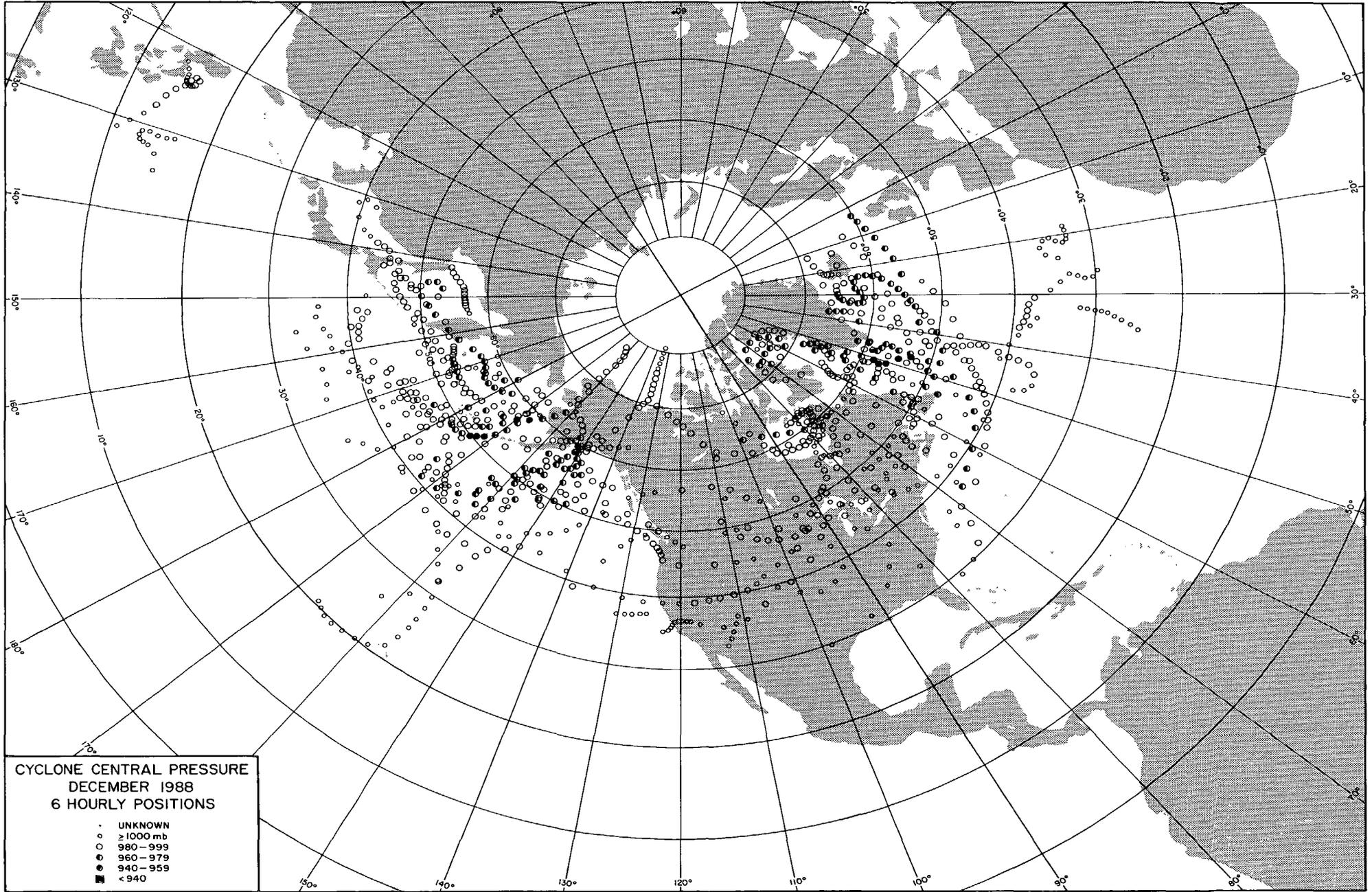
**NUMBER OF CYCLONES**

- 4 BEGAN IN PREVIOUS MONTH
- 60 BEGAN AND ENDED IN THIS MONTH
- 1 CONTINUED INTO NEXT MONTH

---

- 65 TOTAL CYCLONES IN MAP

Mapped at the University of Chicago from NMC, cyclone track data



## 1. TORNADO at FRANKLIN, TENNESSEE on December 24, 1988

On December 24th in Franklin, Tennessee, about 20 miles south of downtown Nashville, residents awoke to a rather cruel Christmas Eve surprise when an early morning tornado touched down at 0604CST in the northwest part of town. The tornado carved an intermittent but at times devastating path of damage for a distance of 6 miles toward the northeast that eventually ended in eastern Brentwood. This tornado was one of only three tornadoes in 1988 to produce damage of F4 intensity; it was also a killer tornado, having caused one death and seven injuries. Damaged or destroyed property included 54 homes, 13 apartment units, 31 businesses, 6 parked airplanes and numerous vehicles, the total loss value of which was estimated at around 8 million dollars. Much of the dollar value in damage was sustained by businesses in a commercial area of southern Brentwood, along General George Patton Drive and Moores Lane. The fact that the tornado had struck so early while most people were still in bed was probably a blessing. Had it struck just a couple of hours later while people were out and about, the death and injury count most probably would have been much higher.



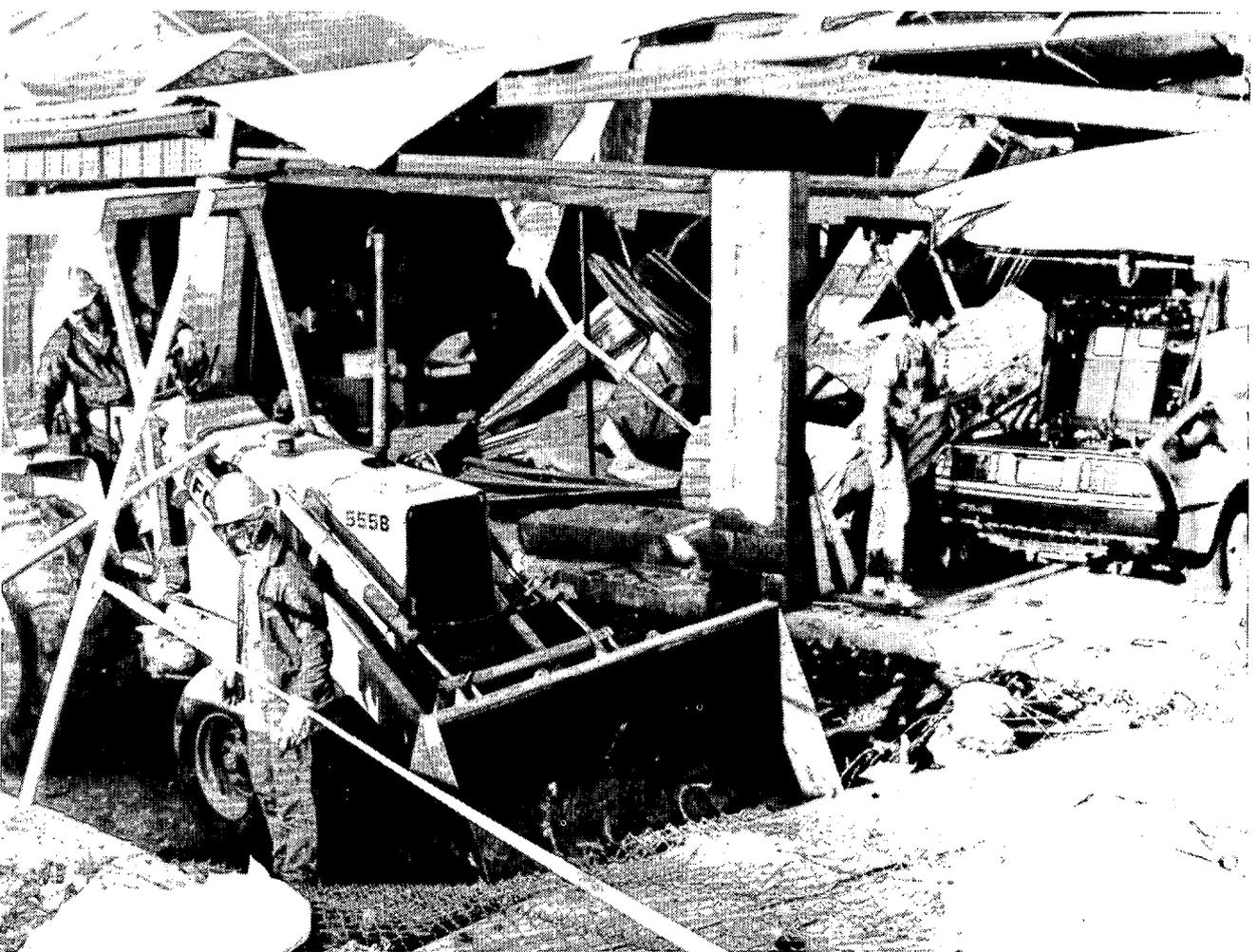
*Although the framework of this building housing the Trinity Ministries on Moores Lane in south Brentwood withstood the tornado's winds rather well, the force of the wind and impact of airborne missiles broke most of the exterior windows, allowing extensive damage to be done to the structure's interior and contents. Note in the bottom photo how the small trees had been pulled at in different directions by the tornado's winds.*



*A badly damaged home in the Rebel Meadows subdivision of northwest Franklin.*



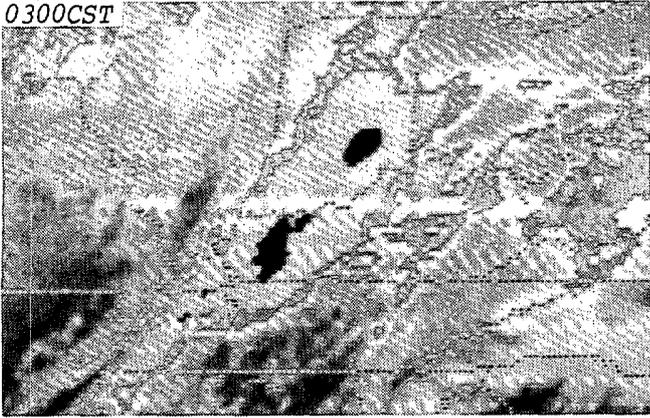
*A wall of The Brentwood Journal building that lost its brick veneer which quite literally fell victim to the tornado.*



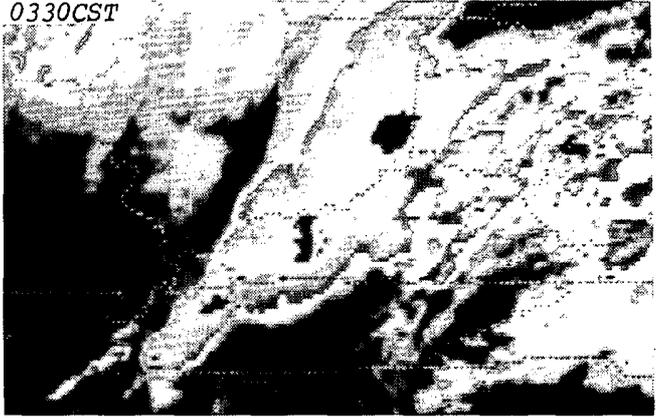
Damage that was done to the Brentwood Self Service Storage facility on General George Patton Drive. In the bottom photo, a cleanup crew clears a path through the debris-strewn drive while a unit renter inspects his extensively damaged 1982 DeLorean which was housed in the facility.

---All photos on pages 6 through 8 are by Michael Clancy, *The Review Appeal*, Franklin, Tennessee.

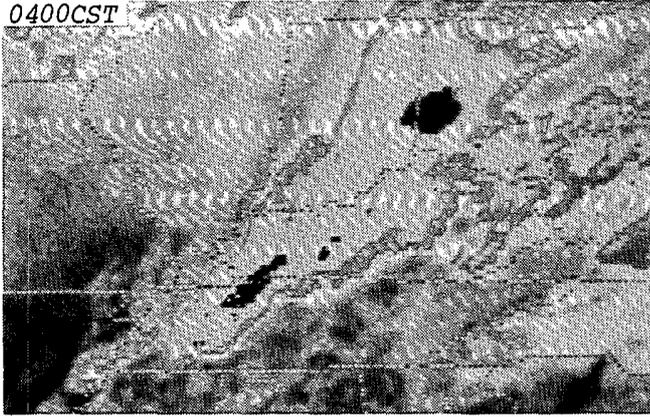
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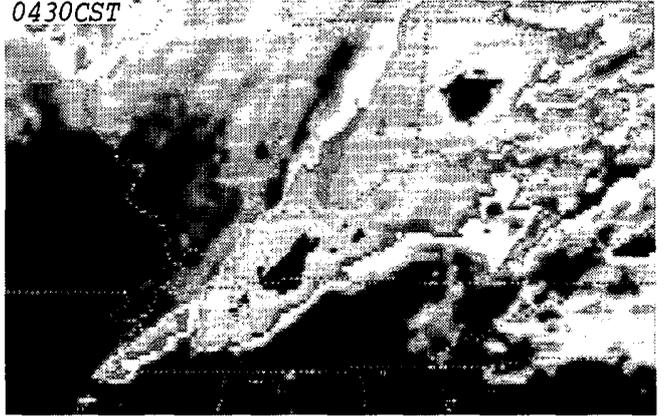
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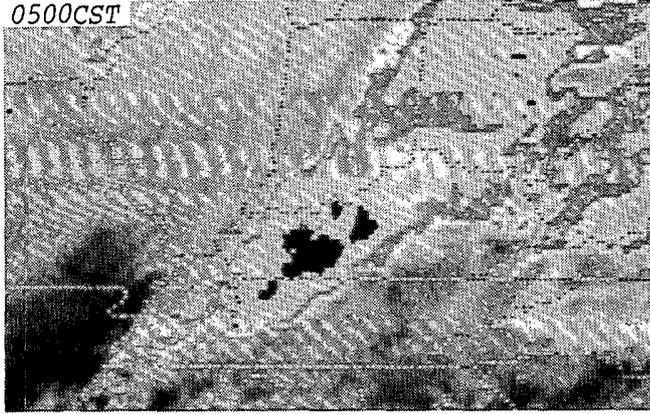
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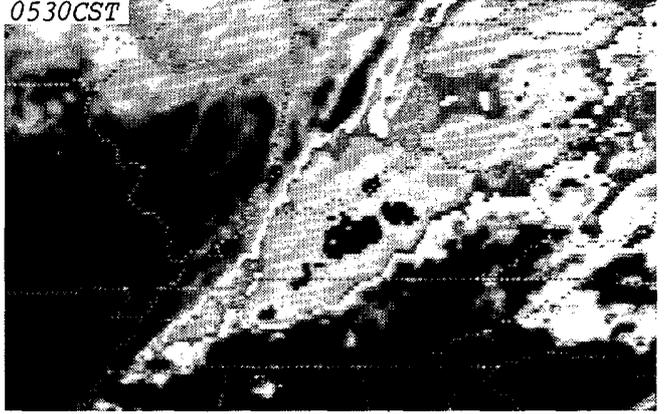
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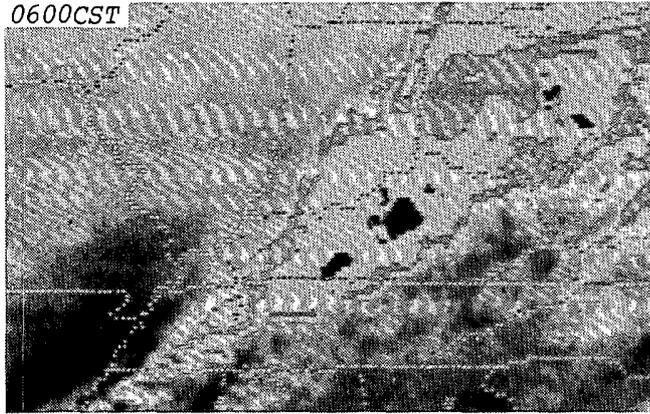
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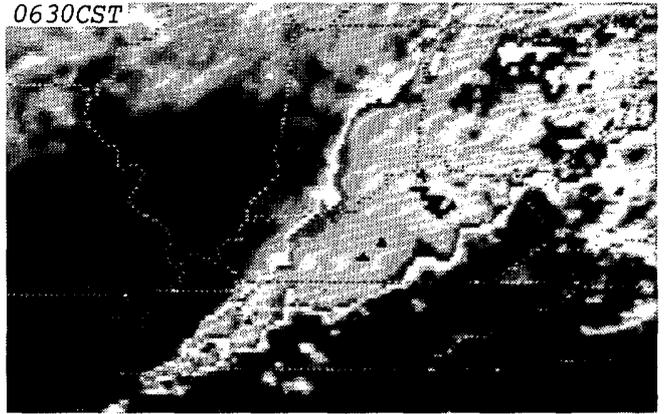
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0600CST



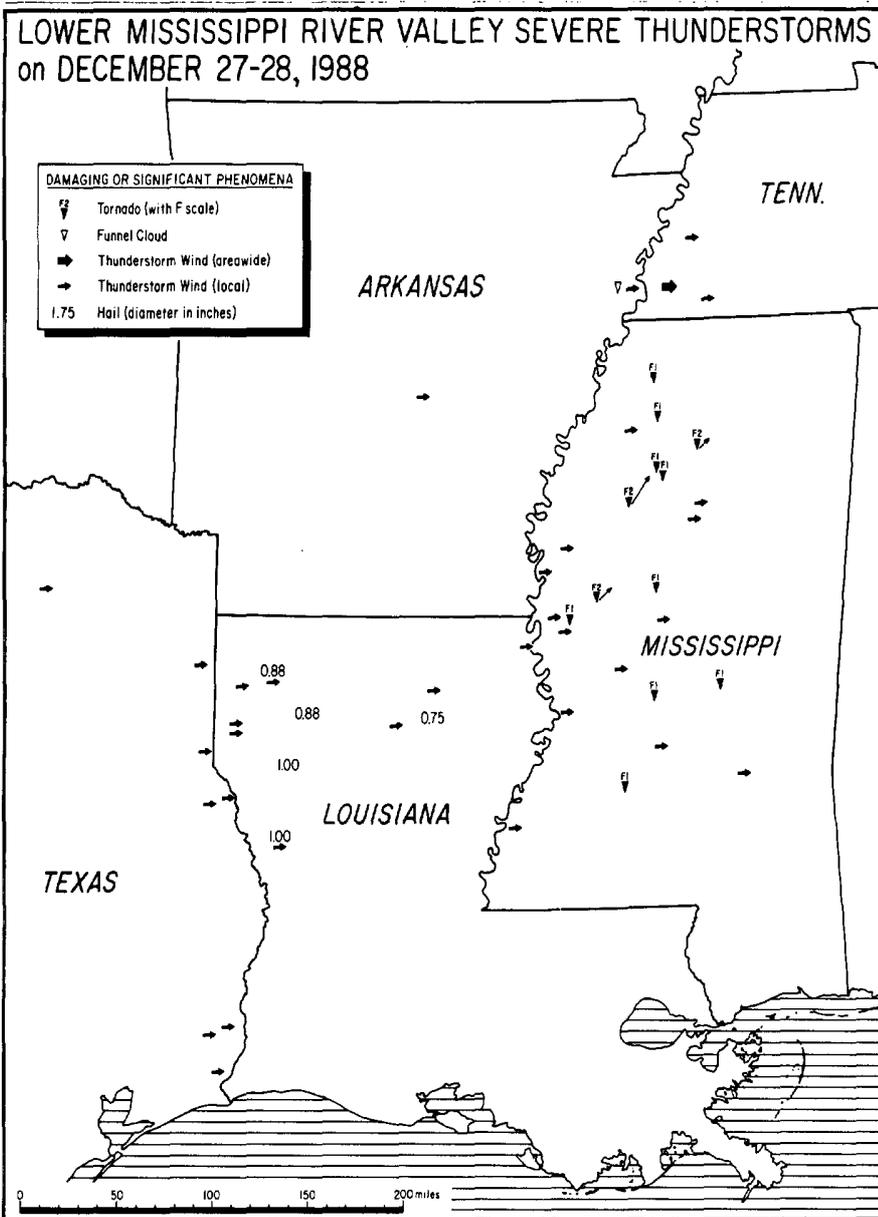
0630CST



GOES 6 satellite, infrared images depict the line of storms that moved through the lower Ohio and Tennessee river valleys during the early morning hours of December 24th. The images are shown in MB curve enhancement taken hourly on the hour (left column), and CC curve enhancement taken hourly on the half hour (right column). Aside from the Franklin F4 tornado, the storms produced little severe phenomena. ---Photos from NESDIS, Washington, DC.

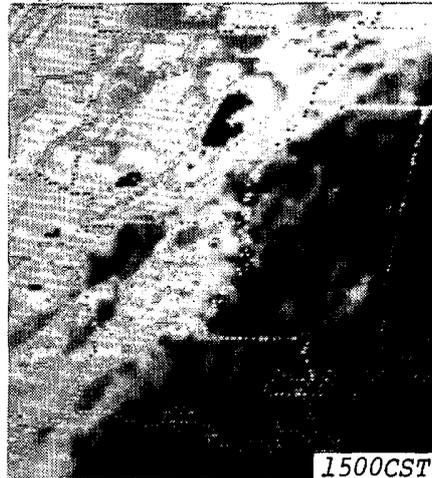
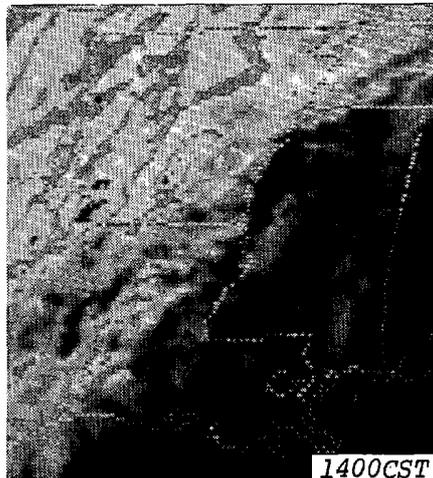
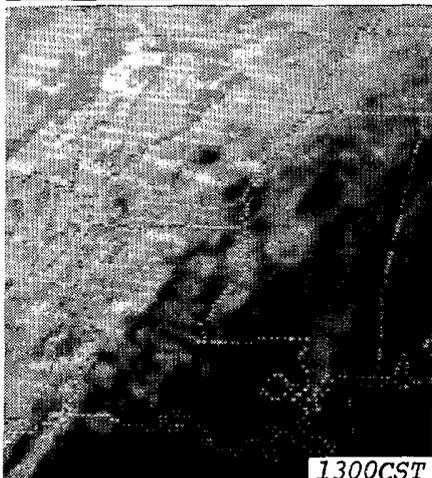
## 2. SEVERE THUNDERSTORMS in the SOUTH-CENTRAL U.S. on December 27-28, 1988

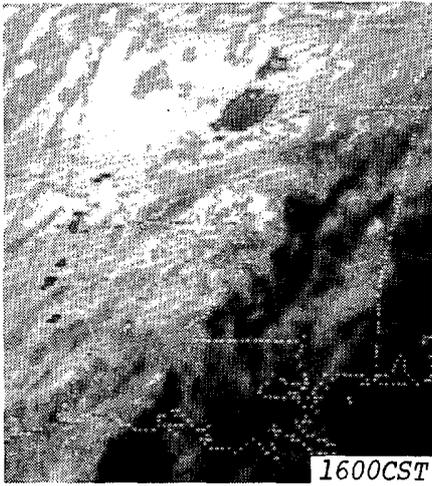
The largest convective, severe weather outbreak during December 1988 occurred from the afternoon of the 27th to the early morning hours of the 28th in the South-Central U.S., mainly in the Lower Mississippi River Valley. The most prominent feature of the outbreak was its 12 tornadoes, three F2 and nine F1, all of which occurred in Mississippi. The outbreak's tornadoes accounted for 60% of the month's total of 20 tornadoes; 16 of December's 20 tornadoes, 80%, occurred in Mississippi. The tornadoes in this outbreak caused no deaths or injuries, but did damage or destroy a number of structures. Most damaging were two F2 tornadoes near Water Valley and Belzoni, Mississippi. An F1 at Harpersville destroyed five chicken houses, killing thousands of chickens.



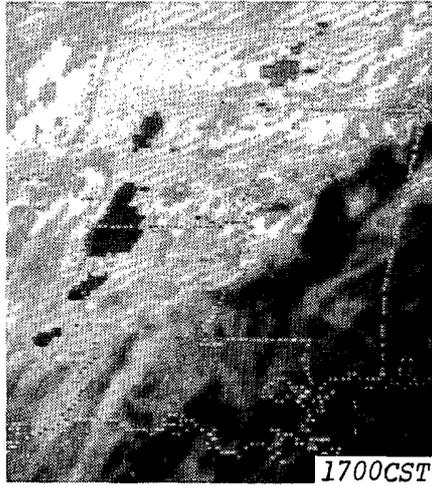
Geographic distribution of reported severe thunderstorm phenomena occurring in the South-Central U.S. from just before noon on December 27th to the early morning of the 28th, 1988. ---Graphic by the University of Chicago from data supplied by NWSFO's at Little Rock, Arkansas; Slidell, Louisiana; Jackson, Mississippi; Memphis, Tennessee; Fort Worth, Texas; and San Antonio, Texas.

Below and on the following page, a sequence of GOES 6 satellite, infrared images taken hourly from 1300CST on December 27th to 0300CST on the 28th, shows the line of storms from its early development to demise. Most of the tornado activity occurred as the cloud top temperature of the storms began to warm after attaining their coldest temperatures. ---Photos from NESDIS, Washington, DC.

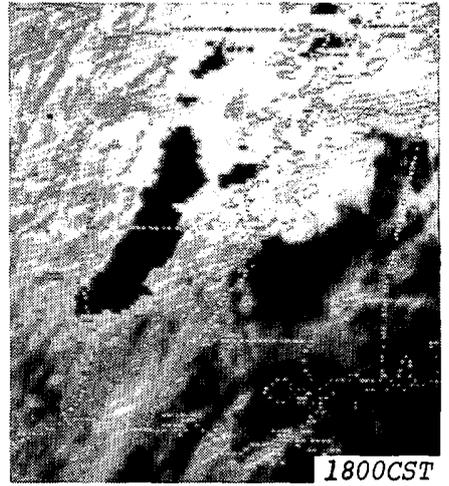




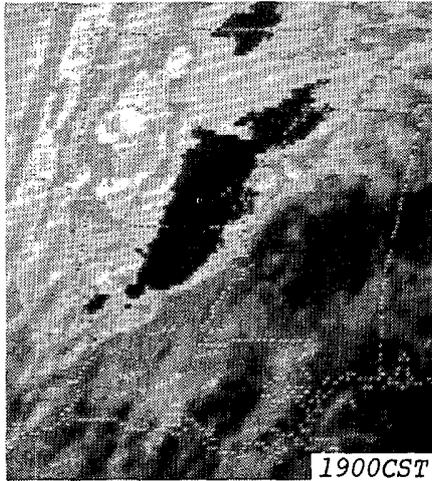
1600CST



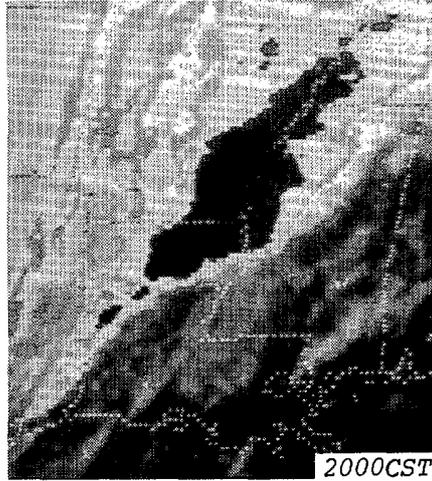
1700CST



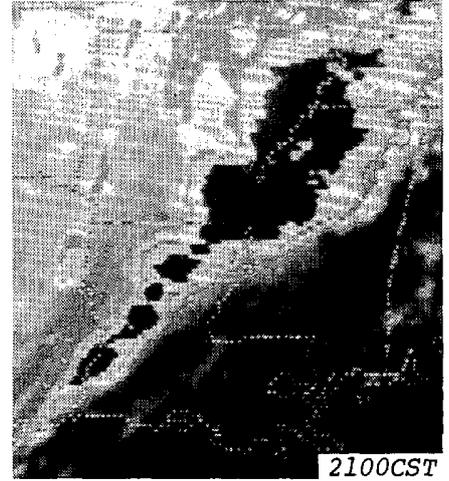
1800CST



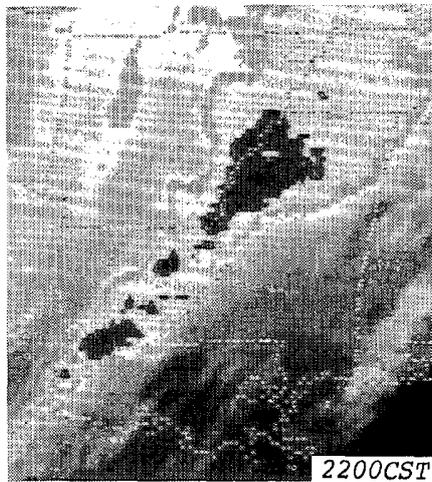
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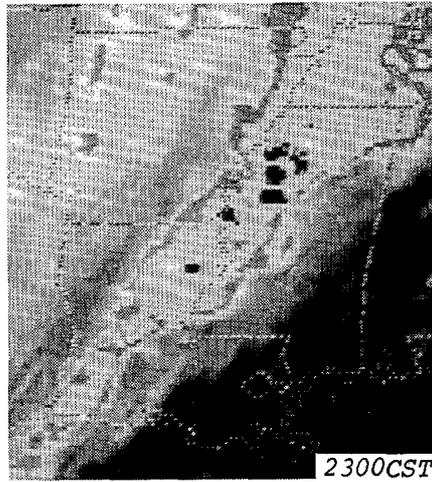
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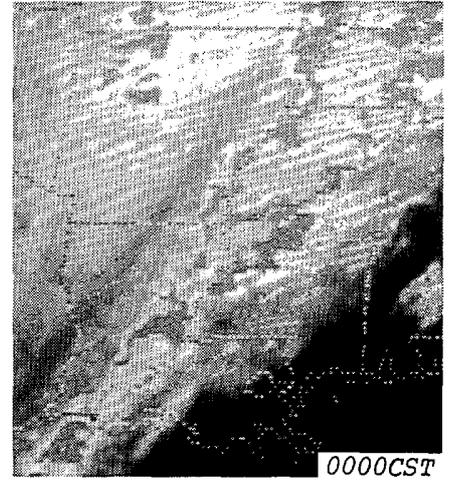
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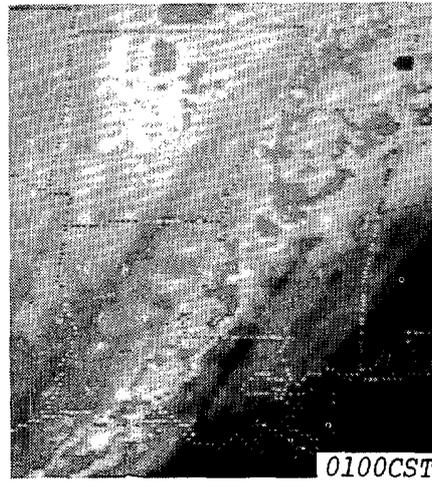
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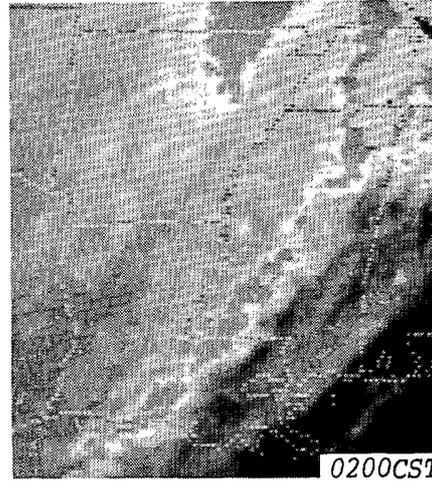
2300CST



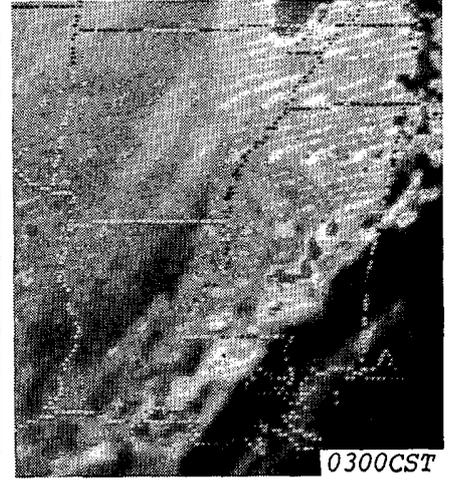
0000CST



0100CST



0200CST



0300CST

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	
<b>1 ALABAMA</b> ————— NONE REPORTED									
<b>2 ARIZONA</b>									
AZZ007-008 Phoenix and Yuma areas	26-31				0	0	0	?	Cold
Widespread citrus damage was reported from growers in the Salt River Valley and Yuma County. This cold period was the most severe freeze period in the Salt River Valley since December 7-10, 1978. Minimum temperatures were as low as the upper teens in the coldest Valley locations while Phoenix airport was one of the warmer spots with 31F on the 28th-30th. The minimum on the 27th was 32F. In the Yuma area, the coldest morning was on the 30th when Tacna reported a minimum of 19F.									
<b>3 ARKANSAS</b>									
ARZ001 Northwest Arkansas	27	0800CST			0	0	?	?	Heavy Snow
Benton County, in extreme northwest Arkansas received its first substantial snow of the season when up to six inches of the white stuff fell. Snow depths around the area ranged from less than two inches south of Siloam Springs, to six inches at Gravette. The snow caused at least 25 accidents on area roads with a number more minor fender-benders.									
Pulaski Co.	27	1420CST			0	0	?	?	Thunderstorm Wind
High winds downed two trees at a home in Hensley.									
Crittenden Co. 1 W of Crawfordville	27	1706CST			0	0	0	0	Funnel Cloud
Crittenden Co.	27	1725CST			0	0	?	?	Thunderstorm Wind
Thunderstorm winds downed power lines at Marion.									
<b>4 CALIFORNIA, Northern</b>									
CAZ001 Northwestern California	14-15	0800-0000PST			0	0	?	0	Strong Winds
CAZ006 Sacramento Valley	14-15	1820-0410PST			0	0	4	?	Strong Winds
CAZ002 San Francisco Bay Area	14-15	2000-1230PST			0	0	6	0	Strong Winds
CAZ005 San Joaquin Valley	15	1100-1500PST			0	0	4	0	Strong Winds
Deepening low pressure over the Sierra Nevada and high pressure building over Western Washington combined to produce a strong northerly gradient over the area. Eureka reported a 47 mph gust and there were widespread power outages and damage to trees. The orientation of the Sacramento Valley accelerated winds to 35 to 45 mph with gusts to 70 mph near Fairfield where gusts toppled a drive-in movie screen and numerous billboards and trees. The downing of lines cut power to nearly 300,000 customers. The strong gradient also forced winds westward through the Carquinez Straits, San Pablo Bay, and out the Golden Gate. Gusts along this route were up to 70 mph, knocking down trees, signs and antennas. A 500-foot commercial radio tower near Petaluma was felled, and numerous boats near Sausalito were sunk, including a small tugboat. The winds were also channeled into the southern end of the San Joaquin Valley where gusts were estimated to be 60 to 80 mph and doing minor damage. Throughout the wind event there were areas of blowing sand and dust with a number of traffic accidents due to reduced visibilities.									
CAZ009 Sierra Nevada	20-21	1000-0800PST			0	0	?	0	Heavy Snow
A moist Pacific cold front and strong cold air advection combined, brought 14 inches of snow in less than 24 hours to Blue Canyon (elevations greater than 6000 feet). Soda Springs (around 7000 feet) reported a 17 inch increase in snow depth in 24 hours.									
<b>CALIFORNIA, Northern</b>									
CAZ009 Sierra Nevada	23-24	2330-2330PST			0	0	?	0	Heavy Snow
A massive Pacific storm system brought, within a 24 hour period, 20 inches of snow to Blue Canyon (elevations greater than 6000 feet), and within a 12 hour period, 8 inches of snow to Truckee (elevations greater than 7000 feet) and 13 inches of snow to Soda Springs (around 7000 feet).									
CAZ001 Northwestern California	27-28	0000-0000PST			0	0	?	0	Strong Winds and Snow
A Pacific cold front moved through the area with unusually cold air behind it, bringing the snowfall level down to 500 feet above mean sea level with a few flurries being reported at sea level. The snow and strong northerly winds combined, broke trees and large tree limbs, caused major power outages, and hampered efforts to restore the power.									
<b>4 CALIFORNIA, Southern</b>									
CAZ011-012-013-016-017-020	7	1830pst			0	0	7	4	High Winds
Low pressure, which developed rapidly at the surface and aloft over Northern Baja California, combined with strong high pressure over the Great Basin to set the stage for a major Santa Ana Wind episode. During the late evening hours of Wednesday, December 7, northeasterly winds began increasing rapidly over the mountain areas north and east of Los Angeles and especially below the passes and canyons in the foothill areas. By the early morning hours of December 8, wind gusts of 80 to 90 MPH were common over a wide area of Los Angeles County and in some areas of San Bernardino and Riverside counties adjoining Los Angeles County. The winds were particularly strong on December 8 and during the early morning hours of December 9. The Santa Ana winds gradually began diminishing in intensity during the daytime hours of the 9th and by sunset, same day, were down to 20 to 40 MPH in the more wind-prone areas. Within a few hours after sunset on the 9th, the episode of strong Santa Ana winds was over. The fierce, unrelenting Santa Ana winds brought down trees, blew roofs off buildings, and downed power lines which in turn ignited five major fires and numerous smaller ones. The final tally of major damage as listed in various newspaper accounts is as follows:									
<ul style="list-style-type: none"> <li>...Homes destroyed by fire - 37</li> <li>...Homes damaged by fire - 84</li> <li>...Businesses destroyed by fire - 7</li> <li>...Apartment/Condominium Complexes destroyed - 4</li> <li>...Automobiles destroyed by fire - 30</li> <li>...Commercial Bldgs. heavily damaged by fire - 6</li> </ul>									
In addition to fire damage caused by the downed power lines, structural damage to homes was reported in many areas. Many residences lost roof shingles, or entire roofs were blown away. The wind also caused significant damage to many homes as uprooted trees fell upon the residences. No accurate count of the number of homes is available, however, newspaper and television accounts placed the number in the hundreds!									
Additional problems included...									
...more than half a million utility customers were without power at some point during the wind episode.									
...the Ventura Freeway, a major thoroughfare for Los Angeles commuters, was completely closed during morning rush hour December 8, causing a massive traffic tie-up. Three miles of blazing brushland along the freeway caused the closure.									
...about 50-100 acres of avocados and orange trees with fruit were completely stripped by the winds in the Pauma Valley area near the Rincon Indian Reservation in San Diego County.									
...80 MPH winds collapsed a three-story apartment building under construction in Rancho Cucamonga and unroofed at least 4 other homes in the area. Damage is estimated at \$1 million.									
...several big-rig trucks were blown over onto their sides along the Pomona Freeway east of downtown Los Angeles.									

