DECEMBER 1989 VOLUME 31 NUMBER 12

STORM DATA

WITH ANNUAL SUMMARIES

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Kenneth D Hadeen

DIRECTOR
NATIONAL CLIMATIC DATA CENTER

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CONTENTS

Cover: Enhancing its already picturesque nature, the St. Charles Street Car Line in New Orleans, Louisiana is graced by an uncommon snowfall on December 22nd. The snow resulted from equally unusual cold temperatures that persisted over much of the eastern two-thirds of the nation during the month. (See RECORD COLD.....pages 6 and 7) ---Photo by Jim Sigmon, The Times-Picayune, New Orleans, Louisiana; and supplied through the NWSFO at Slidell, Louisiana.

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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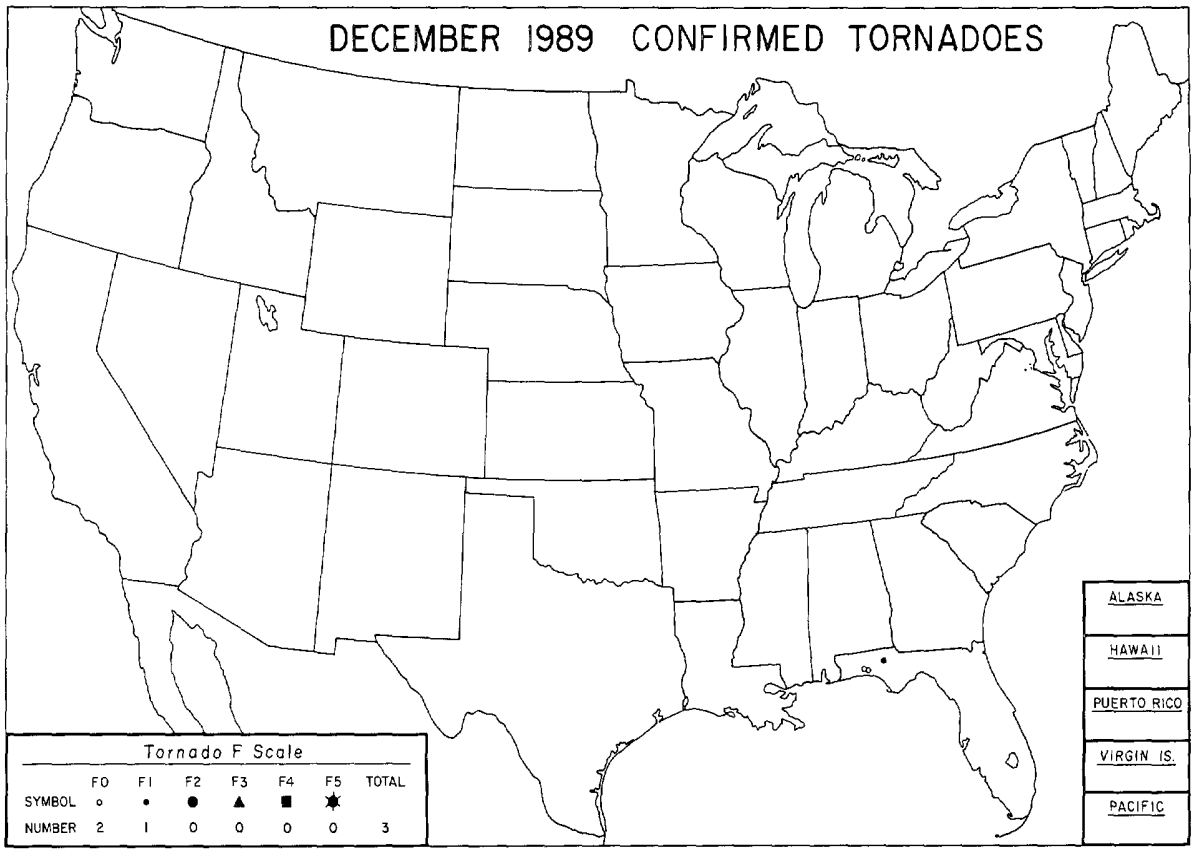
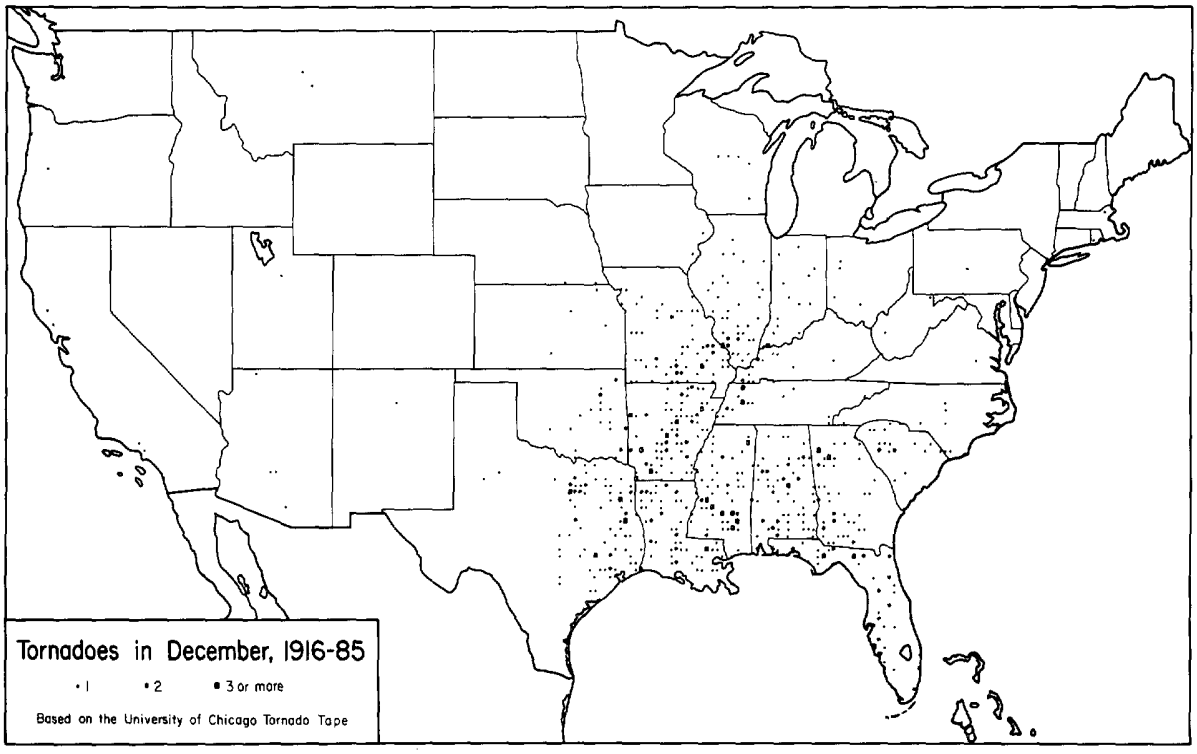
OUTSTANDING STORMS OF THE MONTH

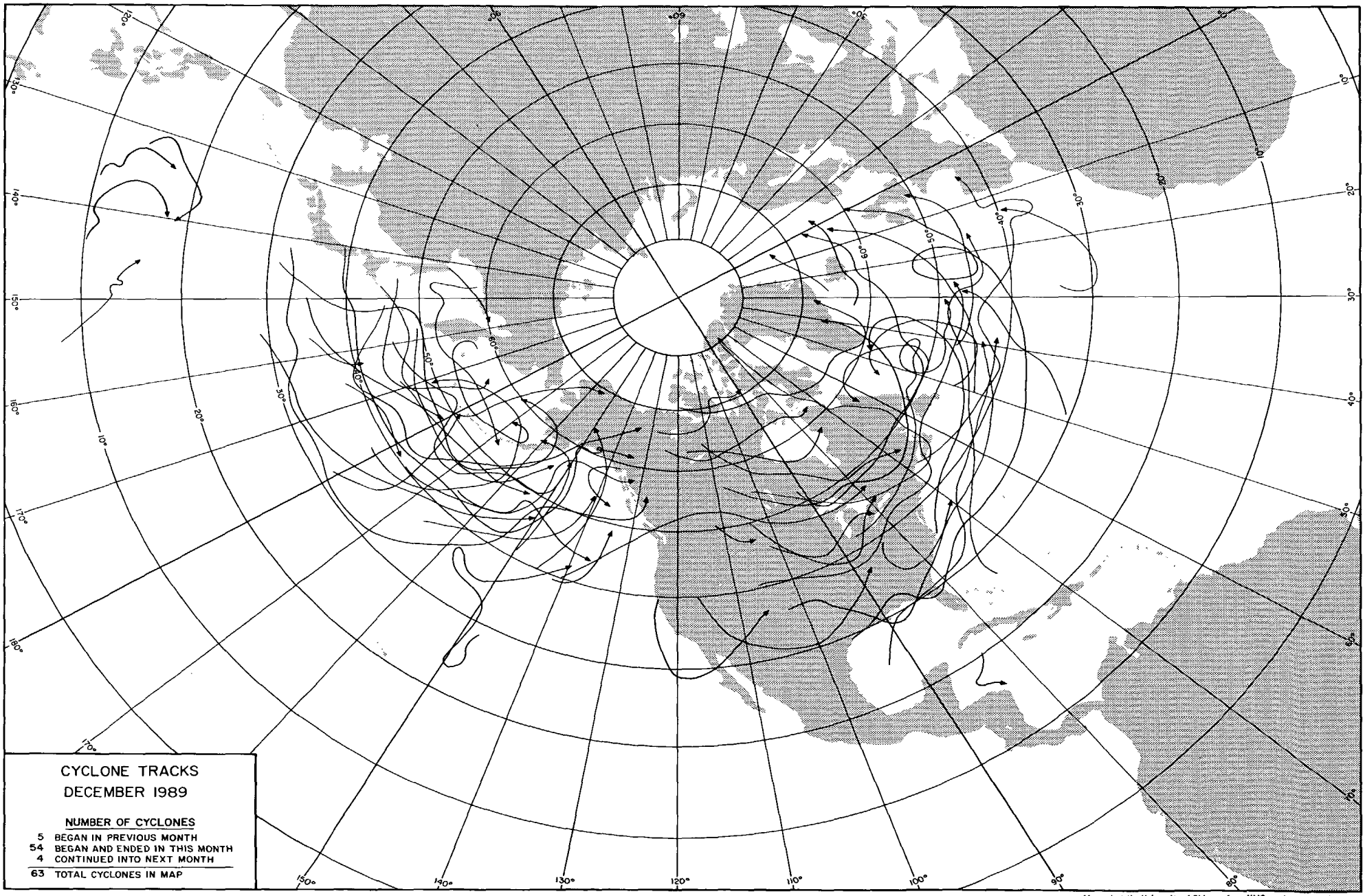


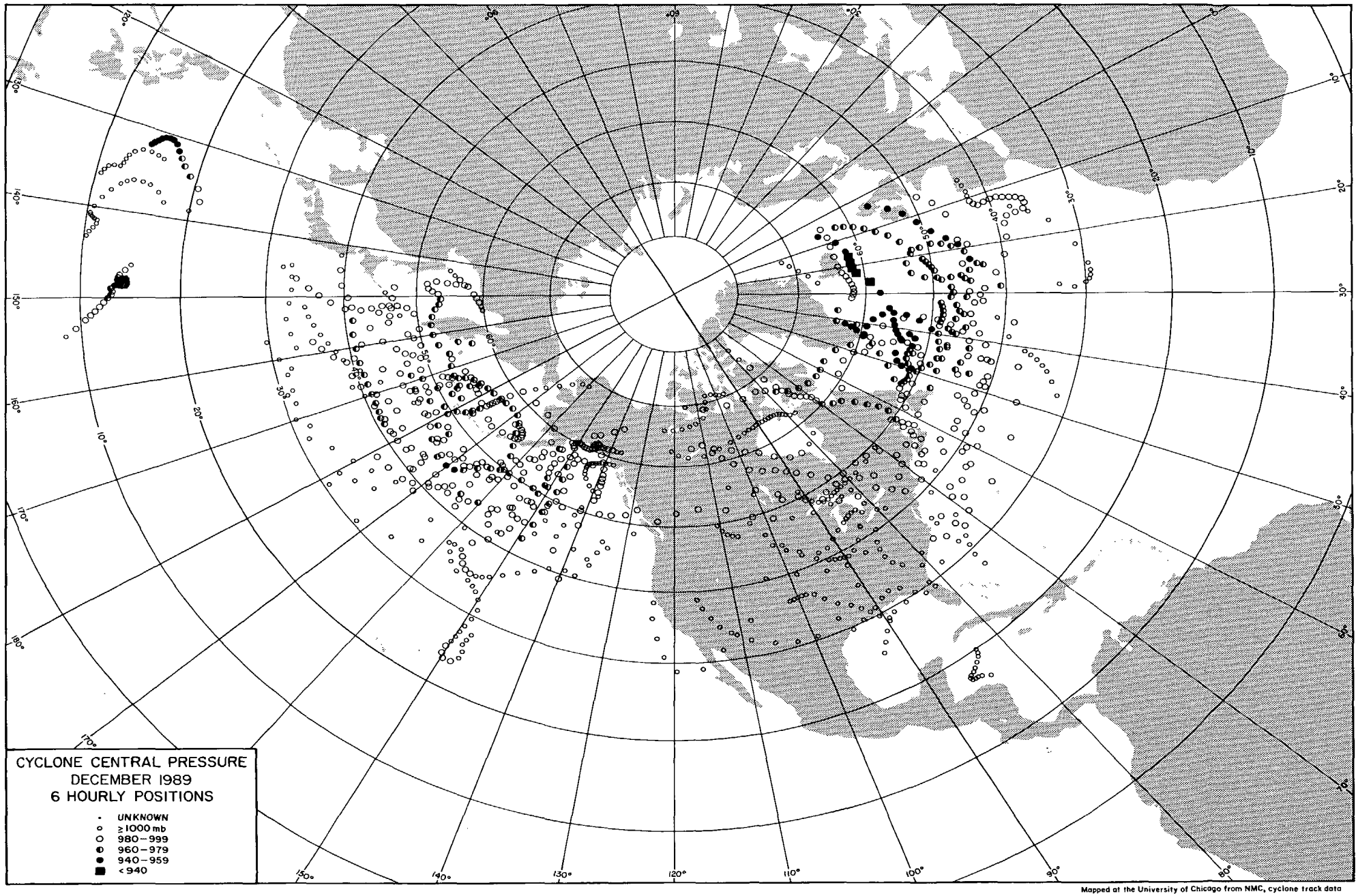
● COMPLETE REPORT RECEIVED
◑ PRELIMINARY REPORT RECEIVED
○ REPORT NOT RECEIVED

(N) northern (W) western
(S) southern (C) central
(E) eastern (O) coastal
(SE) southeastern