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS				ESTIMATED <sup>1</sup> DAMAGE		CHARACTER OF STORM
					KILLED	INURED	PROPERTY	CROPS	PROPERTY	CROPS	
<b>CALIFORNIA, Southern</b>											
											...five floats being built for the Tournament of Roses Parade were wrecked when the giant tent they were being housed in was blown down in Azusa. Damage estimated at \$100,000.
											...heavy winds buffeted a Piedmont Airways jet as it approached Los Angeles International Airport Thursday morning, causing minor injuries to two flight attendants and four passengers. The winds also forced the diversion of 30 incoming flights to the Ontario International Airport.
											There were no deaths or major injuries associated with the windstorm and only a few people suffered minor injuries. However, dollar estimates of damage vary ranging from 15 to 20 million dollars.
CAZ014 Owens Valley	14	1650pst			0	0	4	0			High Winds
											Strong winds blasted through Inyo County Wednesday evening, knocking down tree limbs, tearing up signs, damaging some metal structures and resulting in some power outages. Maximum winds speeds recorded were 68 MPH at WSO Bishop and 78 MPH at the Bishop Fire Department Headquarters. Several highways in the Owens Valley area were closed for several hours due to zero visibility in blowing dust and debris.
CAZ013 Bear Valley Springs	15	1500pst			0	0	5	0			High Winds
											Pressure gradient coupled with high pressure over the Great Basin and low pressure centered just off the Central California coast provided strong gradient winds over Kern County. Exposure to high winds at high elevations over Bear Valley as well as channeled wind flow in easterly exposures contributed to low-level damage from strong winds. An observer at an anemometer site in Bear Valley reported speeds to 61 MPH with a peak gust to 72 MPH occurring sometime later in the evening. Total damage, including that done to structures, landscaping and power lines, was estimated to be at least in the range of \$50,000 to \$500,000.
All Zones	15	evening			2	0	?	0			Rain & Snow
											A cold front swept through California Thursday, leaving plenty of rain and snow behind in Southern California. This was the same storm that produced hurricane-force winds in the Northern/Central part of the state. Southern California's weather-related problems were mostly on outlying highways, as rain, snow, and sleet led to numerous traffic accidents and flooded intersections. In snowy Cajon Pass northwest of San Bernardino, two people died Thursday in accidents involving several dozen vehicles. M60V, M43V. Snow closed California's two major north-south highways - Interstate 5 and Highway 101 - while sleet soaked Los Angeles hills. Up to 50 tractor-trailer rigs jackknifed on slick I-5 on 4,500 foot Tejon Pass north of Los Angeles, closing the route late Thursday until noon Friday, when California Highway Patrol began escorting cars over the summit. Heavier rainfall amounts included 2.6 inches at Yorba Linda and Modjeska Canyon in Orange County. Snow accumulation ranged from 5 to 8 inches at the 3500 foot level to 15 inches above 8000 feet.
All Zones	20	1800pst			0	0	3	0			Heavy Rain & Flooding
											Another in a series of winter storms passed through Southern California Tuesday night and early Wednesday triggering a couple of mudslides in the Hollywood Hills and local flooding in some areas of Santa Barbara County. Rainfall amounts included .80 of an inch in less than one hour at Santa Maria in Santa Barbara County, over an inch of rain at most spots in the Los Angeles Basin, and almost three inches in the mountains.
CAZ014-019	22	1600pst			0	0	0	0			High Wind
											At 4pm Thursday afternoon, Inyokern Airport near State Highway 395 reported south winds 55 MPH with gust to 70 MPH. No damage was reported.
All Zones	29	morning			5	1	0	?			Cold Spell
											A week of subfreezing temperatures contributed to at least five deaths, produced a record turnout of the homeless at the county shelters, and threatened farmers and their frost-sensitive crops. Hypothermia was the suspected cause of 5 deaths and 1 injury. Most of the victims were homeless people sleeping on the streets or people sleeping in unheated houses. M730, M47P, M480, M430, M770.
<b>5 COLORADO</b>											
Eastern Foothills CO2011-014-015	7				0	0	0	0			Snow
											Snow fell across most of Colorado, but caused few problems except along the eastern foothills. Boulder, Fort Collins, and the adjacent foothill areas were hardest hit, with about a foot of snow in each city and up to 18 inches in the higher areas to the west. Elsewhere 4 to 8 inches fell, from Trinidad north through Colorado Springs, Denver, and Greeley. 4 inches of snow at Denver's Stapleton airport caused two-hour flight delays. Major rush hour traffic delays caused near gridlock conditions in Denver and Boulder.
Boulder County CO2011	12	mng.			0	0	0	0			High winds
											Strong winds blew in the Boulder area. The top recorded gusts were 70 mph at Table Mesa at 0722 MST, and 61 mph in eastern Boulder at 0715MST. The winds continued until about 9AM.
Northeast Fthls. Northern Mtns. CO2002-011	13				0	0	0	0			High winds
											A gust of 66 mph occurred at Boulder...time was unknown. 60 mph winds were clocked at Longmont. In the adjacent mountains, Mary Jane ski area (Grand County) clocked 66 mph winds at 2158 MST.
Eastern Foothills CO2011-014-015	14-15				0	0	0	0			Snow, wind
											A snowstorm whitened much of Colorado, with the eastern foothills again bearing the brunt of the storm. 6 to 12 inches fell in the Colorado Springs area, closing most schools and contributing to over 100 traffic accidents. Snowfall along the Front Range was also in the 6 to 12 inch range. Farther south, 18 inches fell near Walsenburg, in Huerfano County. 6 inches fell at Pueblo. Most other areas of the state also had snow, but amounts were generally light, except for a 10 inch accumulation at Crested Butte, in Gunnison County. Winds reached 60 to 65 mph at some ski areas on the morning of the 15th.
Otero County CO2016	19	1603MST			0	0	0	0			High winds
											Winds reached 67 mph at La Junta.
El Paso County CO2014	21	1522MST			0	0	0	0			High winds
											A gust of 77 mph was noted at the Air Force Academy.
Northern, Central Mtns; N.E. Plains Northeast Fthls. CO2002-004-011-012-014	22				0	0	0	0			High winds
											Strong winds hit many areas along the foothills from the Colorado Springs area north to the Wyoming border. Most of the high winds occurred between midnight and 1000 MST. The peak gust recorded in a populated area was 123 mph at 0345 MST in the Horseshoe Heights area, near the crest of a ridge five miles southwest of Fort Collins, in Larimer County. Winds reached 90 mph in Fort Collins; 95 mph just north of Boulder; 80 mph on Table Mesa, just west of Boulder; and 78 mph near Wellington, just north of Fort Collins. All these peak gusts occurred between 0300 and 0500 MST. Later in the day gusts reached 70 mph at the Air Force Academy at 0945 MST and 72 mph in Boulder around 1800 MST. The winds caused power outages around Boulder and Fort Collins, but no other damage was reported. Gusts of 60 to 70 mph also occurred farther east at Fort Morgan in Morgan County, and at several locations in the mountains from Monarch Pass northward. Automatic recording equipment on the summit of Mount Evans, over 14000 feet above sea level in Clear Creek County, recorded a peak gust of 141 mph.
Four Corners, Southwest Mtns. CO2007-008	22-23				0	0	0	0			Snow
											A foot of snow fell in two days at Mesa Verde National Park, with 8 inches at Durango. Icy conditions forced closure of the Durango airport on the evening of the 23rd. Up to 22 inches fell in the nearby San Juan mountains during the period.
Central, S.W. Mountains CO2004-008	22-26				0	0	0	0			Heavy snow
											Periods of heavy snow brought several feet of new powder to many Colorado ski areas during this period. The San Juans had the most snow. Wolf Creek Pass was buried by 24 inches in 24 hours on the 25th/26th, and had 68 inches in the five day period. 51 inches fell at Purgatory ski area, with 49 inches in Gothic, near Crested Butte in Gunnison County. 2 to 4 feet fell at many other spots.

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM	PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS							KILLED	INJURED	PROPERTY	CROPS	
<b>6 CONNECTICUT</b>										<b>IDAHO</b>									
CTZ004-005 Southwest Connecticut	13	0800-2200EST			0	0	0	0	Heavy Snow	IDZ004 Southeastern Idaho	14-15	1700 to 0500MST			0	0	5	0	High Wind
<p>A localized, surprise snowfall of from 5 to 8 inches affected a narrow strip of area in the extreme southwestern portion of the state. Numerous minor auto accidents were reported, schools were closed, and business was disrupted. Plowing operations were delayed since only very small amounts of snow were predicted.</p>										<p>Wind and blowing snow caused the closure of Interstate 84 near the Utah border from midnight until 0500MST when the estimated wind gusts decreased to 45 mph. Several semi-trailer trucks jackknifed. At 1100MST the sea-level pressure difference between Idaho Falls and Salt Lake City was about 12 millibars.</p>									
GTZALL Statewide	28	1700-2200EST			0	0	5	0	High Winds	IDZ001 Southwestern Idaho	19	0500 to 1100MST			0	0	5	0	Snow
<p>A fast-moving cold front brought a period of high winds with gusts of 40 to 60 mph. Bradley International Airport in Windsor Locks recorded a peak gust of 49 mph. A roof was blown off of a small building in Stratford and scattered power losses affected up to 35,000 electric customers statewide when the winds blew down trees and tree limbs.</p>										<p>One inch of fresh snow, the first in three weeks, was blamed for 82 automobile accidents.</p>									
<b>7 DELAWARE</b>										IDZ003-006-007-008 Central and Southeastern Idaho									
Entire State	28	1600EST			0	0	?	0	High Wind (60 kt)	<p>Twenty-two inches of snowfall was evenly distributed over a 48 hour period at Idaho City. Wind and snow caused the closure of U.S. Highway 20 between Mountain Home and Fairfield on the 21st. In Adams County, 500 automobiles became stranded on the 21st and 22nd. Six automobile accident injuries in Idaho Falls were snow related. Snow and wind knocked out power for 7600 customers in Bingham County between 0900 and 1900MST on the 21st. Following the storm, two automobile accident fatalities occurring three miles north of Montpelier on the 23rd were blamed on slippery roads. Island Prairie reported 12 inches of new snow on the 21st, while Moscow reported an overnight accumulation of 4 inches on the 21st. F79V, M85V</p>									
<p>Strong winds following a cold front downed trees, limbs and power lines, and blew a roof off of a house in Newark. A mobile home near Dover was blown off its foundation. Some trees fell on top of unoccupied cars. Power outages were widespread. Wilmington Airport reported a 60 knot gust at 1627EST, and Dover APB had a 57 knot gust at about the same time. Winds averaged 35 to 45 knots between 4 and 5 pm. The temperature dropped about 20 degrees in 1 hour following the front.</p>										<p>Thirteen inches of new snow fell at Pocatello, 8 inches at Parma, 6 inches at Payette, and 12 inches at Sun Valley. After the storm, McCall had 25 inches of snow on the ground, Council had 22 inches, and Burley reported 17 inches. Fairfield and Ketchum each had 24 inches. Grace received another 5 inches of snow during Christmas night. Several major highways were closed in southeastern Idaho on the 25th and 26th.</p>									
<b>8 FLORIDA</b>										IDZ008 Northern Idaho									
Pinellas Co., Treasure Island	11	1559EST	1.0	30	0	0	5	0	Tornado (F0)	<p>Four inches of new snow fell at Grangeville and 8 inches accumulated at Craigmont.</p>									
<p>A tornado damaged the roofs of 15 homes with 7 receiving major damage.</p>										<p>Six to thirteen inches of snow fell over a widespread area, the amounts increasing with altitude. Numerous automobiles slid off of highways. On the 29th, 36 automobile accidents were reported in Boise alone. Snow pulled down power lines in the Coeur d'Alene area at 2000PST on the 29th.</p>									
Pinellas Co., St. Petersburg	11	1601EST			0	0	3	0	TSTM wind (60)	IDZ008 Lewiston area									
<p>High wind damaged the windows of two homes and flipped over a boat in a backyard.</p>										<p>After temperatures rose above freezing during the day, the resulting meltwater froze during the late afternoon. Ten semi-trailer trucks slid off State Highway 3 between Kendrick and Deary in Latah County.</p>									
Sarasota Co., South Venice	11	1900EST	1.0	30	0	0	4	0	Tornado (F0)	<b>11 ILLINOIS</b>									
<p>A tornado damaged two house roofs, destroyed a shed and porch screening and downed several trees.</p>										ILZ002-003-008 Extreme Northeast									
Washington Co., Chipley (1.5mi W)	28	1051CST			0	0	3	0	TSTM wind (60)	<p>26 Day 0 0 ? 0 Heavy snow</p> <p>A narrow band of heavy snow fell from Rockford southeastward through the western and southern suburbs of Chicago and to the north of Kankakee. Some of the heaviest amounts occurred 25 miles north of Kankakee where 14 inches fell, and 12 inches fell at Naperville. The heavy snow changed over to sleet and freezing rain at many locations before the snowstorm ended. The snow caused many holiday travel delays. Many airline flights experienced long delays or were cancelled at Chicago's O'Hare International and Midway airports. Some additional snow reports... 9.5 inches at Rockford and; 9.0 at Orland; 8.0 at Lombard and Burr Ridge; 7.0 Darien; 6.0 Chicago Ridge; 4.0 Kankakee; 3.0 O'Hare Airport.</p>									
<p>High wind destroyed the roof of a mobile home. Trees were downed in the area.</p>										<p>27- Late 0 0 ? 0 Heavy snow</p> <p>28 Early</p> <p>4 to 7 inches of snow fell across central and portions of southern Illinois beginning late on the 27th and ending early on the 28th and extended about as far north as Peoria and about as far south as Carbondale. Some of the heavier amounts: 7.0 inches at East St. Louis, Salem, McLeanboro. Springfield Weather Service accumulated 5.0 inches; Peoria Weather Service 4.0 inches. Some freezing rain and sleet were also reported with the storm.</p>									
<b>9 GEORGIA</b> - NONE REPORTED										<b>10 IDAHO</b>									
IDZ009 Northern Idaho	12-13	2200 to 0500PST			0	0	5	0	High Wind										
<p>Winds associated with a cold front broke major power transmission lines in 30 places. Some plate-glass window and structural damage was reported. Winds were "locked" at 80 mph.</p>																			

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	
<b>12 INDIANA</b>									
Marion County, Indianapolis	21	1300EST		1		?	?		High Wind
			Strong winds gusting to officially near 50 mph with unofficial gusts to near 70 mph toppled a masonry block wall under construction on the city's northeast side. The twenty foot high wall toppled onto a 30 year old male. The construction worker was killed. Wind M300.						
IN2001-002 Southern Lake and Northern Newton Counties	26	0700EST 1600EST						?	Heavy Snow
			Heavy snow accumulated in a narrow band across southern Lake County and northern Newton County. There were numerous accidents and Interstate 65 south of Crown Point was closed for several hours. The snowfall ranged from six to twelve inches.						
IN2005-006-007-008-009-010-011 Central Indiana	27 28	2100EST 1000EST						?	Heavy Snow
			Heavy snow accumulated four to eight inches across central Indiana. Rockville in west-central Indiana recorded the heaviest snow with a total of eight inches. General amounts were four to five inches from Peru and Fort Wayne in the north to Vincennes and Rushville on the south. There was only minor blowing and drifting snow.						
<b>13 IOWA</b>									
Appanoose County, 2SE Centerville	19	2343 CST			0	0	4	0	TSTM Winds (50+)
			A narrow line of thunderstorms moved through Central and Southeast Iowa. Gusty winds were reported with them, although the only damage reported was southeast of Centerville. What appeared to be downburst winds downed trees and damaged a grain bin, fertilizer tank, and an outbuilding on a farm.						
IAZ003-007-008-011-014-015 and ILZ004 East Third of Iowa	22	0700 to 1300 CST			0	0	3	0	Freezing Rain
			Light freezing rain broke out over the east third of Iowa. Driving became very hazardous, and numerous accidents were reported.						
IAZ001-002-003-004-005-006-007-008-009-010-011-012-013-014-015, SDZ018, NEZ010, and ILZ004 All of Iowa	26- 27	0600 to 0700 CST			0	0	4	0	Freezing Rain
			Freezing rain and snow moved into Southern Iowa early on the 26th. The freezing rain spread north over all of the state during the morning. Driving was very hazardous with many roads being 100% ice covered. No major damage occurred as freezing rain amounts were on the light side, however spotty power outages were reported. North-Central and Northeast Iowa bore the brunt of the ice. Much of the precipitation changed to rain over the south half of the state during the afternoon of the 26th.						
<b>14 KANSAS</b>									
KSZ010-011-012-013-014-015-016-017 Central and Eastern Kansas	11	1000 to 2100CST			0	0	0	0	Snow
			The winter season's first snow fell across much of central and eastern Kansas. The snow started during the late morning and continued into the early evening hours. A total of only 1 to 2 inches fell, but the main effects from the storm were scores of traffic accidents due to slick roadways. The cities of Topeka, Wichita and Kansas City had hundreds traffic accidents. Unfortunately, a total of six persons were killed in weather-related traffic accidents. Three attorneys from Wichita were killed on the Kansas Turnpike when their car slid out of control, into the path of an oncoming semi-tractor trailer truck near El Dorado. M61V, M68V, M32V. Two people were killed in a two car collision on Highway 50 near Florence when their car slid into the path of an oncoming truck. F24V, F3V. Near El Dorado, a small child was also killed in a traffic accident. F4V.						
<b>— KANSAS</b>									
Johnson Co. Stanley	19	2220CST			0	0	2	0	TSTM Wind (55)
Labette Co. Parsons Oswego	19	2320CST 2350CST			0	0	2 4	0	TSTM Wind
Crawford Co. Pittsburg	20	0100CST			0	0	3	0	TSTM Wind
			A line of strong thunderstorms formed along a cold front and moved across far eastern Kansas, producing strong straight-line winds in some areas. Winds gusted to 65 MPH in Stanley while strong winds caused \$5,000 damage to the roof of a school in Oswego. The strong winds damaged some Christmas decorations in Parsons and blew out some windows and downed a power pole in Pittsburg.						
KSZ003 Southwest Kansas	19	1600 to 2100CST			0	0	4	0	High Winds
			An intense low pressure system over northwest Kansas brought very strong westerly winds to portions of southwest Kansas during the late afternoon and evening hours. This low pressure system also produced the thunderstorms in eastern Kansas mentioned above. Winds of 30 to 50 MPH prevailed across the area with a peak gust of 62 MPH clocked at Garden City at 2002CST. The strong winds caused the collapse of a 110 foot tall high voltage transmission tower 4 miles west of Garden City. The strong wind gusts also blew a small airplane off a runway as it was landing at the Elkhart Municipal Airport. No damage or injuries were reported to either the airplane or its three passengers. The plane was blown some 30 feet off the runway by the strong winds.						
KSZ016-017 Extreme East-Central and Southeast Kansas	28	0800 to 1400CST			0	0	0	0	Snow
			A storm system that moved from northern Texas across central Arkansas produced a band of snow to far east-central and southeast Kansas. Snowfall amounts ranged from a dusting in Paola to 3 inches at Columbus with 4 inches reported in Pittsburg. Slippery roadways resulted from the snow that caused several accidents in the region.						
<b>15 KENTUCKY</b>									
Simpson County	22	2300CST			0	0	5	0	Thunderstorm Wind
			Winds in excess of 65 mph destroyed a tobacco barn and several small outbuildings in southwestern Simpson County. In addition, part of the roof of a house was blown off. In northern Simpson County, a large barn was destroyed along with a utility building. Two miles west of Franklin, another tobacco barn was destroyed along with a stock barn. Shingles were blown off the roof of a house in the area.						
Casey County	24	0645EST			0	0	4	0	Thunderstorm Winds
			Winds gusting to around 60 mph blew the roof off of a trailer and blew trim off a new garage. Several trees were blown over also. This occurred 10 miles south of Liberty.						
Garrard County	24	0700EST			0	0	4	0	Thunderstorm Wind
			Winds gusting to near 60 mph blew down a radio communications tower on top of the Lancaster City Hall.						
Magoffin County	25	0700EST			0	0	0	0	Flooding
			Minor flooding occurred at Salyersville on the Licking River.						
Nelson County	25	0700EST			0	0	0	0	Flooding
			Minor flooding occurred at Boston on the Rolling Fork River. Only bottomland flooding was reported.						
Warren County	25	0700CST			0	0	0	0	Flooding
			Minor flooding was also reported at Woodbury on the Green River.						

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

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					KILLED	INJURED	PROPERTY	CROPS	PROPERTY	CROPS	
<b>16 LOUISIANA</b>											
Winn Parish, 2 W Calvin	22	1800CST			0	0	?	?	TSTM	Wind	
Sabine Parish, 2 NE Zwolle	22	1801CST			0	0	0	0	Funnel	Cloud	
DeSoto Parish, 4 NE Pelican	22	1810CST			0	0	?	?	TSTM	Wind	
Sabine Parish, 5 NW Many	22	1815CST			0	0	?	?	TSTM	Wind	
Natchitoches Parish, Natchitoches	22	1825CST			0	0	4	?	TSTM	Wind	
Winn Parish, Atlanta	22	1945CST			0	0	?	?	TSTM	Wind	
5 SE Sikes	22	2025CST			0	0	?	?	TSTM	Wind	
Vernon Parish, Rosepine	22	2035CST	1.0	50	0	1	5	?	Tornado	(F1)	
Caldwell Parish, Columbia	22	2210CST			0	0	4	?	TSTM	Wind	
Richland Parish, 5 S Mangham	22	2215CST			0	0	?	?	TSTM	Wind	
Franklin Parish, 3 W Lamar	22	2225CST			0	0	?	?	TSTM	Wind	
					Violent thunderstorms moved across north and west central Louisiana in advance of a cold front. A tornado struck the community of Rosepine damaging 30 homes and businesses, with 3 houses and 1 business destroyed. One minor injury was reported. Damage was estimated around \$200,000. The remainder of the damage across the state was caused by straight-line thunderstorm winds or downbursts as thunderstorms accelerated across the area at 40 to 60 miles an hour. In Columbia, wind gusts pushed a house off its foundation, caused roof damage to 3 houses, and downed numerous trees. In Natchitoches, thunderstorm wind gusts caused a non-support block wall of an apartment house to collapse, and downed numerous trees and signs. The remainder of the severe weather reports were confined to downed trees and power lines.						
St. John the Baptist Parish, La Place	24	1245CST			0	0	3	0	TSTM	Wind	
					Thunderstorm wind gusts damaged a house roof.						
Caddo Parish, Shreveport	27	1645CST			0	0	0	0	TSTM	Wind (51)	
DeSoto Parish, north portion	27	1705CST			0	0	?	?	TSTM	Wind	
Stonewall	27	1715CST			0	0	4	?	TSTM	Wind	
Bossier Parish, Fillmore	27	1710CST			0	0	?	?	TSTM	Wind	
Fillmore	27	1710CST			0	0	0	0	Hail	(0.88)	
Sabine Parish, Fisher	27	1745CST			0	0	0	0	Hail	(1.00)	
5 SSE Fisher	27	1745CST			0	0	?	?	TSTM	Wind	
Red River Parish, 1 W Armistead	27	1810CST			0	0	0	0	Hail	(1.00)	
Bienville Parish, Jamestown	27	1840CST			0	0	0	0	Hail	(0.88)	
Jackson Parish, 5 SE Chatham	27	2010CST			0	0	?	?	TSTM	Wind	
Ouachita Parish, Basco	27	2040CST			0	0	0	0	Hail	(0.75)	
Monroe	27	2045CST			0	0	4	0	TSTM	Wind	
East Carroll Parish, Lake Providence	27	2215CST			0	0	4	0	TSTM	Wind	
					Severe thunderstorms moved across north Louisiana in advance of cold front producing strong wind gusts and hail. At Stonewall, wind gusts damaged two house roofs and blew the roof off a barn. A thunderstorm wind gust damaged a warehouse roof in Monroe, and in Lake Providence, two mobile homes were rolled and a store front was damaged by thunderstorm wind gusts. The remainder of the storm damage was confined to downed trees.						
<b>17 MAINE</b> ————— NONE REPORTED											
<b>18 MARYLAND and D.C.</b>											
NDC008 Western Maryland	13	1630EST			0	0	0	0	Snow		
					Snow accumulations averaged 3 inches in Oakland and 2 to 3 inches in Frostburg.						
<b>19 MASSACHUSETTS</b>											
MAZALL Statewide	28	1700-2200EST			0	0	5	0	High Winds		
					A fast-moving cold front was accompanied by a period of strong and gusty winds. Peak gusts of from 40 to 60 mph were reported, and scattered power outages resulted from the downing of trees and tree limbs. A gust to 53 mph was recorded at Logan International Airport in Boston, and a gust to 77 mph was recorded atop the 640 foot Blue Hill in Milton.						
<b>20 MICHIGAN</b>											
MIZ017-021 Upper Peninsula	14				0	0	0	0	Snow		
					22" fell at the Marquette airport, 13" downtown, 18" at Wakefield, 7" at the Soo. There were 15 auto accidents.						
MIZ001 Hamilton, Allegan Co.	20	1200EST			0	1	3		Wind		
					A concrete block wall under construction collapsed, injuring a workman.						
MIZ003 Holland, Ottawa Co.	22	0950EST			0	1	3		Wind		
					A construction worker was blown off scaffolding.						
MIZ001-002-004-015 South-Central Lower Peninsula	23	morning			0	1	2		Wind		
					A man was injured at Belding when a mobile home was blown off a jack. Power outages occurred.						
<b>21 MINNESOTA</b>											
MNZ001-002-003-004-005-007-008-009 Extreme Northwest through Northeast	13-14	1000CST			0	0	0	0	Heavy Snow		
					A mixture of freezing precipitation and snow spread rapidly across the northern portions of Minnesota. A broad area of snow ranging from 5-7 inches in depth fell north of a line from Crookston (Polk County) in northwest Minnesota to Moose Lake (Carlton County) in northeast Minnesota. Locally heavier amounts were received in and around Duluth. Proctor, Cloquet and Duluth (located in Carlton and extreme southern St. Louis counties) received 9-11 inch amounts.						

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

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					KILLED	INJURED	PROPERTY	CROPS	PROPERTY	CROPS	
<b>MINNESOTA</b>											
MNZ001-002-003-004-005-006-007-008-009-010-011-013-014 Northwest half of Minnesota	26-27	0230CST			0	0	0	0			Heavy Snow
											Light snow spread into southwest Minnesota early Monday morning and spread statewide during the day. Snow ended gradually early on Tuesday morning. Much of the northern one-half to two-thirds was blanketed with 6-12 inches of new snow. The heaviest snowfall was in an area 50-75 miles either side of a line from Moorhead (Clay County) to International Falls (Koochiching County) of northwest and north-central Minnesota. This area received 10-12 inches of new snow clogging roads and reducing visibilities.
MNZ017-018-019 Southern Minnesota	26-27	0230CST			0	0	0	0			Freezing Rain
											Light snow spread into southern Minnesota early Monday morning and gradually changed to freezing rain and drizzle causing the temporary closure of Interstate 90 between Fairmont and Worthington for several hours. Numerous accidents and minor injuries were caused due to the icy conditions. Some areas of the far southwest did incur some power outages due to the heavy ice accumulation. Heaviest ice conditions were along the South Dakota border in Rock County.
<b>22 MISSISSIPPI</b>											
Hancock and Harrison Counties	06	0500-0800CST			0	0	0	0			Dense Fog
											Very dense fog caused 4 accidents. Two crashes involved 18-wheelers where 2 people were killed in separate instances. Two other accidents involved school buses in which students were injured.
Coahoma County, Clarksdale	22	2100-2300CST			0	0	4	0			Flash Flood
											From 2000 to 2200CST, around 3 inches of rain fell. Nearly all of the streets in town were flooded. Water got high enough to threaten 7 homes, but did not get into them.
Bolivar County, Shaw	22	2145CST	.8	40	0	0	5	0			Tornado (F1)
											A small tornado touched down briefly in Shaw. Three buildings suffered roof damage, while one building's roof was completely destroyed. Numerous trees and power lines were blown down.
Calhoun and Chickasaw Counties, 1E Vardaman to 5W Houston	22	2315-2322CST	5.0	60	0	0	4	0			Tornado (F1)
											A small tornado touched down near Vardaman and moved into western Chickasaw County at 2318CST before it dissipated. Damage was mostly confined to trees, but a carport and a roof was torn from one house. A porch was torn off one other home.
Chickasaw County, Houston	22	2330CST			0	0	?	0			Thunderstorm Winds
											Several trees and power lines were blown down in southern Houston.
Chickasaw County, 7SE Houston to 12E Houston	22	2347CST	5.0	40	0	0	4	0			Tornado (F1)
											A tornado tore the roofs off of 2 barns. Numerous trees were snapped off at 50-70 feet above the ground.
Chickasaw and Monroe Counties, 5S Okolona to 5W Amory	22-23	2355-0010CST	11.0	50	0	0	5	0			Tornado (F1)
											A tornado moved northeast from south of Okolona and moved into Monroe County at 23/0000CST. The tornado then moved due east and dissipated west of Amory. Four homes, two mobile homes, a church and a barn were damaged.
Tate County, 5W Senatobia	27	1845CST	1.5	40	0	0	4	0			Tornado (F1)
											A tornado touched down briefly and destroyed an unoccupied mobile home. Trees in the area were also uprooted or snapped off above the ground.
Quitman County, 3E Marks	27	2000CST			0	0	5	0			Thunderstorm Winds
											Mobile homes were heavily damaged when they were overturned by strong straight-line winds.
Panola County, 5NW Batesville	27	2021CST	1.0	30	0	0	4	0			Tornado (F1)
											A tornado touched down briefly northwest of Batesville and tore a porch off a house and uprooted several trees.
<b>MISSISSIPPI</b>											
Tallahatchie and Leflore Counties, 1E Minter City to 7SW Charleston	27	2057-2120CST	18.0	75	0	0	5	0			Tornado (F2)
											A tornado initially touched down one mile east of Minter City. The tornado tracked northeast through the northeast tip of Leflore County and moved back into Tallahatchie County at 2105CST. One mobile home was destroyed and several homes and mobile homes were damaged.
Tallahatchie County, 5SE Charleston to 2SW Oakland	27	2125-2135CST	7.0	70	0	0	5	0			Tornado (F1)
											A second tornado developed from the same storm in Tallahatchie County. One mobile home was destroyed and several others were damaged.
Tallahatchie County, 6ESE Charleston	27	2128CST	2.0	50	0	0	?	0			Tornado (F1)
											A third tornado developed from the same storm in Tallahatchie County. No structures were in the path of the tornado, so all damage was to trees.
Washington County, 8S Greenville	27	2130CST			0	0	?	0			Thunderstorm Winds
											Several billboards were blown over south of Greenville.
Issaquena County, Grace	27	2145CST			0	0	?	0			Thunderstorm Winds
											Several trees and power lines were blown down. Strong winds also damaged some roofs and blew out some windows.
Washington County, 8N Leland	27	2150CST			0	0	4	0			Thunderstorm Winds
											High winds blew part of a roof off of a home on U.S. Highway 61. One wall of the home was partially blown down.
Sharkey County, 1S Anguilla to 2E Anguilla	27	2155-2200CST	3.0	100	0	0	5	0			Tornado (F1)
											A tornado moved through southern Anguilla and demolished a mobile home, damaged several homes, and knocked down many trees and power lines.
Yalobusha County, 1S Water Valley to 4E Water Valley	27	2200-2208CST	5.0	75	0	0	5	0			Tornado (F2)
											The same storm that produced the tornadoes in Tallahatchie County produced this tornado. Several homes were heavily damaged. A roof was blown off of a church. Numerous trees and power lines were also blown down.
Sharkey County, Nitta Yuma	27	2220CST			0	0	4	0			Thunderstorm Winds (G75)
											Winds estimated at greater than 80mph blew shingles off roofs and damaged a few mobile homes.
Humphreys County, Gooden Lake to 2SE Belzoni	27	2225-2240CST	10.0	75	0	0	5	0			Tornado (F2)
											Another tornado developed from the same storm that struck Anguilla. This tornado was stronger leaving one home, one mobile home and a gas station destroyed. Six homes, three mobile homes and six businesses were damaged. Another 25 homes near the tornado suffered roof damage.
Sharkey County, Rolling Fork	27	2230CST			0	0	?	0			Thunderstorm Winds
											Several trees and telephone poles were blown down.
Adams County, Natchez	27	2330CST			0	0	4	0			Thunderstorm Winds
											Strong winds blew the windows out of an Auto Supply Store and also caused the front awning to collapse. A roof of a nearby building was also damaged.
Warren County, Vicksburg	27	2330CST			0	0	4	0			Thunderstorm Winds
											Strong winds ripped the roof off of an appliance store. Several trees were also blown down.
Holmes County, Richland	27	2330CST			0	0	?	0			Thunderstorm Winds
											Several trees were blown down.
Montgomery County, 3NE Duckhill	27	2340CST			0	0	4	0			Thunderstorm Winds
											Several trees were blown down. A roof was blown off of a saw mill.
Grenada County, Gore Springs	27	2340CST			0	0	?	0			Thunderstorm Winds
											Several trees were blown down.
Yazoo County, Bentonla	28	0010CST			0	0	?	0			Thunderstorm Winds
											Power lines were blown down.