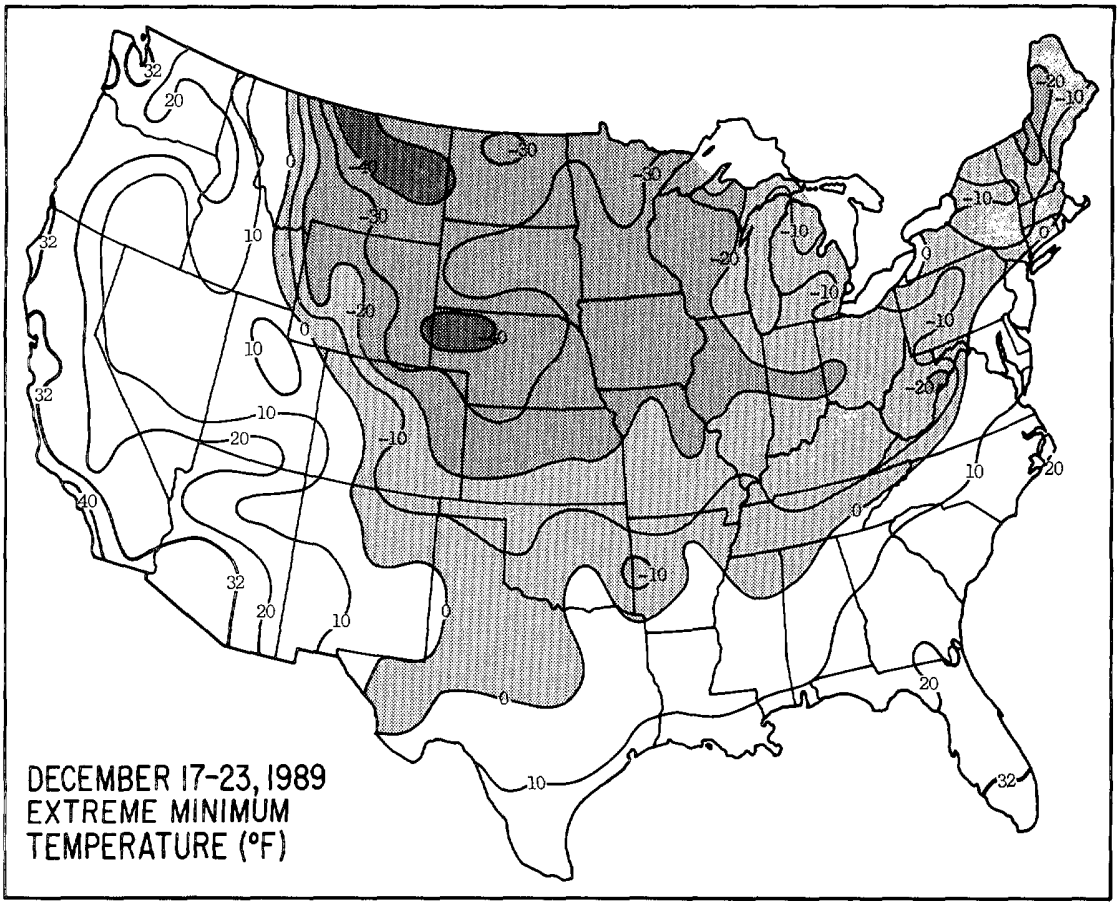
● 1AL	○ 7DE	● 14KS	● 21MN	● 28NJ	● 33OH	● 39SD	○ 44VA	● 49AK(SE)
● 2AZ	● 8FL	● 15KY	● 22MS	● 29NM	● 34OK	● 40TN	● 45WA	● 50HI
● 3AR	● 9GA	● 16LA	● 23MO	● 30NY(O)	● 35OR	● 41TX(N)	● 46WV	● 51PR
● 4CA(N)	● 10ID	● 17ME	● 24MT	● 30NY(C)	● 36PA(E)	● 41TX(S)	● 47WI	● 52VI
● 4CA(S)	● 11IL	○ 18MD	● 25NE	● 30NY(W)	● 36PA(W)	● 41TX(W)	● 48WY	● 53PC
● 5CO	● 12IN	● 19MA	● 26NV	● 31NC	● 37RI	● 42UT	○ 49AK(N)	
● 6CT	● 13IA	● 20MI	● 27NH	● 32ND	● 38SC	● 43VT	● 49AK(S)	



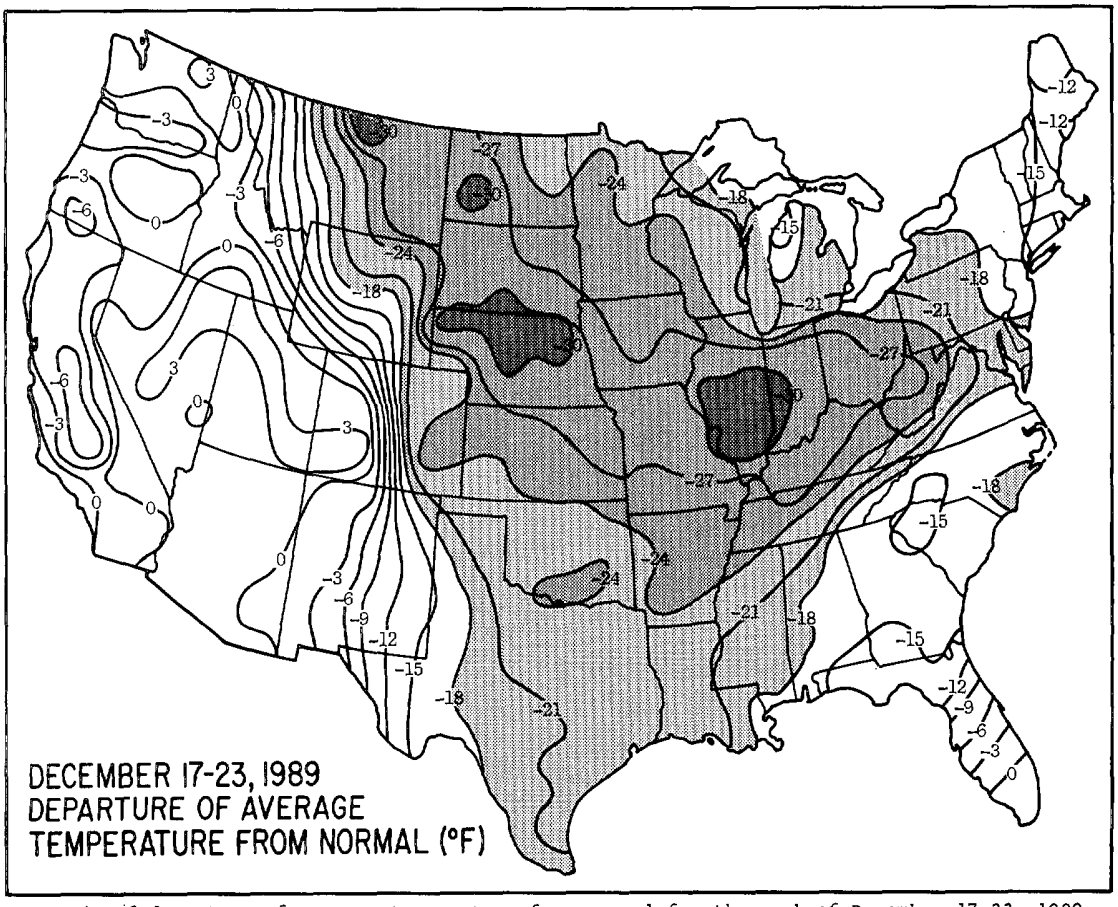

CYCLONE TRACKS
DECEMBER 1989
NUMBER OF CYCLONES
5 BEGAN IN PREVIOUS MONTH
54 BEGAN AND ENDED IN THIS MONTH
4 CONTINUED INTO NEXT MONTH
63 TOTAL CYCLONES IN MAP
Mapped at the University of Chicago from NMC, cyclone track data


CYCLONE CENTRAL PRESSURE
DECEMBER 1989
6 HOURLY POSITIONS
UNKNOWN
≥ 1000 mb
980 – 999
960 – 979
940 – 959
< 940
Mapped at the University of Chicago from NMC, cyclone track data

1. RECORD COLD in the CENTRAL and EASTERN U.S. during December 1989



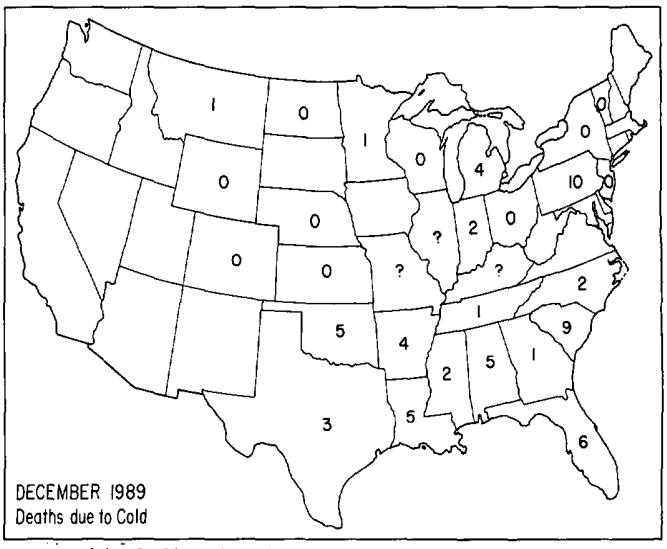
Analysis of extreme minimum temperature in the contiguous U.S. during the week of December 17-23, 1989.



Analysis of departure of average temperature from normal for the week of December 17-23, 1989.

---Both above analyses from the Weekly Weather and Crop Bulletin, NOAA/USDA Joint Agricultural Weather Facility, Washington, DC.

A large portion of the eastern two-thirds of the United States experienced one of its coldest Decembers of record in 1989. The cold was notable for both its prolonged duration and its bitterness, as temperatures were well below normal for about half of the month in most areas and many new low temperature records were set. The most substantial cold period was from about the 14th to the 25th of the month, with the coldest air settling in over the area at the end of the period, from the 22nd to the 25th when numerous existing records were broken. Although the coldest temperatures were in the North-Central U.S., it was in the South that the cold had its greatest impact. Where normally temperatures only go below freezing for a few hours at a time during the winter, they this time stayed at below freezing for several days. This resulted in heavy losses for citrus and other large cash crop industries of the South. Also, the unprepared nature of many Southerners for extended periods of cold most likely contributed to the higher death tolls in that region (see map at right). In all, at least 61 people died due to the cold in December 1989, most as a result of hypothermia brought on by overexposure. For detailed information on deaths and damage resulting from the cold, refer to the individual state reports in the following section.



Geographical distribution of the number of deaths in each state attributed to cold during December 1989. Only states for which reports regarding the cold were filed in Storm Data have values indicated. ---Graphic by the University of Chicago from data supplied by NWSFO's and other reporting offices for states with indicated values in the figure.

A trolley on the St. Charles Street Car Line in New Orleans makes its way through falling snow that accumulated throughout the city on December 22nd. The snow, a byproduct of the extreme cold over the area at the time, was heaviest over coastal Louisiana where 2 to 4 inch amounts were common. Accumulations in New Orleans were generally less than an inch. ---Photo by Jim Sigmon, The Times-Picayune, New Orleans, Louisiana; and supplied through the NWSFO at Slidell, Louisiana.

EDITOR'S NOTE: As this is the last issue in which the University of Chicago will be participating in the publication of Storm Data, the editor, Dr. T. Theodore Fujita and associate editor, Mr. Duane J. Stiegler would like to thank Dr. Robert F. Abbey and the Office of Naval Research for their support, and all those who contributed to the publication during the period of the University's involvement, which consisted of the production of the Outstanding Storms of the Month section and the overall editing of the publication from July 1981 through December 1989. We hope that the publication has served its readers well during that period, and will continue to do so indefinitely.

T. Theodore Fujita,
Editor

Duane J. Stiegler,
Associate Editor

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
[1] ALABAMA									
ALZ-001-018 Alabama, Statewide	15-16	1100-1100CST			1	0	-	-	Cold
An Arctic airmass spread over Alabama dropping temperatures into the 10 to 15 degree range for a large part of the state. Brisk northwest winds created bitterly cold wind chills in the minus 5 to minus 10 degree range. On December 16, a 72 year old Montgomery female died outside of hypothermia. Cold, F720.									
ALZ-001-018 Alabama, Statewide	22-25	1200-1600CST			4	0	-	-	Cold
Just as Alabama recovered from one blast of cold air, another Arctic outbreak of unprecedented proportions overspread the state during the afternoon of Friday, December 22nd and continued through Monday, December 25th. Actual low temperatures for two consecutive nights dropped to the 0 to -5 degree range over the northern third of Alabama, and into the single digits as far south as the coast. Daytime temperatures only reached the teens for two consecutive days. Brisk northerly winds created wind chills as low as -15 to -35 below zero over North Alabama and zero to -15 in South Alabama. The temperature at the Birmingham Airport remained at or below freezing for 93 consecutive hours, demonstrating the prolonged duration of the cold. Many lakes, ponds, and creeks froze over throughout the state. There was widespread damage to water pipes that burst during the lengthy freeze. Four people died during the Arctic seize from cold weather. An 89-year-old man died in his house in Bellwood in Geneva County from hypothermia. An 89-year-old Montgomery female died in her apartment from hypothermia. An 89-year-old man died in his house in Birmingham. A 55-year-old Dothan man died of exposure. Cold, M89P, F89P, M89P, M550.									
December, 1989 ended as the second coldest ever for most reporting stations in Alabama.									
[2] ARIZONA ——— NONE REPORTED									
[3] ARKANSAS									
Unknown	03-09				1	0	0	0	Cold
An elderly man died of hypothermia during the week of December 3-9. Exact details for correct coding were not available.									
ARZ All Statewide	07-08				0	0	?	?	Winter Storm
The first winter storm of the season struck Arkansas on the 7th and 8th. Up to four inches of snow fell in Northwest Arkansas on the 7th, freezing rain hit Northeast Arkansas the night of the 7th, then up to four inches of snow fell across Southeast Arkansas on the 8th. Eight people were killed in traffic accidents across the state due to icy roads. Freezing rain coated trees and power lines across Northeast Arkansas, resulting in numerous power outages. At least 24,000 homes were without power, many from Thursday night, December 7th, to late Saturday, December 9th.									
ARZ 006-007-008-009-010-011-014-015 Southwest through Central to East-Central Arkansas	18-19				0	?	?	?	Ice Storm
A small, but potent ice storm brought Southwest through East-Central Arkansas to a standstill from late Monday afternoon, December 18th, to midday, December 19th. Hotels filled up Monday night as motorists were stranded due to ice-covered roads. Traffic accidents claimed three lives. Injuries too numerous to count, ranged from bumps and bruises to broken bones, as people fell on ice-covered roads and sidewalks.									
ARZ All Statewide	20-23				3	4	?	?	Record Cold
One of the coldest Arctic outbreaks in history hit Arkansas from December 20-23. The cold weather broke water pipes across the state, and in many cities damaged water-pumping equipment. Several cities were under "Boil" orders for several days due to damaged water systems. Propane supplies ran short, and electrical and natural gas supply systems were pushed to the limit in order to meet record demands. Three people died from the severe cold, with all three believed to have died on Saturday, December 23. One death occurred in Jefferson County, and two in Crittenden County. Four other people were treated for hypothermia in Crittenden County. F74P, M23P, F24P									

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
[4] CALIFORNIA, Northern									
Kern County	11	0900-1400PST			0	0	4	?	High Wind
Strong high pressure over the Great Basin and relatively low pressure off the southern California coast set up a strong gradient across the Tehachapis and the southern San Joaquin Valley. Sustained winds exceeded 40 mph, generally, with gusts of up to 100 mph having occurred near Grapevine, 35 miles south-southeast of Bakersfield.									
CAZ009-010 and NVZ001-002 Sierra Nevada	13-14	0900-1500PST			0	0	0	0	Heavy Snow
A cold, moist Pacific storm brought heavy snow to the Sierra Nevada. Amounts exceeded 12 inches and traffic delays and service disruptions resulted.									
Glenn County	14	1238PST			0	0	0	0	Funnel Clouds
The Glenn County Sheriff reported a line of funnel clouds extending from east of Willows to the foothills.									
Santa Clara County	16	1145PST			0	0	0	0	Funnel Clouds
A pilot reported a funnel cloud 5 miles southwest of Hollister. At about the same time, a funnel cloud was spotted over Gilroy. A news photographer for the Gilroy Dispatch photographed the second funnel cloud.									
[4] CALIFORNIA, Southern									
Los Angeles Co., San Bernardino Co., Orange Co., Riverside Co., Southern Kern Co. and Ventura Co.	11-12	0400PST-1000PST			0	1	?	0	High wind
Another episode of Santa Ana winds descended upon southern California early Monday morning through Tuesday morning. There were reports of at least four big rigs, a number of travel trailers and several motorcycles that were tipped over by the strong winds. At least 20 trees were uprooted and windows were shattered in several buildings around the San Bernardino area. Power lines were downed across portions of the Southland, knocking out service to at least 20,000 homes and businesses. Some of the highest wind reports were gusts of 100 mph near Grapevine in southern Kern County, 85 mph near Devore at the base of the Cajon Pass, and 80 mph on the hilltops above Point Mugu in Ventura County. Other strong winds reported were sustained winds to 44 mph at Rialto Airport, gusting to 62 mph, and at Sandberg, 40 mph sustained winds with gusts to 54 mph.									
San Diego Co.	28	1239PST			0	0	0	0	Waterspout
A waterspout was observed by a pilot about 25 nautical miles west of Mission Bay, California. An upper-level disturbance west of San Diego triggered thunderstorms along with the waterspout over the coastal waters of San Diego. No reports of injuries or damage were noted.									
[5] COLORADO									
Gilpin County 1S Rollinsville	08	2150MST			0	0	0	0	High Wind (63)
COZ002-004-011-014-015-016 Northern and Central Mountains, and the Eastern Foothills	10-11				0	0	0	0	Snow
The season's largest snowfall to date hit the northern and central mountains of Colorado, and the areas in and near the eastern foothills. Six to 12 inches of snow fell in the Denver-Boulder area, with the largest amounts having fallen in and near the foothills. Delays at Stapleton Airport reached two hours. Multiple wrecks snarled traffic on Interstate 25 both north and south of the city.									
Farther north, up to 4 inches of snow fell in the Pueblo area. Rye, in the foothills southwest of Pueblo (Pueblo County), had 15 inches. To the west of Pueblo in Fremont County, Canon City had 8 inches.									
Heavy snow also hit the northern and Central Rockies. Two feet of snow fell at Steamboat Springs in Routt County, and Winter Park in Grand County was buried with 21 inches of fresh powder. Many other spots in the area had 6 to 12 inches.									

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
COLORADO									
Larimer County 5.5WNW Wellington	14	afternoon			0	0	0	0	High Wind (50)
Clear Creek County Mt. Evans summit	14	afternoon			0	0	0	0	High Wind (81)
Gilpin County 1S Rollinsville	14	1830MST			0	0	0	0	High Wind (76)
COZ002 Northern Mountains	14-18				0	0	0	0	Heavy Snow
	Snow fell almost continuously in the northern Rockies during this period. A whopping 74 inches of snow piled up in Steamboat Springs in five days, and the skiers celebrated. In fact, in the nine days from December 10th through the 18th, Steamboat had nine feet of new powder. From the 14th through the 18th, 65 inches fell at Vail. Snowfall at other spots in the area ranged from two to three feet.								
COZ002 Northern Mountains	19-20				0	0	0	0	High Winds
	Strong winds howled at mountaintop level in Clear Creek and Gilpin counties. Speeds reached 84 knots (97 mph) on the summit of Squaw Mountain, 11,000 feet above sea level in Clear Creek County, on the evening of the 19th. At 1700MST, speeds reached 73 knots (84 mph) one mile south of Rollinsville in Gilpin County. Gusts over 75 mph continued at both spots before dawn on the 20th.								
COZ004-008 Central and Southwest Mountains	21	evening			0	0	0	0	High Winds
	Wind gusts of 60 to 70 mph were clocked at Monarch Pass in Chaffee County and at St. Paul in San Juan County.								
COZ011-012-013 Northeast Colorado	22	morning			0	0	0	0	Cold
	Temperatures plunged far below zero over all of northeastern Colorado. The coldest reading was -40°F at Galeton, about 10 miles northeast of Greeley in Weld County. Many other spots had frigid temperatures in the -30 to -40°F range, including Greeley, Fort Morgan in Morgan County, and Julesburg in Sedgwick County. The mercury dropped to -27°F at Fort Collins in Larimer County. Denver's Stapleton Airport recorded -18°F, the coldest December temperature in six years.								
Gilpin County Rollinsville	23	1510MST			0	0	0	0	High Wind (78)
Larimer County 5.5WNW Wellington	23	1904MST			0	0	0	0	High Wind (52)
Fort Collins	23	1945MST			0	0	0	0	High Wind (54)
Routt County Steamboat Springs	30-31				0	0	0	0	Heavy Snow
	Thirteen inches of "champagne powder" buried Steamboat in a 24 hour period.								
6 CONNECTICUT									
CTZ001-002-003 All but Coastal and Southwest Connecticut	15-16	2200EST-0600EST			0	0	0	0	Heavy Snow
	A snowstorm of short duration dropped from 5 to 9 inches of snow over much of the state, with the exception of coastal areas where only a couple of inches fell and the snow was mixed with rain. The greatest snowfall total was reported from Union in northern Connecticut at the Massachusetts border. Snow accumulated at a rate of 2 inches per hour, and there were reports of thunderstorm activity in some areas.								
7 DELAWARE									
DEZ001>003	08	0300EST-			?	?	?	0	Heavy Snow
	09	0500EST							
Statewide	A snowstorm affecting the Mid-Atlantic region dumped several inches on the state. The heaviest amounts fell on the southern part, with 7 inches noted in Sussex County. Five inches fell at Dover and 3 inches at Wilmington.								
DEZ001>003	12	0700EST-			?	?	?	0	Snow
	13	0900EST							
Statewide	Another heavy snowstorm in the Mid-Atlantic area deposited 3 to 5 inches across the state, with the heavier totals, around 3 inches, being reported around Wilmington.								

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8 FLORIDA									
Escambia Co., Cantonment	08	0100EST			0	0	4	0	Tstm.wind(65)
	Several outbuildings were destroyed or damaged.								
Walton County: Miramar Beach	12	1030EST	short	?	0	0	4	0	Waterspout-Tornado(F0)
Freeport	12	1030EST	short	?	0	0	4	0	Waterspout-Tornado(F0)
	Two waterspouts moved onshore. One in Miramar Beach broke car windows and damaged a store roof. The one in Freeport damaged a house trailer and utility shed.								
Washington and Jackson Counties, 5S Chipley to 3N Cottondale	12	1115 to 1130EST	10	50	0	0	5	0	Tornado(F1)
	A tornado with an intermittent path began south of Chipley, crossed I-10 and moved to north of Cottondale. At least one other funnel cloud was sighted. Five houses were damaged near Cottondale and one near Chipley.								
FLZALL Statewide	22-25	1400EST-1000EST			6	?	0	9	Cold Spell
	A December cold spell and hard freeze as intense as those in 1985, 1983 and 1977 effected all 67 counties in Florida. Numerous daily and some monthly and all-time temperature minima were tied or broken. Snow and sleet fell as far south as a Sarasota-Melbourne line, with a maximum of 2 to 3 inches having fallen in the panhandle and Northeast Florida having experienced its first white Christmas during this century. Numerous traffic accidents and several fatalities occurred on ice-covered roads in North Florida. At least six people died of hypothermia and another four in space heater-related fires. Extensive crop damage including a loss of about 30% of the $1.4 billion citrus crop left tens of thousands of migrant farm workers unemployed. Winter vegetables, berries, nursery ornamentals and fish suffered heavy losses. Cold M1P M57O M82O M42O F69P M49V								
9 GEORGIA									
MILLER COUNTY 3SW Colquitt, 3NW Colquitt and Colquitt	08	0600EST			0	0	4	?	TSTM Wind
	Thunderstorm winds damaged and uprooted several trees around Colquitt. Southwest of the town, a small building was lifted off its foundation and a large metal building was severely damaged. Scattered trees were damaged and uprooted along U.S. Highway 27 North and over the northern section of the town along Georgia Highway 45 North. Scattered power outages and line damage also occurred.								
GAZ001-007 North and Central Georgia	09	0700EST-1600EST			0	?	?	?	Ice Storm and Snow
	A pool of cool air entered the state during the morning hours. Sleet, freezing rain, freezing drizzle, and snow started over northwest Georgia and moved east across the state. At mid morning, the amount of ice in the storm, detected by radar, was increasing. By 1430EST, two to three inches of snow became common in the northeast counties with greater amounts in the mountains, where snow amounts over six inches accumulated in places. In Gwinnett County, more than a hundred automobile accidents occurred. Injuries were reported in several weather-related accidents across north Georgia. Smaller areas of sleet occurred over central Georgia.								
GAZ001-004 North Georgia	15	0600EST-1200EST			0	0	?	?	Sleet and Light Snow
	A mixture of light snow and sleet occurred across extreme north Georgia. Further south around Atlanta and Athens, light precipitation was falling as a mixture of rain and sleet. Scattered slick spots developed as ice accumulated over roads and bridges, causing several weather-related automobile accidents with resulting injuries. In addition to the sleet, light snow also occurred.								

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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GEORGIA									
GAZ001-007 North and Central Georgia	17-18	1900EST-1035EST			0	0	?	?	Ice Storm and Light Snow
GAZ005-006 Central Georgia	18	1630EST-2200EST			0	0	?	?	Ice Storm
GAZ001-004 North Georgia	18-19	2200EST-2000EST			0	0	?	?	Ice Storm and Light Snow
SPALDING COUNTY Griffin	19	Morning			0	1	?	0	Ice Storm
	Around 1900EST on the 17th, an area of rain with scattered patches of sleet began in the Columbus area of west-central Georgia. By 2115EST, a large area of rain, freezing rain, and sleet extended across the middle of the state and was steadily spreading northward. After midnight, light snow developed and the mixture of wintertime precipitation spread over north, central, and small portions of southeast Georgia. The winter precipitation ended briefly during the morning on the 18th, but reformed over the northern third of Georgia when a large area of rain, freezing rain, and sleet moved in from the Lower Missiesippi River Valley during the day. The leading edge moved into western Georgia during the afternoon. Traveling conditions throughout these winter weather episodes was extremely hazardous as ice accumulated on roads and overpasses across the area. Scattered tree limbs, power lines and telephone lines were broken by the ice, causing localized outages, mainly in northeast and northwest Georgia. Ice-laden tree limbs caused minor damage to homes. One woman was injured while driving when a limb crashed onto her car in Griffin. Several lives were lost and injuries occurred in weather-related automobile mishaps.								
GAZ001-008 North, Central and Southwest Georgia	22-25	0000EST-1200EST			0	0	?	?	Cold and Light Snow
	Bitterly cold weather over north and central Georgia resulted in hundreds of broken and damaged water pipes. In Atlanta alone an estimated 800 pipes had burst. Broken pipes flooded water into apartment homes at one complex, causing extensive damage in several units. Several Georgia counties had widespread water line damage; some automobiles suffered in the cold also. Hundreds of residents and businesses were left without water service at intervals during the weekend. Periods of light snow developed over the weekend and Monday, with occasional scattered accumulations near one inch having occurred over the northern counties.								
GAZ009-015 Southeast, South-Central, and Southwest Georgia	22-25 and 22-23	1000EST-1200EST; 1900EST-2300EST			0	0	?	0	Cold; Heavy Snow and Sleet
	Heavy snow and sleet began over south Georgia on Friday and continued in some areas into late Saturday morning. By Saturday afternoon, generally snow was falling. In some areas as much as three to five inches of snow accumulated over the earlier ice. The heavier amounts fell near the coast. With extremely cold temperatures, many water lines froze up and left residents without water Saturday and Sunday. Burst water pipes also contributed to icing over several roads. By Christmas Day (Monday) most residual ice and snow was melting as temperatures began warming. Traveling conditions were hazardous, resulting in several injuries in weather-related traffic mishaps.								
GREENE COUNTY 10NNW Greensboro	23	0000EST			1	0	0	0	Cold
	A elderly man left his home Friday afternoon and was found dead early Saturday of hypothermia. M890								
10 IDAHO — NONE REPORTED									