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED <sup>1</sup> DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED <sup>1</sup> DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	

## MISSISSIPPI

Madison County, 3SE Madison	28	0030CST	.3	30	0	0	?	0	Tornado (F1)  A small weak tornado touched down briefly near the southwestern end of the Ross Barnett Reservoir. The only damage was to trees, but the tornado lifted about a quarter of a mile before reaching a small subdivision it was headed toward.
Holmes County, 4N Lexington	28	0030CST	1.5	70	0	0	5	0	Tornado (F1)  A tornado touched down north of Lexington and destroyed one mobile home, and damaged 2 others. A couple of homes also suffered roof damage.
Copiah County, 5SE Hazlehurst to 9E Hazlehurst	28	0100- 0108CST	4.0	75	0	0	?	0	Tornado (F1)  A tornado moved through southeast Copiah County, but did not hit any structures. However, extensive tree and power line damage occurred along the tornado's path.
Rankin County, Star	28	0122CST			0	0	4	0	Thunderstorm Winds  Strong winds damaged a roof and blew down several trees.
Scott County, Harperville to 3NE Harperville	28	0200CST	3.0	100	0	0	5	0	Tornado (F1)  A tornado destroyed five chicken houses and killed thousands of chickens. An empty house was blown down and a barn was destroyed. Extensive tree and power line damage also occurred.
Jasper County, 2N Stringer	28	0300CST			0	0	4	0	Thunderstorm Winds  Two pump houses were blown away. Shingles were blown off about five homes. A portion of a barn roof was blown off.

## 23 MISSOURI

MOZ005-006-007-009- 010-011-012-013- 014-015-016-017 Southwest through East-Central Missouri	27	1400- 2200CST			0	0	0	0	Heavy Snow  Heavy snow had spread from southwest Missouri north to just south of Kansas City and northeast to the St. Louis area during the afternoon and evening of the 27th. Most of the snow fell along and 100 miles north of Interstate 44. Most locations received from 4 to 6 inches. Republic and Iberia both reported 8 inches.
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## 24 MONTANA

MTZ007	03	0828MST			0	0	0	0	HIGH WIND (G65) Strong winds were reported in the Upper Yellowstone Valley.
MTZ003	03	1322MST			0	0	0	0	HIGH WIND (G53)
MTZ001	06	1100MST			0	0	0	0	HEAVY SNOW Four inches of snow fell at the Flathead County Airport during the morning.
MTZ003	11	1733MST			0	0	0	0	HIGH WIND (G53)
MTZ007	11	2015MST			0	0	0	0	HIGH WIND (G52)
MTZ007	12	1950MST			0	0	0	0	HIGH WIND (G50)
MTZ002	13	0608MST			0	0	5	0	HIGH WIND (G43)
MTZ001	13	0614MST			0	0	5	0	HIGH WIND (G44)
MTZ004	13	0935MST			0	0	4	4	HIGH WIND (G50)
MTZ006	13	1030MST			0	0	4	4	HIGH WIND (G56)
MTZ009	13	1120MST			0	0	5	4	HIGH WIND (G50)
MTZ007	13	1125MST			0	0	6	4	HIGH WIND (G56)
MTZ003	13	1153MST			0	0	3	4	HIGH WIND (G50)
MTZ008	13	1229MST			0	0	4	4	HIGH WIND (G53)
MTZ005	13	1340MST			0	0	4	4	HIGH WIND (G52)
A fast-moving Pacific cold front crossed the state early on the 13th. Strong damaging winds followed the front. West of the Rockies trees were blown down across power and telephone lines and many outages were reported. East of the Rockies widespread damage occurred to signs and roofs, and several trucks were blown off highways north of Billings.									
MTZ001	29	0600MST- 0600MST			0	0	0	0	HEAVY SNOW Six inches of snow fell at Kallispell with 34 inches at Big Mountain Ski Resort near Whitefish.
MTZ003	29	0941MST			0	0	0	0	HIGH WIND (G51)
MTZ007	29	1951MST			0	0	2	0	HIGH WIND (G70)

## 25 NEBRASKA ————— NONE REPORTED

## 26 NEVADA

NVZ003 Extreme Western Nevada	20	1200PST- 1600PST			0	0	3	0	High Winds  High winds developed along the east slopes of the Sierra Nevada ahead of a Pacific cold front. 70 MPH gusts were common around the Reno area. The strongest gust reported was 90 MPH a few miles south of Reno.
NVZ003 Extreme Western Nevada	22	0100PST- 1930PST			0	0	3	0	Heavy Snow  A strong Pacific cold front moved into the mountains of Extreme Western Nevada and dropped heavy snow around Lake Tahoe. Over 8 inches of snow fell at lake level and over a foot of snow fell on the mountains along the east shore of the lake. The storm continued to drop heavy snow as it moved into the valleys of Extreme Western Nevada. Five to 11 inches of new snow was measured around the Reno area.
NVZ002-006 Northeast, Extreme Western, West- Central, East- Central and South- Central Nevada	23- 25	2200PST- 0500PST			0	0	0	0	Heavy Snow  The strongest in a series of Pacific storms moved into Western Nevada late on the 23rd and dropped heavy snow on its way into Central Nevada. Eleven inches or more of new snow was measured along the east shore of Lake Tahoe. From 7 to 17 inches of new snow fell around the Reno-Carson City-Gardnerville area of Extreme Western Nevada. Six to 12 inches of new snow fell across West-Central Nevada and 4 to 6 inches of snow was measured in the western part of East-Central Nevada and the northern part of South-Central Nevada. The storm gained strength late in the day on the 24th as it moved well into East-Central Nevada and Northeast Nevada. From 5 to 12 inches of new snow fell on this area.
NVZALL Nevada	27	Morning			0	0	3	0	Extreme Cold  Nevada was between storms on the morning of the 27th. High pressure kept skies mostly clear across the state which allowed the morning temperatures to drop well below zero in nearly every corner of the state. Even in the extreme southern tip of Nevada morning low temperatures were below freezing. In Northeastern Nevada temperatures were generally colder than 20 below. Minus 27 degrees was recorded at the ranger station at Wildhorse Reservoir, Ely dropped to 22 degrees below zero and Elko recorded 19 degrees below zero. Smith Valley, in the western part of Nevada, dropped to 20 below and Lovelock recorded minus 16. Low temperature records were broken across the state.

## 27 NEW HAMPSHIRE

NHZ006 Southern Interior	13				0	1	4	0	Ice Storm  A mixture of light snow but mostly freezing rain occurred as a low pressure area moved through southern Quebec, Canada. Auto accidents occurred around Claremont, Dover and Manchester, with one injury being sustained as a car skidded off the roadway. Snowfall estimates were in the range of 1/2 to 2 1/2 inches. The following snowfall amounts in inches were reported: ....Zone 006.... Dover 1.5 Manchester 2
NHZ006 Southern Interior	27				0	1	3	0	Ice Storm  Light freezing rain over a small area resulted in several auto accidents, with one injury being reported in one of the accidents.

## 28 NEW JERSEY, Northern ————— NONE REPORTED

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

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					KILLED	INJURED	PROPERTY	CROPS	PROPERTY	CROPS	
<b>28 NEW JERSEY, Southern</b>											
NJ2003 Long Beach Island, Ocean County	17	1200 EST			0	0	?	0			Isolated Snow Squall
Snow fell over portions of Ocean, Burlington and Atlantic counties from around 7 AM EST until around 5 PM EST. The snow was mostly light with most portions of the counties receiving less than 4 inches accumulation. Many sections had only a trace. However, some heavy snow squalls on Long Beach Island caused accumulations of 6 inches or more. The heaviest accumulations were on the north end of the island. The area from Harvey Cedars to Barnegat Light received 8 inches or more.											
Southern New Jersey	28	1600 EST			0	1	5	0			High Winds (76)
High wind gusts followed a cold front across Southern New Jersey. The high winds began at around 4 PM over western sections along the Delaware River and at around 5:30 PM along the Atlantic Coast. The high winds persisted for an hour or more before subsiding somewhat. In Camden a large portion of the roof was blown off of a church. One man was injured when the brick chimney of a warehouse was blown off and onto the car in which he was sitting. Trees, tree limbs and power lines were downed all across Southern New Jersey. In Swedesboro, Gloucester County wind gusts were estimated at 77 mph at 4 PM. Wind gusts were estimated at 65 to 70 mph at Trenton in Mercer County at 4:50 PM. At Hammonton, Atlantic County gusts were measured at 63 mph at 4:43 PM and at 87 mph between 5 and 6 PM. The National Weather Service measured gusts to 55 mph at the airport in Pamaona, Atlantic County at 5:18 PM and gusts to 71 mph at the nearby upper-air sounding station at 5:15 PM. Wind gusts were measured at 74 mph between 5 and 6 PM on the Ventnor City Fishing Pier, Atlantic County. In Cumberland County, southwest of Millville, wind gusts reached 55 mph at 5:05 PM and were accompanied by heavy rain and small hail. In Ocean City, Cape May County wind gusts to 67 mph were recorded at 5:25 PM.											
<b>29 NEW MEXICO</b>											
Southern New Mexico	08	all day			0	?	?	0			Heavy Snow
The heavy snow was confined mainly to the southern half of the state. The south-central mountains were the hardest hit, with between one and two feet of new snow being reported. Amounts at lower elevations ranged from one to five inches. This same storm moved back over the region on the 10th, producing a band of locally heavy snow from Quemado to Los Lunas. Amounts ranged from two to eight inches.											
<b>30 NEW YORK, Coastal</b>											
NY2015-016 Nassau and Suffolk Counties	13	2100EST			0	0	0	0			Heavy Snow
A stalled frontal zone of warm air overrunning colder air at the surface produced a heavy snowfall across extreme eastern Nassau County and western Suffolk County. The band of heavy snowfall, ranging from 6 to 12 inches, was only about 40 miles wide. Centerreach reported the highest amount with one foot. Tree limbs breaking under the weight of the snow downed several power lines in the process. Nearly 40,000 customers were without power at some time during the storm.											
NY2015-016 New York City and Long Island	28	1700-1800EST			0	3	?	0			High Wind
A powerful cold front moving across the area produced damaging winds in New York City and across Long Island. The winds gusted to 63 knots (73 mph) at LaGuardia Airport at the height of the storm. In New York City, 3 persons were injured when construction material fell onto the streets. In the Bronx the high winds ripped roofs from two subway stations. Across Long Island trees and power lines were blown down, affecting nearly 20,000 customers. In Islip a roof was blown off.											
<b>30 NEW YORK, Central</b>											
Areawide	10 PM to 16 AM				0	0	?	?			Cold Wave
Arctic-like temperatures tied or set new records in many communities. The cold was also blamed for five car fires, thousands of frozen water pipes, and hundreds of broken heating systems. Local power companies were taxed to supply power for all their customers. Occasional snow squalls moved across the area during the six days.											
<b>NEW YORK, Central</b>											
Albany Co. Glenmont	11	1103EST			1	0	3	0			Snow
Light snow and below zero temperatures made local roads slippery. F-60-V											
Areawide	23	0300EST			3	35	5	0			Freezing Rain
Rain, freezing rain, and snow spread over all Eastern New York. Weather conditions were listed as the cause of accidents, power outages, and communication system failures. Icy weather was also listed as the reason for a plane's emergency landing at Griffis Air Force Base. M-25-V (Rhinebeck) M-21-V (Waywaywanda) M-24-V (Waywaywanda)											
Areawide	28	0200EST			0	20	5	0			Freezing Rain
Rain, freezing rain and snow covered Eastern New York for the second time in a matter of days.											
<b>30 NEW YORK, Western</b>											
Chautauqua County Dunkirk	01	0100EST			0	0	3	0			Snow
Dunkirk received 12 inches of snow.											
Genesee County Perry and Warsaw	03	early morning			0	0	3	0			High Winds (50)
Very strong winds downed trees and power lines.											
Erie County Springville	10	0300EST			0	0	4	0			Snow
Cattaraugus County Salamanca	10	1900EST			0	0	3	0			Snow
Oswego County Oswego	10	2100EST			0	0	3	0			Snow
Wayne County Sodus	10	2100EST			0	0	4	0			Snow
Snowfall amounts were as follows: Springville 12 inches Salamanca 8 inches Oswego 8 inches Sodus 14 inches											
Chautauqua County Sherman	18	0300EST			0	0	3	0			Snow
Sherman received 12 inches of snow.											
Steuben County Bath, Campbell and Corning	22	morning			0	0	4	0			Freezing Rain
Genesee County Batavia	22	evening			0	0	4	0			High Winds and Freezing Rain
High winds and freezing rain caused many accidents, minor power problems, and school closings.											
Chautauqua County Dunkirk, Portland, and Brocton	23	early morning			0	0	4	0			High Winds (62)
Ontario County Geneva	23	morning			0	0	4	0			High Winds
Wayne County Newark and Lyons	23	morning			0	0	3	0			High Winds
Erie County Buffalo	23	0900EST			0	0	3	0			High Winds (56)
City of Tonawanda	23	morning			0	0	3	0			Freezing Rain
Allegany County Alfred, Whitesville and Wellsville	23	morning			0	0	4	0			Freezing Rain
Trees and power lines were downed. There were reports of cars having been crushed by falling trees. In Seneca Lake, the Light House Pier at the north end buckled under the force of the waves generated by the strong winds. Several homes along the lake were damaged by the waves. Freezing rain caused many vehicular accidents and was blamed for the cancellation of schools.											
Lewis County Barnes Corners	29	1030EST			0	0	3	0			Snow
Barnes Corners received 8 inches of snow.											

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

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					KILLED	INURED	PROPERTY	CROPS	PROPERTY	CROPS	
<b>31 NORTH CAROLINA</b>											
NCZ001-002-009-010 NC Mountains and Northeast NC	28	1400EST			0	0	0	0			High Winds
<p>A strong cold front swept across the state during the early afternoon producing winds from 50 to over 100 MPH at high elevations in the mountains. At Grandfather Mountain a gust to 127 MPH was reported at 3:00 PM. Winds of 25 to 35 MPH were common across the Western Piedmont. Winds gusted to 50 to 60 MPH from near Duck to Elizabeth City as the front approached the northeast coast.</p>											
<b>32 NORTH DAKOTA</b>											
NDZ003-004-006-007-008-009-011-012-013-016-017 Most of southern, central and eastern North Dakota	13	1300CST to 2330CST			0	0	4	0			Heavy Snow High Winds Sleet Freezing Rain
<p>A deep low pressure center moved southeast out of Canada into northwest North Dakota around Noon on the 13th. This center continued to move rapidly southeastward to just north of Bismarck, in south-central North Dakota, by 1800CST. The fast-moving system then moved eastward reaching Minnesota by midnight of the 13th.</p> <p>This system brought a variety of weather to North Dakota.</p> <p>In the north-central and northeast sections, heavy snow occurred along a narrow line from Bottineau, in north-central North Dakota near the Canadian border, southeastward to Devils Lake then east to Grand Forks. Six to nine inches of snow fell along this path.</p> <p>The heavy snow caused numerous minor traffic accidents, and some schools had to close.</p> <p>In the southwest and south-central sections, strong northwest winds developed over southwest North Dakota during the afternoon and spread into south-central North Dakota by early night. Wind gusts to 55 mph were recorded at the Dickinson airport, while gusts to 56 mph were recorded at the Bismarck airport. The winds diminished by midnight.</p> <p>In addition, freezing rain and sleet occurred over parts of central and southeast North Dakota. This mixed precipitation made roads and highways very slippery. A truck loaded with coal toppled on its side on State Highway 200, while a semi-trailer overturned on ice-covered U.S. Highway 52.</p>											
NDZ002-003-004-006-007-008-011-012-013-014-015-016-017-018 Southern, eastern and parts of northwest North Dakota	25 to 27	2100CST to 0500CST			0	0	0	0			Heavy Snow
<p>Snowfall intensified over western and central North Dakota early Christmas night, and spread eastward across the state during the early morning of the 26th.</p> <p>The snowfall was widespread over North Dakota. Heavy snow occurred over all but the north-central section and northwest corner of the state.</p> <p>In addition, east to northeast winds of 15 to 30 mph caused blowing and drifting snow, and brought wind chill temperatures down to 50 below at times.</p> <p>The snowfall slowly diminished over western and central North Dakota the night of the 26th, and in the east the morning of the 27th.</p> <p>This storm delayed air and highway traffic, stranding post-Christmas shoppers and travelers. Police in the City of Fargo had to erect barricades along some snow- and traffic-blocked streets.</p> <p>The storm was also beneficial to North Dakota, bringing some drought relief and improving the outlook for Spring planting.</p>											
<b>33 OHIO</b>											
OHZ003 East Lakeshore	02	1200 EST			0	0	?	0			Heavy Snow
<p>Six to twelve inches of snow fell north and east of an area bounded by Mentor, Chardon, Jefferson and Monroe Center. The heaviest snow fell north of Interstate 90 in Ashtabula County. The snow began at 0000 EST on the 1st and ended at 0000 EST on the 2nd.</p>											
<b>OHIO</b>											
OHZ003 East Lakeshore	09	2225 EST			0	0	?	0			Heavy Snow
<p>Six to twelve inches of snow fell over most of Geauga, Lake and Ashtabula counties. The heaviest snow fell in Harpersfield and Harts Grove, both in northern Ashtabula County. The snow began at 0700 EST on the 9th and ended at 0700 EST on the 12th.</p>											
OHZ003 East Lakeshore	17	1238 EST			0	0	?	0			Heavy Snow
<p>Six to ten inches of snow blanketed Geauga, Lake and Ashtabula counties. The highest snow amounts recorded were 16 inches in Chardon, Geauga county; and 13 inches in Rittland, Lake county. The snow began at 0800 EST on the 17th and ended at 1000 EST on the 18th.</p>											
OHZ001-009 Northwest and South-Central Ohio	Entire Month				0	0	0	0	C		Drought
<p>South-Central Ohio averaged two and sixty-two hundredths (2.62") inches of precipitation, which was 89 percent of normal. Northwest Ohio averaged one and ninety-three hundredths (1.93") inches, which translates into 84 percent of normal.</p> <p>South-Central Ohio improved from the Severe to the Moderate category of the Palmer Drought Severity Index. Northwest Ohio remained in the Severe category. Around 7 inches of precipitation is needed to end the long-term drought in both of these areas.</p>											
<b>34 OKLAHOMA</b>											
OKZ00C-ONE	27	0600CST-1600CST			0	5	?	?			Heavy Snow
<p>Up to 4 inches of snow fell across portions of East-Central and Northeast Oklahoma. The snow was mixed with sleet and freezing rain at times. Five injuries were attributed to automobile accidents as roads became snowpacked. The counties of Delaware, Sequoyah, Cherokee, and Mayes received the heaviest snowfall with amounts of 4 inches common.</p>											
<b>35 OREGON</b>											
ORZ001-005-006-013 North Oregon Coast, Cascade Mountains, and Siskiyou Mountains	20	0400-1600PST			0	0	?	0			Winter Storm, High Wind
<p>A strong cold front produced winds of up to 62 mph on the north coast of Oregon and 6 to 12 inches of snow in the Cascade and Siskiyou mountains.</p>											
ORZ005-006-013 Cascade and Siskiyou Mountains	21 to 22	2000PST-1600PST			0	0	?	0			Heavy Snow
<p>A strong cold front followed by very cool, unstable air produced the heaviest 24-hour snowfall totals for the month. Crater Lake received 19 inches of snow and Mount Hood Meadows had 18 inches.</p>											
Eastern Oregon, Southwestern Oregon, and Cascade Mountains	23 to 24	1700PST-1000PST			0	0	?	0			Winter Storm
<p>A low pressure system deepened off the south coast of Oregon and moved inland along the southern border. Two to four inches of snow fell in the southwest interior of the state; up to 6 inches of snow fell across most of eastern Oregon above 2000 feet in elevation. Up to a foot of snow fell in the Cascades.</p>											
ORZ011 Northeast Mountains	28 to 29	2000PST-1000PST			0	?	?	0			Winter Storm, Blizzard
<p>Overrunning moisture ahead of a cold front produced 4 to 8 inches of snow in the mountains of northeast Oregon. Strong southerly winds of up to 40 mph with blowing snow closed sections of Interstate 84 between Baker and Lagrange.</p>											
ORZ001-002-006-011-013 North and Central Coast, Cascade Mountains, and Northeast Mountains	29 to 30	1900PST-1700PST			0	?	?	0			Winter Storm, High Wind, Blizzard
<p>A strong cold front produced winds of up to 58 mph on the north and central coast of Oregon. Eight inches of snow fell in the Cascades, and 6 inches fell in the northeast mountains in addition to the previous day's snow. Winds of up to 40 mph in the northeast mountains caused blizzard-like conditions, again causing the closure of Interstate 84 between Baker and Lagrange.</p>											

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM												
					KILLED	INJURED	PROPERTY	CROPS													
<b>36 PENNSYLVANIA, Eastern</b>																					
PAZ009-011-012 Adams, York, Lancaster, and Lebanon Counties; All of East-Central and Southeast Pennsylvania	28	1445EST			3	7	6	0	High Wind (64)												
<p>High wind gusts developed behind a cold front that moved across the area. The high winds continued for 2 hours or more before subsiding somewhat. The high winds began in Adams County in the west shortly before 3 PM and along the Delaware River in the east by shortly after 4 PM. Many trees, tree limbs, power lines, and signs were downed throughout the area. The high gusts also damaged or tore off portions of roofs. Plate glass store or show room windows were blown in, as were other windows. Many automobiles or trucks were damaged or destroyed by falling trees or other debris. In Bedminster Township, Bucks County, a man was killed when a tree fell on his pickup truck. In Philadelphia, a decorative brick parapet was blown off a factory and killed two people sitting in automobiles four stories below. Quite a few houses were damaged by falling trees. Trailers and one cinder block building were blown off their foundations. A York County communications tower was blown down. In Lancaster County, two people were injured when hit by a Christmas tree blown off of a supermarket roof, three Amish people were injured when winds upset their buggy, and two people were injured when a tree blew over onto their automobile. Power outages were experienced by 75,000 or more customers. Some of the higher reported wind gusts were: 74 mph at Lancaster Airport at 3:45 PM, 52 mph at Harrisburg's Capital City Airport at 3:16 PM, 70 mph at G. O. Carlson Airport near Catesville in Chester County, 62 mph at Allentown Airport at 4:04 PM, 58 mph at Philadelphia International Airport at 6:23 PM, 69 mph in Kulpsville in Montgomery County between 3:30 and 4:30 PM, and 70 mph by the Philadelphia Electric Company in Delaware County between 4:30 and 5:30 PM. Some minor tree damage and power outages were also reported in Carbon and Schuylkill counties. M35V, F63V, M58V.</p>																					
<b>36 PENNSYLVANIA, Western</b>																					
PAZ002 Northwestern Pennsylvania	01	2200 EST			0	0	0	0	Heavy Snow												
Six to ten inches of snow fell inland of Lake Erie.																					
PAZ001-002 Northwestern Pennsylvania	11	0400 EST			0	0	0	0	Heavy Snow												
Eight to ten inches of snow fell along the Lake Erie shoreline and just inland.																					
<b>37 RHODE ISLAND</b>																					
RIZALL Statewide	28	1700-2200EST			0	0	4	0	High Winds												
<p>A fast-moving cold front was accompanied by a period of strong and gusty winds during which gusts were reported to be between 40 and 60 mph across the state. Falling trees and tree limbs resulted in scattered power outages. Up to 1200 electric customers were affected.</p>																					
<b>38 SOUTH CAROLINA</b>																					
SCZ003 Eastern Piedmont	28	PM			0	0	0	5	Forest Fires												
<p>Gusty winds following a cold frontal passage reached 35 to 45 mph across much of the state. There was very little, if any, wind damage reported. The winds contributed to forest fire damage in the eastern Piedmont.</p>																					
<b>39 SOUTH DAKOTA</b>																					
Hughes County, Pierre	04	1530 CST			1	0	0	0	Cold												
A man died of exposure near Pierre. M160.																					
SDZ001 Northwestern South Dakota	13	1130 to 1609 MST			0	0	3	0	High Wind												
<p>Strong winds occurred across northwestern South Dakota with a peak gust of 71 mph recorded at Buffalo. Minor damage occurred to a few small buildings.</p>																					
Stanley County, Fort Pierre	16	1800 MST			1	0	0	0	Cold												
A woman died of exposure near Fort Pierre. FB50.																					
SDZ004 Northeastern South Dakota	22	1241 to 2100 CST			0	0	0	0	Heavy Snow												
<p>Heavy snow occurred across northeastern South Dakota on the 22nd. Some of the larger amounts measured were 7 inches at Columbia, 6.5 inches at Aberdeen and 5 inches at Faulkton.</p>																					
SDZ001-002-003-004-005-006-008-009-010-011 Western and Northern South Dakota	25-26	1800 to 1800 CST			0	0	0	0	Heavy Snow												
<p>Six to twelve inches of snow fell across western and northern South Dakota. The following is a list of snowfall amounts in inches.</p> <table style="width: 100%; border: none;"> <tr><td>Timber Lake</td><td style="text-align: right;">12</td></tr> <tr><td>Seneca, Hoven</td><td style="text-align: right;">10 to 12</td></tr> <tr><td>Aberdeen</td><td style="text-align: right;">11</td></tr> <tr><td>Pierre, Eureka, Blunt</td><td style="text-align: right;">8</td></tr> <tr><td>Chelsea, Redfield, Cottonwood, Rapid City</td><td style="text-align: right;">7</td></tr> <tr><td>Ferney, Huron, Eden</td><td style="text-align: right;">6</td></tr> </table>										Timber Lake	12	Seneca, Hoven	10 to 12	Aberdeen	11	Pierre, Eureka, Blunt	8	Chelsea, Redfield, Cottonwood, Rapid City	7	Ferney, Huron, Eden	6
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Chelsea, Redfield, Cottonwood, Rapid City	7																				
Ferney, Huron, Eden	6																				
<b>40 TENNESSEE</b>																					
Madison County	24	0215CST			0	0	1	0	Thunderstorm wind												
<p>A severe thunderstorm knocked down several large trees and numerous tree limbs in the western part of the county as it moved east across the county.</p>																					
Shelby County, Memphis	24	0445CST			0	0	2	0	Thunderstorm wind												
<p>A severe thunderstorm produced damaging winds as it passed through Memphis moving east. A storage building and fence were destroyed at one business and a number of business signs were blown down and damaged.</p>																					
Williamson County, Franklin to Brentwood	24	0604 to 0613CST	6.0	150	1	7	7	0	Tornado (F4)												
<p>A tornado touched down shortly after 6am in the Rebel Meadows area of northwest Franklin. The tornado moved northeast at around 45 mph, leaving a spotty path of damage. The damage was severe in the places that it touched down. It lifted up for good in the Brenthaven area of the eastern part of Brentwood. Property damage was estimated at around \$8 million. Approximately 54 homes, 13 apartment units, 31 businesses and six parked airplanes were damaged or destroyed. There were seven reported injuries. One man was killed when the roof of his house fell in on him. M65P</p>																					
Tipton County, Covington	27	1810CST			0	0	2	0	Thunderstorm wind												
Shelby County	27	1840CST			0	0	2	0	Thunderstorm wind												
Fayette County	27	1855CST			0	0	2	0	Thunderstorm wind												
<p>Damaging thunderstorm wind blew a door off and knocked out several windows at the Covington Manor Nursing Home in Covington. Damaging thunderstorm wind knocked down trees and power lines in portions of Shelby County and pea size hail was reported in Bartlett of northeast Shelby County. In Fayette County trees were knocked down along Macon Road near the town of Macon as a severe thunderstorm passed through.</p>																					

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INURED	PROPERTY	CROPS	

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED DAMAGE		CHARACTER OF STORM
					KILLED	INURED	PROPERTY	CROPS	

### 41 TEXAS, Northern

Anderson County: 3 N Palestine 5 NE Palestine 2 S Neches	7 1715CST 7 1740CST 7 1810CST	0 0 ? 0 0 ? 0 0 ?	?	?	Hail (0.88) Hail (0.75) Hail (1.75)
Cherokee County: Jacksonville New Summerfield Leon County 2 E Centerville	7 1720CST 7 1745CST 7 1852CST	0 0 ? 0 0 ? 0 0 ?	?	?	Hail (0.75) Hail (1.75) Hail (0.75)
Thunderstorms produced hail in Anderson, Cherokee, and Leon Counties.					
Hopkins County 2 N Sulphur Springs	27 1115CST	0 0 ?	?	?	TSTM Wind
Harrison County Karnack	27 1510CST	0 0 ?	?	?	TSTM Wind
Panola County 4 SE Deadwood	27 1640CST	0 0 ?	?	?	TSTM Wind
Shelby County: 2 SE Shelbyville Huxley	27 1710CST 27 1710CST	0 0 ? 0 0 ?	?	?	TSTM Wind TSTM Wind
A thunderstorm downburst destroyed a barn and blew down three telephone poles two miles north of Sulphur Springs. Downbursts blew down trees at Karnack. Trees were also blown down four miles southeast of Deadwood and two miles southeast of Shelbyville. A roof was blown off a barn at Huxley.					

### 41 TEXAS, Southern

Hardin County	22 1730CST	0 0 4 0	Istm.Wind (?)
High winds from a thunderstorm tore the roof off of a residence just northeast of Votaw in the northwest part of county. Nearby sheds were destroyed and tree limbs downed.			
Tyler County	22 1745CST	0 0 4 0	Istm.Wind (?)
High winds from a thunderstorm, likely the same cell that produced the damage above, blew the roof off of a home east of Warren in the southern part of the county. Nearby trees were uprooted and lots of limbs downed.			
Orange County	27 2105CST	0 0 0 ?	Istm.Wind (?)
High winds from a thunderstorm blew over large trees north of Vidor.			
Jefferson County	27 2115CST	0 0 0 ?	Istm.Wind (?)
High winds from a thunderstorm downed large tree limbs in the City of Port Arthur.			
Orange County	27 2115CST	0 0 0 ?	Istm.Wind (?)
High winds from a thunderstorm downed large tree limbs near Mauriceville in the northern part of the county.			

### 41 TEXAS, Western

Culberson County	5 1549 MST	0 0 0 0	High Wind (64)
A westerly gradient wind gusted in excess of 50 knots between 0849 MST and 1929 MST at Guadalupe Pass, in the northwest corner of the county. Between 1549 and 1729 MST gusts attained a speed of 64 knots at the remote mountain site. No damage was observed in the sparsely populated area.			
Lubbock County	5 1458 CST	0 0 0 0	High Wind (50)
Gradient wind gusted to 50 knots at Reese Air Force Base, in the westernmost portion of the county. No damage was reported.			
Midland County	8 0804 CST	1 0 4 0	Ice Storm
A winter-like storm that brought icy roadways across the county resulted in a number of automobile accidents and at least one fatality. Ice pellets began to fall at Midland Regional Airport at 0200 CST and continued until approximately 0800 CST. Freezing rain accompanied the sleet between 0700 and 0800 CST, and the mixed freezing precipitation created very dangerous road conditions. Rush-hour accidents totalled approximately two dozen, among which was the fatal collision at 0804 CST on Briarwood Avenue in northwest Midland. The victim, 26-year-old Debra McAden of Midland, lost control of her automobile and collided with an oil field truck.			

F26V

### 42 UTAH

UTZ003	14 1855MST	0 0 6 0	High Wind (857)
UTZ003	14 2240MST	0 0 6 0	High Wind (887)
UTZ003	15 0705MST	0 0 2 0	High Wind (883)
Wasatch Front A severe canyon wind episode caused an estimated 10 million dollars damage along the Wasatch Front. Wind gusts from 60 mph to over 100 mph were reported by spotters from Davis County north along the Wasatch front many times during the night. Most of the damage occurred in Davis and Weber Counties, with some damage as far north as Cache County. The Ogden Defense Depot sustained an estimated \$1.03 million in damage to roofs, broken windows, doors, etc. One house under construction was destroyed, and several large trucks were blown over.			
UTZ003	19 0625MST	0 0 1 0	Heavy Snow
UTZ006	19 0815MST	0 0 1 0	Heavy Snow
UTZ011	19 0820MST	0 0 1 0	Heavy Snow
Wasatch Front, Southern Mountains A low pressure center moving through Southern Utah produced heavy snowfall as far north as Utah County overnight. Spotters in Orem and Provo reported from 6 to 12 inches of snow accumulation during the early morning hours. In the southern mountain areas spotters reported 10 inches at Duck Creek and 15 inches at the Elk Meadows ski resort. Two people were killed when a small car slid out of control on snowpacked Highway 6 west of Soldier Summit, and was hit broadside by a truck in the other lane.			
UTZ010	21 0800MST	0 0 1 0	Heavy Snow
UTZ001	21 0930MST	0 0 1 0	Heavy Snow
UTZ003	21 1210MST	0 0 1 0	Heavy Snow
UTZ005	21 1335MST	0 0 1 0	Heavy Snow
UTZ011	21 1525MST	0 0 1 0	Heavy Snow
UTZ010	21 1600MST	0 0 1 0	Heavy Snow
UTZ003	21 1705MST	0 0 1 0	Heavy Snow
Cache Valley, Northern Mountains, Wasatch Front, Southern Mountains, and the Castle Valley Heavy snow spread across the northwest part of Utah during the morning hours, then moved into the south during the afternoon. Overnight snowfall amounts in the northern Wasatch ski resorts ranged from 4 to 9 inches. In the Cache Valley 4 inches of new snow accumulated overnight, with 4 to 6 inches piling up further south in Davis and Weber Counties by midday. A spotter in Price reported 8-10 inches of new snow by early afternoon. In the Southern Mountains, Duck Creek and Glendale reported 8 and 10 inches respectively by the early afternoon hours. By late afternoon a spotter in Spanish Fork reported 8 inches of new snow, and the Alta ski resort had recorded 11.5 inches of new snow in the 12 hours preceding 4 p.m..			
UTZ008	23 0610MST	0 0 1 0	Heavy Snow
UTZ010	23 0625MST	0 0 1 0	Heavy Snow
UTZ003	23 0745MST	0 0 1 0	Heavy Snow
UTZ003	23 1136MST	0 0 1 0	Heavy Snow
Southeast Valleys, Northern Mountains, Wasatch Front Heavy snowfall occurred overnight for a wide range of locations across the state. From 6 to 12 inches fell in the Kanab area, and 8 to 13 inches in the northern Wasatch Mountains. Four to six inches fell along the Wasatch Front during the night, then an additional 5 inches fell during the morning hours between 7:30 a.m. and 11:35 a.m. in Centerville, and Bountiful.			
UTZ005	24 0625MST	0 0 1 0	Heavy Snow
Castle Valley Five to six inches of snow fell in Clawson overnight.			
UTZ008	25 0430MST	0 0 1 0	Heavy Snow
UTZ001	25 0630MST	0 0 1 0	Heavy Snow
UTZ005	25 0650MST	0 0 1 0	Heavy Snow
UTZ011	25 0850MST	0 0 1 0	Heavy Snow
UTZ010	25 0910MST	0 0 1 0	Heavy Snow
UTZ003	25 0935MST	0 0 1 0	Heavy Snow
UTZ003	25 1635MST	0 0 5 0	Heavy Snow
Southeast Valleys, Cache Valley, Castle Valley, Southern Mountains, Northern Mountains, and Wasatch Front A low pressure system in the south and another Pacific storm moving into the north produced heavy snow over much of the state on Christmas Day. By the early morning hours from 4 to 12 inches of new snow had fallen over many of the western valleys of the state, and nearly two feet in a few of the mountain locations. A few of the heavier storm total amounts included, 14 inches at Clarkston by 9:25 a.m., 21 inches at Deer Valley by 1:15 p.m., 12 to 14 inches in the Salt Lake Valley for the 24 hours ending at about 5:00 p.m., and around 14 inches in some spots in Davis County. The roof of a Fred Meyer store caved in near the end of the storm, due to the large accumulation of snow.			
UTZ002	31 2110MST	0 0 1 0	Heavy Snow
Box Elder County The Utah Highway Patrol in Box Elder County reported 6 to 8 inches of new snow accumulation during the evening hours.			