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
11 ILLINOIS									
ILZALL Statewide	12-24				?	?	0	0	Extreme Bitter Cold
	Record-breaking cold gripped many areas of Illinois beginning on December 12th and continuing through the 24th. The very coldest weather occurred during the period of December 21st through the 23rd when temperatures plunged to -20°F or colder throughout most of the state, except over the extreme south and the extreme northeast sections. During the latter-mentioned period, wind chill temperatures at times reached -50 to -60°F across Illinois. Parts of southern and east-central Illinois experienced all-time record minimum temperatures for the month of December. A National Weather Service cooperative observer reported an extreme low temperature reading of -26°F at Hutsonville in Crawford County in southeast Illinois on the 22nd. A -21°F reading was recorded as far south as Washington County (40 miles southeast of St. Louis, Missouri). Other Illinois cooperative observers reporting minimums of -26°F -the coldest reading reported in Illinois for December- included: Watseka, Iroquois County on the 22nd; Chenoa, McLean County on the 22nd; Elizabeth, Jo Daviess County on the 23rd; and Tuscola, Douglas County on the 22nd. Many daily minimum temperatures were broken across the state during the 12-day severe cold wave. Peoria's 11 consecutive days of minimum temperatures below zero tied an all-time record (also 11 days in 1979), and the -23°F recorded on the 22nd was the 5th coldest reading on record for any month. Peoria set 5 new daily record lows and tied one record low during the period of December 14th to the 23rd (3 record low maximums were also set during the period). At Springfield, three new record lows were set and one record low was tied during the period of December 17th to the 23rd, and the record low of -21°F on the 23rd set a new all-time low temperature for the month of December (old record, -18°F). Rockford set record lows on the 15th and 22nd (-19°F) and tied a record low on the 14th. Temperatures in the immediate Chicago metropolitan area did not reach the extreme minimums that were prevalent over most of the rest of the state. However, the minimum of -14°F at Chicago's official recording station at O'Hare International Airport on the 21st did establish a new daily record low. The cold was directly or indirectly blamed for 19 weather-related deaths in the Chicago area's Cook County alone.								
12 INDIANA									
Northern Indiana	2-3				0	0	?	?	Heavy Snow
	Very cold air combined with strong northwest winds to produce heavy lake-effect snow over Northern Indiana. Over a foot of snow fell at South Bend. Snowfall amounts of from 6 to 12 inches were reported at Elkhart, Goshen and Plymouth.								
Southern Indiana	15				0	0	?	?	Heavy Snow
	Heavy snow occurred over Southern Indiana on the morning of the 15th. Five to six and one-half inches was reported at Bedford, Palmyra, Scottsburg, Vincennes and Petersburg.								
Northern Indiana	16				0	0	?	?	Heavy Snow
	Arctic air and strong winds combined to produce heavy lake-effect snow near Lake Michigan. Thirty inches of snow fell at New Carlisle, 8 miles west of South Bend. Elsewhere within 20 miles from the Lake Michigan shoreline, the heavy snow caused poor visibilities and forced the closing of some highways in the area for several hours.								
Northeast Indiana	17-18				2	0	?	?	Record Cold
	Two deaths directly related to very cold temperatures were reported. One was a woman found frozen to death in her car in northwest DeKalb County. The other fatality was a man who died from hypothermia as he tried to walk 2 miles home from his job in Huntington County. F36V, M27O.								
All of Indiana	22				0	0	?	?	Record Cold
	Record cold temperatures were set on the morning of the 22nd. At Indianapolis the coldest low temperature of the century of 23 degrees below zero was recorded forcing the closure of the public school system. Scattered power outages occurred, as well as water main breaks due to the extreme cold. Other record lows were reported for December from Fort Wayne with 18 below zero and Evansville with 15 below zero. Wind chills also reached dangerous levels in the minus 30 to minus 45 degree range.								
Northern Indiana	22-23				0	0	?	?	Heavy Snow.
	Heavy lake-effect snow was reported over Northwest Indiana. New snowfall amounts were 6 inches in LaPorte County and Michigan City. Eight to ten inches of new snow fell at Long Beach on the Lake Michigan shoreline.								

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED DAMAGE PROPERTY	ESTIMATED DAMAGE CROPS	CHARACTER OF STORM
13 IOWA									
ILZ004 East-Central Iowa	02	0652 to 1553 CST			0	0	4	0	High Winds
	High winds buffeted East-Central Iowa during the day. Sustained winds were around 40 mph with a peak gust of 52 mph recorded at the Moline Airport at 1311 CST. Some damage occurred, but was relatively minor.								
SDZ018,IAZ004-005 Northwest Iowa	10	0200 to 1200 CST			0	0	4	0	Snow and Heavy Snow
IAZ013-014-015 South-Central and Southeast Iowa	10-11	1400 to 0200 CST			0	0	3	0	Snow
	Following the passage of an Arctic cold front, an upper air system moved across Iowa. As this system moved through, a narrow band of snow fell in the northwest counties. Amounts were generally in the 3 to 6 inch range, but a few areas north of Sioux City received upwards of 10 inches of snow. After this band broke apart, a general area of light snow fell over most of the state except the northeast counties. Since the temperatures had been quite warm prior to the snowfall, roads became icy. The result was hundreds of car accidents across most of Iowa. Later in the afternoon, a second band of snow developed. Amounts across the south-central and southeast counties were generally in the 3 to 6 inch range.								
IAZ009-010-012-013-014-015 West-Central into Southern Iowa	26	1900 to 2300 CST			0	0	3	0	Freezing Rain
	Freezing rain, mixed with some light snow, moved from West-Central into Southern Iowa. Roads became ice covered quickly, and some power line outages were reported. Ice amounts were generally less than 1/10th of an inch, with isolated 2/10th inch amounts reported.								
IAZ015,ILZ004 East-Central and Southeast Iowa	29-30	1700 to 0700 CST			0	0	3	0	Ice Storm
	Freezing rain and freezing drizzle fell over East-Central and Southeast Iowa. Though only minor damage occurred to power lines, the icing caused considerable traffic problems. Farther to the northwest, freezing drizzle occurred over a large part of Iowa. Only minor traffic problems occurred over the rest of the state and damage was minimal.								
14 KANSAS									
KSZALL All of Kansas	22-24	0000- 0000CST			0	0	0	0	Severe Cold
	Severe cold blasted into Kansas on December 22nd and 23rd. All-time record low temperatures were recorded across the state. Goodland set an all-time record low of -27°F. Topeka and Concordia had readings of -26°F, and Dodge City had -21°F. All of these readings were new all-time record low temperatures. Wichita set a new record for the month of December with a reading of -16°F. Many of the former all-time records dated back into the late 1800's.								
	Other readings around the state included -32°F at Brewster and Colby, and -31°F at Oberlin. Temperatures of between -20°F and -30°F were reported at over 20 cities across the state.								
	Wind chill readings dipped to between -50°F and -60°F, making this period truly one of the coldest periods ever in Kansas.								
15 KENTUCKY									
KYZALL All of Kentucky	22				?	?	?	?	Cold
	The month of December 1989 was extremely cold across Kentucky. All-time record low temperatures for the month were set around the state on the 22nd. Some of the lows included -15°F at Louisville, -19°F at Lexington, -10°F at Paducah, and -13°F at Jackson.								

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED DAMAGE PROPERTY	ESTIMATED DAMAGE CROPS	CHARACTER OF STORM
16 LOUISIANA									
LAZALL Entire State	21-26	0000CST- 0000CST			5	0	6	?	Extreme Cold
	The last in a series of Arctic cold fronts swept across Louisiana on the 21st bringing some of the coldest weather of the 20th Century to south Louisiana. By the morning of the 23rd the cold airmass was entrenched over the state, and record monthly low temperatures were established at nearly all stations. Representative minimum temperatures (degrees Fahrenheit) on the 23rd included: 5 at Shreveport, 9 at Alexandrida, 8 at Baton Rouge, 11 at Lake Charles, and 12 at New Orleans Audubon Park. The minimum temperature at Lake Charles was the coldest temperature ever recorded since observations began in 1919. Over south Louisiana, the minimum temperatures recorded in this event were the coldest since the devastating Arctic blast of February 1899. Consecutive hours at or below freezing during the Arctic outbreak of December 1989 ranged from 77 hours at Shreveport to 63 and 64 hours at Lake Charles and New Orleans, respectively.								
	On Dec. 22nd, snow and sleet fell across the southern third of the state, paralyzing much of the area's transportation system. The largest snow and ice accumulations were in the coastal parishes, as two to four inches were common from the coastal sections of Vermillion Parish eastward into Lafourche and Terrebonne parishes. Snow and ice covered the ground in New Orleans; however, accumulations were generally less than an inch.								
	The results of this cold weather were particularly devastating on water systems, with widespread breakage of pipes and resultant loss of water pressure. House fires were numerous across the state due to improperly used heaters, and resulted in the deaths of several persons. Over 100 fires occurred in New Orleans alone during a 24-hour period. Losses in the commercial fishing industry were significant as many fish perished when water temperatures plummeted. One to two inch thick ice was reported on the shallow coastal bays and marshes, and a thin sheet of ice was reported extending several miles from shore over the open Gulf of Mexico. In northwest Louisiana, large chunks of ice were observed in the Red River. The long duration of sub-freezing temperatures inflicted widespread damage to plants in south Louisiana, particularly to commercial nurseries raising ornamental plants. The small citrus industry in Plaquememines Parish also suffered severe losses.								
	There were five fatalities directly related to the Arctic outbreak of December 1989: a 36-year-old man died of exposure in New Orleans, Orleans Parish on December 21; a 64-year-old female died of exposure in New Orleans, Orleans Parish on December 24; and a 90-year-old man died of exposure in his poorly heated home in St. Francisville, West Feliciana Parish on December 22; a 13-year-old boy drowned in rural East Feliciana Parish southeast of Clinton on December 23, when the ice-covered pond on which he was playing collapsed sending the boy into the frigid water. A similar incident occurred in Slidell, St. Tammany Parish on December 25, when a 13-year-old boy drowned when the ice-covered pond on which he was playing collapsed. M360, F640, M90P, M130, M130.								
17 MAINE									
MEZ 001-002-003-004 005-006-007-008 009-010-011-012 013-014 All of Maine	02-04	2330 EST- 2000 EST			0	5	5	0	Blizzard and Heavy Snow
	An Alberta Clipper picked up moisture as it crossed the Great Lakes and headed southeast towards the Gulf of Maine on the evening of December 2nd. At the same time, an area of low pressure formed off the New Jersey coastline. The two systems combined into an intense winter storm in the Gulf of Maine before heading slowly into the Canadian Maritimes. Heavy snow broke out across southern Maine on the 2nd, however, the greatest snow depth reports were located in northeastern sections of the state due to the deceleration of the storm on the 3rd and 4th. The hardest hit area was near Presque Isle where 24-hour snowfall records were broken. Thirty inches of snow fell in this section of the state, which made it the worst storm since 1987. Winds were sustained at 28 mph with a peak gust of 46 mph in Presque Isle. Due to the early warning and timing of the storm there were surprisingly few accidents. In Newport, a tractor-trailer jackknifed. Also, in the same town there was a three-car pileup on Route 10. Along the coast, high winds damaged a waterfront structure at Clark Point Road in Southwest Harbor, and Fox Island Electric Corporation sustained $40,000 damage. Some snow totals include (in inches):								

Limestone	31	Bangor	10
Presque Isle	30	Waterville	9
Grand Lake	28	Augusta	8
Houlton	18	Portland	8
Danforth	14	Brunswick	7
Eustis	14	Skowhegan	7
Veazie	12	Fort Kent	7
Jackman	12	Kennebunkport	5

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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

MAINE

MEZ 001-002-003-004 005-006-007-008 009-010-011-012 013-014 All of Maine	16-17	0100EST-0400EST			0	15	5	0	Heavy Snow

Low pressure formed along the southern New England coast, pushing snow into Maine early on the 16th. The storm intensified rapidly and moved northeast, crossing over Casco Bay, then proceeding on a course to eastern Maine on the afternoon of the 16th. Many thunderstorms were reported in Portland and surrounding towns close to the path of the low. Lightning struck a radio station at 0953EST in the morning. Up to three bolts of lightning struck a chairlift tower at the Camden Snow Bowl. By 1050EST, the storms had reached Castine when WERU radio was hit by lightning. Over 100 traffic accidents were reported during the weekend. An accident on Ferry Street in Solan knocked out power in a section of the town. Slick roads caused an 18-car pileup near the Bangor Mall. Many accidents were noted in the Fairfie[illegible] area. The Portland International Jetport delayed and can- ed flights early on the 16th. Some of the snow totals include up to a foot in the Bangor area (9 inches reported at the airport); 6 to 12 inches in downeast sections and 8 inches in Portland.

18 MARYLAND and D.C. —— NO REPORT RECEIVED

19 MASSACHUSETTS

MAZ002-004-005-006-007 Southern portion of State	15-16	2300EST-0600EST			0	0	0	0	Heavy Snow

A brief-but-heavy snowstorm dropped 6 to 9 inches of snow in the southern portion of the state from the Berkshires to Bristol County. South coastal sections had only a few inches before the snow changed to rain.

MAZ005 Berkshire County, Adams area	17	0400EST-1000EST			0	0	4	0	Gusty Winds

A period of gusty winds comparable to the chinook winds that occur in the western U.S., swept down from Mount Greylock, shaking houses, ripping off shingles, blowing apart a fence and blasting a porch off of a building. A peak wind gust of 45 mph was measured at the local airport, but gusts of up to more than 60 mph were estimated to have occurred in a localized area.

20 MICHIGAN

MIZ001-005-006-007-017-019-020-021 Upper Peninsula and Northwest and Southwest Lower Michigan	02	0700EST			0	0	0		Heavy Snow

Heavy snow fell from the morning of December 2nd through the evening of the 3rd. Strong winds caused near-blizzard conditions and resulted in 150 auto accidents. Twenty-two people were injured and 16 people died in the accidents. Drifts up to four feet deep were reported in many areas. Some snowfall amounts in inches included:

Upper Peninsula		Lower Peninsula	
20	Ironwood	13	Cassopolis
16	Bergland Dam	16	Watervliet
13	Gwinn	8	Kalkaska
10	Munising		

MIZ017-020 Western Central Upper Peninsula	10	1800EST			0	0	0		Heavy Snow

Heavy lake-effect snow began on the night of December 10th. The snow ended by late evening on the 11th. Snowfall amounts in inches included: 18 at Ontonagon, 14 at Green Garded (just north of Ironwood), and 9 at Duke. No significant accidents were noted.

MIZ009-012-018 Northeast Lower Michigan and North Thumb, and South Upper Peninsula	13	0800EST			0	0	0		Heavy Snow

Heavy lake-effect snow fell from mid morning of December 13th through the early morning hours of the 14th. The heavy snow was localized. Kindle received 17 inches of snow, while only 3 inches fell 7 miles south of Bad Axe. Oscoda had 12 inches. Over the Upper Peninsula another very localized heavy snowfall occurred. Twenty-four inches of snow fell at Manistique. No accidents were a result of any of these snowfalls.

MICHIGAN

MIZ001-009-017-020 Northeast Lower, Southwest Lower, and West and Central Upper Michigan	14	0100EST			0	0	0		Heavy Snow

Heavy lake-enhanced snow began early on the morning of the 14th. By the time the snow ended late on the 15th, several areas received considerable amounts of snow. The hardest hit area was northeast Michigan, where over two feet of snow fell across a large area. Southwest Lower Michigan had from 6 to 12 inches. All of the 70 reported accidents associated with the snowfall occurred over Southwest Lower Michigan. Only 3 injuries resulted from the accidents which were mostly minor. Snowfall amounts in inches included:

Northeast		Southwest		Upper Peninsula	
29	Hubbard Lake	12	Benton Harbor	13	Marquette
28	Posen	7	Allegan	9	Ironwood
24	Harrisville				

MIZ001-007 Northwest Lower and Southwest Lower Michigan	15	0800EST			0	0	0		Heavy Snow

A series of lake-effect snows caused very heavy snowfall from the morning of the 15th through the 18th. Most of the snow fell late on the 15th through the late evening of the 16th. During that time, 25 inches of snow fell at Three Oaks. Of 15 accidents associated with the event, 12 occurred in Southwest Lower Michigan. Snowfall amounts in inches included:

Southwest Lower		Northwest Lower	
30	Three Oaks	26.5	Benzie
28	Chikaming Township	15.0	Leelanau
16	New Buffalo		
9	Holland		

MIZ022 Extreme Southeast Lower Michigan	18-24				4	0	0	0	Extreme Cold

Four people died between December 18th and the 24th due to extreme cold that covered the state during the period. All four deaths occurred in the Detroit area of extreme southeast Lower Michigan. A 65 year old man died in his home in Hillsdale on the 18th. On the 20th, a 59-year-old man was found dead outside of his apartment in Detroit. On the same day, an 86-year-old woman was found frozen to death on her driveway. On the 21st, a man, who's age is not known, was found frozen to death in a wooded area in Taylor. M65P, M590, F890, M??O.

MIZ001-003-005-007-016 Western Lower Michigan	18	0700EST			0	0	0		Heavy Snow

Heavy lake-effect snow fell, mostly near the Lake Michigan shore areas. This event continued during the late evening hours of the 19th. Snowfalls of 6 to 12 inches were common. Holland had a total of 15 inches and Pellston had 11 inches. Only a few fender-bender accidents resulted from this snowfall event.

MI2001-003-005-007-017 Western Lower and Central Upper Michigan	21	0700EST			0	0	0		Heavy Snow

Heavy lake-effect snow again fell on the lakeshore areas of western Lower Michigan and a small area of the central Upper Peninsula near Munising. By the time the snow ended on the morning of the 22nd, 7 to 13 inches of snowfall was common across western Lower Michigan. Nine inches fell at Munising.

MIZ019-020 Western Upper Peninsula	24	0200EST			0	0	0		Heavy Snow

Heavy lake-effect snow fell from early on the 24th until mid morning on the 26th. Snowfalls of from 6 to 12 inches were reported. The 12-inch amount was reported at Ironwood.

MIZ001-002-003-004 West and Southwest Lower Michigan	25	0700EST			0	0	3		Heavy Snow and Ice Storm

A storm center that moved across northern Lower Michigan during the 25th caused freezing drizzle and snowfall of 3 to 10 inches across west and southwest portions of Lower Michigan. This resulted in 70 accidents, one of which caused the death of a 15-year-old boy. There were also 15 injuries. M15V.

MIZ001-002-003-004-005-006-007-008-009-010-011-012-013-014-015-022 All of Lower Michigan	30	1200EST				6	5		Ice Storm

Freezing rain began over southwest Lower Michigan and spread to the northern areas during the night of the 30th. The precipitation ended as rain on the 31st during the morning. Around 100 accidents occurred. Most were minor. On the night of the 30th through late in the day on the 31st, 34,000 power outages were reported. In southeast Michigan, 1.9 million customers lost power.

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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

21 MINNESOTA

Southeast Minnesota	02	0230-0600CST			0	0	?	?	High Winds

Damaging winds accompanied a cold front that roared across southeast Minnesota during the early morning hours. Winds averaged over 40 mph with peak gusts of up to 56 mph at the Rochester airport during this time. Power outages were reported at Owatonna in Steele County, and Rollingstone, Altura and Minneiska in Winona County.

Some specific damages included a large tree that was blown over onto a car and power lines that were downed in the Dodge Center area of Dodge County at about 0400CST. High winds also downed several trees and power lines at Dundas in Rice County at about 0415CST. There were also reports of several windows being broken and numerous shutters being blown off in Dundas. And at 0540CST, a heavy canoe was reported to have been blown across a road and into a building at Faribault in Rice County, the canoe ending up smashed.

MNZ005 Extreme Northeast Minnesota	13-14	1800CST-afternoon			0	0	0	0	Heavy Snow

Snow started to fall along the north shore of Lake Superior from Grand Portage to Tofte during the morning of December 13th. The snow increased in intensity late in the afternoon and in the evening, then gradually spread south along the lake shore toward Duluth during the morning of December 14th. By 2330CST, Lutsen had received 10 inches of snow. An amount of 19.5 inches eventually fell near Grand Marais. Twelve inch amounts were common from Lutsen to the Canadian border and eight inch amounts were reported from Knife River north to Lutsen. The lake-effect snow had spread inland 15 miles along the Gunflint Trail. The snow ended in the Lutsen area by 0745CST, but persisted in the Duluth area through the early afternoon of December 14th. An amount of 4.5 inches was reported from Duluth's east end.

MNZALL All of Minnesota	14-?				1	0	0	0	Extreme Cold

Subzero temperatures and bitterly cold wind chill values engulfed the state for an extended period of time. Wind chills were occasionally in the -50 to -70°F range. Minneapolis recorded subzero temperatures for 116 consecutive hours. A man died of hypothermia near Strandquist late in the evening of the 14th or during the morning of the 15th.
M650

22 MISSISSIPPI

MSZALL All of Mississippi	21-25				0	0	6	?	Extreme Cold

On December 21st, an extremely cold Arctic airmass entered the state. Temperatures fell below freezing during the day on the 21st at most locations throughout the state, and temperatures did not rebound above the freezing mark until the 25th. On three consecutive days, December 22nd, 23rd and 24th, low temperature records were broken at Jackson, Meridian and Tupelo. On the morning of the 24th these three offices also set all-time record low temperatures for the month of December. Jackson recorded 4°F, Meridian's temperature went down to -2°F, and Tupelo's temperature got down to -3°F. In conjunction with the extremely cold temperatures, strong northerly winds at times lowered wind chill indices to the -25°F to -40°F range. The extreme cold accounted for numerous reports of water lines freezing or breaking. In the city of Jackson alone, over 200 water mains broke, there was a loss of water pressure, and many customers lost water service completely. The estimated damage to the Jackson water system alone was 209,000 dollars. Similar costs were incurred in many areas of the state.

Neshoba County	24				1	0	0	0	Extreme Cold

A Neshoba County man died from exposure to the cold after wandering from his house in search of firewood.
M350

Lauderdale County, Meridian	24				1	0	0	0	Extreme Cold

A Meridian man died of hypothermia while in his House. He had laid down on the floor in front of a space heater and froze to death in his sleep, while the warm air from the heater rose to the ceiling. Authorities beleive that if he had been lying on the sofa instead of the floor, his life might have been saved.
M89P

23 MISSOURI

MOZ001-002-003-004-005-006-007-008-009-010-011-012-013-014-015-016-017-018-019-020 All but extreme Southeast Missouri	21-23				?	?	?	?	Extreme Cold

Arctic air covered the area from December 21st through the 23rd. This was a record cold for December in most locations. Temperatures reached -15°F to -25°F over most of the central and lower portions of the state. The low neared -30°F in the extreme northwest at Maryville. Kansas City set an all-time record low. Wind chill readings reached -50°F to -70°F over the area.

24 MONTANA

MTZ003 Northern Chinook	03	0800-1600MST			0	0	2	0	High Winds (G78)

Strong winds with gusts to 90 mph occurred between Augusta and Choteau.

MTZ007 South-Central Montana	04	0753MST			0	0	0	0	High Winds (G52)

Livingston Airport reported a wind gust of 60 mph.

MTZ007 South-Central Montana	08	1455-1652MST			0	0	0	0	High Winds (G55)

MTZ009 Southeast Montana	12	1045-2345MST			0	0	0	0	Heavy Snow

Snow fell in amounts of 3 to 10 inches in southeast Montana.

MTZ006 Central Montana	14-15	0400MST-1200MST			0	0	4	0	Heavy Snow

Snow fell in amounts of 6 to 12 inches across central Montana, requiring the closing of roads and schools.

MTZ007 South-Central Montana	15-16	2000MST-0800MST			0	0	4	0	Winter Storm

Snow fell in amounts of 4 to 8 inches across the southern portion of south-central Montana overnight. Strong winds drifted the snow, and Interstate 90 was closed for a time.

MTZ006 Central Montana	15-16	2200MST-1100MST			1	0	0	0	Cold

A man in Lewistown died from hypothermia after leaving his car when it became stuck in the snow on Lime Kilm Road. The man was lightly dressed and was found within 100 yards of his car.
M480

MTZ002 West-Central Montana	19-20	2200MST-0800MST			0	0	0	0	Heavy Snow

A foot of snow fell in Lincoln overnight.

25 NEBRASKA

NEZ003-004,IAZ004 Northeast Nebraska	10	0030CST-1330CST			0	0	1	1	Heavy Snow

Snow of 6 inches or more fell north of a line from Butte to Royal to Martinburg. Some of the reported snow amounts included 7 inches at Crofton and 6 inches at Butte, Gavins Points, Laurel, Newcastle, Royal and Spencer.

NEZALL Entire State	19-23	Morning to Evening			0	2	4	2	Extreme Cold

Record-breaking, bitter cold Arctic air covered the state with subzero readings. The morning of the 22nd was the coldest when the all-time record low for the state was equaled in the panhandle as the temperature fell to -47°F. Other °F minimums in the panhandle on the morning of the 22nd included 46 below at Crescent Lake Wildlife Refuge, 44 below at Harrisburg and Agate and a record low for the month of 42 below at Scottsbluff. The lowest temperature for any month was recorded at Valentine with -39°F. On the same morning of the 22nd, low temperature records for the month were also set at North Platte with 34 below, Norfolk with 30 below, Grand Island with 26 below and Omaha with 25 below. During the cold spell, wind chill values in the north-central and northeast areas of the state lowered to around 75 below. Two severe frostbite cases were reported during the cold period. One male transient in Omaha and a man whose vehicle broke down near Chappel. A number of power outages were reported in various sections of the state as power lines contracted and snapped in the cold. Schools closed in many areas.

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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

26 NEVADA — NONE REPORTED

27 NEW HAMPSHIRE

NHZ 001-002-003-004 005-006	02-03	2300EST-2000EST	0	0	4	0			Heavy Snow

An Alberta Clipper picked up moisture as it crossed the Great Lakes and headed southeast towards the Gulf of Maine on the evening of December 2nd. At the same time, an area of low pressure formed off the New Jersey coastline. The two systems combined into an intense winter storm in the Gulf of Maine before heading slowly into the Canadian Maritimes. Snow began late in the evening on the 2nd in southern and western sections of the state and proceeded to spread northeast, ending late on the 3rd. Heaviest snowfall totals were reported in central and northern areas. This was due to the "backlash" effect of the storm while it passed through the Maritimes. In addition, a changeover to rain occurred in southern sections. Suprisingly, no major accidents were reported. Some of the snow totals include (in inches):

Errol	14	Gorham	4
Crawford	13	Keene	4
Newport	8	Berlin	3
Marlow	6	Concord	3
Franklin	6	Rochester	3
Walpole	5	Portsmouth	2

28 NEW JERSEY, Northern

NJZ001 and NYZ015 Northwestern and Metropolitan New Jersey	15	2300EST	0	0	0	0			Heavy Snow

A weakening low pressure system that moved across northern New England and a secondary low pressure system that moved northeast across central New Jersey and Long Island dumped heavy snow across sections of northern New Jersey. New Providence in western Union County recorded 5 to 7 inches. Sussex county received 5 to 7 inches, while Passaic and Morris counties received 5 to 6 inches.

28 NEW JERSEY, Southern

NJZ003-004-006 Interior and Coastal Zones	08	1700EST*	0	0	1	0			Heavy Snow
NJZ002 Metropolitan Delaware Valley	08	1900EST*	0	0	1	0			Heavy Snow

(* times at which 4-inch accumulation was reached, not starting times)

Snow began falling across the area at around 0900EST and continued through the day, finally tapering off and ending at around 2200EST. The snow accumulation reached 4 inches at around 1900EST in the Metropolitan Delaware Valley Zone and at around 1700EST over the remainder of Southern New Jersey. The total accumulation was generally 4 inches, but as much as 5 inches fell in portions of the Southern Interior Zone.

NJZ006 Coastal Delaware Bay	13	0100EST*	0	0	1	0			Heavy Snow
NJZ003-004 Coastal and Interior Zones	13	0200EST*	0	0	1	0			Heavy Snow

(* times at which 4-inch accumulation was reached, not starting times)

Snow began falling across the area at around 0900EST on the 12th and continued until around 0800EST on the 13th. The snow was light during the day, then picked up in intensity after 2000EST on the 12th. The snow accumulation reached 4 inches at around 0100EST on the 13th in the Coastal Delaware Bay Zone and at around 0200EST on the 13th in the Southern Coastal and Southern Interior zones. The total accumulations were in the 4 to 6 inch range.

NJZ005 Southern New Jersey		monthlong	0	0	?	0			Record Cold

Persistent cold through the month of December resulted in the coldest December on record. The temperature averaged 24.7°F for the month at the Atlantic City National Weather Service Office in Pomona which is 11.1°F below normal.

29 NEW MEXICO — NONE REPORTED

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

30 NEW YORK, Coastal

NYZ014 Rockland and Westchester Counties	15	2300EST	0	0	0	0			Heavy Snow

A weakening low pressure system that moved across northern New England and a secondary low pressure system that moved northeast across central New Jersey and Long Island dumped heavy snow across sections of northern Rockland and Westchester counties. Snowfall amounts ranged from 6 to 7 inches over northern areas of the counties, but snowfall was considerably less over their southern portions.

30 NEW YORK, Central

Eastern New York areawide		monthlong	0	18	5	?			Record Cold

December 1989 was the coldest December ever at many recording stations in Eastern New York. The record cold caused rivers and streams to freeze over earlier than usual and produced a thicker ice cover than normal. The Coast Guard responded to the extreme ice buildup in the lower reach of the Hudson River by bringing in two ice breakers, which freed 40 ships during the month. On average, 60 to 70 ships are freed from ice during a winter season. The coldest temperature of the month was -48°F recorded at Chippewa Bay in St. Lawrence County, at 0426EST on the 28th.

Eastern New York areawide	15-16	PM-AM	2	3	6	?			Snow

Between 6 and 11 inches of snow blanketed Eastern New York. During the snowstorm, a twin-engine airplane crashed in the Catskill Mountains near East Jewitt. Six persons were killed in the crash. One female died in a car crash that was blamed on icy roads and poor visibility. A firefighter died in a car accident blamed on icy roads also, as he was responding to a motor vehicle accident.

F18V, M62V

Saratoga County northern sections	23-24	1430EST-0700EST	0	0	4	0			High Wind and Cold

Gusty winds blew down a primary electric cable, shorting out a power substation. Due to record cold temperatures, over 7000 homes were without power during a peak cold snap. County emergency services opened emergency shelters for those who wished to seek alternative shelter.

Eastern New York areawide	29-30	PM-AM	4	12	5	0			Snow

Snowfall of 4 to 6 inches in amount occurred over Eastern New York. One woman was killed in Columbia County in a car crash that resulted from icy roads and poor visibility. Another car crash claimed the life of one male in Rensselaer County. In Dutchess County, snow-covered roads resulted in two fatal car accidents.