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

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					KILLED	INJURED	PROPERTY	CROPS	
<b>43 VERMONT</b>									
Statewide	10 PM to 16 AM				0	?	?	?	Cold Wave
	Cold temperatures tied or set many records across Vermont. Power demands reached or exceeded previous peak demands. Hundreds of broken water pipes, and fires were blamed on the cold wave.								
Statewide	20 0605-0845EST				0	4	5	?	Freezing Rain
	Freezing rain brought morning traffic to a standstill. Hundreds of accidents were reported around the state. One male was injured when he was tossed off the back of a refuse truck as it slid and spun out of control on an ice-covered road.								
<b>44 VIRGINIA</b>									
VAS002-003-006-007-008-009-010-011-012-013-014-015-016	7	2300EST			0	0	?	0	Snow
	Snow began just before midnight, December 7 in extreme southwestern Virginia then overspread central and eastern Virginia on the 8th and the morning of the 9th. The heaviest snow fell in the mountain districts during the predaylight hours. Skyline Drive closed at Big Meadows in Page County where 7 to 8 inches fell. Up to 8 inches fell in Bland County and 4 to 6 inches in Pulaski County. Seven to 9 inches was reported in Tazewell County. Generally 1 to 3 inches fell in the piedmont and coastal areas during the late morning and midday hours on the 9th.								
Entire State	28	1430-1700EST			0	9	5	0	High Winds (56 kt)
	Strong winds developed behind a cold front, producing widespread damage. Gusts reached 45 knots in Roanoke, knocking over a partially constructed wall, injuring two workers. In Augusta County winds peaked at 45 to 50 knots. An empty 18-wheeler was blown off I-81 in Shenandoah County, where gusts reached 50 knots. A townhouse was partially destroyed when 40 to 50 knot winds blew over a fire wall. Dulles Airport reported a peak gust of 49 knots at 3:28 pm; 49 knots was also reported in Richmond, where pieces of building material on the 15th and 16th floor of a hotel were ripped off. Norfolk Airport reported 44 knots at 2:45 pm. A church addition was damaged in Ring William County by 56 knot gusts. Four construction workers were injured in Prince William County where a roof blew off a house under construction. Three older persons in the northern part of the state were injured by debris. Numerous trees and power lines were downed, causing widespread power outages. Several unoccupied cars were demolished by falling trees in northern Virginia. Average winds in northern Virginia were 35 to 43 knots. The winds followed a cold front that also produced a sharp temperature drop; many areas dropped 20 to 25 degrees in 1 to 2 hours.								
<b>45 WASHINGTON</b>									
WAZ001-002-012 Northwest Interior and North-Central Washington	12	1800PST			0	0	4	0	High Wind
	A cold front extending from a low pressure center moving over the Queen Charlotte Islands of British Columbia caused strong winds during the evening in the Northwest Interior and overnight in parts of North-Central Washington. Power outages were scattered from Port Angeles, across Kitsap, Snohomish, and King counties, and into Okanogan County. A falling tree near Port Angeles damaged a vintage sports car and caused minor damage to the house next to which it was parked. Wind gusts to 56 mph caused a half hour closure of the Hood Canal Floating Bridge.								
<b>46 WEST VIRGINIA</b>									
Hampshire County	28	0230EST			0	0	?	0	High Winds
	Winds reported to be in excess of 80 mph folded over a 300 foot section of roof from an elementary school, causing an estimated \$75,000 damage. Trees were blown down and signs were damaged also.								
Berkley County	28	0250EST			0	0	?	0	High Winds
	Wind gusts in excess of 50 mph blew through the county, downing trees and power lines which blocked roadways. The high winds were associated with a strong, fast-moving cold front.								
<b>47 WISCONSIN</b>									
WIZ001-002 Lake Superior Snowbelt	13	Evening into 14 Morning			0	0	0	0	Heavy Snow
	A snowstorm dumped from 6 to 10 inches of snow across the Lake Superior Snowbelt. Snow amounts included 10 inches at Poplar (Douglas County), 8 inches at Iron River (Bayfield County) and Mellen (Ashland County). US Highway 2 across the snowbelt area became snow covered and a few accidents were reported.								
<b>48 WYOMING</b>									
WYZ005-010-011-012-016-017 NORTHERN FRONT RANGE, WIND RIVER BASIN, CENTRAL PLAINS, EASTERN PLAINS, LARAMIE VALLEY, SOUTHEAST PLAINS	07	0001 TO 2000MST			0	0	0	0	SNOW
	A WEAK UPPER-LEVEL STORM SYSTEM COMBINED WITH A MOIST, UPSLOPE, NORTHEASTERLY SURFACE FLOW PRODUCED GENERALLY 1 TO 4 INCHES OF SNOW ACROSS EASTERN WYOMING DURING THE 7TH, WITH 6 TO 8 INCHES IN THE LARAMIE RANGE. SOME SPECIFIC SNOWFALL AMOUNTS INCLUDED 4 INCHES AT SHERIDAN AND DOUGLAS, WITH 3 INCHES AT CHEYENNE AND LANDER.								
WYZ016 LARAMIE VALLEY	09	0001 TO 0200MST			0	0	0	0	HIGH WIND
	DURING THE EARLY MORNING OF THE 9TH, STRONG SOUTHWEST WINDS HAVING SUSTAINED SPEEDS OF 50 MPH WITH GUSTS TO 61 MPH OCCURRED AT VEDAUNOO. THIS IS LOCATED NEAR THE INTERSTATE 80 SUMMIT ABOUT 20 MILES WEST OF CHEYENNE.								
WYZ002-006-006-011-012-016-017 NORTHWEST CHINOOK, NORTHERN FRONT RANGE, NORTHEASTERN PLAINS, CENTRAL PLAINS, EASTERN PLAINS, LARAMIE VALLEY, SOUTHEAST PLAINS	13	0400 TO 2100MST			0	0	?	0	HIGH WIND
	THE COMBINATION OF A STRONG, WESTERLY UPPER-LEVEL FLOW AND AN EMBEDDED DISTURBANCE CREATED STRONG CHINOOK WINDS OVER A SMALL PORTION OF NORTHWESTERN WYOMING ALONG WITH MOST OF THE EASTERN PART OF THE COWBOY STATE ON THE 13TH. NUMEROUS REPORTS OF SUSTAINED WIND SPEEDS OF 40 MPH WITH GUSTS IN EXCESS OF 60 MPH WERE LOGGED. SOME OF THESE REPORTS INCLUDED THE CITY OF CODY. IN FAR NORTHWESTERN WYOMING, WITH A GUST TO 63 MPH AT 1045 MST AND SHERIDAN HAVING A GUST TO 62 MPH AT 1125 MST. VARIOUS LOCATIONS IN CASPER HAD GUSTS BETWEEN 58 MPH AND 67 MPH. FINALLY, SEVERAL INDEPENDENT OBSERVERS ABOUT 25 TO 50 MILES NORTH OF CHEYENNE RECORDED PEAK WIND GUSTS BETWEEN 55 MPH AND 70 MPH DURING THAT AFTERNOON.								

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS				ESTIMATED <sup>1</sup> DAMAGE	CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS		
<b>WYOMING</b>										
WY2012-016-017 EASTERN PLAINS, LARAMIE VALLEY, SOUTHEAST PLAINS	14-15	0800MST-1200MST			0	0	0	0	SNOW	
WY2013-014 SOUTHWEST RED DESERT	14-15	0800MST-1200MST			0	0	5	0	BLIZZARD	
WY2015 SOUTHERN MOUNTAINS	14-15	1200MST-1200MST			0	0	0	0	HEAVY SNOW	
			<p>AN UPPER-LEVEL STORM SYSTEM, MOVING EASTWARD THROUGH THE ROCKIES, AND A STRONG ARCTIC COLD FRONT MOVING SOUTHWARD ALONG THE EAST SLOPES OF THE MOUNTAINS, COMBINED TO PRODUCE ADVERSE WEATHER CONDITIONS ACROSS SOUTHERN WYOMING. DURING A 24-HOUR PERIOD ENDING AT 1200 MST ON THE 15TH, THE SNOWY RANGE SKI RESORT RECEIVED 11 INCHES OF NEW SNOW. MOST OTHER LOCATIONS ACROSS SOUTHERN WYOMING ACCUMULATED 1 TO 6 INCHES. SOME OF THESE REPORTS INCLUDED 6 INCHES AT LONETREE AND 4 INCHES AT LYMAN, LOCATED IN THE EXTREME SOUTHWESTERN PORTION OF THE COWBOY STATE. THE AIRPORT AT LANDER PILED UP 5 INCHES OF NEW SNOW.</p> <p>IN ADDITION TO THE SNOW, STRONG NORTHEAST WINDS OF 20 TO 35 MPH WITH FREQUENT GUSTS TO AROUND 50 MPH DEVELOPED OVER SOUTHWESTERN WYOMING DURING THE 14TH. THIS CAUSED BLIZZARD CONDITIONS AS SURFACE VISIBILITIES WERE REDUCED TO NEAR ZERO. THE RESULT WAS NUMEROUS AUTOMOBILE ACCIDENTS AND THE CLOSURE OF INTERSTATE 80 BETWEEN EVANSTON AND LYMAN. TWO ACCIDENTS RESULTED IN FATALITIES. THREE MOTORISTS WERE KILLED AND 4 INJURED DUE TO WEATHER-RELATED ACCIDENTS ON INTERSTATE 80. ALSO, THESE WINDS BLEW DOWN A 25- BY 50-FOOT GARAGE AT A HOME RESIDENCE NORTH OF EVANSTON, RESULTING IN ABOUT 25,000 DOLLARS IN DAMAGE. OTHER ISOLATED DAMAGE TO STRUCTURES WAS REPORTED THROUGHOUT THE CITY OF EVANSTON AND UINTA COUNTY.</p>							
WY2001 NORTHWEST MOUNTAINS	20-21	1800MST-1930MST			0	0	0	0	HEAVY SNOW	
WY2007-013 WESTERN MOUNTAINS, SOUTHWEST	20-21	1800MST-1930MST			0	0	0	0	SNOW	
			<p>THE COMBINATION OF AN EASTWARD-MOVING UPPER-LEVEL TROUGH AND A SURFACE PACIFIC COLD FRONT RESULTED IN A FAIRLY PROLONGED EVENT OF MOSTLY LIGHT SNOW ACROSS EXTREME WESTERN WYOMING. THE EXCEPTION WAS OVER THE NORTHWEST MOUNTAINS WHERE 11 INCHES OF NEW SNOW FELL AT GRANT VILLAGE, LOCATED IN YELLOWSTONE PARK, AND A SKI AREA AT TETON VILLAGE, NORTH OF THE TOWN OF JACKSON, HAVING REPORTED 7 TO 10 INCHES. OTHER AMOUNTS INCLUDED 2 TO 4 INCHES IN THE TOWN OF JACKSON, 3 INCHES AT EVANSTON AND 1 INCH AT KEMMERER. OLD FAITHFUL AND THE SOUTH ENTRANCE, LOCATED IN YELLOWSTONE PARK, ACCUMULATED 6 INCHES AND 4 INCHES OF NEW SNOW, RESPECTIVELY.</p>							
WY2016-017 LARAMIE VALLEY, SOUTHEAST PLAINS	22	0200 TO 1200MST			0	0	0	0	HIGH WIND	
			<p>DURING THE MORNING HOURS OF THE 22ND, STRONG WINDS WERE REPORTED ACROSS FAR SOUTHEASTERN WYOMING. SOME PEAK GUSTS INCLUDED 63 MPH AT VEDAWOOD, LOCATED ABOUT 20 MILES WEST OF CHEYENNE, AND 59 MPH AT THE CHEYENNE AIRPORT. AN OBSERVER LOCATED IN THE LARAMIE RANGE, ABOUT HALFWAY BETWEEN CHEYENNE AND LARAMIE, REPORTED SUSTAINED WIND SPEEDS OF 40 TO 45 MPH WITH GUSTS BETWEEN 80 AND 85 MPH.</p>							
<b>WYOMING</b>										
WY2013 SOUTHWEST	24-25	1930MST-2300MST			0	0	0	0	HEAVY SNOW	
WY2010-011-014-015-016 WIND RIVER BASIN, CENTRAL PLAINS, RED DESERT, SOUTHERN MOUNTAINS, LARAMIE VALLEY	25	0100 TO 2359MST			0	0	0	0	SNOW	
			<p>AN UPPER-LEVEL STORM SYSTEM DEVELOPING OVER THE NORTHERN ROCKIES PRODUCED WIDESPREAD SNOW ACROSS MUCH OF THE COWBOY STATE DURING THE 25TH. THE LARGEST SNOWFALL REPORTED WAS AT EVANSTON, WHERE 12 INCHES PILED UP IN ABOUT 27 HOURS. OTHER AREAS MOSTLY IN CENTRAL WYOMING ACCUMULATED BETWEEN 2 AND 6 INCHES. SOME REPORTS INCLUDED 5 INCHES AROUND LANDER AND IN THE SNOWY RANGE MOUNTAINS. THE INTERSTATE 80 SUMMIT, ABOUT HALFWAY BETWEEN CHEYENNE AND LARAMIE, PICKED UP ABOUT 3 TO 4 INCHES OF NEW SNOW.</p>							
WY2016 LARAMIE VALLEY	26	0800 TO 1200MST			0	0	0	0	HIGH WIND	
			<p>DURING THE LATE MORNING OF THE 26TH, SUSTAINED WIND SPEEDS OF 45 TO 55 MPH WITH GUSTS TO 63 MPH OCCURRED AT VEDAWOOD. THIS IS LOCATED NEAR THE INTERSTATE 80 SUMMIT, ABOUT HALFWAY BETWEEN CHEYENNE AND LARAMIE.</p>							
WY2002-016 NORTHWEST CHINOOK, LARAMIE VALLEY	29	0600 TO 2359MST			0	0	0	0	HIGH WIND	
			<p>STRONG WINDS DEVELOPED ABOVE 7,500 FEET DURING THE EARLY MORNING OF THE 29TH AND CONTINUED FOR THE REST OF THAT DAY. CODY, LOCATED ALONG THE EAST SLOPES OF THE ABSAROKA MOUNTAINS IN NORTHWEST WYOMING, HAD WIND GUSTS TO 58 MPH. ALONG INTERSTATE 80 FROM CHEYENNE TO RAWLINS, WINDS GUSTED IN EXCESS OF 60 MPH ABOVE 7,500 FEET. CRYSTAL RESERVOIR, ABOUT 15 MILES WEST OF CHEYENNE, LOGGED GUSTS GREATER THAN 80 MPH. WINDS GUSTING OVER 80 MPH WERE ALSO REPORTED IN THE LARAMIE RANGE, ABOUT HALFWAY BETWEEN THE CITIES OF CHEYENNE AND LARAMIE.</p>							
<b>49 ALASKA, Northern</b> ——— NO REPORT RECEIVED										
<b>49 ALASKA, Southern</b>										
North Gulf Coast	2	1800AST			0	0	3	0	High Winds	
			<p>A strong 962 mb low in the Gulf of Alaska produced wind gusts to 60-65 mph from Kodiak Island east to Yakutat. Heavy snow east of Anchorage triggered seven avalanches.</p>							
Aleutians	3	1800 AST			0	0	2	0	Blizzard	
			<p>A storm produced blizzard conditions on the island of Amchitka with 2 feet of snow and gusts to 60 mph.</p>							
Kodiak Island	7	1200 AST			0	0	2	0	High Winds	
			<p>A 982 mb low south of Kodiak Island produced gusts of 55-75 mph around Kodiak Island and over portions of Bristol Bay.</p>							

# STORM DATA AND UNUSUAL WEATHER PHENOMENA

DECEMBER 1988

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS		ESTIMATED <sup>1</sup> DAMAGE		CHARACTER OF STORM
					KILLED	INJURED	PROPERTY	CROPS	
<b>ALASKA, Southern</b>									
Aleutians	10-11	1800 AST			2	3	6	0	High Winds and Blizzard
	<p>An intense 960 mb low south of the Alaska Peninsula produced strong winds from near Adak Island in the Aleutians to Kodiak Island. Wind gusts over the eastern Aleutians were reported in excess of 100 mph. Saint Paul Island in the Bering Sea and Cold Bay on the Alaska Peninsula reported blizzard conditions. A Japanese, 288 foot cargo vessel was lost along with a 115 foot fishing vessel. Significant damage occurred to the runway and road system around Dutch Harbor.</p>								
Aleutians to South-Central Alaska	13	1500 AST			0	0	5	0	High Winds
	<p>A strong 962 mb low south of Adak Island in the Aleutians produced strong gusty winds from the Alaska Peninsula to South-Central Alaska. Wind gusts to 80 mph were reported in the Anchorage Bowl with 90-100 mph gusts in Turnagain Arm east of Anchorage.</p>								
Aleutians and Alaska Peninsula	17	1800 AST			0	0	2	0	High Winds
	<p>A strong 968 mb low moved north through the Aleutians producing wind gusts to 60 mph at Nikolski, 62 mph at Dutch Harbor, 54 mph at Saint Paul Island in the Bering Sea, and 72 mph at Cold Bay.</p>								
Aleutians	23	1200 AST			0	0	2	0	High Winds
	<p>A 970 mb low in the Aleutians produced wind gusts to 60 mph at Adak Island and Cold Bay, and 80 mph at Port Heiden on the Alaska Peninsula.</p>								
Aleutians	26	1500 AST			0	0	5	0	High Winds
	<p>A very intense 947 mb low moved through the Aleutians near Adak Island. It produced wind gusts to 70+ mph at Adak Island, 62 mph at Cold Bay and 70 mph at Nikolski. Several ships reported winds of 60-85 mph near Unimak Pass at the eastern end of the Aleutians. A boat in the harbor at Onalaska (Dutch Harbor) reported winds above 100 mph.</p>								
Aleutians	30	1200 AST			0	0	3	0	High Winds
	<p>A strong low in the central Bering Sea moved through the Aleutians near Adak Island. Gusts to near 65 mph were reported at Adak, Cold Bay and Port Heiden with near blizzard conditions reported over Bristol Bay and the Yukon Kuskokwim Delta.</p>								
<b>49 ALASKA, Southeastern</b> — NONE REPORTED									
<b>50 HAWAII</b>									
Oahu, Molokai, Lahai, and Maui	5-6				0	0	5	0	Flash Flooding, Wind, and Lightning
	<p>A low pressure system developed northwest of the Hawaiian Islands with a cloud band that moved across Kauai late on the 5th, into Oahu early on the 6th, and to Maui during the forenoon hours on the 6th. Rainfall was heaviest on Maui where in excess of 10 inches fell on west Maui. Some flooding and road closures occurred on west Maui and near Kihui. There was localized flooding on Oahu as well. Strong southerly winds gusting near 50 mph caused minor wind damage along the normally windward slopes. There were reports of lightning damage to radio transmitter equipment and to electrical transformers.</p>								
Maui and Hawaii	17-18				0	0	4	4	Rain and Ice
	<p>A cold upper low pressure system dropped southward and later south-westward over the Hawaiian Islands bringing with it some isolated heavy thunderstorms with hail and gusty winds. Some ice and lightning damage occurred at a transmitter site on Mount Haleakala. Severe wind, snow, ice and cold caused the evacuation of astronomical observatories on Mauna Kea. Cold and wet conditions caused some damage to tender crops.</p>								
Statewide	30-31				0	0	4	0	Wind and Surf
	<p>A strong high pressure system located to the northeast of the Islands caused gusty easterly winds which gusted locally at 40 to 50 mph. Many trees and utility poles were blown over on Maui and the Big Island. Power outages were extensive on west Maui. An easterly swell caused minor surf damage along the Puna beaches on Hawaii.</p>								
<b>51 PUERTO RICO</b> — NONE REPORTED									
<b>52 VIRGIN ISLANDS</b> — NONE REPORTED									
<b>53 PACIFIC</b> — NONE REPORTED									

# STORM SUMMARY

DECEMBER 1988

TYPE	ALABAMA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND & DC	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE
<b>TORNADOES</b>	0				0				0								0				0			0			
Number								2								1						16					
Days								1								1						4					
Deaths								0								1						0					
Injuries								0								1						0					
Property Damage								5								1						6					
Crop Damage								0								5						0					
<b>HAIL</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>THUNDERSTORM WINDS</b>																											
Deaths			0					0					0	0	0	0						0					
Injuries			0					0					0	0	0	0						0					
Property Damage			?					3					4	4	5	5						5					
Crop Damage			?					0					0	0	0	0					0						
<b>HIGH WINDS</b>																											
Deaths				0		0	0			0	1			0				0	0	0				0		0	
Injuries				0		0	0			0	0			0				4	5	3				0		0	
Property Damage				7		5	?			5	?			4				5	5	3				6		0	
Crop Damage				4		0	0			0	?			0				0	0	0				5		0	
<b>LIGHTNING</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>FLASH FLOODS</b>																											
Deaths																						0					
Injuries																						0					
Property Damage																						4					
Crop Damage																						0					
<b>FLOODS</b>																											
Deaths				0																							
Injuries				0																							
Property Damage				3																							
Crop Damage				0																							
<b>HEAVY SNOWSTORMS AND BLIZZARDS @</b>																											
Deaths			0	0					0	0	0	0														0	
Injuries			0	0					0	0	0	0														0	
Property Damage			?	4					5	?	?	?														3	
Crop Damage			?	0					0	0	?	?														0	
<b>ICE STORMS #</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>HURRICANES AND TROPICAL STORMS</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>ALL OTHERS</b>																											
Deaths		0		5						0																0	
Injuries		0		1						0																0	
Property Damage		0		0						5																0	
Crop Damage		?		?						0																0	

SEE REFERENCE NOTES FOR STORM DAMAGE CATEGORIES

# STORM SUMMARY

DECEMBER 1988

TYPE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	ALASKA	HAWAII	PACIFIC	PUERTO RICO	VIRGIN ISLANDS	NATIONAL DEATH & INJURY TOTALS
<b>TORNADOES</b>				0																0		4		0	0	0	
Number													1														
Days													1														
Deaths													1														1
Injuries													1														8
Property Damage													7														
Crop Damage													0														
<b>HAIL</b>																											
Deaths														0													
Injuries														0													
Property Damage														?													
Crop Damage														?													
<b>THUNDERSTORM WINDS</b>																											
Deaths													0	0													
Injuries													0	0													
Property Damage													3	4													
Crop Damage													0	?													
<b>HIGH WINDS</b>																											
Deaths	0		0	0				0	3	0	0	0			0		0	0	0					0			4
Injuries	1		3	0				?	7	0	0	0			0		9	0	0				0				
Property Damage	5		5	4				?	6	4	3				6		5	4	?				?				27?
Crop Damage	0		0	0				0	0	0	0			0		0	0	0					0				
<b>LIGHTNING</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>FLASH FLOODS</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>FLOODS</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>HEAVY SNOWSTORMS AND BLIZZARDS @</b>																											
Deaths		0	0	0	0	0	0	0	0	0	0	0	0		0												0
Injuries	?	0	0	0	0	0	0	?	?	?	?	?			0						0						?
Property Damage	?	?	5	4	?	?	?	?	?	?	?	?			5												
Crop Damage	0	0	0	0	0	?	?	0	?	?	?	?			0						0						
<b>ICE STORMS #</b>																											
Deaths			0	0										0			0										
Injuries			0	0										0			0										
Property Damage			6	4										4			5										
Crop Damage			0	0										0			?										
<b>HURRICANES AND TROPICAL STORMS</b>																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
<b>ALL OTHERS</b>																											
Deaths	0	0				0					0	2															7
Injuries	0	0				0					0	0															1?
Property Damage	?	?				0					0	0															
Crop Damage	0	?				?					5	0															

SEE REFERENCE NOTES FOR STORM DAMAGE CATEGORIES.

## STORM DAMAGE CATAGORIES

## REFERENCE NOTES

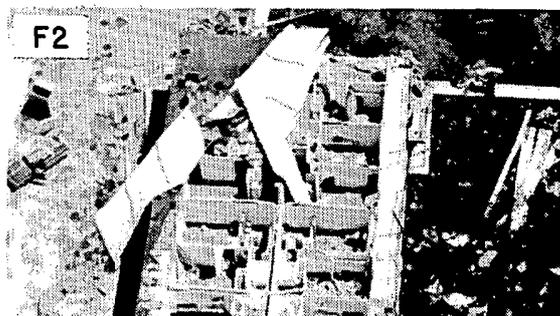
- 1 Less than \$50
- 2 \$50 to \$500
- 3 \$500 to \$5,000
- 4 \$5,000 to \$50,000
- 5 \$50,000 to \$500,000
- 6 \$500,000 to \$5 Million
- 7 \$5 Million to \$50 Million
- 8 \$50 Million to \$500 Million
- 9 \$500 Million to \$5 Billion

- 0/Blank None reported.  
 \* Miles instead of yards.  
 \*\* Yards instead of miles.  
 @ Includes heavy sleet storm.  
 # Freezing drizzle and freezing rain, commonly known as glaze.  
 ≠ Report incomplete.  
 ≠# Report not received.  
 o/c Indicates Crop Damage amount is included in the value given for property damage.

When reports are not received or are incomplete, the Storm Summary National Death and Injury totals may also be incomplete.

### Definition of Fujita Tornado Scale (F scale)

(F0) Gale tornado (40-72 mph): Light damage  
 Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage sign boards.



(F1) Moderate tornado (73-112 mph): Moderate damage  
 The lower limit (73 mph) is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads.



(F2) Significant tornado (113-157 mph): Considerable damage  
 Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.

(F3) Severe tornado (158-206 mph): Severe damage  
 Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.



(F4) Devastating tornado (207-260 mph): Devastating damage  
 Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.

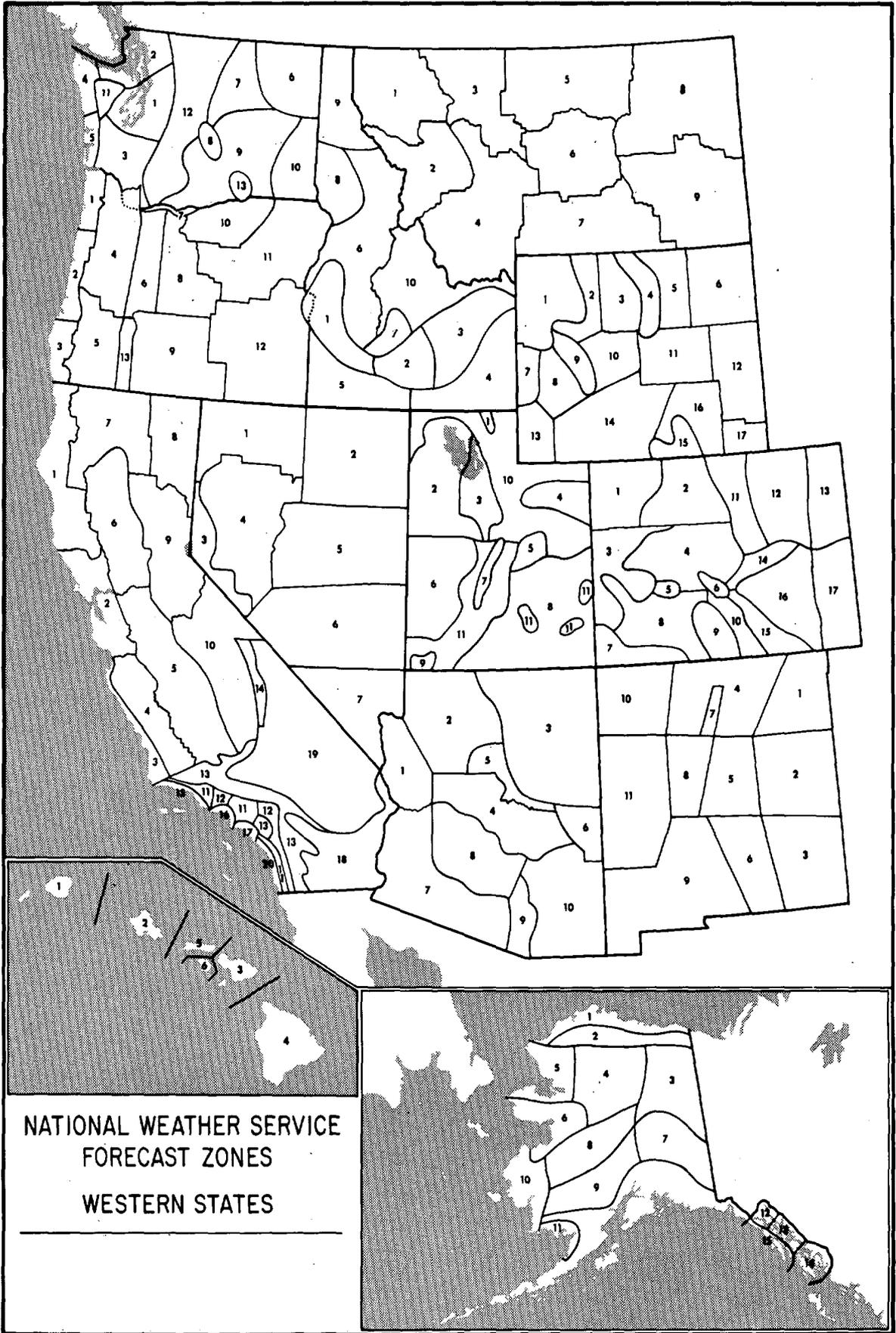
(F5) Incredible tornado (261-318 mph): Incredible damage  
 Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 m; trees debarked; incredible phenomena will occur.

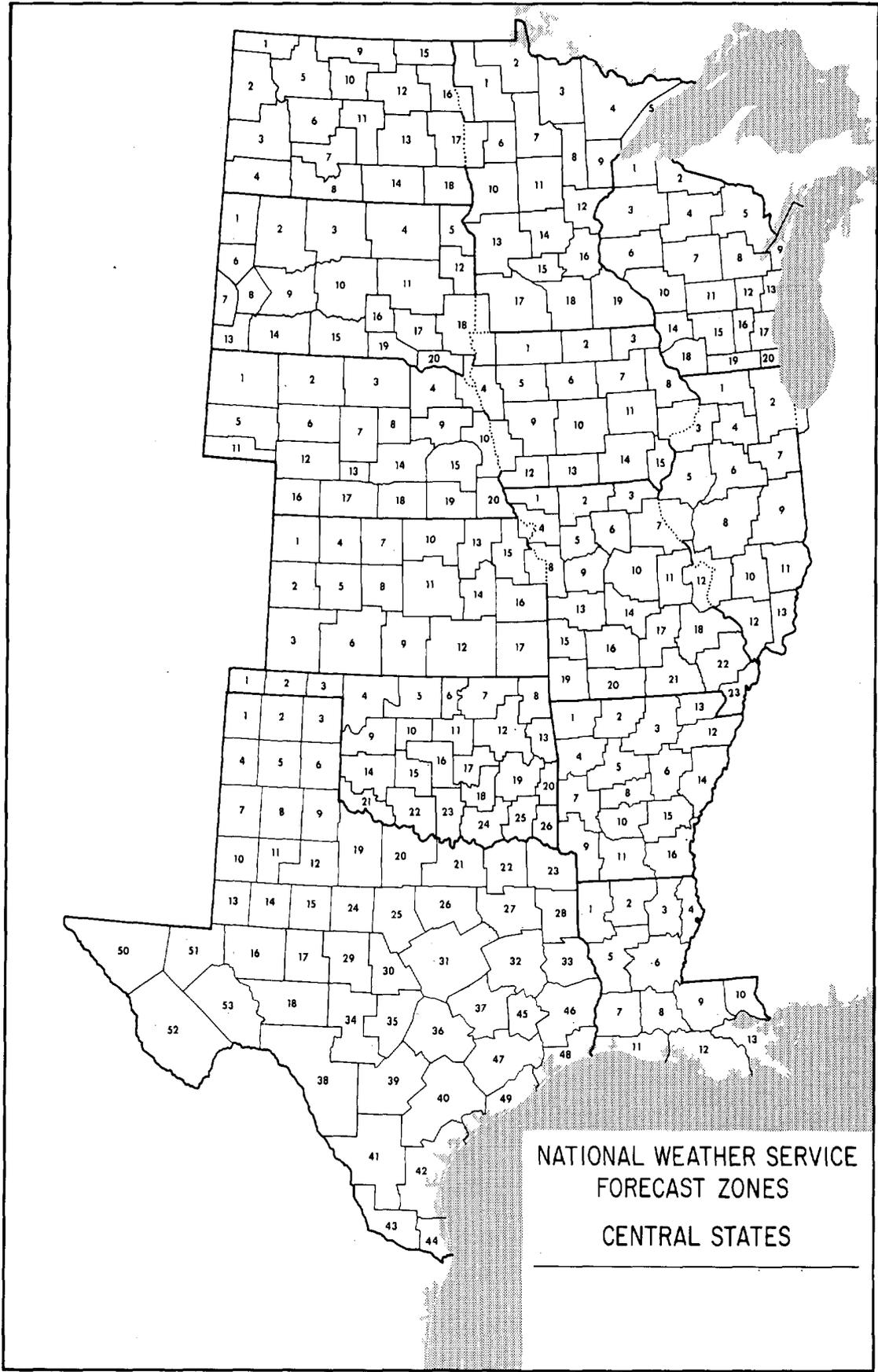


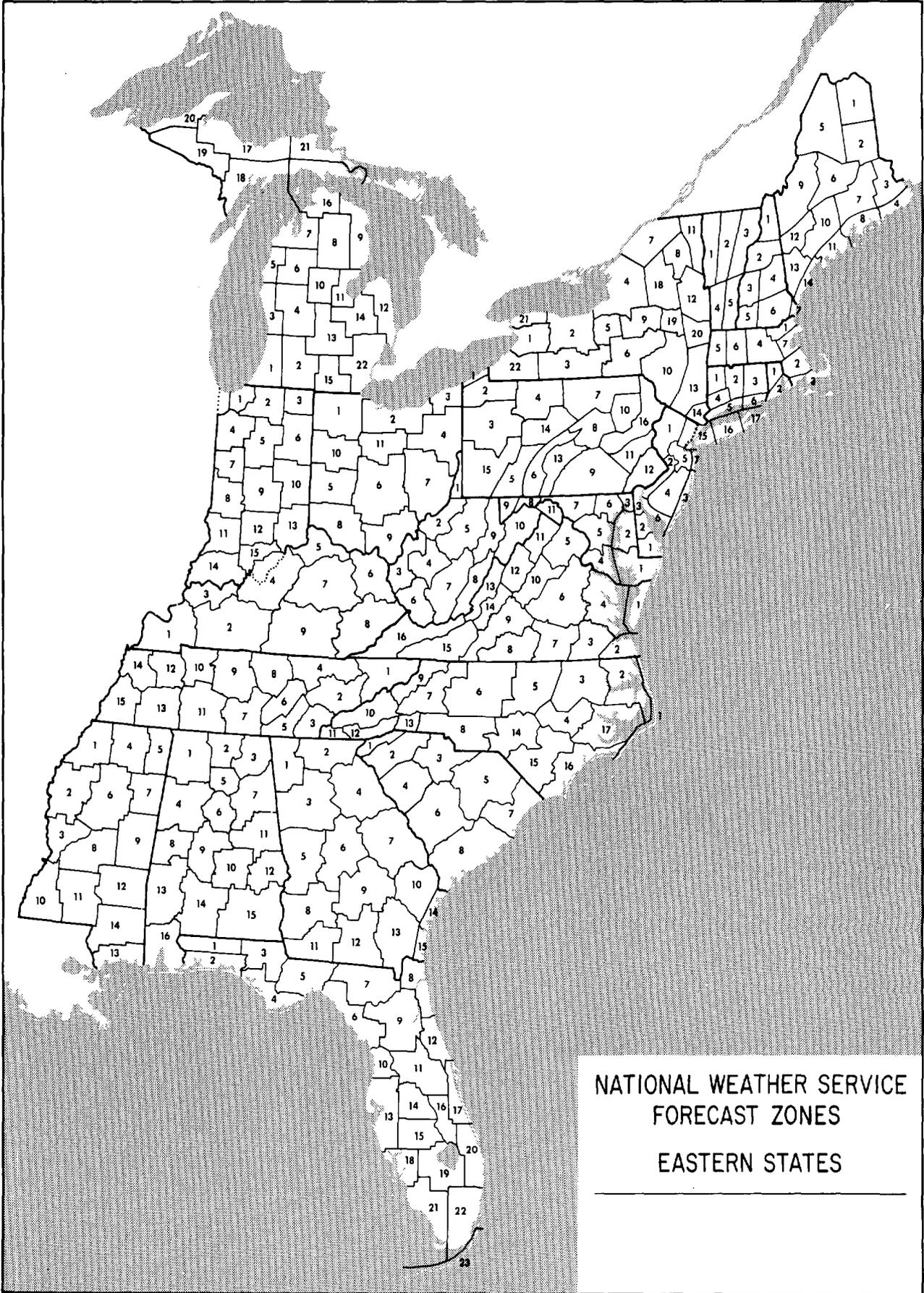
(F6-F12) (319 mph to Mach 1, the speed of sound):  
 The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

(F0+F1) Weak Tornado  
 (F2+F3) Strong Tornado  
 (F4+F5) Violent Tornado

From J. Atmos. Sci., August 1981, p. 1517-1519







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# NATIONAL SUMMARY OF TORNADOES, 1988

HENRY N. VIGANSKY  
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
 NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE  
 NATIONAL CLIMATIC DATA CENTER

A total of 702 tornadoes was reported in the United States during 1988. Tornadoes occurred on 156 days. Eighteen of these storms were classified as killer tornadoes, which resulted in the death of 32 people. Property damage was in excess of \$500 million. Tornadoes damaged or destroyed over 400 mobile homes and caused 15 deaths. No tornado activity was reported in the following states: Alaska, Connecticut, Maryland, Massachusetts, Ohio, Oregon, Rhode Island, Washington, and West Virginia. Locations of killer tornadoes and new monthly records since 1953 by state or nation are shown in the following two tables:

TABLE I. LOCATION OF KILLER TORNADOES

<u>DATE</u>	<u>STATE</u>	<u>COUNTY</u>	<u>TOTAL DEATHS</u>
January 19	Tennessee	Haywood	1
January 19	Tennessee	Fayette	3
January 19	Tennessee	Gibson	1
March 28	Oklahoma	Oklahoma	1
April 19	Florida	Madison	4
May 7	Nebraska	Sarpy	2
May 9	Kentucky	Bell	1
August 14	Michigan	Ingham	1
August 28	New York	Schuyler	1
August 28	South Carolina	Clarendon	1
September 17	Texas	Bexar	1
November 5	Florida	Madison	1
November 15	Arkansas	Van Buren	1
November 15	Arkansas	Lonoke	5
November 15	Missouri	Barry	1
November 19	Mississippi	Lee	2
November 28	North Carolina	Nash	2
		Wake	2
December 24	Tennessee	Williamson	1
			<u>32</u>

TABLE II. NEW MONTHLY RECORDS (SINCE 1953)

<u>MONTH</u>	<u>STATE</u>	<u>NEW RECORD</u>	<u>PREVIOUS RECORD (YEAR)</u>
February	Nevada	2	-0-
April	Colorado	5	4 (1976)
	Idaho	5	1 (1987)
May	Iowa	25	22 (1971)
	Wisconsin	24	17 (1959)
July	Montana	12	8 (1978)
August	New Jersey	3	1 (1987)
	North Dakota	12	9 (1985)

**TABLE II. NEW MONTHLY RECORDS (SINCE 1953) Cont'd**

<u>MONTH</u>	<u>STATE</u>	<u>NEW RECORD</u>	<u>PREVIOUS RECORD (YEAR)</u>
September	Indiana	6	4 (1965)
	New Mexico	4	2 (1971)
October	Montana	1	-0-
November	Mississippi	32	18 (1987)
	Missouri	13	9 (1984)
	North Carolina	8	2 (1987)
	United States	121	81 (1973)

**NOTE: There was no reports of state-to-state border crossings.**

The first tornado of the 1988 season touched down at 9:30 a.m., on January 18 in the exclusive community of Cato de Caza (east of El Toro, California). A few homes received minor damage.

On January 19, fourteen tornadoes touched down in Alabama, Arkansas, Mississippi, and Tennessee. The first tornado of the outbreak touched down at 6:20 a.m., one mile (1.6 km) east of Crossett, Arkansas and moved northeast to four miles (6.4 km) north of Hamburg, Arkansas. Eighteen homes and seven mobile homes were destroyed. Twenty-five other homes received minor damage. A vocational school was destroyed with damage estimated at \$1.6 million. Total damages were approximately \$3 million. Thirteen people were injured. At 10:00 a.m., a weak tornado touched down seven miles (11.3 km) southeast of Cleveland, Mississippi and left an intermittent path of destruction to four miles (6.4 km) north of the city. Two service buildings were destroyed and several mobile homes and permanent structures suffered minor damage. The third tornado touched down six miles (9.7 km) west-northwest of Hernando, Mississippi at 10:12 a.m., and moved northeast at 55 mph (88.5 km/h) to three miles (4.8 km) southeast of Southhaven, Mississippi. Heavy damage was reported in the Southhaven area. Four homes were destroyed and 89 homes were damaged. The tornado also derailed 14 cars of a freight train. Total damage was estimated at \$1.2 million. One person was injured. A small tornado touched down three miles (4.8 km) east of Goodman, Mississippi, at 11:10 a.m. The twister moved northeast 1.5 miles (2.4 km) through mostly farmland; a roof was blown off a house and a barn, numerous trees were uprooted, and an irrigation system was destroyed. The most powerful tornado of the outbreak touched down at 11:20 a.m., and moved through 13 miles (20.9 km) of heavily forested area of northeastern Attala County, Mississippi. The twister inflicted F-4 damage (Fujita Tornado Damage Scale) over a three-mile (4.8 km) area near the Liberty Chapel Community, located about 16 miles (25.7 km) northeast of Kosciuko, Mississippi. The tornado traveled through very sparsely populated country; one man was severely cut when the twister dismantled his home. A total of five homes were destroyed, seven others were damaged, and five barns were destroyed. The Forestry Commission estimated that 1,920 acres of forest land were badly damaged. In Haywood County, Tennessee, at 11:30 a.m., the first killer tornado of the 1988 season touched down four miles (6.4 km) northeast of Brownsville, Tennessee, and traveled northeast to Cobbs Crossing where it destroyed two homes and damaged one. One man was killed, and six people were injured. Another killer tornado touched

down at 11:52 a.m., near Moscow, Tennessee and traveled northeast for 22 miles (35.4 km) to near Mount Moriah, Tennessee. Thirty-three homes were destroyed; one woman and two men were killed, and 24 people were injured. In Gibson County, Tennessee, a tornado touched down one mile (1.6 km) east of Humbolt, Tennessee, and traveled northeast to two miles (3.2 km) southeast of Gibson, Tennessee. The storm damaged a barn, injuring three horses, destroyed a mobile home, and a one-story frame house. One person was killed. A tornado touched down in Clay County, Mississippi and traveled 10.5 miles (16.9 km) into the southeast corner of Chickasaw County, Mississippi. In Clay County, ten homes were destroyed, and five homes were severely damaged. Additional damages included farm machinery and 240 acres of timber. A tornado touched down at 1:05 p.m. near Hico, Tennessee; damage assessments are not available. A small short-lived tornado struck the Meridian Naval Air Base, located 16 miles (25.7 km) northeast of Meridian, Mississippi at 3:20 p.m. Damage was limited to storage trailers, power lines, and trees. Ten people were injured. A tornado touched down eight miles (12.9 km) south-southwest of Cullman, Alabama at 5:25 p.m. The twister left an intermittent path of destruction to five miles (8 km) northeast of Cullman. Damage estimates were placed at nearly \$11 million. Thirty-five people were injured. A survey showed that 13 houses, 15 mobile homes, and six businesses were destroyed; 114 houses, eight mobile homes, 26 businesses, five apartment complexes, and one church were damaged. In Ashby, Alabama, a tornado touched down at 6:15 p.m. and left an intermittent path of destruction for six miles (9.7 km) in southwest Shelby County, Alabama. In Bibb County, Alabama, roofs were ripped from several homes; a barn and a syrup mill were destroyed. Damage to buildings and timber was placed at \$300,000. The final tornado of the outbreak touched down in Clay County, Alabama, and left a six-mile (9.7 km) path of scattered destruction which included: two houses, one chicken house, three barns, four storage sheds, and a church. Damage estimates were placed at \$60,000. In summarization, the outbreak covered a four-state area (Alabama, Arkansas, Mississippi, and Tennessee); 14 tornadoes were spawned over a period of 15 hours; estimated property damage exceeded \$20 million; five people were killed and 90 people were injured.

During February, four tornadoes were reported in the United States; one each in Alabama and Louisiana, and two in Nevada. All four tornadoes lasted for a short period of time and caused minimal damage. The two

tornadoes in Nevada set a new monthly record for the state.

On March 2 a line of thunderstorms moving across southern Louisiana produced two tornadoes, and there were several reports of damage from thunderstorms and wind. In Lafayette, Louisiana at 8:21 p.m., a tornado touched down at the airport, damaging or destroying 35 light aircraft, three hangars, and causing minor damage to an industrial park just south of the airport. Estimated damages were in excess of \$5 million. Another tornado touched down at 10:00 p.m.; northeast of Baton Rouge, Louisiana; two people were injured. The twister damaged two houses, demolished one mobile home, and damaged five other mobile homes.

On March 24 a line of thunderstorms developed in north-central and central Iowa during the afternoon hours. Four tornadoes were spawned. The first tornado touched down at 2:45 p.m. on a farm four miles (6.4 km) northeast of Clear Lake, Iowa, destroying three buildings. Another tornado touched down at 3:15 p.m. east of Nora Springs, Iowa and caused minor structural damage to several buildings. A third tornado touched down briefly at 4:22 p.m., one mile (1.6 km) south of Riceville, Iowa and destroyed a machine shed. The last tornado of the outbreak touched down at 3:15 p.m. near Waucoma, Iowa and was on the ground for nine miles (14.5 km) to two miles (3.2 km) west of Calmar, Iowa. Considerable damage was inflicted to farm buildings in the path of the tornado. Estimated damage exceeded \$2 million.

A super-cell thunderstorm moved across the southern half of Oklahoma County, Oklahoma on March 28, producing a tornado that touched down at 6:05 p.m. in a mobile home park, located in the southeast section of Oklahoma City. Several mobile homes were damaged, and one mobile home was destroyed. A woman was killed in the destroyed mobile home and her husband was injured. Damage at the mobile home park was estimated at \$150,000.

On April 1 three tornadoes were spawned from a severe thunderstorm in northeast Texas. The first tornado touched down instantaneously at 4:25 p.m., two miles (3.2 km) southwest of Gladewater, Texas and caused no damage. The second tornado spawned from the thunderstorm touched down at 4:42 p.m., one mile (1.6 km) northeast of Gladewater, Texas and left a path of destruction to 14 miles (22.5 km) northeast of Gladewater. The twister ranged from 150 to 450 yards (137 to 411 m) wide. Nineteen houses and nine mobile homes were destroyed; sixty-one houses, five mobile homes, and four businesses were severely damaged. Damage from the tornado was estimated at \$2.5 million. The final tornado produced by the thunderstorm touched down at 5:10 p.m., and left a 16-mile (25.7 km) path of heavy timber damage from 3.5 miles (5.6 km) north-northeast of Ashland, Texas, to four miles (6.4 km) north-northeast of Avinger, Texas. Hail up to one inch (2.5 cm) in diameter accompanied the tornado. Monetary value of damages was not available.

A tornado touched down on April 19 at 3:50 a.m., one mile (1.6 km) southwest of Madison, Florida, and moved to 11 miles (17.7 km) east-northeast of Madison. At the North Florida Junior College, three buildings were destroyed and nine buildings were heavily damaged. Seventeen houses, one church, and four chicken barns (with 90,000 chicks) were destroyed. Thirty houses and several commercial buildings were damaged. Four people were killed and eighteen people were injured.

On May 7 at 9:25 p.m., a tornado touched down five miles (8 km) northwest of Ashland, Nebraska and moved northeast to six miles (9.7 km) southeast of Elkhorn, Nebraska. Six farmsteads, numerous boats, and buildings were damaged; one mobile home was destroyed. Two occupants were killed, and one person was injured in the mobile home, located about two miles (3.2 km) northwest of Gretna, Nebraska. Damages were estimated to be in excess of \$2 million.

Iowa will long be remembered for its record number of tornadoes in a single day on May 8, Mother's Day. A total of 22 tornadoes were reported. A cold front moved southeast across the state, setting off a line of severe thunderstorms. They first developed over south-central Iowa. The line quickly moved across the eastern part of the state during the early and mid-afternoon hours. At first, the line only produced strong winds and hail. As the storm system passed east of Des Moines, Iowa, the first tornado touched down at Hartford, Iowa and traveled to two miles (3.2 km) south of Prairie City, Iowa, causing considerable wind and hail damage in the town of Colfax, Iowa. Nearly every roof in town needed replacing after hail, two inches (5.1 cm) in diameter, pelted the area. Several tornadoes had long path lengths. The longest, 67 miles (107.8 km), touched down three miles (4.8 km) west of Bloomfield, Iowa and lifted two miles (3.2 km) west of Conesville, Iowa. Damages from this tornado were in excess of \$500,000. In most cases, many of the tornadoes touched down intermittently in open country, keeping the dollar damage amounts down. The strongest tornado inflicting F-3 left a 32-mile (51.5 km) path of destruction from Dixon, Iowa to two miles (3.2 km) north of Clinton, Iowa. Numerous semi-trailer trucks were picked up and overturned west of Clinton. Another tornado drove 2x6s through the side of a farm house near Tipton, Iowa. Fortunately, there were no deaths during this episode; one person was injured. Final dollar damage estimates are not available.

A widespread outbreak of tornadoes and severe thunderstorms on May 8 created havoc over southern and central Wisconsin during the afternoon and early evening hours. A total of 24 tornadoes and numerous severe thunderstorms were responsible for damages in excess of \$4.5 million. Many of the tornadoes were weak. However, seven had tracks of ten miles (16.1 km) or longer. The first tornado of the outbreak touched down at 2:30 p.m., one mile (1.6 km) northeast of Cashton, Wisconsin, and traveled 27 miles (43.4 km) to five miles (8 km) west of Warrens, Wisconsin. Damage occurred on several farms, where sheds and barns were destroyed, along with numerous uprooted trees. Seven tornadoes were reported in Grant County, Wisconsin. Numerous homes and farm buildings were damaged or destroyed. Two twisters left a combined path of scattered damage for 25 miles (40.2 km) in Lafayette County, Wisconsin. Damages included four homes, 12 farm buildings, and numerous trees. A tornado touched down at 3:30 p.m., four miles (6.4 km) southwest of Richland Center, Wisconsin, and traveled 20 miles (32.2 km) to one mile (1.6 km) west of Cazenovia, Wisconsin. Numerous barns, farm buildings, trees, and two homes were damaged. A tornado touched down instantaneously and destroyed a barn, located 1.5 miles (2.4 km) east-northeast of Hollandale, Wisconsin. In Dane County, Wisconsin, a tornado touched down one mile (1.6 km) south of Marxville and traveled to three miles (4.8 km) west of Dane. One person was injured in the Marxville area; several sheds and barns were damaged. In Columbia County, Wisconsin, a weak tornado set down momentarily in the Lodi area. Another one touched down briefly in the Rio area. Seven barns and one house were

destroyed; three homes and a mobile home were damaged. A mini tornado touched down in Lenonwier, Wisconsin, and damaged a farm building. Another mini tornado near Mauston injured one person. One mobile home, two houses, and two barns were damaged; many trees were blown down. At 4:30 p.m., a tornado touched down two miles (3.2 km) west-southwest of Union, Wisconsin, and terminated 2.5 miles (4 km) south of Lake Mills. Five barns and several farm buildings were destroyed, and two homes sustained minor damage. Marquette, Waushara, Dodge, and Portage counties each reported one mini tornado. No significant damages were recorded. The most destructive tornado of the outbreak touched down at 5:10 p.m., 4.5 miles (7.2 km) southwest of Halder and moved to Rib Falls. Two people were injured in the town of Emmet when their mobile home was destroyed. Three mobile homes, six large barns, three machine sheds, and two silos were destroyed; numerous buildings were damaged. Thirty-nine acres of ginseng racks were knocked off their posts, causing \$450,000 in damage. Just three hours and 28 minutes after the initial touch down of the outbreak, the final tornado touched down at 5:52 p.m., near Hartland. No damage was reported.

On May 9 at 9:17 p.m., a tornado touched down two miles (3.2 km) west of Middlesboro, Kentucky and destroyed a mobile home, killing one person and injuring two others; an additional 13 people were injured. The twister traveled east through the city, creating massive damage to the entire downtown area. Buildings and vehicles were damaged. Utility and communication lines were downed. Damage to the downtown area of Middlesboro was estimated in excess of \$22 million.

Three tornadoes touched down in the Denver, Colorado area on June 15 between 3:03 and 3:40 p.m. The first tornado touched down just northeast of the Rocky Mountain Arsenal, located ten miles (16.1 km) northeast of Stapleton airport. The twister traveled extremely slow, taking 28 minutes to travel two miles (3.2 km). A very small electrical substation was destroyed. The second tornado was on the ground for 24 minutes, covering a six-block area in northeast Denver. About 500 trees, owned by the city, in this thickly wooded area were uprooted, many of them large elms 75 to 100 years old. Hundreds of privately-owned trees were also uprooted by the slow-moving twister. The replacement cost of the city-owned trees was estimated at \$1.5 million. Damage to buildings was minimal; some homes suffered roof and chimney damage, and several cars were damaged by falling trees. The uprooted trees caused considerable curb and sidewalk damage. After the twister lifted off the ground, the funnel passed very close to Stapleton airport, causing the control tower operators to evacuate the control tower for 20 minutes. The final tornado touched down at 3:24 p.m. It was on the ground for 16 minutes and traveled 2.5 miles (4 km) in the southern part of Denver. The twister damaged 85 buildings, valued at \$7.5 million. Fifteen vehicles were overturned and demolished. One trailer was lifted onto the top of a building that had just been unroofed. Numerous antique automobiles inside the building were damaged. The twister uprooted hundreds of trees, many on the golf course along the 18th fairway. Considering the strength of the storm, no one was seriously hurt. Seven people suffered minor injuries from flying debris. A golfer was thrown 40 feet (12.2 m), but was not injured; a man clinging to a telephone pole was left unscathed, but lost both shoes, a sock, and buttons off his shirt. A woman holding a baby was sucked through a broken window of a convenience store; both were unharmed. A dog, tethered to the ground by its leash, was

suspended in air by the tornado; the dog was unharmed. As with the twister in northeast Denver, uprooted trees crushed numerous cars, and damaged curbs and sidewalks. People in downtown Denver had a view of the three tornadoes occurring simultaneously.

On July 5 during the middle of the afternoon, five tornadoes touched down in north-central Montana. Three of the tornadoes left 62 miles (99.8 km) of scattered damage. The areas involved were sparsely populated. Two people were injured. Later in the evening, six small twisters touched down in the northeast part of Montana; no damage was reported.

On July 15, three tornadoes created havoc to a 700-square block of North Council Bluffs, Iowa; 88 people were injured. Eighteen homes and three mobile homes were destroyed. Damage was extensive to over 1,000 homes, five mobile homes, and 21 apartment complexes. Along West Broadway, numerous motels and automobile dealerships were severely damaged. One of the tornadoes blew a 40-car freight train off the tracks. Strong thunderstorm winds caused extensive damage to trees, utility lines, signs, and traffic lights. Total damages were estimated to be near \$40 million.

At 9:56 p.m. on August 14, a tornado touched down in East Lansing, Michigan and moved 26 miles (41.8 km) southeast to one mile (1.6 km) north of Gregory. In the Lansing area a warehouse was unroofed and the wall of the Amtrak Station was blown out. Five houses were unroofed, and a garage was destroyed two miles (3.2 km) southwest of Okemos. Two rooms were torn from a house near Dansville. Four miles (6.4 km) north of Stockbridge, a barn was destroyed and 11 head of cattle were killed. A man was killed when a tree fell on his camper two miles (3.2 km) north of Stockbridge.

On August 28, a tornado touched down in Hector, New York. The tornado demolished two trailer homes, killed one woman, and severely injured her husband. The twister moved east to Perry City, where it demolished two barns. The tornado continued moving east and terminated in Jacksonville, New York where it destroyed five barns. Numerous trees and utility lines were blown down along its path.

On September 16 and 17, Hurricane Gilbert spawned 29 tornadoes in southern Texas. One person was killed and ten people were injured. Initially on September 16, seven small tornadoes set down between 8:45 a.m. and 11:30 a.m. in Hidalgo County, Texas; one person was injured. Seven additional tornadoes touched down on the 16th, three in Cameron County, two in Nueces County, and one each in Bee and Goliad counties. No significant damage was reported. The first tornado to touch down on the 17th occurred at 4:10 a.m., four miles (6.4 km) west of Karnes City. One house and a shed were damaged. A twister touched down at 4:45 a.m. in the southern part of Bexar County, killing one woman in a mobile home, and injured her son who was also in the mobile home. Nine homes and five mobile homes were destroyed. A tornado hit Kelly Air Force Base, located in southwest San Antonio. The tornado touched down just outside of the east side of the base and moved northwest over the base. The hardest hit area was rows of warehouse storage buildings. Twelve of the buildings were severely damaged, and two of the warehouses were totally destroyed. There were 15 employees in the warehouse area; three of them were injured. Outside the base area, there was scattered damage to residential homes and 20 vehicles. Total damage to warehouses and

contents was estimated to be in excess of \$28 million. The third tornado to hit Bexar County touched down at 6:30 a.m. on the northwest side of San Antonio. It ripped several roofs off of homes in the Hillcrest and Oakhills areas. The twister moved into the Texas Medical Complex. Most of the damage was to the Audie Murphy Hospital; windows were blown out and severe damage was done to the roof where air conditioning equipment was ripped loose. Windows were blown out of nearby hospitals and an apartment building. The tornado continued on a northwest course and heavily damaged an apartment complex, unroofing several units; three people were injured. The twister continued its path of destruction and unroofed a supermarket and numerous homes in the Oxbow area. Seventy-eight homes were destroyed, and 308 homes were damaged. Five hundred vehicles were damaged. The damage to residential homes and apartment complexes was estimated at \$4 million. Damage to the Medical Complex was estimated at \$2 million. On September 17 at 6:44 a.m., a tornado touched down five miles (8 km) southwest of La Grange. Several roofs of outbuildings and barns were ripped off. Atascosa, Caldwell, Comal, Dimmit, Edwards, and Maverick counties each reported one tornado, all of which had short and narrow paths; damage was minimal. Four tornadoes touched down in Val Verde County. The first twister to touch down was in open country near Comstock. No damage was reported. At 4:45 p.m., a tornado touched down on the north side of Del Rio, causing extensive damage in three sub-divisions. Eighteen homes were destroyed and 89 others were severely damaged. Several mobile homes were either destroyed or heavily damaged. At least 20 automobiles were considered a total loss. A marina on Lake Amistad sustained considerable damage, and two people were injured. The National Park Service personnel reported a tornado near Rough Canyon. No damage was reported. The final tornado spawned by Hurricane Gilbert touched down at 5:52 p.m. just north of Comstock. A few outbuildings sustained minor damage.

Only 19 tornadoes were reported in the nation during October: six in Louisiana; four each in Indiana and Texas; and one each in Florida, Mississippi, Montana, Nevada, and North Carolina. The one tornado in Montana set a monthly record for October.

On November 15, seven tornadoes were reported in central and north-central Arkansas. The first tornado touched down at 6:28 p.m. along the Arkansas River, three miles (4.8 km) southwest of Clarksville. The twister left a continuous path of damage to nine miles (14.5 km) north of Hagarville. Thirteen homes were destroyed and 25 others were damaged. Two chicken houses were destroyed along with 40,000 chickens. As the twister passed over Interstate 40, a large tractor-trailer was overturned. Total damage from the storm exceeded \$2 million. Nine people were injured. At 7:20 p.m., a small twister touched down along the Arkansas River five miles (8 km) west of Morrilton. The tornado traveled northeast for nine miles (14.5 km), causing mostly minor damage. A F-3 tornado touched down 1.5 miles (2.4 km) east of Cypress Valley, and moved northeast to three miles (4.8 km) southwest of Higden. Extensive timber damage was noted just northwest of Martinville. The twister destroyed a home in Southside and killed one man. Also, the Southside High School gymnasium was destroyed, with significant damage to other school buildings. Sixteen houses and six mobile homes were destroyed, and 16 other homes were damaged. In addition to the one death, ten people were injured. Damages were assessed at \$2.2 million. At 7:45 p.m., a

tornado touched down in southwest Fox and traveled northeast for 13 miles (20.9 km). The storm passed over sparsely populated areas, thus the injuries were limited to four people. Damages were estimated at \$200,000. At 8:00 p.m., a tornado of F-3 intensity touched down in a heavily wooded area three miles (4.8 km) south of Alpine. The storm traveled northeast and passed between Lambert and Bismarck, causing significant damage. Five houseboats were destroyed on Lake De Gray, while 25 homes were destroyed and 30 additional homes were damaged in the Lambert area. Near Highway 290, just south of Lake Hamilton, a fire station was destroyed and five fire trucks damaged. The last report of damage was at Carpenter Dam, located on the east end of Lake Hamilton. Four people were injured. A weak tornado touched down at 8:30 p.m., near Larkin and traveled northeast through Horseshoe Bend and seriously damaged 12 homes as well as several barns and outbuildings; one woman was injured. The final storm of the outbreak, a killer tornado of F-2 intensity, touched down at 9:36 p.m. and left a 43-mile (69.2 km) path of destruction through four counties (Saline, Pulaski, Lonoke, and Prairie). The twister initially touched down near US Highway 167 in the extreme eastern end of Saline County. It then moved northeast and passed just north of Wrightsville, destroying two homes and damaging five others. Two people were injured. The storm crossed the Arkansas River and caused substantial property damage and three fatalities. The twister moved into Scott, destroying 20 houses and 20 mobile homes; 50 people were injured. The tornado continued on a northeast course to Lonoke. Just west of Lonoke, the tornado heavily damaged a minnow farm. Passing through the northwest side of Lonoke, the twister destroyed 12 homes and damaged 60 others. Also, an apartment complex, one department store, one grocery store, and a large grain silo were severely damaged. As the tornado moved across Interstate 40, it destroyed a van, killing its occupants. The last damage from the tornado occurred in Hickory Plains area, located in the extreme northwest part of Prairie County, where several trees were downed. Five people were killed and 60 were injured from this one tornado. In summary, the outbreak lasted just over two hours. Total damage exceeded \$17 million. Six people were killed and 88 were injured.

An outbreak of 13 tornadoes was reported in Missouri on November 15, establishing a new state record for the month. The first tornado touched down at 3:45 p.m. in southeast McDonald County and traveled 28 miles (45.1 km) northeast into central Barry County. The most significant damage was reported in the Butterfield area; 48 houses and 20 mobile homes were either destroyed or severely damaged. One person was killed and 12 people were injured. A tornado touched down in the northwest portion of Christian County and moved to just northeast of Springfield. The twister caused extensive damage to homes, businesses, and manufacturing plants. Damages were in excess of \$25 million. A tornado of F-2 intensity touched down in the area of Saint Roberts and left a three-mile (4.8 km) path of destruction to homes and businesses. Damage was estimated at \$3.2 million. A tornado of F-3 intensity touched down on the southwest side of O'Fallon. The twister was on the ground for one mile (1.6 km). The tornado destroyed 64 condominiums and caused considerable damage to roofs, garages, fences, and trees. Ten people were injured. Tornadoes were reported in the following counties with only minimal damage: Greene, Henry, Jasper, Johnson, Pettis, and Saint Charles. The final tornado of the outbreak touched down at 8:55 p.m. in a wooded area in northeast

Dent County. It traveled through Crawford County. One house and four buildings were destroyed.

A powerful tornado set down on November 19 at 10:15 p.m., about one mile (1.5 km) northwest of Nettleton, Mississippi, and moved northeast to Richmond. The twister destroyed five homes, seven mobile homes, and two businesses. Fourteen other homes were damaged. Also destroyed was a chicken house, several cars, and farm buildings. Two people were killed and 11 injured.

At 1:00 a.m., on November 28, a destructive F-4 tornado touched down in Umstead State Park in the northwest part of Raleigh, North Carolina. The tornado tracked across the most densely populated area of Raleigh, destroying hundreds of homes and damaging thousands of others. Two people were killed in the disaster. The tornado continued moving northeast, passing north of New Hope and Justice. The tornado then cut across the northwest corner of Nash County between Castalia and Aventon, killing one man and woman. The twister continued on its northeast path of destruction and terminated three miles (4.8 km) north of Jackson. The tornado left, in its wake, 83 miles (133.6 km) of destruction which included: 426 residences and 78 businesses destroyed and 2,057 residences damaged, leaving 978 people homeless. Four people were killed, and 157 people were injured. Damages were estimated to be in excess of \$77 million.

A total of 20 tornadoes were reported in December; 16 were reported in Mississippi; two in Florida; and Louisiana and Tennessee each reported one tornado.

A devastating tornado (F-4 on the Fujita scale) touched down in northwest Franklin, Tennessee at 6:04 p.m. on December 24. The tornado moved northeast to Brentwood. Fifty-four homes, 13 apartments, 31 businesses, and six airplanes were damaged or destroyed. Property damage was estimated at \$8 million. One man was killed, and seven people were injured.

On December 28 at 2:00 a.m., the final twister of the 1988 season touched down in the Harpersville, Mississippi area; five chicken houses and thousands of chickens were destroyed. An empty house and barn were also destroyed.

More detailed information concerning tornado activity can be obtained from the monthly Storm Data publications. The National Severe Storms Forecast Center has generated a magnetic tape which contains tornado statistics for the period 1950-1988. A copy of that tape can be obtained by contacting the National Climatic Data Center, Federal Building, Asheville, North Carolina 28801-2696 (telephone: (704) 259-0692).