F45V, M17V, M67V, M50V

30 NEW YORK, Western

NYZ001-004-022 Areas East of Lakes Erie and Ontario	02-03	1500EST-1500EST	0	0	3	0			Heavy Snow

A northwest flow of cold air across Lakes Erie and Ontario produced localized snowsqualls. The snow began on Saturday afternoon, the 2nd, and continued through Sunday. Snowfall amounts of up to two feet were reported. In Cattaraugus County, Perrysburg received 12 inches and West Valley received 18 inches. Chaffee in Erie County reported 12 inches. In Lewis County, between 12 and 18 inches fell at Harrisville.

NYZ001 Buffalo Metropolitan Area	14-15	1600EST-0400EST	0	0	3	0			Heavy Snow

A heavy lake-effect snowsquall dumped over a foot of snow in a 10 mile wide band from Buffalo to Lancaster. At the Buffalo Airport, eight inches of snow was recorded; however, just south of the airport, West Seneca reported 12 inches, and 15 inches fell in Hamburg. Several suburban school systems were forced to close for the day.

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
—— NEW YORK, Western									
NYZ001-002-022 *Much of the area* East of Lake Erie and South of Lake Ontario	15- 16	1200EST- 1200EST			0	0	4	0	Heavy Snow
A low pressure system over the Ohio Valley strengthened and moved northeast across New York to the New England Coast. A widespread snowfall of 6 to 12 inches was reported across the western part of the state. Reported snowfalls included: 6 inches at Buffalo in Erie County, 7 inches at Sinclairville in Chautauqua County and Geneva in Ontario County, 9 inches at Rochester in Monroe County, and 12 inches at Fairport in Monroe County. The Greater Rochester Airport was shut down for several hours for snow removal. The Monroe County Sheriff blamed the snowfall for over 50 accidents across the county.									
NYZ004-005 *East* and Southeast of Eastern Lake Ontario	16- 17	1500EST- 2200EST			0	0	3	0	Heavy Snow
A westerly flow of cold air across Lake Ontario produced localized snowsqualls that meandered north and south across the area from Saturday the 16th through Sunday the 17th. Hancock Airport in Syracuse recorded about 18 inches of snow. Over a foot and a half of snow was reported at the Niagara Mohawk 9-Mile power plant in Oswego County. The State University at Oswego received 10 inches of snow.									
NYZ001-022 Area immediately East of Lake Erie	20- 21	1200EST- 1600EST			0	0	3	0	Heavy Snow
Localized snowsqualls off of Lake Erie produced snowfalls of up to a foot over portions of the traditional snowbelts south of Buffalo. Reports included: 9.5 inches at Colden in Erie County; 7 inches at Little Valley in Cattaraugus County; and 8 inches at Sinclairville, 10 inches at Sherman, and 12 inches at Fredonia, all in Chautauqua County.									
NYZ004-005 East and Southeast of Eastern Lake Ontario	20- 21	1200EST- 2200EST			0	0	3	0	Heavy Snow
A blast of Arctic air across Lake Ontario produced snowsqualls that dumped snows ranging in fall from 6 inches in Syracuse to 12 inches in Pulaski. In Lewis County, over two feet of snow fell in fourteen hours at Barnes Corners.									
31 NORTH CAROLINA									
NCZ005-006-007 -009-010 Northern Mountains to Piedmont	8	0500EST			0	0	0	0	Heavy Snow and Ice Storm
A mix of freezing rain and heavy snow fell over the Northern Mountains and Foothills and the Northwest Piedmont. Six inches of snow was reported in Watauga County. One to three inches of freezing rain, sleet and snow covered the ground from the foothills to the *Greensboro area. Numerous areas reported trees* and power lines down from the freezing rain.									
NCZ007-013 Southern Foothills	9	1600EST			0	0	0	0	Heavy Snow
Snow up to four inches deep fell in Rutherford, McDowell, and Catawba counties.									
NCZ0015 Robeson Co.	9	2100EST			0	0	0	0	Ice Storm
Freezing rain fell in parts of the Coastal Plain and the Southern *Coastal area. Trees and power lines fell in Robeson County where* ice accumulations were about one-half inch thick.									
NCZ007-009 Northern Mountains and Foothills	11	2130EST			0	0	0	0	Heavy Snow
Five to eight inches of new snow fell in Ashe, Alleghany and Surry counties.									
NCZ015-016-017 Southeast *North Carolina*	18	2200EST			0	0	0	0	Ice Storm
Widespread freezing rain fell in southeast North Carolina. Ice accumulations of up to a half inch thick brought down trees and power lines across the area.									
—— NORTH CAROLINA									
NCZ001-002-003 -004-015-016-017 Southeast and Eastern North Carolina	22	2110EST			2	0	?	0	Blizzard
On the evening of December 22 a developing offshore storm system began to produce snow in southeastern North Carolina. By early on the 23rd, the storm had intensified dramatically, producing 60 MPH winds and waves as high as 34 feet in the near-shore waters. The tanker Benjamin Isherwood ran aground just off Corolla. Snow fell from the evening of the 22nd to about midday on the 24th. Final snow depths were from one to three inches across the Sandhills and Northern Coastal Plain, with four to 12 inches in the Southern and Central Coastal Plain. Up to 15 inches of show fell in the immediate coastal counties from Cape Hatteras to Cape Lookout. The final snow depth at Cape Hatteras was 13.3 inches. This does *not account for about five inches of snow* that melted when the snow changed briefly to rain on the 23rd. Along the northern coast, snow amounts ranged from 10 inches at Manteo to one inch at the Virginia border. Gusty winds piled snow drifts four to eight feet high all along the coast. Many towns were paralyzed. The snow shattered most snow records for the area. It was also the first White Christmas on record for coastal North Carolina. Two deaths in Camden County were attributed to the winter weather. An elderly man went outside for kerosene, slipped and fell in a snow bank, was unable to get up, and froze to death. The second death involved an elderly man who died of hypothermia in an unheated home. M67O M73P									
NCZ016-017 Southeastern North Carolina	25	0600EST			1	0	?	0	Record Cold
Christmas morning low temperatures along the coast set all-time low records in many locations. Wilmington reached zero degrees F. Jacksonville reached minus 5 degrees. The cold produced widespread damage to subtropical ornamental plants and winter crops in the area. Large numbers of waterfowl and fish were killed in the sounds and estuaries. A Warsaw man was found dead in his home on the 27th. M67P									
32 NORTH DAKOTA									
NDZALL all of North Dakota	20 21	night to night			0	0	?	0	Extreme Cold
Temperatures of 20 below zero and colder combined with northwest winds to bring wind chill factors of 60 below and colder during the harshest period of a ten-day cold spell. On the morning of the 21st, at the Dickinson airport, a temperature of 33 below zero was recorded with a 21 mph wind. This produced a wind chill index of 86 below zero.									
The cold stressed heating systems and vehicles.									
NDZ001-002-006-007- 008-014 northwest and south-central North Dakota	23	0700CST to 2000CST			0	0	?	0	Ice Storm
Freezing rain began in northwest North Dakota at about 0700CST on the 23rd and spread into south-central North Dakota by noon. The rain was continuous, persisting for eight hours duration, before ending in the evening.									
The freezing rain followed a prolonged cold spell which had frozen the ground. Rain continued to freeze on impact even after temperatures had risen above freezing.									
The rain turned hard surfaces into sheets of ice. Roads became extremely icy and many vehicles slid off the roads. There were many collisions but, fortunately, no serious injuries. The ice buildups made some highways impassable.									
Slippery sidewalks created hazardous conditions for Christmas shoppers and other pedestrians.									

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
33 OHIO									
OHZ002-003-004 Central Lakeshore, Northeast Lakeshore & Northeast Inland	02- 03	Afternoon- Morning			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow developed over northeast Ohio. Snow depths reached six inches over the Northeast Lakeshore Zone at around 2300 EST on the 2nd. Snow depths reached six inches over the Northeast Inland Zone, around 0420 EST, and over the Central Lakeshore Zone at 0800 EST on the 3rd. Total snowfall was between 8 and 16 inches over Ashtabula County and between 6 and 12 inches over Lake and Geauga counties. Northern Summit and Portage, southern Cuyahoga, and Medina counties received between 5 and 7 inches of snow.								
OHZ003 Northeast Lakeshore	13	Morning- Evening			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow developed over extreme northeast Ohio and reached a depth of six inches in Conneaut at 2330 EST. Total snowfall was between 5 and 7 inches across Ashtabula County.								
OHZ002-003-004-005-006-007-008-009 Central Lakeshore, Northeast Lakeshore, Northeast Inland, Miami Valley, Central, East-Central, Southwest and South-Central	15- 16	Early Morning- Afternoon			0	0	6	0	Heavy Snow
	Heavy snow moved into southwest Ohio during the morning of the 15th and spread across much of Ohio. Snow reached a depth of four inches at 0950 EST in Southwest and the Miami Valley zones, and at 1030 EST in South-Central Ohio. In Central and East-Central Ohio snow reached four inches at about 1300EST. The snow depth reached six inches at 1520 EST over the Central Lakeshore, at 1630 EST over the Northeast Lakeshore, and at 2000 EST over the Northeast Inland zones of Ohio. This storm eventually brought much of Ohio to a halt as final snow depths were 6 to 9 inches in southern Ohio and 8 to 14 inches over northeast Ohio. Snowfall continued in extreme northern Ohio, as lake effect, with some amounts in Cuyahoga, Geauga, Lake and Ashtabula counties as high as two feet. Strong winds caused significant blowing and drifting of the snow, thereby closing roads throughout Ohio for a time.								
OHZALL Statewide	15- 24	Evening- Afternoon			0	?	?	0	Severe Cold
	A prolonged period of very cold weather struck Ohio on the heals of the snowstorm on the 15th and 16th. During this period much of Ohio remained below freezing and 42 record low temperatures were set. All of the regular reporting stations set or tied the all-time low temperature for the month of December. Lowest temperatures reached 15 to 25 degrees below zero on the 22nd. Wind chill readings during this period fell to between 30 and 50 below zero at times, but amazingly there were no deaths directly attributable to the cold. Rivers and lakes turned to ice and even Lake Erie developed a thick layer of ice.								
OHZ003 Northeast Lakeshore	20	Early Morning- Afternoon			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow fell on extreme northeast Ohio. Snow accumulated to six inches at 1202 EST over Ashtabula County before ending during the early afternoon.								
OHZ003 Northeast Lakeshore	20 21	Evening- Noon			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow redeveloped during the evening of the 20th and reached a depth of six inches over Ashtabula and Lake counties at around 0500 EST on the 21st.								
OHZ003 Northeast Lakeshore	21- 22	Evening- Early Morning			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow again redeveloped during the evening of the 21st. Snowfall totaled six inches in Geauga County at around 2145EST.								
OHZ003 Northeast Lakeshore	22- 23	Afternoon- Noon			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow began during the afternoon of the 22nd with six inches of snow accumulating in Fairport Harbor by around 2200EST on the 22nd. The heavy lake-effect snow finally ended just before noon on the 23rd. Total snowfall from the 20th to the 23rd over extreme northeast Ohio ranged from six inches over Geauga County, to between 12 and 20 inches over Lake and Ashtabula counties.								
OHZ003 Northeast Lakeshore	25- 26	Evening- Morning			0	0	?	0	Heavy Lake-Effect Snow
	Lake-effect snow developed at about 2100EST on the 25th and totaled six inches in Chardon at 0421 EST on the 26th. Total snowfall was 4 to 6 inches over Lake and Geauga counties.								
—— OHIO									
Holmes and Washington Counties	31	1100 EST- 2000 EST			0	0	?	0	Ice Jam Flooding
	Ice jams formed on Killbuck Creek in Holmes County and flooded roads and farmland in Millersburg. The fairgrounds in Millersburg were completely covered by water. In Washington County, ice jams formed on Bear Creek near Veto Lake. County Road 76, and the intersection of State Routes 555 and 676 were flooded. State Route 3 near Veto Lake was also flooded.								
34 OKLAHOMA									
OKZONW-ONC-OOC . Northwest, North-Central, and Central Oklahoma	07	0600- 2400CST			0	0	?	?	Heavy Snow
	The first winter storm of the season resulted in as much as 6 inches of snow in northwest Oklahoma in Taloga. Five inches was reported in Alva, Perry, and Piedmont, and 4 inches was observed in Blackwell, Lamont, and Mulhall. Lesser amounts across the state included 2 inches in Tulsa and McAlester, and one inch in Oklahoma City. Numerous traffic accidents resulted from the icy streets.								
Leflore County, Poteau	08	Morning			1	0	0	0	Cold
	A 44 year old Heavener woman died from hypothermia after she left a car in which she was a passenger and walked into a wooded area. Overnight lows were in the low 20s. F440								
McClain County, 3 N Goldsby	08	Morning			1	0	0	0	Cold
	A 28 year old Norman man died from hypothermia after eluding police who were attempting to arrest him. The man crossed the South Canadian River and hid in a wooded area where he died. Overnight lows were in the lower 20s. M280								
OKZALL Statewide	14- 23				3	0	?	?	Record Cold
	A series of Arctic outbreaks resulted in record cold over all of Oklahoma during a nine day period. New record lows of -1°F in Tulsa and 3° F in Oklahoma City occurred on the 15th. On the 22nd and 23rd, records were again established as Tulsa recorded lows of -6°on the 22nd and -8°on the 23rd. In Oklahoma City the overnight lows were -4°on the 22nd and -8°on the 23rd. Guymon reported a low of -15°on the 22nd. Strong north winds produced wind chills of -30 to -50 degrees. Schools were closed when buses failed to start, and numerous homes and businesses sustained damage due to broken water pipes. There were three hypothermia fatalities during the record cold. A 24 year old Oklahoma City man died in his unheated home on the 22nd, a 28 year old Ardmore man died on a city street on the 23rd, and a 35 year old Oklahoma City man died on the 22nd after leaving his car. M24P M280 M350								
35 OREGON									
ORZ001-002-004 Clatsop, Tillamook, Lincoln, and Marion Counties	03- 04	0800PST- 2000PST			1	2	5	0	Flooding and High Winds
	A warm Pacific storm system brought high wind and heavy rains to extreme northwest Oregon during a two-day period. Twenty-four hour rainfall totals were commonly in the 2.0 to 3.0 inch range. Storm totals in some areas approached 5 inches. Flood warnings were issued for the Wilson and Newhalem rivers in Tillamook County and the Siletz River in Lincoln County. A 42-foot long fishing vessel capsized near Newport, Lincoln County at the start of the storm. One person drowned, but two others were rescued while seas were at 16 feet and winds were blowing at 40 mph. Mud slides temporarily closed two highways. There was local flooding farther inland that affected homes and roads around Woodburn and Keizer in Marion County. Southerly winds peaked at 71 mph at Netarts in Tillamook County and 67 mph at Seaside in Clatsop County on Sunday the 3rd.								

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

36 PENNSYLVANIA, Eastern

PAZ016 Poconos	15- 16	1400EST- 0000EST			0	0	1	0	Heavy Snow
	The snow began between 1400 and 1500 EST across the area and continued until around midnight. Total accumulations were mainly in the 6 to 8 inch range, but 3 to 5 inches fell over some lower elevation areas. Snow accumulations over the remainder of Eastern Pennsylvania were mostly under 4 inches, with southernmost areas having little if any accumulation.								
PAZ00E Eastern Pennsylvania	monthlong				10	0	?	0	Record Cold
	Persistent cold through the month of December resulted in the coldest December on record for most of Eastern Pennsylvania. Some of the average temperatures for the month and departures from normal, respectively, at National Weather Service Offices were: 21.2°F, 10.3°F below normal at Allentown; 22.6°F, 10.8°F below normal at Harrisburg; 19.8°F, 10.9°F below normal at Williamsport; and 18.6°F, 11.1°F below normal at Wilkes-Barre Scranton. These are all coldest average temperatures for December on record. Only Philadelphia with an average temperature of 25.5°F or 10.0°F below normal missed its record for the coldest December, but that was only by one tenth of a degree from the 25.4°F set in 1876. At least 10 people died directly or indirectly from the prolonged cold. Statistics on the age and sex of these persons is not available. Seven of the ten were in Philadelphia, and a number of them were homeless people on the street.								

36 PENNSYLVANIA, Western

PAZ001 Lakeshore	03	0300EST			0	0	0	0	Heavy Snow
	Six to eight inches of snow fell across the Lakeshore Zone bordering Lake Erie.								
PAZ002 Northwestern	03	0700EST			0	0	0	0	Heavy Snow
	Six to eight inches of snow fell in the area, and there was one report of 12 inches at Lowville.								
PAZ005 Laurel Mountains	03	0700EST			0	0	0	0	Heavy Snow
	Six inches of snow fell at Seven Springs.								
PAZ005 Laurel Mountains	03	1800EST			0	0	0	0	High Wind
	Nonconvective high winds were experienced across the Laurel Mountains throughout the day. Gusts as high as 73 mph were observed at the Johnstown Flight Service Station.								
PAZ002 Northwestern	03	1800EST			0	0	0	0	Heavy Snow
	Six to eight inches of additional snow fell in the area, making for a thirty-six hour total snowfall at Lowville of 20 inches. Clarks Corner received 11 inches.								
PAZ003 Western	03	2130EST			0	0	0	0	Heavy Snow
	Six inches of snow fell in northern Venango County.								
PAZ001 Lakeshore	15	2200EST			0	0	0	0	Heavy Snow
	Six inches of snow fell along the shoreline of Lake Erie.								
PAZ005 Laurel Mountains	15	2200EST			0	0	0	0	Heavy Snow
	Six to seven inches of snow fell across the Laurel Mountains.								
PAZ006 South-Central Mountains	15	2200EST			0	0	0	0	Heavy Snow
	Seven inches of snow was recorded at the Altoona Flight Service Station.								
PAZ014 North-Central Mountains	15	2200EST			0	0	0	0	Heavy Snow
	Six to seven inches of snow fell throughout the zone.								
PAZ015 Southwestern	15	2300EST			0	0	0	0	Heavy Snow
	Six to nine inches of snow fell throughout the zone.								
PAZ002 Northwestern	16	0700EST			0	0	0	0	Heavy Snow
	Seven to 14 inches of snow fell throughout the zone.								
PAZ003 Western	16	0700EST			0	0	0	0	Heavy Snow
	Seven to ten inches of snow fell throughout the zone.								
PAZ004 Northern Mountains	16	0700EST			0	0	0	0	Heavy Snow
	Eight to ten inches of snow fell throughout the zone.								
PAZ002 Northwestern	20	1600EST			0	0	0	0	Heavy Snow
	Six inches of new snow fell throughout the zone.								
PAZ001 Lakeshore	20	1600EST			0	0	0	0	Heavy Snow
	Twelve inches of new snow fell at Erie, making for a total of 32 inches on the ground.								

PENNSYLVANIA, Western

PAZ001 Lakeshore	21	0700EST			0	0	0	0	Heavy Snow
	Nine inches of new snow accumulated on the ground at Erie, making for a new on-ground total of 39 inches.								
PAZ003 Western	21	0700EST			0	0	0	0	Heavy Snow
	Seven inches of new snow accumulated on the ground.								
PAZ002 Northwestern	21	1600EST			0	0	0	0	Heavy Snow
	Six to seven inches of snow fell across the zone, making for a total on the ground at Lowville of 28 inches.								

37 RHODE ISLAND

RIZ001 Northern portion of Rhode Island	15- 16	2200EST- 0600EST			0	0	0	0	Heavy Snow
	A snowstorm of short duration brought a rapid accumulation of 6 to 10 inches of snow to the northern portion of the state. Snow fell at the rate of 2 inches per hour at the height of the storm. The National Weather Service at Warwick recorded a total of 8.2 inches, and up to 10 inches was reported to have fallen to the west and north of Providence. Only a few inches of snow fell over coastal sections of the state, where the snow changed to rain during the period. Thunder and lightning was reported in some areas.								

38 SOUTH CAROLINA

SCZ001-002-004 Mountains, Foothills, and Lower Piedmont	09	0600EST to 1600EST			1	0	?	?	Freezing Rain, Snow & Cold
	Freezing rain fell from early morning to early afternoon. It changed to snow as cold air moved in. Accumulations varied from almost nothing up to about 2 inches in northern Greenville and Spartanburg counties - and also in Laurens County. The snow was spotty, and many areas saw almost nothing. A man was found dead in Roebuck, Spartanburg County, in the back yard of a home at 1200EST. M610.								
SCZ003-004 Piedmont	18	0300 to 0900EST			0	0	?	?	Freezing Rain
	A light glaze of freezing rain accumulated on road surfaces and bridges and overpasses, disrupting early morning traffic.								
SCZ001-002-003-004 Mountains, Foothills, and Piedmont	18 19 19	2100EST to 1500EST 1220EST			0	0 1	? ?	? ?	Snow, Sleet & Freezing Rain Extreme Cold
	A pesky mixture of precipitation disrupted activities over the upstate overnight and during the day. The greatest accumulations were in a narrow band from southern Anderson County into northern Laurens and southern Greenville counties. Accumulations of up to 2 inches were reported. A 62-year-old woman from Gaffney, Cherokee County, was hospitalized for hypothermia.								
SCZ005-007 North Midlands and North Coast	19	AM-PM			0	1	?	?	Ice Storm
	Ice covered the county and freezing rain fell all day, downing power lines and leaving thousands of people without electricity. The accumulation of ice caused at least two trees to fall on cars in Conway, Horry County, but no one was injured. In Hickory Grove, Horry County, a woman was injured when a tree fell on the hood of her car as she traveled on SC Hwy. 905 at 1734EST.								

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
SOUTH CAROLINA									
SCZ001-002-003-004-005-006 Mountains, Foothills, Piedmont & Midlands	22 25	2100EST to 0600EST			6	4	6	?	Extreme Cold
An Arctic outbreak caused many problems over the upstate during the holiday weekend. The episode was not quite as bad as the Christmas 1983 episode primarily because the wind did not gust nearly as high as then. However, persistent northeast winds of 10 to 20 mph brought wind chills down as low as 20 degrees below zero for a time at the Greer NWSO. Actual temperatures and wind chills were more extreme in the mountains and in northern parts of the foothills. Property damage was extensive from burst water pipes. There were six deaths associated with the cold in the upstate and midlands. In Carlisle, Union County, a man was found dead on December 23 in the morning, in an unheated home. In Greenville, Greenville County, a man was found dead in an unheated home, around 0900EST; also in Greenville, a woman was found dead outside two blocks from her home around 1500EST on December 23. A 60-year-old man was found dead in Pageland, Chesterfield County, during the morning of December 23, in the yard of a house. A 39-year-old man was found dead in Alcolu, Clarendon County, near a mobile home at 0130EST on December 25. A 65-year-old man was found dead in his home in Blacksburg, Cherokee County, on December 25. The heating unit in his home failed. The exact time of death was uncertain, as the last time he was seen alive was on December 22. There were at least four injuries due to hypothermia. A 79-year-old woman from Chesnee, Spartanburg County, was hospitalized for hypothermia at 1040EST on December 23. A 59-year-old man from Inman, Spartanburg County, was hospitalized for hypothermia at 1500EST on December 23. A 69-year-old woman from Chesnee was hospitalized for hypothermia at 1610EST on December 23. M39O, M60O, M80P, M56P, F80O, M65P.								
SCZ007-008 Coast	22 26	2100EST to 2000EST			3	3	7	0	Extreme Cold & Heavy Snow
A winter storm developed along the southern edge of the Arctic outbreak described above in the Gulf of Mexico, and tracked eastward across the Florida Peninsula and then northward along the South Atlantic Coast of the nation, bringing heavy snow to coastal South Carolina on the 22nd, 23rd and 24th. The extreme cold following the winter storm was directly responsible for four deaths which are described separately. At least 3 people suffered from hypothermia during the period; each incident is described separately, below. It was the first white Christmas since record keeping began in coastal South Carolina. Snowfall totaled 1 inch at Wedgefield, Sumter County, 4 inches at Yemassee, Jasper County, 5 inches at Beaufort, Beaufort County, 6 inches at Lake City, Florence County, 8 inches at Charleston WSFO and 9 inches at McClellanville, both in Charleston County, 12 inches at Brookgreen Gardens, Georgetown County, 13 inches at Conway, 14 inches at Myrtle Beach, and 14.5 inches at Loris, all in Horry County. The cold was also responsible for burst pipes throughout coastal South Carolina, causing extensive damage. Damage from burst pipes along the coast was worse than in inland sections, due to the minor depth of water service and minor insulation in houses. Many cities and towns went without water for several days, as work crews repaired broken water mains and service connections. Some areas had to boil water for several days until the water pressure returned to healthy levels. The lowest water temperatures in 40 years were blamed for the state's worst shrimp kill since the late 1970s. An estimated 95 percent of the white shrimp were killed in lower Charleston Harbor and just offshore. A man was found unconscious, lying in the snow at 0700EST on December 23, at North Charleston, Charleston County, and died seven hours later. A man was found dead at 0800EST, in Charleston, Charleston County, in an abandoned cab on December 26. A man was found dead in an abandoned mobile home in North Charleston, at 1000EST on December 26. There were numerous traffic accidents, and at least one traffic-related death from the storm. A man in his 40's was traveling east on U.S. Hwy. 178 in Dorchester County when his car apparently slid sideways into an oncoming vehicle at 1840EST. Police accounts of the accident described the road conditions as being "a heavy sheet of ice". A 20-year-old man was rescued from the Black River near Oatland, Georgetown County, after his boat ran out of gas at 1030EST on December 23. He was suffering from hypothermia and was taken to a nearby house to recover. A load of snow and ice apparently sank a boat near Hagley, Georgetown County, at 1946EST on December 26, injuring the captain and one passenger. MUNKO, M65V, M62M.								
Spartanburg County, Spartanburg	28	1600EST			0	3	0	0	Extreme Cold
Two boys who took a dare to retrieve a basketball from an icy pond fell in the water and had to be rescued, along with a man who had tried in vain to save them.									

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
39 SOUTH DAKOTA									
SDZ007 Northern Black Hills	12- 13	0300- 1020CST			0	0	0	0	Heavy Snow
A prolonged period of heavy snow started early on December 12th as snow began falling across a small part of the northern Black Hills and amounted to as much as three feet at Deer Mountain before ending on the 13th. Lesser amounts of 16 to 20 inches fell in the Lead-Deadwood areas, while 3 to 7 inches fell in and around Rapid City. The fresh snow and winds that gusted up to 25 mph on the afternoon of the 12th, produced near-whiteout conditions. Motorists traveling on Interstate 90 were forced to stop and wait for improved visibility.									
40 TENNESSEE									
TNZ007-008-009-010-011-012-013-014-015- West and Middle Tennessee	07	1900CST			0	?	?	?	WINTER STORM
A low pressure system that developed in Texas and moved east, brought a variety of winter weather to West and Middle Tennessee on the 7th and 8th. Rain, freezing rain, sleet and then snow fell across the region. Many schools were closed and numerous wrecks were caused by icy roads and bridges. There were scattered areas of power outages caused by the extra weight of ice on electrical wires, ice-coated tree limbs and small trees falling, and strong gusty winds blowing wires together. In the Nashville area 30,000 to 40,000 homes were without power for several hours.									
TNZ001-002-003-004-016 Northeast and Mountains	12	0600EST			0	?	?	?	WINTER STORM
A storm system that continued to develop as it moved east across Tennessee brought a mixture of weather to East Tennessee. Precipitation started as rain, then changed to sleet and snow as colder air invaded the region. This caused icy roads and forced the closing of schools in 5 counties. Snowfall by evening measured between 1 and 6 inches across the area.									
TNZALL Statewide	16- 25	0000CST			1	?	?	?	EXTREME COLD
An unusual weather pattern caused very cold air from the polar regions to come south over the U. S., including Tennessee. Bitter cold gripped the state from the 16th to the 25th. Most parts of the state did not get above 32 degrees until the 25th. This caused severe problems for electric companies due to the drain on electricity for the extra heating needed. Numerous homes had burst water pipes and a much larger than normal amount of home fires were reported. There were numerous record cold temperatures set across the state, helping December 1989 to become one of the coldest Decembers on record in Tennessee. In Etowah, McMinn County an elderly woman wandered away from her home before 0600EST, Christmas Day December 25th, and was lost. She was found dead the next day due to exposure to the bitter cold. F72O									
TNZALL Statewide	18	1500CST			0	?	?	?	WINTER STORM
A winter storm that developed in the plains states and moved east spread some rain, freezing rain, sleet and snow across Tennessee on the 18th and 19th. The biggest problem was freezing rain across the state. In the Memphis area alone there were 170 traffic accidents Monday evening the 18th and another 60 to 70 accidents on Tuesday morning the 19th due to the icy roads. There were traffic problems from one end of the state to the other, and numerous school closings were necessary.									
41 TEXAS, Northern									
North Texas	20- late pm- 24 early pm				0	4	7	?	Bitter, prolonged cold
A frigid Arctic air mass plunged temperatures below freezing over most of North Texas on the 20th, with some areas not rising above the freezing mark until the afternoon of December 24th. Several record lows were set during this period, while minimum temperatures on the morning of December 23rd were the coldest observed since the year 1949. Injuries were limited to 2 known cases of frostbite and 2 cases of hypothermia. Several utility companies set new records for usage over a 24-hour period. A few gas and electric companies reported brief outages, while some areas were forced to curtail commercial usage to meet consumer demands during the siege of cold air. Thousands of water line breaks were reported. Some customers were without water for a few days, while others were cleaning up flood damage that occurred when water lines broke inside buildings, ruining walls, ceilings, floors and other furnishings. Damage from water line breaks amounted to several million dollars across all of North Texas, with estimates in Dallas County alone approaching 25 million dollars.								