# TORNADO SUMMARY BY STATE AND NATION, 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA													
NUMBER	3	1		1	3				3		5		16
DAYS	1	1		1	3				1		3		10
DEATHS													0
INJURIES	35										24		59
ARIZONA													
NUMBER							1						1
DAYS							1						1
DEATHS													0
INJURIES													0
ARKANSAS													
NUMBER	1		2		1		1				7		12
DAYS	1		1		1		1				1		5
DEATHS											6		6
INJURIES	13										88		101
CALIFORNIA													
NUMBER	2		1	3									6
DAYS	1		1	2									4
DEATHS													0
INJURIES													0
COLORADO													
NUMBER				5	7	18	14	3					47
DAYS				3	3	8	5	3					22
DEATHS													0
INJURIES						7							7
DELAWARE													
NUMBER						1	1						2
DAYS						1	1						2
DEATHS													0
INJURIES						30							30
FLORIDA													
NUMBER	1			9	5	5	6	2	7	1	8	2	46
DAYS	1			4	4	5	5	2	4	1	3	1	30
DEATHS				4							1		5
INJURIES	3			18		2					3		26
GEORGIA													
NUMBER				3	1								4
DAYS				2	1								3
DEATHS													0
INJURIES				3									3
HAWAII													
NUMBER			2										2
DAYS			2										2
DEATHS													0
INJURIES													0
IDAHO													
NUMBER			2	5		1	1						9
DAYS			2	2		1	1						6
DEATHS													0
INJURIES													0
ILLINOIS													
NUMBER				4	10				1		5		20
DAYS				3	1				1		1		6
DEATHS													0
INJURIES					6								6
INDIANA													
NUMBER			1					2	6	4			13
DAYS			1					1	2	1			5
DEATHS													0
INJURIES									4	4			8
IOWA													
NUMBER			5	1	25		6	4			8		49
DAYS			2	1	3		2	2			1		11
DEATHS													0
INJURIES							88				4		92
KANSAS													
NUMBER			1		9	2	4				8		24
DAYS			1		3	1	3				2		10
DEATHS													0
INJURIES											24		24

# TORNADO SUMMARY BY STATE AND NATION, 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
KENTUCKY													
NUMBER				1	1		2						4
DAYS				1	1		2						4
DEATHS					1								1
INJURIES					15								15
LOUISIANA													
NUMBER		1	3	6	6	1	3		3	6	6	1	36
DAYS		1	2	3	1	1	3		3	2	3	1	20
DEATHS													0
INJURIES			4		1						2	1	8
MAINE													
NUMBER							1						1
DAYS							1						1
DEATHS													0
INJURIES													0
MICHIGAN													
NUMBER				5	4		7	10	1				27
DAYS				1	1		4	7	1				14
DEATHS								1					1
INJURIES				6	1			1					8
MINNESOTA													
NUMBER					1		1	2	1				5
DAYS					1		1	2	1				5
DEATHS													0
INJURIES													0
MISSISSIPPI													
NUMBER	6		1	1	2				3	1	32	16	62
DAYS	1		1	1	2				2	1	4	4	16
DEATHS											2		2
INJURIES	12		5								16		33
MISSOURI													
NUMBER			2				2				13		17
DAYS			1				1				1		3
DEATHS											1		1
INJURIES											23		23
MONTANA													
NUMBER			1			5	12	1		1			20
DAYS			1			1	2	1		1			6
DEATHS													0
INJURIES							2						2
NEBRASKA													
NUMBER				1	7	5	4	3					20
DAYS				1	6	3	3	3					16
DEATHS					2								2
INJURIES					1								1
NEVADA													
NUMBER		2				1				1			4
DAYS		1				1				1			3
DEATHS													0
INJURIES													0
NEW HAMPSHIRE													
NUMBER							1						1
DAYS							1						1
DEATHS													0
INJURIES													0
NEW JERSEY													
NUMBER					1		2	3					6
DAYS					1		2	1					4
DEATHS													0
INJURIES							1						1
NEW MEXICO													
NUMBER				1	4	1			4				10
DAYS				1	2	1			2				6
DEATHS													0
INJURIES					1								1
NEW YORK													
NUMBER							2	3					5
DAYS							2	3					5
DEATHS								1					1
INJURIES							1	1					2

# TORNADO SUMMARY BY STATE AND NATION, 1988

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
NORTH CAROLINA													
NUMBER			2	1	2	2		3		1	8		19
DAYS			1	1	2	1		1		1	3		10
DEATHS											4		4
INJURIES						2		1			162		165
NORTH DAKOTA													
NUMBER					2	6	8	12					28
DAYS					2	3	5	3					13
DEATHS													0
INJURIES						1							1
OKLAHOMA													
NUMBER			5		2	3			2		5		17
DAYS			2		2	3			1		3		11
DEATHS			1										1
INJURIES			1										1
PENNSYLVANIA													
NUMBER							3	1	1		1		6
DAYS							2	1	1		1		5
DEATHS													0
INJURIES							2						2
SOUTH CAROLINA													
NUMBER					1			1					2
DAYS					1			1					2
DEATHS								1					1
INJURIES								1					1
SOUTH DAKOTA													
NUMBER					1	1	3						5
DAYS					1	1	2						4
DEATHS													0
INJURIES													0
TENNESSEE													
NUMBER	4				2	1					3	1	11
DAYS	1				2	1					2	1	7
DEATHS	5											1	6
INJURIES	30										1	7	38
TEXAS													
NUMBER				11	7	7	6	2	42	4	10		89
DAYS				5	4	5	3	2	4	1	4		28
DEATHS									1				1
INJURIES				10					10		2		22
UTAH													
NUMBER					1								1
DAYS					1								1
DEATHS													0
INJURIES													0
VERMONT													
NUMBER							1	1					2
DAYS							1	1					2
DEATHS													0
INJURIES													0
VIRGINIA													
NUMBER						1		2			2		5
DAYS						1		2			1		4
DEATHS													0
INJURIES								1			1		2
WISCONSIN													
NUMBER					24	1	2	6	2				35
DAYS					1	1	2	4	1				9
DEATHS													0
INJURIES					4								4
WYOMING													
NUMBER					3	1	9						13
DAYS					1	1	4						6
DEATHS													0
INJURIES					2								2
UNITED STATES													
NUMBER	17	4	28	58	132	63	103	61	76	19	121	20	702
DAYS	3	3	10	16	24	21	23	13	16	8	13	6	156
DEATHS	5	0	1	4	3	0	0	3	1	0	14	1	32
INJURIES	93	0	10	37	31	42	94	5	14	4	350	8	688

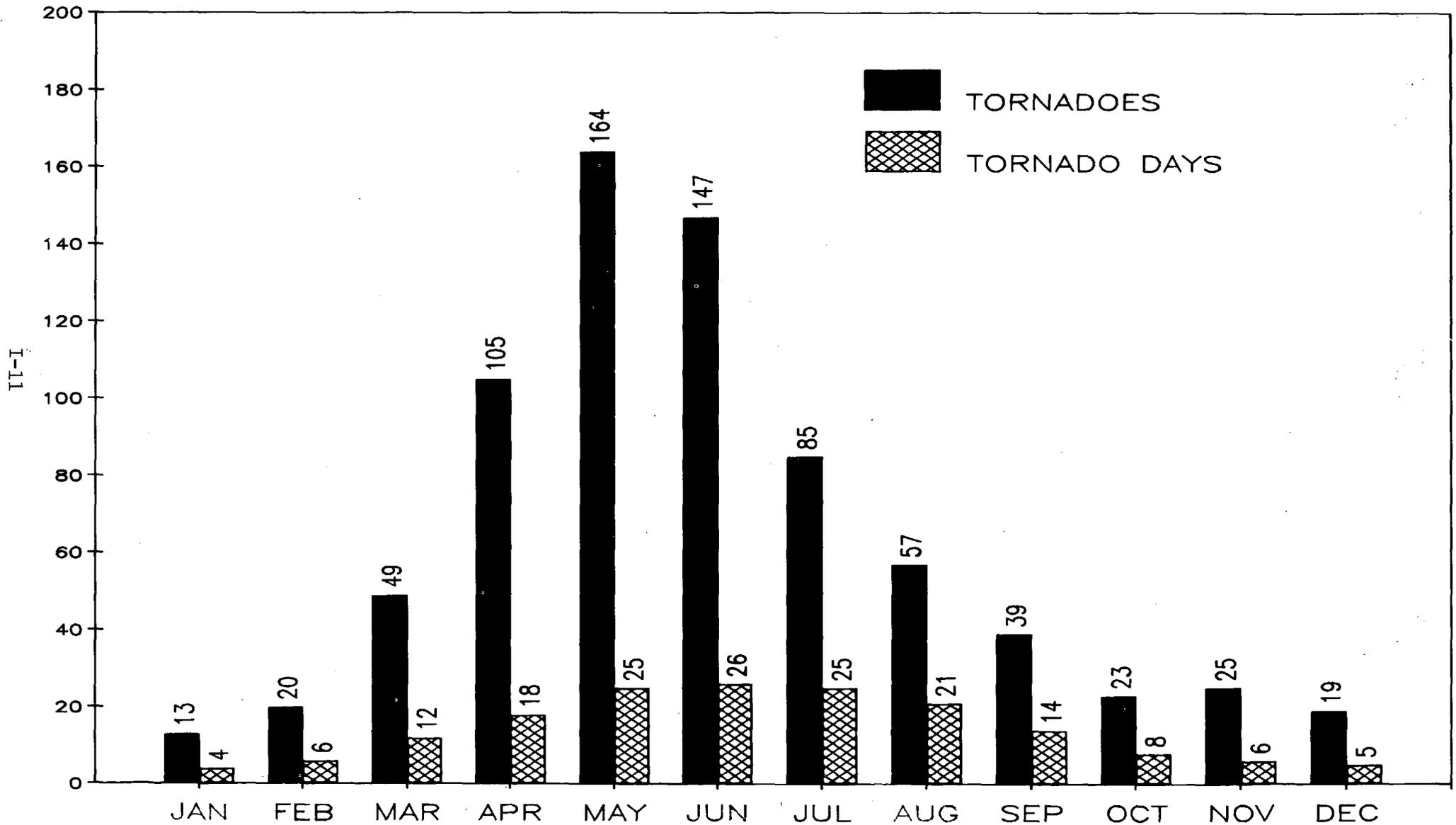
& TORNADO DAYS FOR COUNTRY AS A WHOLE.

# NATIONAL SUMMARY OF TORNAOES, TORNAO DAYS, AND DEATHS BY MONTH AND ANNUAL, 1953-88

I-10

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			ANNUAL		
	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS			
1953	14	6	0	16	3	3	40	10	24	47	16	34	94	21	161	111	24	244	31	19	0	24	15	0	5	4	0	6	4	0	12	6	0	21	8	49	421	136	515
1954	2	1	0	17	9	2	63	13	10	112	22	3	101	22	9	107	26	5	45	23	0	49	21	1	21	10	3	14	8	2	2	2	17	3	1	550	160	36	
1955	3	2	0	4	3	0	43	15	5	99	18	7	147	26	103	154	28	2	49	21	5	33	18	0	15	8	2	23	7	1	20	4	1	3	2	0	593	152	126
1956	2	2	0	47	12	8	31	7	1	85	15	67	79	24	4	65	21	0	91	26	1	43	20	2	16	10	0	29	8	0	7	6	0	9	4	0	504	155	83
1957	17	3	13	5	3	0	38	7	1	216	21	29	227	26	87	147	25	14	55	19	0	20	14	0	17	10	2	18	11	2	58	11	25	38	4	19	856	154	192
1958	12	7	0	20	5	13	15	10	0	76	19	4	68	21	0	127	27	42	121	30	1	46	20	1	24	14	1	9	4	4	45	6	0	1	4	0	564	166	66
1959	16	2	3	20	5	21	43	11	9	30	12	1	226	28	8	73	25	2	63	24	0	38	18	0	58	15	14	24	6	4	45	6	0	1	0	0	604	156	58
1960	9	4	0	28	10	0	28	10	0	70	20	7	201	26	34	124	27	3	43	22	0	47	23	1	22	13	0	18	10	1	25	6	0	1	1	0	616	172	46
1961	1	1	0	31	8	0	124	17	7	74	19	3	137	25	23	107	23	2	77	27	0	27	16	0	53	16	15	14	5	0	36	7	0	16	5	0	697	169	51
1962	12	3	1	25	7	0	37	9	17	41	8	1	200	22	3	171	29	0	78	26	0	51	21	6	24	11	0	11	10	0	5	4	0	2	2	0	657	152	28
1963	15	5	1	6	3	0	48	12	8	84	14	16	71	21	1	91	23	0	62	26	0	26	13	2	33	13	3	13	5	0	15	6	0	0	0	0	464	141	31
1964	14	3	10	2	2	0	36	11	6	157	23	15	135	20	16	136	24	0	63	23	0	79	23	2	25	10	0	22	4	22	17	8	0	18	5	2	704	156	73
1965	21	11	0	32	4	0	34	9	2	129	20	267	275	25	17	147	28	6	86	26	0	61	23	1	64	21	0	16	4	1	34	6	5	7	4	0	906	181	299
1966	1	1	0	28	5	0	12	6	58	80	20	12	98	17	0	126	28	19	100	27	3	58	21	0	22	13	0	29	6	6	20	2	0	11	3	0	585	150	98
1967	39	4	7	8	5	0	42	14	3	149	18	73	116	25	3	210	28	6	90	25	1	28	16	2	139	16	5	36	7	4	8	5	0	61	10	10	926	173	114
1968	5	3	0	7	3	0	28	8	0	102	15	40	145	26	72	136	27	11	56	22	2	66	23	2	25	14	0	14	9	0	44	12	3	32	9	1	660	171	131
1969	3	1	32	5	5	0	8	1	1	68	15	2	145	25	4	137	28	7	99	27	0	69	21	19	20	11	0	26	10	0	5	3	0	23	7	1	608	155	66
1970	9	5	0	16	3	0	25	12	2	117	16	29	88	19	26	134	24	6	81	26	3	55	21	0	54	20	0	50	13	6	10	4	0	14	8	0	653	171	72
1971	18	7	1	83	12	131	40	13	2	75	14	11	166	24	7	199	28	1	100	30	1	50	21	0	47	15	0	38	12	0	16	7	0	56	9	2	888	192	156
1972	33	10	5	7	4	0	69	17	0	96	20	16	140	27	0	114	25	2	115	29	0	59	23	2	49	19	0	34	10	0	17	4	2	8	6	0	741	194	27
1973	33	7	1	10	4	0	80	16	17	150	22	10	250	26	35	224	26	2	80	26	0	51	23	4	69	22	3	25	11	0	81	11	12	49	12	3	1102	206	87
1974	24	8	2	23	9	0	36	12	1	269	22	313	144	28	10	194	26	31	59	19	0	107	26	0	25	11	0	45	10	4	13	8	0	8	5	0	947	184	361
1975	52	7	12	45	12	7	84	16	12	108	20	13	188	30	5	196	28	6	79	26	2	60	25	2	34	17	0	12	7	0	40	8	0	22	8	1	920	204	60
1976	12	5	0	37	6	5	180	18	21	113	23	1	155	24	8	169	26	3	84	28	2	38	18	1	35	15	3	11	5	0	0	0	0	1	1	0	835	169	44
1977	5	4	0	17	3	2	64	15	0	88	15	26	228	29	4	132	27	0	99	27	1	82	26	6	65	21	1	25	5	1	24	10	0	23	7	2	852	189	43
1978	23	7	2	6	3	0	17	8	0	107	17	4	213	27	7	148	28	17	143	30	11	65	24	1	20	10	6	7	5	0	9	5	0	30	9	5	788	173	53
1979	16	9	0	4	3	0	53	13	1	120	17	58	112	23	2	150	24	8	132	30	1	127	27	5	68	19	2	47	12	7	21	8	0	2	1	0	852	186	84
1980	5	4	0	11	9	0	41	15	2	137	16	4	203	25	8	217	30	7	95	26	5	73	27	0	37	14	1	43	7	1	3	2	0	1	1	0	866	176	28
1981	3	3	0	25	5	2	33	13	1	84	18	13	187	24	0	223	29	8	98	27	0	64	22	0	26	16	0	32	12	0	7	5	0	1	1	0	783	175	24
1982	18	8	1	3	2	0	60	15	6	150	20	30	327	28	14	198	30	4	95	29	0	34	15	0	38	12	2	9	4	0	19	6	0	95	13	7	1046	182	64
1983	13	2	2	41	7	1	71	21	0	65	15	6	249	26	14	178	27	2	99	27	4	76	21	0	20	15	0	12	5	0	49	11	0	58	13	5	931	190	34
1984	1	1	0	27	4	0	73	15	64	176	22	33	169	27	6	242	25	14	72	21	0	47	20	0	17	12	0	49	12	4	30	5	1	4	2	0	907	166	122
1985	2	2	0	7	4	0	38	12	2	134	19	5	182	28	78	82	24	3	51	19	0	108	26	3	40	16	0	18	8	0	19	8	3	3	2	0	684	168	94
1986	0	0	0	30	11	2	75	9	6	84	17	2	173	25	1	134	25	0	88	24	3	67	23	1	65	17	0	26	7	0	17	8	0	5	2	0	764	168	15
1987	6	3	0	19	4	6	38	11	1	20	8	1	126	25	31	132	29	2	163	28	0	63	24	1	19	10	0	1	1	0	55	5	11	14	3	6	656	151	59
1988	17	3	5	4	3	0	28	10	1	58	16	4	132	24	3	63	21	0	103	23	0	61	13	3	76	16	1	19	8	0	121	13	14	20	6	1	702	156	32
POR	476	154	98	716	200	203	1775	432	291	3770	632	1160	5897	889	804	5298	943	479	3045	908	46	2052	751	68	1387	506	64	825	278	66	915	227	78	676	179	115	26832	6099	3472
MEAN	13	4	3	20	6	6	49	12	8	105	18	32	164	25	22	147	26	13	85	25	1	57	21	2	39	14	2	23	8	2	25	6	2	19	5	3	745	169	96

**AVERAGE NUMBER OF TORNADOES AND TORNADO DAYS  
EACH MONTH IN THE UNITED STATES**  
(BASED ON 26,832 TORNADOES THAT OCCURRED FROM 1953-1988)



# TORNADOES, TORNADO DAYS, AND DEATHS BY STATE AND NATION, 1953-88

STATE	TORNADOES							DAYS		DEATHS		
	TOTAL	AVERAGE	GREATEST	YEAR	LEAST	YEAR	PER # 10,000 SQ. MI.	TOTAL	AVERAGE	TOTAL	AVERAGE	PER # 10,000 SQ. MI.
ALABAMA	765	21	45	1983+	5	1956	4.12	404	11	216	6	42
ALASKA	1	0	1	1959	0	1988+	.00	1	0	0	0	0
ARIZONA	122	3	17	1972	0	1965	.30	98	3	3	0	0
ARKANSAS	725	20	78	1982	2	1987+	3.79	328	9	163	5	31
CALIFORNIA	144	4	14	1983	0	1968+	.25	108	3	0	0	0
COLORADO	749	21	58	1982	1	1959	2.00	448	12	2	0	0
CONNECTICUT	46	1	8	1973	0	1988+	2.55	42	1	4	0	8
DELAWARE	32	1	5	1975	0	1987+	4.32	29	1	2	0	10
DISTRICT OF COLUMBIA	0	0	0		0		-	0	0	0	0	0
FLORIDA	1579	44	97	1975	10	1956	7.49	1009	28	67	2	11
GEORGIA	705	20	46	1974+	2	1987	3.33	398	11	72	2	12
HAWAII	26	1	4	1971	0	1987+	1.12	22	1	0	0	0
IDAHO	75	2	10	1986+	0	1977+	.25	61	2	0	0	0
ILLINOIS	945	26	107	1974	4	1953	4.65	438	12	147	4	26
INDIANA	718	20	48	1973	4	1984	5.50	350	10	206	6	57
IOWA	1076	30	61	1984	7	1956	5.31	476	13	60	2	11
KANSAS	1501	42	97	1955	14	1976	5.07	702	20	168	5	20
KENTUCKY	286	8	34	1974	0	1953	1.97	170	5	102	3	25
LOUISIANA	796	22	64	1983	3	1955	4.56	479	13	94	3	19
MAINE	75	2	11	1971	0	1987+	.63	66	2	1	0	0
MARYLAND	88	2	10	1975	0	1988+	2.31	68	2	2	0	2
MASSACHUSETTS	117	3	12	1958	0	1988+	3.94	86	2	99	3	120
MICHIGAN	596	17	39	1974	2	1959	2.84	344	10	236	7	41
MINNESOTA	641	18	34	1968	5	1988+	2.12	366	10	77	2	9
MISSISSIPPI	834	23	62	1988	1	1979	4.86	411	11	343	10	72
MISSOURI	983	27	79	1973	6	1987+	3.92	429	12	133	4	19
MONTANA	156	4	20	1988	0	1974+	.29	110	3	1	0	0
NEBRASKA	1255	35	78	1975	10	1966	4.51	619	17	51	1	6
NEVADA	35	1	8	1987	0	1985+	.09	31	1	0	0	0
NEW HAMPSHIRE	68	2	9	1963	0	1987+	2.03	59	2	0	0	0
NEW JERSEY	67	2	9	1987	0	1984+	2.38	54	2	0	0	0
NEW MEXICO	283	8	18	1972	0	1953	.65	219	6	3	0	0
NEW YORK	148	4	9	1986	0	1953	.83	117	3	7	0	1
NORTH CAROLINA	437	12	38	1973	2	1970	2.30	270	8	74	2	14
NORTH DAKOTA	657	18	52	1976	2	1961	2.58	357	10	21	1	3
OHIO	497	14	43	1973	0	1988	3.45	257	7	170	5	41
OKLAHOMA	1919	53	107	1957	17	1988	7.62	789	22	200	6	29
OREGON	31	1	4	1984	0	1988+	.09	27	1	0	0	0
PACIFIC ISLANDS	2	0	1	1981+	0	1988+	-	2	0	0	0	0
PENNSYLVANIA	314	9	33	1985+	0	1959	1.92	205	6	73	2	16
PUERTO RICO	9	0	2	1979	0	1988+	.73	8	0	0	0	0
RHODE ISLAND	5	0	3	1986	0	1988+	1.14	4	0	0	0	0
SOUTH CAROLINA	317	9	23	1973	1	1986+	2.84	212	6	40	1	13
SOUTH DAKOTA	920	26	64	1965	1	1958	3.32	434	12	8	0	2
TENNESSEE	397	11	44	1974	1	1987+	2.61	216	6	81	2	19
TEXAS	4439	123	232	1967	32	1953	4.61	1732	48	445	12	17
UTAH	50	1	6	1984	0	1985+	.16	41	1	0	0	0
VERMONT	30	1	5	1962	0	1985+	.87	27	1	0	0	0
VIRGINIA	202	6	22	1975	1	1982+	1.37	137	4	16	0	4
VIRGIN ISLANDS	2	0	1	1979+	0	1988+	-	2	0	0	0	0
WASHINGTON	48	1	4	1983+	0	1988+	.20	41	1	6	0	1
WEST VIRGINIA	68	2	6	1980+	0	1988+	.78	53	1	2	0	1
WISCONSIN	697	19	43	1980	3	1953	3.45	366	10	75	2	13
WYOMING	339	9	42	1977	0	1970	.96	229	6	2	0	0
TOTAL: UNITED STATES	26832*	745	1102	1973	421	1953	2.06	60998	169	3472	96	10

+ ALSO IN EARLIER YEAR(S).  
 \* CORRECTED FOR BOUNDARY-CROSSING TORNADOES.  
 & TORNADO DAYS FOR COUNTRY AS A WHOLE.

# MEAN ANNUAL TORNADOES PER  
 10,000 SQUARE MILES.  
 ' NUMBER OF DEATHS PER 10,000  
 SQUARE MILES.

# NATIONAL TORNADOES, TORNADO DAYS, DEATHS AND RESULTING LOSSES BY YEARS, 1916-88

YEAR	NUMBER TORNADOES	TORNADO DAYS	TOTAL DEATHS	MOST DEATHS IN SINGLE TORNADO	TOTAL PROPERTY LOSSES \$	PROPERTY LOSS FREQUENCY *		
						CATEGORY 5	CATEGORY 6	CATEGORY 7 AND OVER
1916	90	36	150	30	6	7	1	0
1917	121	38	551	101	7	21	9	0
1918	81	45	136	36	7	20	9	0
1919	64	35	206	59	7	10	0	0
1920	87	50	499	87	7	14	10	0
1921	105	55	202	61	7	22	3	0
1922	108	64	135	16	7	27	3	0
1923	102	59	110	23	6	21	1	0
1924	130	57	376	85	7	26	1	1
1925	119	65	794	689	7	34	2	1
1926	111	57	144	23	6	28	0	0
1927	163	62	540	92	7	42	9	1
1928	203	79	95	14	7	40	7	0
1929	197	74	274	40	7	48	4	0
1930	192	72	179	41	7	38	6	0
1931	94	57	36	6	6	14	6	0
1932	151	67	394	37	7	23	1	1
1933	298	96	362	34	7	46	9	0
1934	147	77	47	6	6	10	0	0
1935	180	77	71	11	6	29	0	0
1936	151	71	552	216	7	17	5	1
1937	147	75	29	5	6	24	0	0
1938	213	76	183	32	7	29	6	0
1939	195	75	91	27	7	21	0	0
1940	124	62	65	18	7	13	2	0
1941	111	57	53	25	6	24	1	0
1942	167	66	384	65	7	42	10	0
1943	195	61	58	5	7	28	8	0
1944	169	68	275	100	7	50	9	0
1945	121	66	210	69	7	21	10	1
1946	101	65	78	15	7	23	7	0
1947	166	78	313	169	7	46	7	1
1948	183	68	139	33	7	62	1	2
1949	244	80	211	58	7	54	13	2
1950	200	88	70	18	7	47	9	0
1951	226	113	34	6	7	35	1	0
1952	244	98	229	57	7	53	1	0
1953	221	136	515	116	8	63	18	1
1954	300	160	36	6	7	63	1	1
1955	330	152	126	80	7	74	13	1
1956	354	155	83	25	7	83	24	1
1957	388	154	192	44	8	109	26	3
1958	398	166	66	19	7	70	8	1
1959	404	156	58	21	7	70	4	1
1960	411	172	46	16	7	65	1	1
1961	437	169	51	16	7	103	2	1
1962	452	152	28	17	7	51	10	0
1963	444	141	31	5	7	77	1	1
1964	447	156	73	22	7	113	17	1
1965	496	181	299	44	8	126	30	1
1966	508	150	98	58	0	79	1	4
1967	528	173	114	33	0	117	3	0
1968	566	171	131	34	0	127	3	0
1969	590	155	66	22	0	98	6	0
1970	550	171	72	22	0	97	4	0
1971	586	192	156	58	0	71	3	0
1972	741	194	27	6	0	100	1	0
1973	1000	206	87	7	9	219	2	0
1974	944	184	361	34	9	166	2	0
1975	920	204	60	9	9	189	1	0
1976	889	169	44	5	0	145	4	0
1977	889	189	43	2	0	173	4	0
1978	789	173	166	16	0	153	4	0
1979	889	186	84	4	0	169	5	0
1980	889	177	229	3	0	201	5	0
1981	783	177	244	3	0	144	5	0
1982	934	188	64	10	0	254	6	0
1983	931	190	34	3	0	111	6	0
1984	907	166	122	16	0	193	6	0
1985	684	168	94	18	9	114	5	4
1986	744	168	15	3	9	157	6	0
1987	656	151	59	30	9	112	6	0
1988	702	156	32	5	9	148	8	1
MEAN	745	169	96	-	-	125	37	7

NOTE: - THE ABOVE ESTIMATED LOSSES ARE BASED ON VALUES AT TIME OF OCCURRENCE.  
MEAN WAS DERIVED FROM DATA FOR PERIOD 1953-1988.

\$ STORM DAMAGES IN CATEGORIES:

- 5. \$50,000 TO \$500,000
- 6. \$500,000 TO \$5 MILLION
- 7. \$5 MILLION TO \$50 MILLION
- 8. \$50 MILLION TO \$500 MILLION
- 9. \$500 MILLION AND OVER

\* NUMBER OF TIMES PROPERTY LOSSES REPORTED IN STORM DATA IN CATEGORIES 5,6,7, AND OVER.

# NUMBER OF FUNNEL CLOUDS BY STATE AND NATION, 1988

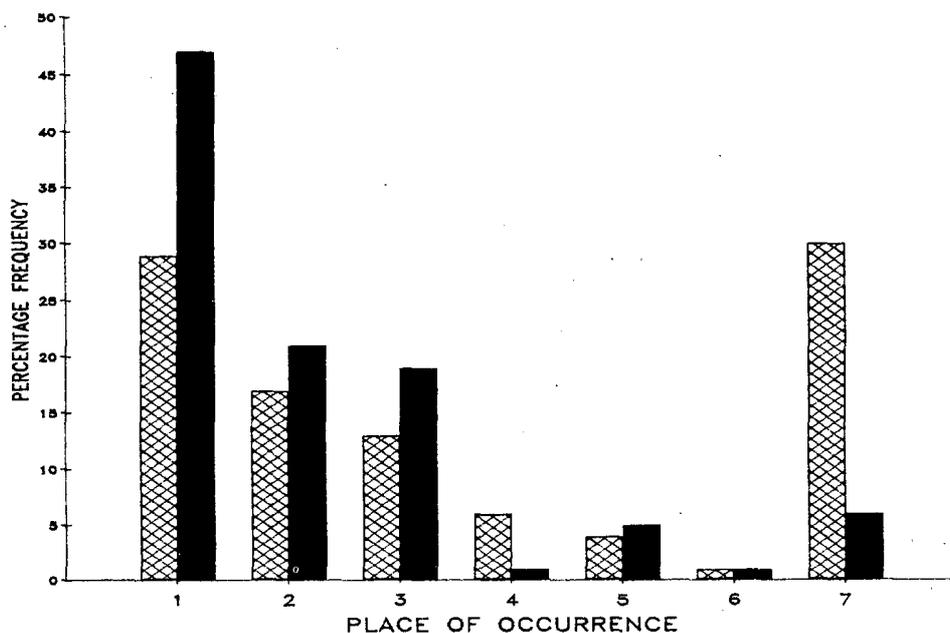
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA					1		1				1		3
ALASKA													0
ARIZONA			3	3	1	2	1	2					12
ARKANSAS								2	2				18
CALIFORNIA		5	3	6				1		2	13	1	15
COLORADO													0
CONNECTICUT													0
DELAWARE													0
DISTRICT OF COLUMBIA													0
FLORIDA													0
GEORGIA				1	3						1		5
HAWAII													0
IDAHO				2		2							4
ILLINOIS					6	1							7
INDIANA													0
IOWA					13		4		1		1		19
KANSAS					18	13					1		32
KENTUCKY													0
LOUISIANA			1	2	2	3		2	1		4		15
MAINE													0
MARYLAND													0
MASSACHUSETTS													0
MICHIGAN				3			2	2	1				8
MINNESOTA						2	8	4	1				15
MISSISSIPPI	1		2		1			1	1		21		27
MISSOURI													0
MONTANA													0
NEBRASKA					1	3	10		1				15
NEVADA				1	2	1							4
NEW HAMPSHIRE													0
NEW JERSEY													0
NEW MEXICO					8	2	4	1	2				17
NEW YORK							3						3
NORTH CAROLINA			2	2	13	11							28
NORTH DAKOTA						1	3	4					8
OHIO													0
OKLAHOMA				1									1
OREGON													0
PACIFIC ISLANDS													0
PENNSYLVANIA					2						1		3
PUERTO RICO													0
RHODE ISLAND													0
SOUTH CAROLINA													0
SOUTH DAKOTA							2	2					4
TENNESSEE					4						1		5
TEXAS			3	5	19	9	24			2	7		69
UTAH													0
VERMONT													0
VIRGINIA													0
VIRGIN ISLANDS													0
WASHINGTON				1		1							2
WEST VIRGINIA													0
WISCONSIN					4		2						6
WYOMING				2		6	18		1				27
TOTAL: UNITED STATES	1	5	14	29	98	57	82	21	11	2	51	1	372

# NATIONAL SUMMARY OF LIGHTNING, 1988

HENRY N. VIGANSKY  
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
 NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE  
 NATIONAL CLIMATIC DATA CENTER

Sixty-eight people were killed by lightning in the United States during 1988, which was 30 percent below the national average of 96 deaths. On the other hand, the 311 injuries were 22 percent above the national average of 255. Location and percentage frequency of lightning deaths and injuries are depicted in the following two figures for 1988, and for the period 1959-1988:

FIGURE 1A - Lightning Deaths

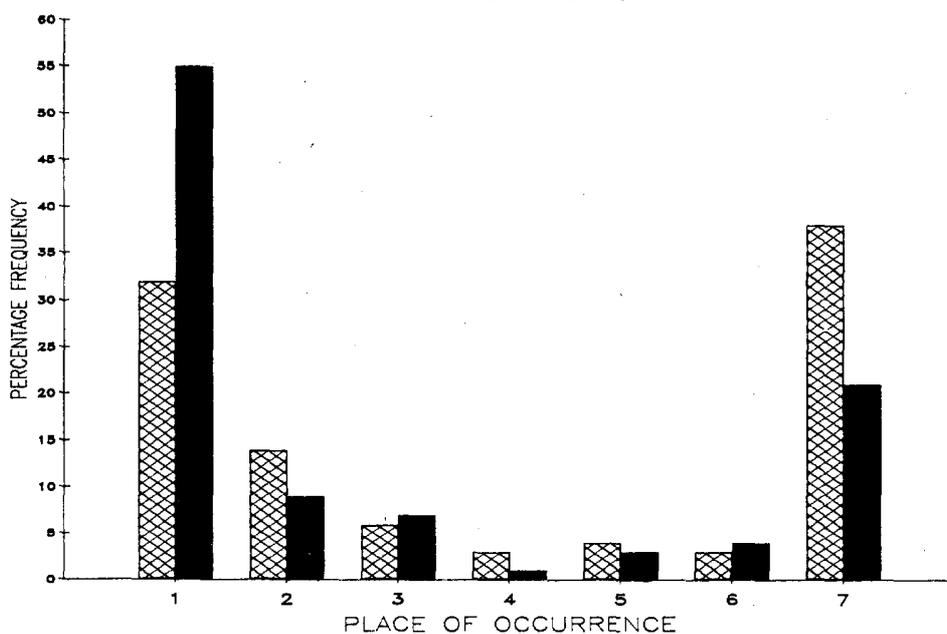


LEGEND  
 1959-1988  
 1988

PLACE OF OCCURRENCE

1. Open fields, Ball fields, etc.
2. Under trees
3. Boating, fishing and water related
4. Near tractors, heavy road equipment
5. Golf Courses
6. At telephones
7. Various other and unknown locations

FIGURE 1B - Lightning Injuries



Some lightning incidents are briefly described in the following monthly summaries:

**JANUARY:** A lightning-induced fire caused \$25,000 damage to a lumber yard in Fitzgerald, Georgia.

**FEBRUARY:** No incidents reported in Storm Data.

**MARCH:** Near Boise, Idaho, lightning struck the nose of a United Airlines plane two times, leaving a small hole and a large tear in the nose and causing minimal damage to the left wing. Lightning struck a woman while she was doing chores on a farm near Sully, Iowa. She was critically injured with third degree burns caused by her clothing being set on fire. Lightning caused a \$65,000 house to burn in Choateau, Oklahoma and also caused \$10,000 damage to an oil battery in Weleetka, Oklahoma.

**APRIL:** Lightning struck and killed 13 head of beefmaster cattle near Rose Bud, Arkansas. The cattle were valued at \$30,000. Near Tustin, California, a girl's softball team took shelter under a tree to ward off the rain. The tree was struck by lightning, injuring nine girls. Several of the girls had to be revived by applying cardiopulmonary resuscitation (CPR). Lightning struck two 14-year old girls on a softball field in Westminster, Colorado. One girl was killed; the other suffered moderate injuries. In Gonzales, Louisiana, lightning started a fire that subsequently destroyed two businesses and severely damaged three others. Damages were estimated to be in excess of \$300,000. In Moab, Utah, a 13-year old girl was seriously burned when lightning struck a tree near her home. The girl was talking on a telephone at the time lightning struck, and the electrical charge traveled through the underground phone lines into the telephone. The lightning also caught the house on fire and did about \$5,000 damage.

**MAY:** A 19-year old student was killed and another injured on the University of Georgia golf course located in Athens, Georgia. The man killed was holding the flagstaff when struck by lightning. Twenty-four head of cattle were killed by lightning while standing under a tree near Carnesville, Georgia. Lightning struck a hog confinement building located in Langdon, Iowa, resulting in the death of 1,300 hogs. In the Wichita, Kansas area, lightning struck and killed a man as he was playing softball; several other people were knocked to the ground, resulting in two injuries. In Montezuma, New York, lightning hit a telephone line; the electrical surge traveled through the wire into a nearby house, killing a woman who was using the telephone. The woman was eight months pregnant. In Spring Lake, North Carolina, a man was injured by lightning while using a telephone. Lightning struck and killed a woman while on a tractor near Howard, Ohio. Two miles (3.2 km) southwest of Glenside, Pennsylvania, lightning struck in the midst of the Beaver College graduating class, injuring 12 students and killing one.

**JUNE:** In Mobile, Alabama, a woman was slightly injured when she was struck by lightning while talking on a telephone. Another woman was injured by lightning while she was talking on a telephone in Dothan, Alabama. In Eureka Springs, Arkansas, a schoolhouse was struck by lightning. The ensuing fire caused damage to be in excess of \$300,000. On Santa Cruz Beach, California, a bolt of lightning hit between two girls; both girls sustained minor burns and temporary paralysis. Near Eldorado Springs, Colorado, lightning struck two rock climbers; a 25-year old man was killed and his 21-year

old partner suffered from extensive injuries. A teenage couple were walking in a field in New Haven County, Connecticut when struck by lightning, injuring the girl and killing the boy instantly. In Stonington, Connecticut, a woman was injured while using a telephone. Near Melbourne, Florida, lightning injured two men on an airboat; at the time light rain was falling from an approaching thunderstorm. In Heard County, Georgia, a man was killed by lightning as he was returning from a day of fishing. He just left a boat and was struck by lightning in an open area away from the water. His companion was knocked unconscious and slightly injured. Five miles (8.0 km) south of Dahlonega, Georgia, five people were injured when lightning struck a pavilion next to a church. In Bonner County, Idaho, lightning struck the power plant at Cabinet George Dam; numerous appliances and satellite systems were damaged by the power surge. In some cases the surge protectors were melted. In Lawrence, Massachusetts, a lightning-induced fire gutted a mill building, causing approximately \$1 million damage. In Raleigh, North Carolina, a fast food restaurant worker was injured by lightning while serving food from the drive-in window. In Portsmouth, Rhode Island, lightning struck a radio antenna and traveled into the radio receiver, injuring the radio operator. Twenty-one cows were killed by a single bolt of lightning in Oconee County, South Carolina. In White Settlement, Texas, lightning struck a crane, injuring three construction workers. Lightning struck a power pole and injured a teenager in Arlington, Texas while she was talking on a telephone. Sixteen miles (25.7 km) south of Rocksprings, Texas, five men who were cutting and stacking cedar posts on a metal trailer took shelter under the trailer during a thunderstorm. Lightning hit a metal post on the trailer, killing two of the men and injuring the other three.

**JULY:** A man's life was saved by immediate administration of CPR after being struck by lightning at the Cherry Creek Reservoir located in Denver County, Colorado. In Summit County, Colorado, two women were injured by lightning while boating on Lake Dillon. A man was injured by lightning on Blue Mesa Reservation, Colorado. The two puppies he was holding in his lap were killed instantly. On a golf course near Loveland, Colorado, a man was injured by lightning. In Golden, Colorado, lightning struck a group of people at the Jefferson County fairgrounds; a woman was seriously injured and was hospitalized for three days. Four other people sustained minor injuries. In Durango, Colorado, a woman and her daughter were struck and injured by lightning; the zippers on their clothes turned red hot. A woman was injured by lightning while talking on a telephone in Milton, Delaware. Two miles (3.2 km) east of Homestead, Florida, a man on a motor boat was struck and killed by lightning. A 13-year old boy was swimming 10 feet (3 m) offshore in Pensacola, Florida when struck and injured by lightning. The lightning was observed to travel a considerable distance from the thunderstorm. Nine families in Amesbury, Massachusetts were left homeless after a lightning bolt struck an apartment building, tearing off a portion of the roof. The resulting fire caused extensive damage. In Wexford County, Michigan, three people standing on the shore of Lake Mitchell were struck and injured by a bolt of lightning. Near Pinconning in Bay County, Michigan, a man was killed and his wife seriously injured by lightning as they attempted to cover a boat moored 35 yards (32 m) offshore. Three men and a woman were injured by lightning while standing in an orchard near Picacho, New Mexico. Six boy scouts were struck by

lightning while on a backpack outing near the Philmont National Boy Scout Ranch located in Colfax County, New Mexico. Five scouts were injured and one scout went immediately into a coma and never regained consciousness. He died in a hospital two weeks later. Lightning struck and killed a young girl and injured a young boy while they were riding horses near Mount Taylor, New Mexico. The two horses were killed. Two nearby adults and two children were also injured. A family playing volleyball in Prospect Park located in Kings County, New York, attempted to ward off torrential rains associated with a passing thunderstorm by running under a nearby tree. The tree was struck by lightning, killing one man and injuring 12 members of his family and friends. In Henderson County, North Carolina, near Tuxedo, a woman was injured by lightning while holding a curling iron. She was found unconscious shortly after the strike and was taken to a nearby hospital. In Gates County, North Carolina, an eight-year old boy was killed and his grandfather injured when the two were struck by lightning. They were outside the house picking up toys as the storm approached. Lightning caused \$500,000 damage to a warehouse in Ada, Oklahoma. In northern Oklahoma City, lightning caused \$250,000 damage to a restaurant. In Fall River County, South Dakota, lightning struck a campground, injuring four campers. In Union City, Tennessee, four people were injured when lightning struck a power pole near the plant where they worked. Two women were near the pole when lightning struck; one man was on a forklift, and another man was working on electrical equipment inside the plant. In northeast Bexar County, Texas, eight youngsters were playing softball when lightning struck the ballfield. Two of the players had to be hospitalized while the other six players were treated at the scene and released. One of the boys' tennis shoes were melted; this individual was not breathing when firemen arrived on the scene. They administered CPR and restored his breathing. The other youngster was hospitalized for eye damage. A boy was struck by lightning while camping in Hobble Creek Canyon near Springville, Utah. The boy was knocked unconscious, but was later revived. He suffered second degree burns on the lower half of his body. In Kearns, Utah, a boy was struck by lightning while riding a skateboard. The victim was paralyzed by the strike; he later recovered with only minor burns. On the shore of the Nottoway River located in Southampton County, Virginia, one man was killed and another injured by lightning after stepping out of a boat. During July, at least 59 fires were started by lightning from high-based thunderstorms that produced very little rainfall. These included very large forest fires, such as the Clover Mist Blaze in Yellowstone Park and Lost Fire over the Big Horn Mountains of northern Wyoming.

**AUGUST:** In Logan County, Arkansas, a dairy farmer was struck by lightning inside his barn. He was thrown 15 feet (4.6 m) across the barn and suffered temporary paralysis. Later he had slurred speech and lost part of his vision. A man was killed near Dunedin, Florida when lightning struck the mast of a sailboat. He and his friends were attempting to get out of the water. One companion suffered minor injuries. On a golf course near Panama City, Florida, a man was struck and killed by lightning. A man and a woman were injured by lightning while walking along the beach in Fort Lauderdale, Florida. In Lawrenceville, Georgia, a man was injured by lightning while talking on a telephone. A man was injured by lightning while standing outside his residence in Mountain View, Hawaii. Lightning had struck a nearby tree. The man was hospitalized for

several days. In Arlington, Kentucky, a man was struck and killed by lightning while he was mowing grass. On a golf course near Shreveport, Louisiana, a man was injured by lightning. In Lafourche Parrish, Louisiana, three boys were injured when lightning struck a tree they were standing under while fishing along Bayou Lafourche. One boy, who was leaning against the tree, suffered burns to his hip and leg. Injuries were relatively minor; all three boys were released from the hospital on the following day. In Pearl River County, Mississippi, lightning struck a forestry observation tower, lighting up "like a Christmas tree". The lightning bolt traveled into a pole shed where two employees were sitting at a table drinking sodas. The charge traveled through the table into the soda cans, burning both of their hands. Both injuries were minor. In Wilmington, North Carolina, a television reporter setting up equipment for a live outdoor broadcast was slightly injured by lightning. "Lightning strikes twice" - lightning struck a large coal shovel near Plainfield, Ohio, injuring one man. While the second person was administering first aid to the injured man, another lightning bolt struck, injuring both of them. On a golf course in Lake County, Ohio, lightning struck and injured three golfers. On a ranch five miles (8 km) southwest of Poteau, Oklahoma, three men were struck by lightning while they were working with cattle. Lightning injured a woman on a golf course in Rutherford County, Tennessee. She received second and third degree burns. At the time she was struck by lightning, she was on her way to a shelter, and lightning struck the golf cart she was pulling. A man was seriously injured when he was struck by lightning while riding in a boat on Lake Loudon, Tennessee. Several other people were on the boat, but were unharmed. A golfer was struck by lightning in Austin, Texas. He was knocked unconscious and treated at a local hospital. He was released after two hours of observation. A bolt of lightning struck six children at a campground near Wautoma, Wisconsin, killing two and injuring four.

**SEPTEMBER:** A man was killed by lightning while golfing near Fort Smith, Arkansas. He was walking under a tree; his female companion was knocked down, but unharmed. In Linwood, Kansas, a woman was injured while talking on a telephone. Lightning struck nearby and the charge entered the house through the telephone line. She was taken to a local hospital where she was treated for minor injuries and released. In Pinckney, Michigan, lightning struck in a parking lot adjacent to a football field, injuring thirteen people. North of Grantham, North Carolina, two men camping by the Neuse River were injured by lightning. Lightning struck the ground near their tent, and the charge traveled along the wet ground to inside the tent. Both men were hospitalized for a short period of time.

**OCTOBER:** In Phoenix, Arizona, lightning struck a car lot, slightly injuring three people. They were treated at a nearby hospital and released. A woman was killed in an open field near Benson, Arizona. Four people were jolted by lightning while standing near a concourse at Chicago, O'Hare Airport. One person was treated at a hospital and released; the other three persons declined treatment. Lightning struck Castle Point Apartments in South Bend, Indiana, causing \$150,000 damage.

**NOVEMBER:** In Pike County, Arkansas, nine head of cattle were lost when lightning struck a tree under which they were standing. Lightning struck a garage in Leavenworth County, Kansas. The blaze totally destroyed the garage and its contents, including six automobiles and numerous

tools. On the Louisiana State University grounds in Baton Rouge, a student was knocked to the ground by a lightning strike, yet apparently unharmed except for tingling sensations. An eyewitness said the lightning struck immediately behind the student as she was walking across an open area. In Rankin County, Mississippi, a hunter was struck by lightning while he was occupying a deer stand. The victim survived, although he spent several weeks in a hospital.

**DECEMBER:** No incidents reported in Storm Data.

Additional information is presented in the following tables.

More detailed information concerning lightning data can be obtained by the monthly STORM DATA publications. The National Climatic Data Center has lightning data available on magnetic tape for the period 1959-1988. The tape contains the date/time (year, month, day, and hour), location (state and county), number of fatalities, number of injuries, and amount of damage. A copy of this tape can be obtained by contacting the National Climatic Data Center, Federal Building, Asheville, North Carolina 28801-2696 (telephone: (704) 259-0682).

# TOTAL DEATHS BY STATE AND NATION FOR YEAR 1988

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	0	0	2	0	0	0	0	0	0	2
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	0	0	0	0	0	1	0	0	1
ARKANSAS	0	0	0	0	0	0	0	0	1	0	0	0	1
CALIFORNIA	0	0	0	0	0	0	0	0	0	0	0	0	0
COLORADO	0	0	0	1	0	3	2	0	0	0	0	0	6
CONNECTICUT	0	0	0	0	0	1	0	0	0	0	0	0	1
DELAWARE	0	0	0	0	0	0	0	0	0	0	0	0	0
DISTRICT OF COLUMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0
FLORIDA	0	0	0	0	0	2	2	4	1	0	0	0	9
GEORGIA	0	0	0	1	2	1	0	0	0	0	0	0	4
HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0
IDAHO	0	0	0	0	0	0	0	0	0	0	0	0	0
ILLINOIS	0	0	0	0	0	0	0	0	0	0	0	0	0
INDIANA	0	0	0	0	0	0	0	0	0	0	0	0	0
IOWA	0	0	0	0	0	0	0	0	0	0	0	0	0
KANSAS	0	0	0	0	1	0	1	0	0	0	0	0	2
KENTUCKY	0	0	0	0	0	0	0	1	0	0	0	0	1
LOUISIANA	0	0	0	0	0	0	1	0	0	0	1	0	2
MAINE	0	0	0	0	0	0	0	0	0	0	0	0	0
MARYLAND	0	0	0	0	0	0	0	0	0	0	0	0	0
MASSACHUSETTS	0	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN	0	0	0	0	0	0	2	1	0	0	0	0	3
MINNESOTA	0	0	0	0	0	1	1	1	0	0	0	0	3
MISSISSIPPI	0	0	0	0	0	0	0	0	0	0	0	0	0
MISSOURI	0	0	0	0	0	0	0	0	0	0	0	0	0
MONTANA	0	0	0	0	0	0	0	0	0	0	0	0	0
NEBRASKA	0	0	0	0	0	1	0	0	0	0	0	0	1
NEVADA	0	0	0	0	0	1	0	0	0	0	0	0	1
NEW HAMPSHIRE	0	0	0	0	0	0	1	0	0	0	0	0	1
NEW JERSEY	0	0	0	0	0	0	1	0	0	0	0	0	1
NEW MEXICO	0	0	0	0	1	0	2	0	0	0	0	0	3
NEW YORK	0	0	0	0	1	0	3	0	0	0	0	0	4
NORTH CAROLINA	0	0	0	0	2	1	1	0	0	0	0	0	4
NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
OHIO	0	0	0	0	1	0	0	1	0	0	0	0	2
OKLAHOMA	0	0	0	0	0	0	0	2	0	0	0	0	2
OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	0	0	0	1	1	0	0	0	0	0	0	0	2
PUERTO RICO	0	0	0	0	0	0	2	0	0	0	0	0	2
RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	0	0	0	0	0	1	0	0	0	0	0	0	1
SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
TENNESSEE	0	0	0	0	0	0	0	0	0	0	0	0	0
TEXAS	0	0	0	0	0	2	1	0	0	0	0	0	3
UTAH	0	0	0	0	0	0	0	0	0	0	0	0	0
VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	0	0	0	0	0	1	1	0	0	0	0	0	2
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0
WISCONSIN	0	0	0	0	0	0	0	4	0	0	0	0	4
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	0	0	0	3	9	17	21	14	2	1	1	0	68

# TOTAL INJURIES BY STATE AND NATION FOR YEAR 1988

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	1	0	4	0	0	0	0	0	0	5
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	0	0	1	1	0	3	0	0	5
ARKANSAS	0	0	0	0	0	0	0	1	0	0	0	0	1
CALIFORNIA	0	0	0	9	0	2	0	0	0	0	0	0	11
COLORADO	0	0	0	1	0	7	15	0	1	0	0	0	24
CONNECTICUT	0	0	0	0	1	2	0	0	0	0	0	0	3
DELAWARE	0	0	0	0	0	0	1	0	0	0	0	0	1
DISTRICT OF COLUMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0
FLORIDA	0	0	0	0	0	2	4	8	0	0	0	0	14
GEORGIA	0	0	0	2	3	6	0	1	0	0	0	0	12
HAWAII	0	0	0	0	0	0	0	1	0	0	0	0	1
IDAHO	0	0	0	0	0	0	0	0	0	0	0	0	0
ILLINOIS	0	0	0	0	0	0	0	0	0	1	0	0	1
INDIANA	0	0	0	0	0	0	1	2	0	0	0	0	3
IOWA	0	0	1	0	0	0	2	0	0	0	0	0	3
KANSAS	0	0	0	0	3	0	1	0	1	0	0	0	5
KENTUCKY	0	0	0	0	0	1	0	7	0	0	0	0	8
LOUISIANA	0	0	0	0	0	0	0	0	1	0	0	0	1
MAINE	0	0	0	0	1	0	0	0	0	0	0	0	1
MARYLAND	0	0	0	0	0	0	1	0	0	0	0	0	1
MASSACHUSETTS	0	0	0	0	0	5	1	1	0	0	0	0	7
MICHIGAN	0	0	0	0	0	0	11	3	15	0	0	0	29
MINNESOTA	0	0	0	0	0	0	1	1	0	0	0	0	2
MISSISSIPPI	0	0	0	0	0	0	1	2	0	0	1	0	4
MISSOURI	0	0	0	0	0	0	0	0	0	0	0	0	0
MONTANA	0	0	0	0	0	0	0	3	0	0	0	0	3
NEBRASKA	0	0	0	0	0	0	1	0	0	0	0	0	1
NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW HAMPSHIRE	0	0	0	0	0	2	0	2	0	0	0	0	4
NEW JERSEY	0	0	0	0	0	0	0	1	0	0	0	0	1
NEW MEXICO	0	0	0	0	0	1	18	1	0	0	0	0	20
NEW YORK	0	0	0	0	0	3	23	1	0	0	0	0	27
NORTH CAROLINA	0	0	0	0	1	2	10	1	2	0	0	0	16
NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
OHIO	0	0	0	0	0	0	0	10	0	0	0	0	10
OKLAHOMA	0	0	0	0	0	0	0	4	0	0	0	0	4
OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	0	0	0	0	13	1	23	0	0	0	0	0	37
PUERTO RICO	0	0	0	0	0	0	1	0	0	0	0	0	1
RHODE ISLAND	0	0	0	0	0	3	0	0	0	0	0	0	3
SOUTH CAROLINA	0	0	0	0	0	1	3	2	0	0	0	0	6
SOUTH DAKOTA	0	0	0	0	0	0	4	0	0	0	0	0	4
TENNESSEE	0	0	0	0	0	0	4	2	0	0	0	0	6
TEXAS	0	0	0	0	0	9	0	1	0	0	0	0	10
UTAH	0	0	0	1	0	0	4	0	0	0	0	0	5
VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	0	0	0	0	0	2	2	0	0	0	0	0	4
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0
WISCONSIN	0	0	0	0	0	0	0	7	0	0	0	0	7
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	0	0	1	14	22	53	133	63	19	5	1	0	311

# TOTAL DEATHS BY STATE AND NATION FOR PERIOD 1959-88

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	2	2	4	21	26	18	1	1	0	0	75
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	2	1	17	15	11	1	0	0	47
ARKANSAS	0	0	8	0	13	30	27	20	4	0	0	0	102
CALIFORNIA	0	0	0	0	0	2	6	5	3	0	0	0	16
COLORADO	0	0	0	2	10	19	33	15	0	1	0	0	80
CONNECTICUT	0	0	0	0	0	4	5	3	1	0	0	0	13
DELAWARE	0	0	0	0	2	2	4	3	0	0	0	0	11
DISTRICT OF COLUMBIA	0	0	0	0	0	2	1	1	0	0	0	0	4
FLORIDA	0	0	4	3	23	69	78	72	35	3	1	1	289
GEORGIA	0	0	2	4	6	18	30	10	2	1	0	0	73
HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0
IDAHO	0	0	0	1	1	6	5	5	1	0	0	0	19
ILLINOIS	0	0	0	4	9	22	12	12	10	2	0	0	71
INDIANA	0	0	1	2	7	21	15	12	5	2	0	0	65
IOWA	0	0	1	3	10	18	6	13	4	4	0	0	59
KANSAS	0	0	0	4	10	5	14	8	4	2	0	0	49
KENTUCKY	1	0	0	3	9	19	16	11	10	0	0	0	69
LOUISIANA	0	0	1	5	10	20	40	15	11	0	3	1	106
MAINE	0	0	0	0	0	3	5	6	0	3	0	0	17
MARYLAND	0	0	0	0	4	5	8	11	1	1	0	81*	111
MASSACHUSETTS	0	0	0	1	3	4	5	9	1	0	0	0	23
MICHIGAN	0	0	0	1	6	20	28	22	7	0	0	0	84
MINNESOTA	0	0	0	3	3	10	11	13	10	1	0	0	51
MISSISSIPPI	1	0	4	2	12	11	26	19	5	0	0	0	80
MISSOURI	0	0	5	4	20	19	13	8	3	1	0	0	73
MONTANA	0	0	0	0	2	8	6	2	1	0	0	0	19
NEBRASKA	0	0	0	1	3	14	8	6	4	0	0	0	36
NEVADA	0	0	0	0	0	2	0	2	0	0	0	0	4
NEW HAMPSHIRE	0	0	0	0	0	3	3	0	0	0	0	0	6
NEW JERSEY	0	0	0	1	3	8	21	14	6	0	0	0	53
NEW MEXICO	0	0	0	1	4	10	23	29	4	0	0	0	71
NEW YORK	0	0	0	0	7	18	58	26	5	2	0	0	116
NORTH CAROLINA	0	1	4	3	23	32	49	34	4	0	0	0	150
NORTH DAKOTA	0	0	0	0	0	4	4	3	0	0	0	0	11
OHIO	0	0	0	3	9	22	40	16	8	2	2	0	102
OKLAHOMA	1	1	1	9	14	13	7	17	13	3	2	0	81
OREGON	0	0	0	0	2	0	0	1	2	1	0	0	6
PENNSYLVANIA	0	1	0	1	8	24	29	25	8	1	0	0	97
PUERTO RICO	0	0	0	0	0	3	8	9	5	3	0	0	28
RHODE ISLAND	0	0	0	0	0	1	1	0	2	0	0	0	4
SOUTH CAROLINA	0	0	1	0	6	11	30	12	7	0	0	0	67
SOUTH DAKOTA	0	0	0	0	4	1	6	1	3	3	0	0	18
TENNESSEE	0	1	1	7	14	31	23	18	14	2	3	0	114
TEXAS	0	0	0	14	26	16	39	21	15	7	1	0	139
UTAH	0	0	0	3	1	5	5	6	2	1	0	0	23
VERMONT	0	0	0	0	0	4	5	4	0	0	0	0	13
VIRGINIA	0	0	0	0	10	9	10	10	3	0	0	0	42
WASHINGTON	0	0	0	0	0	1	0	0	0	0	0	0	1
WEST VIRGINIA	0	0	0	0	4	2	8	2	1	0	0	0	17
WISCONSIN	0	0	0	1	2	8	12	15	2	1	1	1	43
WYOMING	0	0	0	0	2	4	7	6	2	0	0	0	21
TOTAL: UNITED STATES	3	4	35	88	308	605	833	605	240	49	15	84	2869

\* ON DECEMBER 8, 1963 THE CRASH OF A JETLINER KILLING 81 PEOPLE NEAR ELKTON, MARYLAND, WAS ATTRIBUTED TO LIGHTNING BY THE CIVIL AERONAUTICS BOARD INVESTIGATORS.

# TOTAL INJURIES BY STATE AND NATION FOR PERIOD 1959-88

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	6	1	10	3	7	19	56	44	2	4	0	0	152
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	2	0	0	0	6	1	28	22	17	3	0	0	79
ARKANSAS	1	2	2	11	29	24	34	59	10	1	0	1	174
CALIFORNIA	1	0	0	13	0	2	15	7	1	1	1	1	42
COLORADO	0	0	0	1	27	56	63	46	8	0	0	0	201
CONNECTICUT	0	0	2	0	7	19	14	11	6	0	0	0	59
DELAWARE	0	0	0	0	8	9	1	1	2	0	0	0	21
DISTRICT OF COLUMBIA	0	0	0	0	0	4	1	1	0	0	1	0	7
FLORIDA	0	2	15	12	28	180	187	179	141	27	0	1	772
GEORGIA	0	0	5	4	21	65	116	33	3	5	0	0	252
HAWAII	0	0	0	0	0	0	0	1	0	0	0	0	1
IDAHO	0	0	0	1	6	17	15	17	4	1	0	0	61
ILLINOIS	0	0	0	2	16	39	59	32	28	2	0	0	178
INDIANA	0	0	2	4	21	32	28	24	1	0	0	0	112
IOWA	0	0	2	7	22	41	39	18	16	3	1	0	149
KANSAS	0	0	5	10	17	23	41	30	28	5	1	0	160
KENTUCKY	0	0	0	2	20	59	59	35	10	1	0	0	186
LOUISIANA	1	0	6	2	13	13	95	39	14	2	2	1	188
MAINE	0	0	0	0	4	5	25	50	0	0	1	0	85
MARYLAND	0	0	0	0	35	17	34	20	6	2	0	0	114
MASSACHUSETTS	0	0	1	11	20	44	108	74	26	4	2	1	291
MICHIGAN	0	0	1	9	37	135	127	194	47	6	0	0	556
MINNESOTA	0	0	0	0	15	17	22	19	9	4	0	0	86
MISSISSIPPI	1	2	4	3	13	13	104	41	10	2	3	1	197
MISSOURI	0	1	3	8	20	16	4	15	3	2	4	0	76
MONTANA	0	0	0	0	5	9	10	11	2	0	0	0	37
NEBRASKA	0	0	0	4	14	6	9	16	6	0	0	0	55
NEVADA	0	0	0	0	0	1	1	3	0	0	0	0	5
NEW HAMPSHIRE	0	0	0	0	2	20	30	5	2	0	0	0	59
NEW JERSEY	0	0	0	0	5	11	53	19	16	0	0	0	104
NEW MEXICO	0	0	0	1	19	15	54	49	6	0	0	0	144
NEW YORK	0	0	0	1	10	55	130	127	24	3	1	0	351
NORTH CAROLINA	0	2	27	13	40	69	110	109	25	2	1	0	398
NORTH DAKOTA	0	0	0	0	2	0	0	5	4	0	0	0	11
OHIO	0	0	32	3	54	51	57	102	49	4	11	0	363
OKLAHOMA	1	1	3	14	31	38	33	37	21	19	5	2	205
OREGON	0	0	0	0	2	2	0	9	3	0	0	0	16
PENNSYLVANIA	0	6	0	0	22	112	114	134	41	2	0	0	431
PUERTO RICO	0	0	0	0	0	0	3	0	2	1	0	0	6
RHODE ISLAND	0	2	0	0	1	13	12	12	3	0	1	0	44
SOUTH CAROLINA	0	0	0	3	20	16	94	29	20	1	0	0	183
SOUTH DAKOTA	0	0	0	1	4	18	15	9	1	2	0	0	50
TENNESSEE	0	1	4	6	30	52	102	50	20	4	0	0	269
TEXAS	0	2	5	36	43	47	37	42	30	10	2	0	254
UTAH	0	0	0	1	4	18	16	14	4	2	0	0	59
VERMONT	0	0	0	0	0	3	10	2	0	0	0	0	15
VIRGINIA	0	0	0	2	8	15	51	30	6	0	0	0	112
WASHINGTON	0	0	0	0	4	1	7	8	0	1	0	1	22
WEST VIRGINIA	0	0	0	0	0	3	23	25	1	1	0	0	53
WISCONSIN	0	1	2	3	16	26	52	30	7	2	2	0	141
WYOMING	0	0	0	0	4	32	18	21	6	0	0	0	81
TOTAL: UNITED STATES	13	23	131	191	732	1483	2316	1910	691	129	39	9	7667

## NATIONAL TOTAL DEATHS BY YEAR FOR PERIOD 1958-1988

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1959	1	0	1	4	18	25	50	39	13	7	0	0	158
1960	0	0	1	5	7	33	25	17	9	0	0	0	97
1961	0	0	1	2	9	23	47	20	10	1	0	0	113
1962	0	0	3	6	27	20	26	28	9	1	0	0	120
1963	0	0	4	3	11	37	42	20	10	2	0	81*	210
1964	0	0	9	6	15	21	29	19	7	1	1	0	108
1965	0	0	2	4	12	34	39	28	4	2	0	0	125
1966	0	0	1	1	8	15	21	16	11	3	0	0	76
1967	1	0	1	2	3	26	21	14	1	2	1	1	73
1968	0	0	0	1	5	24	30	29	9	3	1	1	103
1969	0	0	1	5	13	17	27	13	14	3	0	0	93
1970	0	0	0	1	17	25	27	19	21	1	0	0	111
1971	0	0	2	1	12	27	33	19	19	0	0	0	113
1972	0	0	1	1	5	21	31	28	3	1	0	0	91
1973	0	1	2	3	10	24	31	18	13	2	1	0	105
1974	0	2	0	7	12	21	28	24	6	0	2	0	102
1975	0	1	3	3	11	19	28	18	6	2	0	0	91
1976	0	0	0	1	9	19	19	19	3	2	0	0	72
1977	0	0	0	4	9	19	16	35	14	1	0	0	98
1978	0	0	1	1	9	26	24	22	3	1	0	1	88
1979	0	0	0	3	11	4	20	16	4	3	2	0	63
1980	0	0	0	0	7	16	27	20	5	1	0	0	76
1981	0	0	0	4	5	13	19	19	5	0	2	0	67
1982	1	0	0	3	5	14	29	18	4	3	0	0	77
1983	0	0	1	2	4	8	28	23	8	1	2	0	77
1984	0	0	1	3	10	14	20	10	7	1	1	0	67
1985	0	0	0	5	12	12	26	8	8	1	1	0	73
1986	0	0	0	2	9	13	21	17	5	1	0	0	68
1987	0	0	0	2	14	18	28	15	7	2	0	0	86
1988	0	0	0	3	9	17	21	14	2	1	1	0	68
TOTAL	3	4	35	88	308	605	833	605	240	49	15	84	2869
MEAN	0	0	1	3	10	20	28	20	8	2	1	3	96

\* ON DECEMBER 8, 1963 THE CRASH OF A JETLINER KILLING 81 PEOPLE NEAR ELKTON, MARYLAND, WAS ATTRIBUTED TO LIGHTNING BY THE CIVIL AERONAUTICS BOARD INVESTIGATORS.

## NATIONAL TOTAL INJURIES BY YEAR FOR PERIOD 1958-1988

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1959	0	0	0	5	27	52	110	103	23	3	1	1	325
1960	0	0	2	11	12	70	28	50	16	9	4	0	202
1961	0	0	7	14	15	49	83	50	31	5	1	1	256
1962	0	0	3	5	39	38	90	49	12	6	0	0	242
1963	7	0	0	6	14	64	55	44	18	1	0	0	209
1964	0	0	10	15	14	38	99	53	8	1	1	0	239
1965	3	2	2	4	26	42	59	59	19	1	0	0	217
1966	0	2	1	2	37	39	42	44	15	1	0	0	183
1967	0	0	0	4	7	35	59	33	4	2	0	1	145
1968	0	0	4	2	16	52	117	155	14	9	1	0	370
1969	0	0	0	4	19	75	39	23	12	0	0	1	173
1970	0	0	1	5	40	40	82	43	43	4	1	0	259
1971	0	1	0	1	24	71	79	54	22	1	1	0	254
1972	0	0	8	6	12	24	72	54	24	2	1	0	203
1973	0	0	10	2	20	23	74	59	29	9	2	0	228
1974	1	9	1	3	12	27	56	51	12	1	0	0	173
1975	0	3	0	1	30	60	107	154	42	1	0	1	399
1976	0	1	0	7	16	39	73	68	13	1	0	1	219
1977	0	0	0	3	35	58	58	67	62	4	4	0	291
1978	0	0	5	3	19	100	73	54	42	5	0	0	301
1979	0	2	4	26	32	73	55	49	9	2	2	0	254
1980	0	1	2	11	11	49	50	134	16	1	0	0	275
1981	1	0	2	9	34	60	108	52	9	3	13	0	291
1982	1	0	2	6	38	20	54	32	11	4	4	2	174
1983	0	0	24	3	25	24	87	113	30	31	0	0	337
1984	0	0	7	5	13	43	80	53	44	7	1	0	253
1985	0	0	29	4	42	48	61	33	27	4	0	0	248
1986	0	2	4	2	15	68	112	43	22	3	0	0	271
1987	0	0	2	8	66	49	121	70	43	3	1	1	364
1988	0	0	1	14	22	53	133	63	19	5	1	0	311
TOTAL	13	23	131	191	732	1483	2316	1910	691	129	39	9	7666
MEAN	0	1	4	6	24	49	77	64	23	4	1	0	256



# LIGHTNING INJURIES BY STATE, RANK, AND LOCATION OF OCCURRENCE

1959-1988

1988

STATE	RANK	1959-1988												1988																
		OPEN FIELDS, BALL PARKS, AND OPEN SPACES		UNDER TREES		BOATING, FISHING AND WATER RELATED		NEAR TRACTORS HEAVY ROAD EQUIPMENT		GOLF COURSES		AT TELEPHONES		VARIOUS OTHER AND UNKNOWN LOCATIONS		OPEN FIELDS, BALL PARKS, AND OPEN SPACES		UNDER TREES		BOATING, FISHING AND WATER RELATED		NEAR TRACTORS HEAVY ROAD EQUIPMENT		GOLF COURSES		AT TELEPHONES		VARIOUS OTHER AND UNKNOWN LOCATIONS		
		NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	
ALABAMA	20	52	34	22	14	3	2	1	1	1	1	10	7	63	41					1	20					2	40	2	40	
ALASKA	52																													
ARIZONA	31	48	61	5	6	2	3	5	6	1	1			18	23	5	100													
ARKANSAS	18	42	24	25	14	10	6	7	4	4	2	10	6	76	44															
CALIFORNIA	42	10	24	10	24			5	12					17	40			9	82	2	18							1	100	
COLORADO	12	92	46	16	8	15	7	6	3	16	8	2	1	54	27	16	67	2	8	5	21			1	4					
CONNECTICUT	34	6	10	21	36	1	2			3	5	3	5	25	42	2	67								1	33				
DELAWARE	43	8	38	7	33							2	10	4	19										1	100				
DISTRICT OF COLUMBIA	48	1	14	3	44			1	14	1	14			1	14															
FLORIDA	1	276	36	81	10	110	14	23	3	28	4	20	3	234	30	4	29			6	43				1	7	3	21		
GEORGIA	10	95	38	33	13	14	6	3	1	21	8	4	2	82	32	1	8	1	8	1	8			1	8	1	8	7	60	
HAWAII	51	1	100													1	100													
IDAHO	33	9	15	7	12	2	3	2	3	2	3	4	7	35	57															
ILLINOIS	17	72	41	45	25	4	2	4	2	13	7	5	3	39	22													1	100	
INDIANA	25	16	14	26	23	12	11	3	3	8	7	3	3	44	39	3	100													
IOWA	21	27	18	20	13	1	1	1	1	2	1	1	1	97	65	2	67											1	33	
KANSAS	19	23	14	14	9	2	1	7	5	10	6	5	3	99	62	3	60									1	20	1	20	
KENTUCKY	15	55	29	23	12	7	4	3	2	11	6	7	4	80	43	3	37	3	37					1	13			1	13	
LOUISIANA	14	94	50	30	16	18	10	4	2			2	1	40	21	1	100													
MAINE	29	3	4	31	36	3	4			1	1	1	1	46	54	1	100													
MARYLAND *	24	45	39	16	14	15	13	4	4	3	3	1	1	30	26													1	100	
MASSACHUSETTS	7	58	20	12	4	9	3	5	2	2	1	5	2	200	68	4	57										3	43		
MICHIGAN	2	219	40	95	17	26	5	13	2	30	5	16	3	157	28	18	62	1	3	4	14					6	21			
MINNESOTA	28	14	16	14	16	6	7	1	1	8	10	11	13	32	37	1	50			1	50									
MISSISSIPPI	13	71	36	38	19	27	14	2	1	4	2	9	5	46	23			1	25								3	75		
MISSOURI	32	23	31	16	21	1	1	1	1	1	1	3	4	31	41															
MONTANA	41	14	38	5	14	3	8			1	3	3	8			2	67										1	33		
NEBRASKA	37	21	38	1	2			5	9	5	9	5	9	18	33	1	100													
NEVADA	50	2	40	1	20									2	40															
NEW HAMPSHIRE	35	11	19	1	2					4	7			43	72	2	50											2	50	
NEW JERSEY	27	49	47			8	7	1	1	5	5	2	2	39	37	1	100													
NEW MEXICO	22	93	64	21	15	2	1	3	2	3	2	1	1	21	15	16	80	4	20											
NEW YORK	6	44	12	76	21	20	6	22	6	6	2	9	3	174	50	12	45											13	48	
NORTH CAROLINA	4	135	34	33	8	21	5	9	2	21	5	7	2	172	44	8	50									2	13	1	6	
NORTH DAKOTA	47	5	46	1	9	1	9	2	18			1	9	1	9													5	31	
OHIO	5	90	28	80	19	9	2	4	1	28	8	10	3	142	39	3	30										3	30	4	40
OKLAHOMA	11	78	38	12	6	9	4	10	5	5	2	16	8	75	37	3	75										1	25		
OREGON	45	5	31					1	6			1	6	9	57															
PENNSYLVANIA	3	153	35	19	4	5	1	2	1	9	2	4	1	239	56	35	94									1	3			
PUERTO RICO	49	1	17	1	17									4	66			1	100											
RHODE ISLAND	40	9	20	15	34					2	5			18	41													3	100	
SOUTH CAROLINA	16	56	31	8	4	10	5	7	4	2	1	5	3	95	52	2	33									1	17	3	50	
SOUTH DAKOTA	39	10	20	5	10	2	4	9	18			1	2	23	46	4	100													
TENNESSEE	8	88	33	80	30	4	2	6	2	8	3	9	4	74	26	4	66			1	17				1	17				
TEXAS	9	109	43	36	14	32	12	4	2	4	2	3	1	66	26	4	40	4	40							1	10	1	10	
UTAH	36	24	41	11	19	2	3	1	2	4	7	3	5	14	23	2	40	2	40							1	20			
VERMONT	46	4	27	1	7									10	66															
VIRGINIA	26	14	13	35	31	7	6	1	1	7	6	2	2	46	41	1	25			1	25							2	50	
WASHINGTON	43	2	9	4	18							2	9	14	64															
WEST VIRGINIA	38	14	26	9	17	3	6	1	2	2	4	1	2	23	43															
WISCONSIN	23	57	40	8	6	4	3	1	1	6	4	5	4	60	42	7	100													
WYOMING	30	39	48	3	4	13	16	8	10	4	5			14	17															
UNITED STATES		2487	32	1076	14	444	6	194	3	298	4	211	3	2957	38	172	55	28	9	23	7	2	1	10	3	12	4	64	21	



## North Atlantic Tropical Cyclones, 1988

*Nearly a decade of calm came to an end in the Caribbean Sea as two major storms—Gilbert and Joan—wreaked havoc in these waters.*

James M. Gross  
and Miles B. Lawrence

The hurricane season of 1988 will be remembered as the season of Hurricane Gilbert. Never had a pressure so low—888 millibars (26.22 inches)—been measured in the Western Hemisphere. For years the standard was the Labor Day Hurricane of 1935, which ravaged the Florida Keys. Its pressure, measured near the north end of Long Key, was 892 millibars (26.34 inches).

However while Gilbert was a damaging, record-breaking storm, reaching category 5 on the Saffir/Simpson Scale, Helene and Joan reached category 4. Its been 27 years since three hurricanes have achieved that status in a single season. Gilbert wrecked havoc across the central and northwestern Caribbean and southwestern Gulf of Mexico, killing 318 people. Joan the other major Caribbean hurricane was responsible for 216 deaths, mainly along the southern and southwestern coast of the

Caribbean. Joan's track was unusual since no other tropical cyclone has travelled on so southerly a course, affecting the northern coast of South America from the Windward Islands through Central America.

The 1988 hurricane season for the North Atlantic Ocean, Caribbean Sea and Gulf of Mexico was above average with seven tropical storms and five hurricanes. This compares to a long term seasonal average of four tropical storms and six hurricanes. Debby, Florence, Gilbert, and Joan were hurricanes that made landfall while Beryl, Chris, and Keith made landfall as tropical storms.

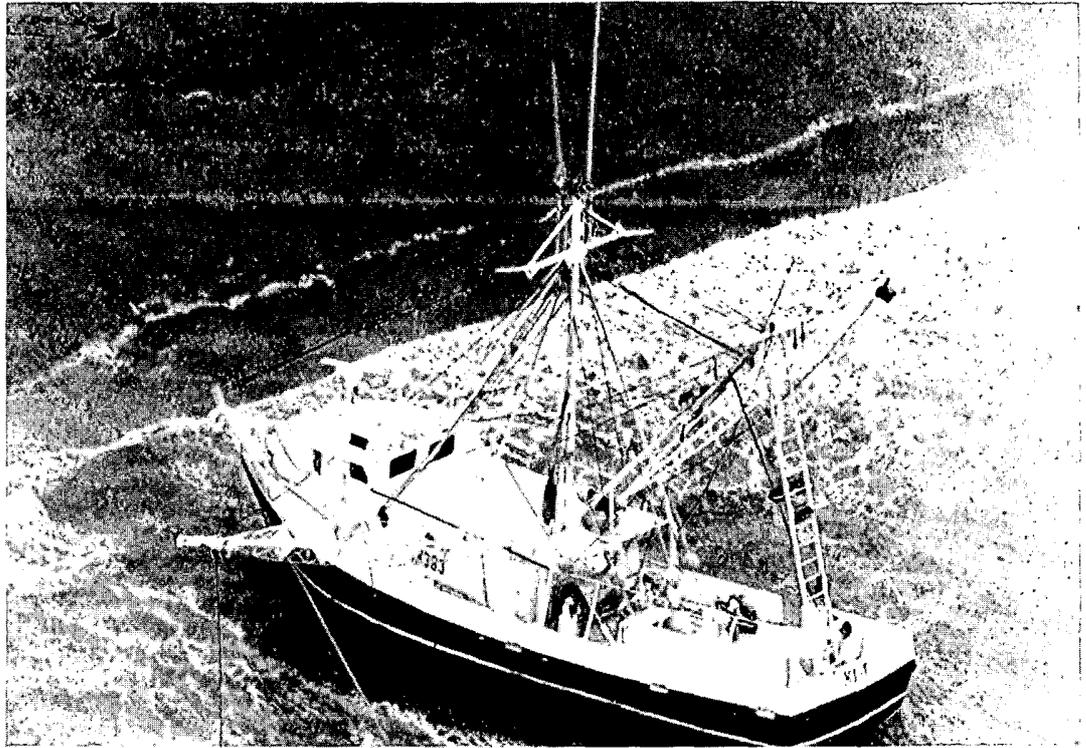
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Dr. James M. Gross and Miles B. Lawrence are forecasters at the National Hurricane Center in Miami, FL.

*A passenger bus plows through water in the Mexican town of Campeche in the wake of hurricane Gilbert on the 18th of September. This was one of several towns hard hit by the hurricane. These passengers were lucky compared to those on four buses in the Monterrey area the day before. The buses were overturned and crushed by the Rio Santa Catarina River's floodwaters and several hundred people were killed.*



Shrimp boats are coming but no dancing tonight. This 72-foot shrimp boat from Venice, LA is beached on the Texas coast near Boca Chica on the 17th of September. The crew was air lifted to safety as Hurricane Gilbert approached.



This season's tropical cyclone tracks are in general quite smooth and outline the western boundary of the North Atlantic subtropical high. As determined by the number of ships reporting 50 knots or greater, shipping was, for the most part, able to avoid this season's intense tropical cyclones. The exception was Tropical Storm Keith. Because of its rapid acceleration just before and after it became extratropical, it moved quickly through the western North Atlantic shipping lanes.

#### Tropical Storm Alberto

Alberto originated from a low pressure trough that formed on the 4th of August off the South Carolina coast. It reached tropical depression status on the 5th. Moving northeastward in advance of an approaching frontal trough, it became a tropical storm on the 7th, while centered just south of Nantucket, MA. It crossed Nova Scotia without significant effect and became extratropical near Newfoundland on the 8th.

There were no reported surface winds of tropical storm force. Alberto's tropical storm status was based on satellite intensity estimates and pressure readings from a NOAA data buoy located southeast of Nantucket, which showed a 7-millibar fall,

in 3 hours, to 1004 millibars as the storm went by.

#### Tropical Storm Beryl

Like Alberto, Beryl formed from a low pressure area that was not of tropical origin. The first signs of a low-level circulation occurred within a low pressure area that had meandered westward across the northeastern Gulf of Mexico and was near the Mississippi coast on the 4th of August. The system gradually organized into a depression on the 7th, having drifted over southeastern Louisiana. The center drifted back to the Gulf Coast and was upgraded to a tropical storm the following day. On

the 9th the center turned 180° and headed back over southern Louisiana. The highest reported sustained wind over land was 40 knots at Gulfport, MS on the 8th. Beryl's highest sustained wind over the water was 46 knots reported on the 9th from the *Puritan*. Beryl weakened later that day, and by the 10th it had become extratropical.

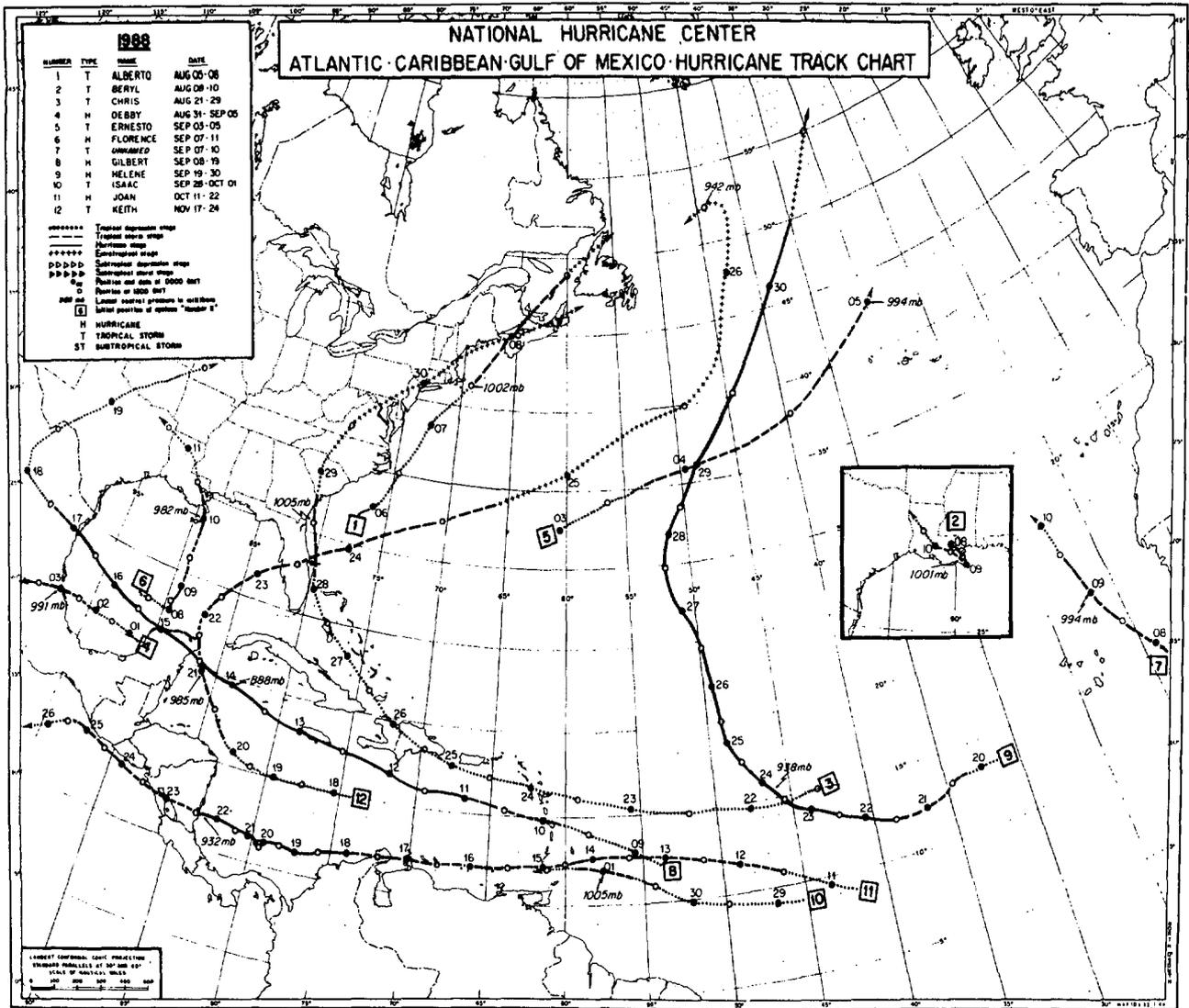
Beryl produced 10 to 12 inches of rain along the Gulf Coast from Alabama to Texas. Storm surge caused by onshore winds produced tides 3 to 5 feet above normal. The one death attributed to Beryl occurred when a 15-year-old boy drowned due to an overturned shrimp boat in Mobile Bay.

#### Saffir/Simpson Scale of Hurricane Intensity

Storm category	Storm surge (feet)	Mean wind speed (knots)
1 Weak	4—5	64—82
2 Moderate	6—8	83—95
3 Strong	9—12	96—112
4 Very Strong	13—18	113—135
5 Devastating	18—	136—

#### Tropical Storm Chris

A tropical wave was detected near the coast of Africa on the 15th of August. Its track across the subtropical Atlantic followed the southern periphery of the subtropical high. By the 21st, halfway between Africa and the Lesser Antilles, satellite imagery depicted a low-level circulation had formed. As a depression, the system moved over the islands of the northeast Caribbean. Four inches of rain fell on Puerto Rico on the 24th causing three deaths.



Early on the 28th, the depression was accelerating northward just off the south-east Florida coast when the *Hoegh Carin* reported 40-knot sustained winds 50 nautical miles northeast of the center. The system was upgraded to Tropical Storm Chris and the center crossed the South Carolina coast midday on the 28th, near Savannah. The highest reported sustained wind at the coast was 37 knots at the Savannah Light Tower.

Chris weakened to a depression over the Carolinas only 12 hours after becoming a storm and then merged with a cold front while turning extratropical. Rainfall totals ranged from 3 to 5 inches in a swath from South Carolina through Pennsylvania and into Vermont. One death resulted from a hurricane-spawned tornado in South Carolina.

### Hurricane Debby

Debby originated from the same tropical wave that spawned Chris. On the 31st of August, this disturbance became a tropical depression over the southeast Bay of Campeche in the Gulf of Mexico. Drifting slowly westward, the depression strengthened to a tropical storm early on the 2d of September. Later that same day, based on aircraft reconnaissance, Debby became the 1988 season's first hurricane. It made landfall 6 hours later near Tuxpan, Mexico as a minimal hurricane with wind speeds of 65 knots.

Weakened by mountainous terrain, the remnants of Debby were tracked across Mexico by satellite into the eastern North Pacific Ocean. The weak circulation drifted northward for several days before finally dissipating in the Gulf of

California on the 8th. No meteorological observations were received from the land-fall area, but press reports indicated that inland flooding and mudslides caused 10 deaths in Mexico.

### Tropical Storm Ernesto

An area of disturbed weather, associated with a tropical wave, turned northwestward while still far out in the central tropical Atlantic. The system was just east of Bermuda on the 2d of September when a surface low pressure area became associated with it. Recurving toward the northeast it became a tropical depression on the 3d and was upgraded to a tropical storm 6 hours later, based on satellite intensity estimates and reports from unidentified ships. Tropical Storm Ernesto accelerated and was absorbed by a large extratropical storm over the North Atlantic.

## Hurricane Florence

Observations from unidentified ships, helped determine that on the 7th of September, a circulation formed in the south-central Gulf of Mexico. The system quickly strengthened to a tropical storm. On the 9th, it accelerated toward the northern Gulf Coast and became a hurricane just before making landfall over southeastern Louisiana. Florence quickly weakened as it moved over the New Orleans area and dissipated on the 11th in east Texas.

Florence was a hurricane for only 12 hours. The highest sustained wind near the surface was 70 knots reported from an oil rig (MP 73) near the Mississippi River Delta. Florence's lowest surface pressure, estimated from Air Force reconnaissance, was 982 millibars. Rainfall totals ranged up to 4 inches along the path of the storm. Storm surge water levels rose from 3 to 6 feet above normal along the southeast Louisiana and Mississippi coasts just east of where the center moved ashore. Several tornados and inland river flooding were reported from the western Florida Panhandle, far from the center of the hurricane. As a result of Florence, one fisherman died in Mobile Bay while trying to secure his boat. The damage total is estimated at \$2.5 million, primarily in southeastern Louisiana.

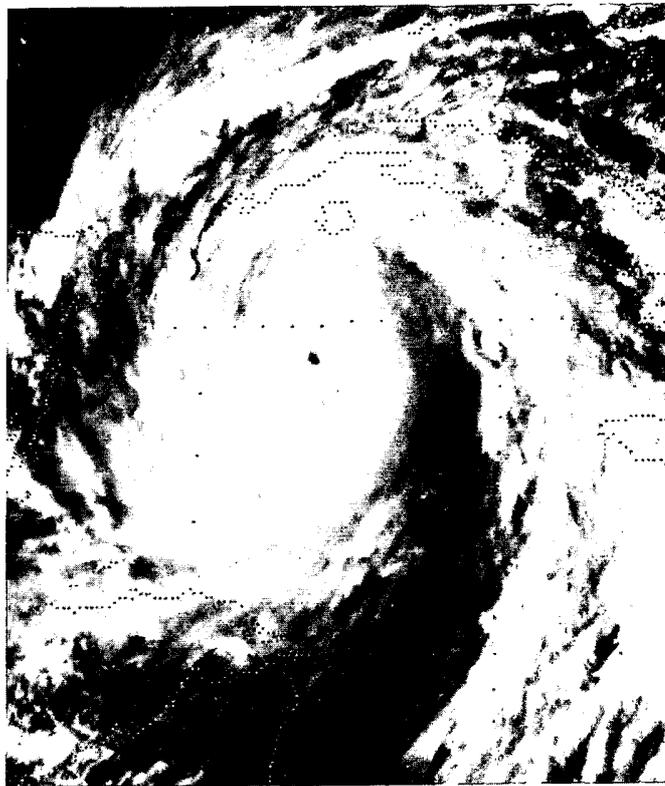
## Unnamed Tropical Storm

While Florence and Gilbert were forming farther west, an area of disturbed weather moved off the African coast. On the 7th of September, based on satellite imagery, the area was declared a depression while only 85 nautical miles off the African coast. An after-the-fact review of ship data indicated that the depression reached tropical storm strength that same day. The key ships used to determine this were the *Baco-Liner 2*, *Antchar* and the *Stollberg*, which reported sustained wind speeds of 35 knots associated with this system. The storm moved north north-westward for the next two days and merged with a large low pressure trough. The entire track of the tropical storm remained east of 25°W.

## Hurricane Gilbert

The source of Gilbert was a tropical

*One hour before the record—a visible satellite picture of Hurricane Gilbert taken at 2031 UTC on September 13, 1988. This was about one hour prior to the observation of the NOAA reconnaissance aircraft, which put the hurricane's central sea level pressure at 888 millibars. This now becomes the record low for the Western Hemisphere. In the western North Pacific the record low was set by Super Typhoon Tip on October 12, 1979 at 870 millibars. This is the world record for a tropical cyclone.*



wave which left the African coast on the 3d of September. It developed a low-level circulation and became a tropical storm on the 9th. The next day it reached hurricane intensity while south of Puerto Rico, and on the 11th passed close to the southern coast of Hispaniola.

Gilbert was a category 3 on the Saffir/Simpson intensity scale when its well-defined eye passed from east to west across Jamaica on the afternoon of the 12th. A sustained wind of 101 knots was measured at the Kingston weather office along with a minimum pressure of 965 millibars. A ham radio operator also reported a sustained wind of 105 knots near Kingston. Most surprisingly, aircraft observations reported a minimum central pressure of 940 millibars when the eye crossed the east coast and the same value when the center moved off the west coast — hours later.

Following Gilbert's passage over Jamaica, a remarkably rapid intensification occurred as the storm passed just south of Grand Cayman on the 13th. The hurricane's central sea level pressure fell 72 millibars in 24 hours to reach a new

record minimum pressure of 888 millibars (26.22 inches) for the Western Hemisphere. The NOAA reconnaissance aircraft, which made the pressure observation, also measured flight-level winds of 160 knots in the eyewall.

The next day at a slightly higher central pressure, Gilbert made landfall on the northeast Yucatan Peninsula, near Cozumel, Mexico. Sustained winds at landfall were estimated near 150 knots, making this a Saffir/Simpson category 5 landfall, the first since Camille in 1969. Gilbert weakened over the Yucatan Peninsula and moved over the southwest Gulf of Mexico during the next 2 days. Its final landfall occurred late on the 16th as a category 3 hurricane near the town of La Pesca on the coast of Mexico about 110 nautical miles south of the Texas border. After moving inland, Gilbert weakened as it turned north across Texas and into Oklahoma where it merged with a frontal low pressure system. This system continued to produce high winds as noted by the *Roger M. Simons* in southern Lake Michigan which reported 52 knots on the 20th.

Storm surge flooding produced tides to 9 feet above normal on the northeast coast of Jamaica and 5 feet above normal at Grand Cayman. Extreme storm tides of as much as 15 feet were reported also along the northern and northwestern portions as the storm pushed off the Yucatan. The total death toll associated with Gilbert was estimated to be 318 deaths, including: Mexico 202, Jamaica 45, Haiti 30,

Guatemala 12, Honduras 12, Dominican Republic 5, Venezuela 5, United States 3, Costa Rica 2 and Nicaragua 2. Besides being a very intense hurricane, Gilbert was large in areal extent. Deaths in countries far from the hurricane's center were caused by heavy rainfall and resultant flash flooding. Damage estimates are \$2 billion (U.S.) each in Jamaica and in Mexico. The U.S. damage total is \$50

million, primarily associated with tornadoes occurring near San Antonio, Texas. The total damage estimate for Gilbert is \$5 billion.

### Hurricane Helene

On September 15th, as Gilbert was entering the Gulf of Mexico, a tropical wave moved off the African coast. It organized into a depression on the 19th,

## Gilbert's Effect on Sea Surface Temperature

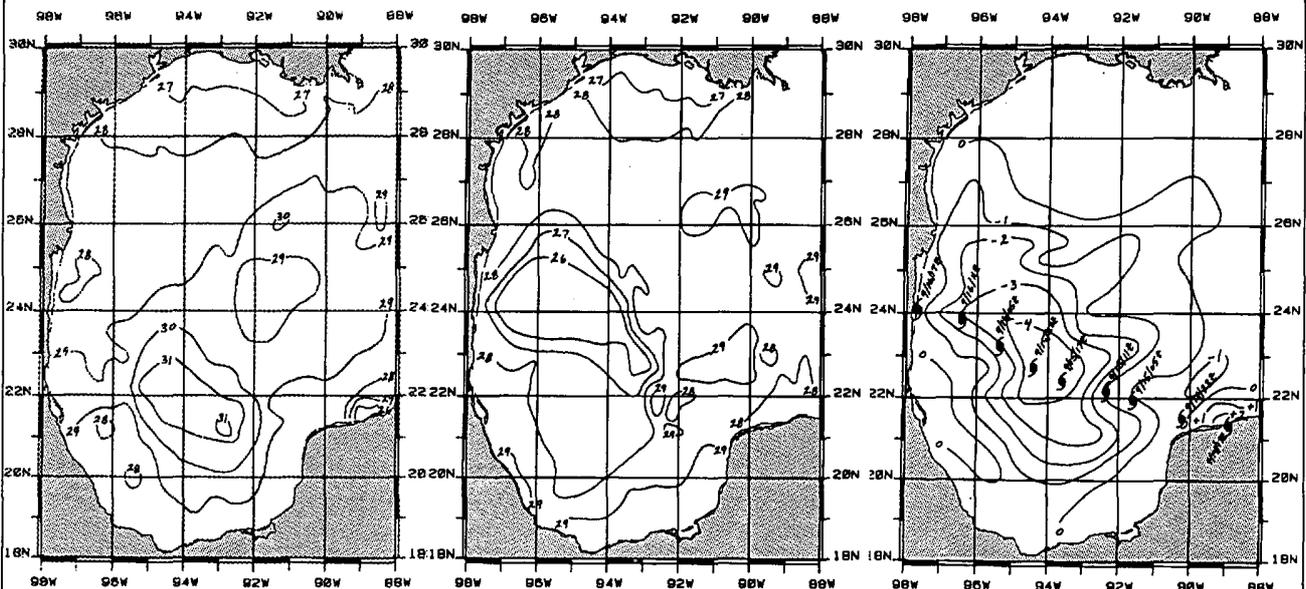
**G**ilbert was one of the strongest hurricanes in history. Its damage and death figures were well publicized. Some of the hurricane's aftermath was less conspicuous. One of the lesser-known effects of Gilbert's trek from the Yucatan Peninsula into northern Mexico was a dramatic cooling of Gulf of Mexico sea-surface temperatures (SSTs). The Gilbert-produced SST pattern persisted into the following week and was not a short-lived phenomenon. As late as October 15th, one month after Gilbert, SSTs had not recovered to their September 10th values.

Besides the obvious cooling in the Bay of Campeche and western Gulf, Gilbert produced another anomaly in the SST structure. Along the northern tip of the Yucatan Peninsula existed a region of cooler water caused by upwelling. As Gilbert moved from the Caribbean across the Yucatan into the Gulf of Mexico, this cool pattern was altered by turbulent mixing, causing the SSTs to actually warm by as much as 2°C (3°F).

A theory exists that Gilbert had a far-reaching effect on Hurricane Joan, a month later. Along the northern coast of South America is a region of cooler water, historically a graveyard for hurricane or tropical storm formation or intensification. The path of Gilbert took it to the north of this region, but close enough to possibly mix this water and alter SSTs upward, as was the case in northern Yucatan. Speculation is, Joan gained strength from the rearranged thermal structure, rather than weakened as would normally be the case, as she passed westward across this then-warmer water. Joan would eventually become one of the most powerful storms ever to strike the Central American isthmus.

A cursory examination of available SST data in this region was inconclusive. Perhaps further studies, utilizing more precise data, may validate or refute this theory.

by Larry Peabody and Anthony Amos



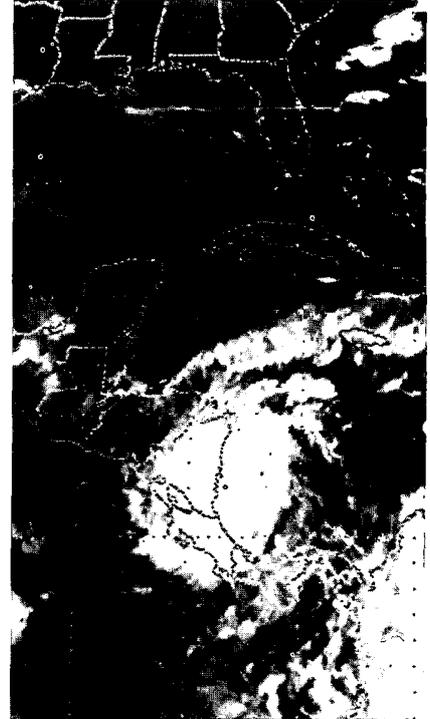
The Gulf of Mexico sea surface temperature pattern on September 10, 1988. Before Gilbert's arrival a warm core of 31°C (88°F) is located in the Bay of Campeche.

After Gilbert on September 17, 1988, turbulent mixing brings cool subsurface water to the surface (upwelling); also rain and cloud cover adds to the almost 5°C (9°F) drop.

Gilbert's path is shown along with the change in sea surface temperature between the 10th and 17th of September. It can be assumed that the mixing extended to 30 meters or more.



*Hurricane Helene, left, poses for a photograph at 1301 UTC on September 23, 1988. This was near the time of maximum intensity, when winds reached 125 knots and pressure dipped to 938 mb.*



*Hurricane Joan (right) is displayed in an infrared satellite picture at 0601 on the 22d of October. This was just before land-fall near Bluefields, Nicaragua, as a category 4 hurricane. Joan later became Miriam in the eastern North Pacific.*

increased to a tropical storm on the 20th and became a hurricane on the 21st over the mid tropical Atlantic. Helene began a northward turn on the 23d and for the next week moved northward. On the 28th Helene turned toward the northeast and accelerated. It became an extratropical system on the 30th, but remained far at sea.

Satellite pictures showed a well-defined eye for much of its lifetime. It is estimated that Helene's winds reached a maximum of 125 knots on the 23d, a category 4 on the Saffir/Simpson scale. Helene was estimated to be a hurricane for 9 days making it the longest-lived hurricane for this season.

#### **Tropical Storm Isaac**

The origin of Isaac was tracked back to a weak disturbance located near the African coast on the 23d of September. The westward moving disturbance became a depression on the 29th. It was upgraded to a tropical storm late on the 30th when an Air Force reconnaissance plane reported flight-level winds of 50 knots, while its center was about 200 nautical miles east southeast of Barbados. Shortly, thereafter, the storm weakened and dissipated.

#### **Hurricane Joan**

Joan developed into a tropical storm on

the 11th of October in the mid tropical Atlantic. The storm moved through the Windward Islands on the 11th and then across the southern Caribbean. Its center affected the north coasts of Venezuela and

Colombia, including the Netherlands Antilles.

Soon after the storm moved away from the La Guajira Peninsula of Colombia, strengthening began and Joan became a

### **1988 North Atlantic Tropical Cyclones**

Name	Class <sup>1</sup>	Dates <sup>2</sup>	Maximum sustained wind (knots)	Lowest pressure (mb)	U.S. damages (\$millions)	Deaths
Alberto	T	8/5—8	35	1002		
Beryl	T	8/8—10	45	1001	3.0	1
Chris	T	8/21—29	45	1005	0.5	4
Debby	H	8/31—9/5	65	991		10
Ernesto	T	9/3—5	55	994		
Florence	H	9/7—11	70	982	2.5	1
unnamed	T	9/7—10	50	994		
Gilbert	H	9/8—19	160	888	50.0	318
Helene	H	9/19—30	125	938		
Isaac	T	9/28—10/1	40	1005		
Joan	H	10/10—23	115	932		216
Keith	T	11/17—24	60	985	3.0	

<sup>1</sup> T: tropical storm, wind speed 34—63 knots  
H: hurricane, winds speed 64 knots or higher

<sup>2</sup> Dates begin at 0000 UTC and include tropical depression stage

hurricane. Joan made landfall on the coast of Nicaragua near Bluefields early on the 22d, as a Saffir/Simpson category 4 hurricane, with maximum sustained winds estimated at 125 knots and a central pressure of 932 millibars. Joan weakened to a tropical depression as it crossed Central America into the eastern Pacific Ocean. It later reintensified to become Tropical Storm Miriam in the eastern North Pacific.

Joan was responsible for an estimated 216 deaths across the southern Caribbean including: Nicaragua 148, Costa Rica 28, Colombia 25, Venezuela 11, and Panama 4. The total damage estimate was \$2 billion with nearly half of that in Nicaragua.

### Tropical Storm Keith

Keith's initial low-level circulation was detected over the central Caribbean late in the season on the 17th of November. It became a tropical storm on the 20th and moved on a northwesterly track that took its center over the northeast tip of the Yucatan Peninsula the next day. The storm recurved northeastward across central Florida on the 23d. Keith almost became a hurricane on the 21st when the *Mariano Moctezuma*, located near Cozumel off the eastern Yucatan, reported gusts to 80 knots and 985 millibars while a ship in Puerto Morelos reported 60-knot winds with gusts to 80 knots.

The storm center moved inland near

Sarasota, FL on the 23d. The highest sustained wind reported in Florida was 55 knots north of the center in the Tampa area. Sustained gale force winds were also reported south of the center through Fort Myers. No deaths were reported due to Keith but the damage estimate for Florida was \$3 million. Keith moved off the Florida east coast and headed out to sea. Bermuda reported sustained winds of 40 knots on the 24th as the storm went by to the north. Keith became extratropical and its rapid acceleration during this stage did not allow adequate time for shipping to clear its path. As a result there were a large number of ships reporting 50-knot or greater winds for this storm.

## Tropical Cyclone Winds (ship encounters of 50 knots or more)

Tropical Cyclone	Vessel Name	Date Mo/Da	Time UTC	Ship Position Lat°N, Lon°W	Wind Dir/Speed (kn)	Pressure (Mb)
Unamed	ZGKH	9/8	1200	18.3, 20.2	020/50	1008.3
Gilbert	Monsun	9/10	1200	15.8, 62.7	140/50	1004.0
	Ronneburg	9/13	0000	22.0, 77.3	090/52	1005.0
	Overseas Chicago	9/14	1800	20.3, 84.1	180/50	1002.0
	Sealift Atlantic	9/15	1800	19.9, 94.9	290/60	999.8
	KR4370	9/20	0000	42.8, 87.0	270/52	
Helene	Zhalgiris	9/30	1200	47.7, 31.9	200/50	992.6
	Edinburgh Talla	9/30	1200	49.6, 25.2	180/52	1002.7
Keith	Mariano Moctezuma	11/21	0300	W of Cozumel		985.0
	SHIP	11/21	0700	20.8, 86.8	/60	
	ABKC	11/22	1800	24.9, 84.5	190/54	994.6
	Rhine Forest	11/24	0000	26.0, 78.2	120/54	1005.0
	MSC Chiara	11/25	1200	34.8, 48.8	180/53	988.0
	Fairload	11/25	1200	36.5, 49.5	190/55	983.0
	Zim Savannah	11/25	1200	37.7, 50.2	190/55	972.0
	Sonora	11/25	1800	40.3, 41.9	180/60	978.5
	Lexa Maersk	11/25	1800	45.6, 42.7	140/52	964.0
	Demyansk	11/26	0000	42.8, 49.9	340/50	957.5
	Lok Pragati	11/26	0000	44.4, 41.5	180/52	958.7
	Ziemia Olsztynska	11/26	0000	47.1, 43.0	110/78	951.0
	Margit Gorthon	11/26	0000	49.2, 40.5	090/60	968.0
	Sealand Integrity	11/26	0600	46.8, 39.8	220/60	973.0
	Margit Gorthon	11/26	0600	49.3, 42.7	180/60	945.0
	KNDB	11/26	0600	49.7, 41.0	200/55	947.6
	JCLL	11/26	1200	49.0, 40.0	220/57	974.2
Margit Gorthon	11/26	1200	49.3, 43.2	230/63	964.0	
KNDB	11/26	1200	49.4, 40.5	200/65	968.0	
Margit Gorthon	11/26	1800	49.3, 43.1	200/55	972.0	





# CLIMATOLOGICAL DATA ANNUAL SUMMARY PENNSYLVANIA 1987

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**CLIMATOLOGICAL DATA** is a unique source of weather information derived from data collected by over 8,000 cooperative weather observers located throughout the United States, Puerto Rico, the Virgin Islands, and U. S. Pacific Islands. It is published monthly, with an Annual Summary, for each State or combination of States/Areas by the National Climatic Data Center, Asheville, North Carolina.

\* **MONTHLY** editions contain:

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- Daily precipitation, maximum and minimum temperatures, snowfall, soil temperatures, and evaporation & wind.
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\* **ANNUAL SUMMARY** contains monthly and annual:

- Total precipitation and departures from normal.
- Average temperatures and departures from normal.
- Temperature extremes and freeze data.
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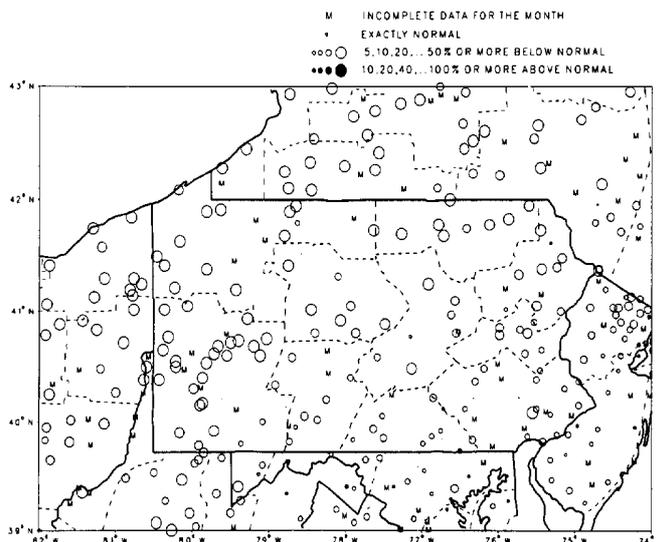
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MONTHLY PRECIPITATION DEPARTURE FROM  
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CIRCLE DIAMETER IS PROPORTIONAL TO DEPARTURE ON A CONTINUOUS SCALE

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*Samuel D. Walter*  
DIRECTOR, NATIONAL CLIMATIC DATA CENTER

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