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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

41 TEXAS, Southern

TXZALL Southern Texas	22-24				3	?	8	8	Severe Cold

A record cold outbreak of Arctic air struck South Texas on Friday the 22nd and continued its grip over the area until Sunday the the 24th. On the morning of the 23rd many record low temperatures were set across South Texas for the month of December. Victoria tied their all-time record low temperature with 9 degrees and, no doubt, some locations recorded the lowest temperature ever recorded. Temperatures dropped to 5 below zero in the area west and northwest of Austin. Record high barometric pressure readings were recorded at several locations. The effects or stress of the severe cold was aggravated by the strong winds that persisted all day on the 22nd and continued through the 23rd. Gale warnings were in effect for all of the Texas Coast on the morning of the 23rd.

Southeast Texas was dusted with some snow and sleet on the 22nd. The Houston Intercontinental Airport measured 1.7 inches of snow. Galveston reported a snow cover of 2 inches. Beaumont reported just less than one inch. The City of Houston reported between a trace and one inch. The rest of Southern Texas east of a San Antonio - Victoria line reported a trace of ice.

The weather was colder than the Arctic outbreak of Dec. 1983. There was widespread plumbing damage to homes, apartment complexes, businesses, industry, hospitals and municipal power plants. The severe cold created many serious problems, broken water pipes, low or no water pressure and low gas pressure. Overloaded electrical power systems caused power outages at critical demand times. Business and industry, especially petro- and energy-related industry along the coast suffered major losses from damage to facilities and production. The severe cold caught many home owners away from their residences because of the Christmas Holiday weekend, and they were not home to take the needed precautions.

In the Lower Rio Grande Valley on the morning of the 23rd, the temperature dropped to 15 degrees. North winds were blowing 15 to 20 mph and citrus fruit froze solid on trees. The damage to the citrus industry was devastating. The full extent of damage to the trees will not be known for some time. However, some say the damage was not as severe as the Arctic blast and freeze of Dec. '83. Vegetable crops suffered major damage also, with most being rendered a total loss. All plant nurseries in the area reported huge losses.

The Texas Parks and Wildlife reported a considerable fish kill in the Laguna Madre from near Port Mansfield northward to Baffin Bay. However, the kill was not as severe as the fish kill of Dec. '83. 21 bottle nose porpoises were found dead in the eastern part of Matagorda Bay. Tony Amos, a marine biologist was quoted as saying that some marine life kill occurred to depths of 50 feet just off shore. He measured the sea water temperature in the surf at 34 degrees on the morning of the 23rd. Comparatively, in Dec. of 1983 the reading was 38 degrees at the same location. Ice formed along the shoreline of many bays and inland waterways.

The severe cold and stress killed many livestock. Some cattle froze to death in the Alice area. However the cattle were in less than normal condition from the extended drought that has persisted for 2 years.

Total damage from the severe cold in South Texas is hard to estimate. Considering the indirect effects also, it would be in the neighborhood of one billion dollars. In the Lower Valley alone, 300-400 million dollars damage was done to the citrus fruit and trees, and job losses accounted for another million in loss. The upper Texas Coast and the Southeast had an estimated damage of 300 to 500 million. A spokesman from the Houston area was quoted as saying that the damage exceeded the amount from all of the three tropical storms that hit the area this past year and from the floods during the month of May. In the interior sections of South Texas, major losses were reported from all areas, including the cities of San Antonio and Austin.

Total deaths in the area, directly attributed to the cold were three. All died from hypothermia. One man was found in a field near Austin. Another woman in the area was found dead in an unheated room where the heater had gone out. In San Antonio, a man was found in an unheated vacant house. There were several deaths from fires. Numerous wrecks on icy roads caused many injuries. M500, F800, M600.

41 TEXAS, Western

Brewster County 5 E of Study Butte	11	Est. 2000 CST			0	0	3	0	High Wind (52)

A construction foreman reported that strong wind gusts caused an estimated $1,000 damage at a construction site on the eastern side of Big Bend National Park. Shingles were removed from the roofs of 2 prefabricated garages at the site. The winds were associated with a cold front blowing rapidly through the area.

Texas Panhandle	16	All Day			0	0	5	0	Snow

A one to three inch snowfall contributed to at least 75 motor vehicle accidents across the Texas Panhandle. Although the majority of the wrecks were minor, there were 4 reported roll-overs because of the icy conditions. Two persons required hospitalization.

Much of West Texas	21-24	Early AM - Afternoon			0	0	6	0	Bitter Cold

A frigid Arctic airmass swept into West Texas early on the morning of the 21st. The deep freeze replaced a number of low temperature records over the next several days and caused widespread bursting of pipes.

Among the notable temperatures were a minus 16 at Perryton on the morning of the 22nd and minus 4 at San Angelo on the 23rd. This established a new all-time record low for San Angelo.

Problems with bursting pipes began as early as the 21st. The majority of damage, however, occurred from the 23rd to the 24th as temperatures began to warm. Damage included broken water pipes, water meters and sewage lines, and extensive flooding to a number of residences and businesses throughout the region. Regulators on many gas meters also froze, bringing the bitter chill indoors to some, although no casualties could be directly attributed to the cold.

42 UTAH — NONE REPORTED

43 VERMONT

VTZALL Statewide	monthlong				0	0	5	?	Record Cold

December 1989 was the coldest December ever at many recording stations in Vermont. The record cold caused rivers and streams to freeze over earlier than usual and produced a thicker ice cover than normal.

VTZALL Statewide	15-16	PM- AM			0	0	4	?	Snow

Between 6 and 12 inches of snow blanketed Vermont.

VTZALL Statewide	29-30	PM- AM			4	12	5	0	Snow

Between 4 and 6 inches of snow fell over Vermont.

44 VIRGINIA — NO REPORT RECEIVED

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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

45 WASHINGTON

Whatcom, Skagit, Snohomish and King Counties	04	All Day			0	1	6	0	Floods

Heavy rains across western Washington on the 2nd, 3rd and 4th combined with high freezing levels, already saturated ground, and a low mountain snowpack to cause flooding on seven northwest Washington rivers. Three to five inches of rain fell across the Puget Sound basin during the three-day period and rainfall amounts over the west slopes of the Cascades were up to ten inches. Flood stages were observed on the Nooksack, Skagit, Stilliguamish, Snohomish, Skykomish, Snoqualmie, and White rivers. Flooding was worst along the Skagit River where about 500 people in various towns along the river had to be evacuated during the highest water. One person was briefly hospitalized for treatment of hypothermia after being rescued from flooding along the Snoqualmie River. The person had tried to cross a flooded section of road near the town of Carnation when the car stalled and was swept away. Water over dozens of roads and mudslides over a few roadways caused closures which lasted up to a couple of days. In addition to flooding along rivers, a house in Mount Vernon and another on the Sammamish Plateau, about 20 miles east of Seattle, were damaged when trees fell on them because root structures had been weakened by wet ground. The Sammamish Plateau house sustained $40,000 damage and the Mount Vernon house sustained $15,000 damage. Brief flooding on the Skokomish River in Mason County covered some roads with water, but caused no other substantial damage.

46 WEST VIRGINIA

WVZ003-004-006-007-008 Southern half of West Virginia	08	morning and afternoon			0	0	0	0	Heavy Snow

Snowfall of 4 inches was common in southwestern West Virginia, as was snowfall of 4 to 6 inches in the southern mountains.

WVZ006-007-008 Southern mountains of West Virginia	12	morning			0	0	0	0	Heavy Snow

Three to five inches of snow fell across the southern West Virginia mountains.

WVZ001-002-005-009 Northern half of West Virginia	15	daytime			0	0	0	0	Heavy Snow

Widespread snow fell in amounts of 4 inches across northwest West Virginia and amounts of 6 inches in the northern mountains.

Mercer County, Oakvale	31	0240EST			0	0	4	0	Flash Flooding

Ice jams on the East River necessitated the evacuation of 15 people near Oakvale. Several homes had water in them. The water receded by 0500EST.

Kanawha County, near Holley Grove	31	0500EST			0	0	4	0	Flash Flooding

Ice jams on Paint Creek flooded a home and church at the mouth of the creek where it enters the Kanawha River. The water receded by 0700EST.

WVZ001 Northern Marshall County and Ohio County	31	1225EST			0	0	0	0	Flash Flooding

An ice jam caused backwater flooding along Wheeling Creek in both northern Marshall County and Ohio County.

47 WISCONSIN

WIZ005-009 Extreme Northeast Wisconsin	13-14	Morning into Early Morning			0	0	?	0	Heavy Snow

A band of lake-effect snow became nearly stationary over extreme northeast Wisconsin, dumping snow amounts of up to 18 inches. Businesses closed early and several accidents were reported. Snow amounts included 18 inches in Algoma (Kewaunee County), 16 inches in Sturgeon Bay (Door County) and 8 inches in Marinette (Marinette County).

WIZ001-002 Lake Superior Snow Belt	14-15	Late Morning into Early Afternoon			0	0	?	0	Heavy Snow

Lake-effect snow squalls deposited 6 to 12 inches along the Lake Superior snowbelt region. Some snow amounts included 12 inches at Bennet and 10 inches at Poplar (Douglas County), and 8 inches at Hurley (Iron County).

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

—— WISCONSIN

WIZ005-008-009-013 Northeast Wisconsin	14-15	Afternoon into Early Afternoon			0	0	?	0	Heavy Snow

A second snowstorm in as many days hit portions of northeast Wisconsin, with two-day snow totals reaching 18 to 30 inches. Schools closed as 24-hour snow amounts included 14 inches at Sturgeon Bay (Door County), 12 inches at Algoma (Kewaunee County) and 8 inches in Green Bay.

WIZALL Statewide	16-24				0	0	?	0	Severe Cold

Very cold temperatures as low as 33 below zero and occasionally brisk winds creating wind chill readings to 80 below zero gripped the state. Energy consumption records were set by Wisconsin Electric, homeless shelters were packed to capacity, schools were closed, thousands of vehicles were disabled, and numerous water mains broke.

48 WYOMING

WYZ012-016-017 EASTERN PLAINS, LARAMIE VALLEY, AND SOUTHEAST PLAINS	05	0430 TO 1630MST			0	0	0	0	HIGH WIND

FROM THE EARLY MORNING THROUGH THE LATE AFTERNOON OF THE 5TH, HIGH WINDS BLEW ACROSS SOUTHEAST WYOMING. REPORTS OF WIND GUSTS BETWEEN 60 AND 70 MPH WERE COMMON 25 TO 50 MILES NORTH AND EAST OF CHEYENNE, WITH THE HIGHEST BEING 76 MPH. VEDAUWOO, 30 MILES WEST OF CHEYENNE, HAD SUSTAINED 45 TO 55 MPH WINDS WITH OCCASIONAL GUSTS BETWEEN 60 AND 65 MPH.

WYZ004 BIG HORN MOUNTAINS	06-07	1800MST- 0600MST			0	0	0	0	HEAVY SNOW

DURING THE EVENING OF THE 6TH THROUGH THE EARLY MORNING OF THE 7TH, LOCALIZED HEAVY SNOW FELL IN THE BIG HORN MOUNTAINS, LOCATED IN NORTH-CENTRAL WYOMING. STORY, 12 MILES SOUTH OF SHERIDAN, RECEIVED 11 INCHES OF NEW SNOW.

WYZ011-016 CENTRAL PLAINS AND LARAMIE VALLEY	08	0900 TO 1600MST			0	0	0	0	HIGH WIND

FROM THE MORNING THROUGH THE LATE AFTERNOON OF THE 8TH, VERY STRONG WINDS OCCURRED OVER SOME SECTIONS OF SOUTHEAST WYOMING. A WIND GUST OF 59 MPH WAS REPORTED IN THE SOUTHEAST SECTION OF CASPER. VEDAUWOO, 30 MILES WEST OF CHEYENNE, LOGGED SUSTAINED WINDS OF FROM 45 TO 53 MPH AND A PEAK GUST OF 62 MPH.

WYZ016 LARAMIE VALLEY	12	0830 TO 1200MST			0	0	0	0	HIGH WIND

ON THE MORNING OF THE 12TH, HIGH WINDS OCCURRED ACROSS PORTIONS OF EXTREME SOUTHEAST WYOMING. VEDAUWOO, 30 MILES WEST OF CHEYENNE, EXPERIENCED 45 MPH SUSTAINED WINDS WITH GUSTS TO 55 MPH.

WYZ004-005-006 BIG HORN MOUNTAINS, NORTHERN FRONT RANGE, AND NORTHEASTERN PLAINS	12-13	1200MST- 1200MST			0	0	0	0	HEAVY SNOW

FROM AROUND MIDDAY OF THE 12TH THROUGH THE MORNING OF THE 13TH, HEAVY SNOW FELL ON THE BIG HORN MOUNTAINS AND EXTREME NORTHEAST WYOMING. SOME 24-HOUR SNOWFALLS WERE 14 INCHES AT STORY AND MOORCROFT, AND 12 INCHES IN SUNDANCE.

WYZ016 LARAMIE VALLEY	13	1100 TO 1500MST			0	0	0	0	HIGH WIND

DURING THE LATE MORNING THROUGH THE AFTERNOON OF THE 13TH, STRONG WINDS BLEW IN THE LARAMIE RANGE. VEDAUWOO, 30 MILES WEST OF CHEYENNE, EXPERIENCED 40 TO 45 MPH SUSTAINED WINDS WITH GUSTS UP TO 54 MPH.

STORM DATA AND UNUSUAL WEATHER PHENOMENA

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
—— WYOMING									
WYZ001-004-005-006-012 NORTHWEST MOUNTAINS, BIG HORN MOUNTAINS, AND NORTHEAST WYOMING	13-15	1800MST-1200MST			0	0	0	0	HEAVY SNOW
		A LARGE AREA OF NORTHERN AND EASTERN WYOMING EXPERIENCED A PROLONGED HEAVY SNOWFALL EVENT FROM THE EARLY EVENING OF THE 13TH THROUGH THE MORNING OF THE 15TH. SOME 24-HOUR SNOWFALLS WERE 20 INCHES IN BURGESS JUNCTION, 16 INCHES AT STORY AND BIG HORN, 15 INCHES IN GILLETTE, 12 INCHES IN THE NORTHEAST PART OF YELLOWSTONE NATIONAL PARK AND 6 INCHES AT BOTH TORRINGTON AND LUSK. BY THE TIME THE SNOW ENDED ON THE 15TH, TOTAL SNOW DEPTHS FROM 1-1/2 TO 4 FEET DEEP WERE COMMON OVER THE BIG HORN MOUNTAINS AND NORTHEAST WYOMING.								
WYZ016 LARAMIE VALLEY	14	0800 TO 1600MST			0	0	0	0	HIGH WIND
		VEDAUWOO, 30 MILES WEST OF CHEYENNE, REPORTED SUSTAINED WINDS OF 45 TO 55 MPH WITH GUSTS TO 62 MPH.							
WYZ015-016 SOUTHERN MOUNTAINS AND LARAMIE VALLEY	14-15	1800MST-0600MST			0	0	0	0	HEAVY SNOW
		HEAVY SNOW OCCURRED IN THE MOUNTAINS OF SOUTHERN WYOMING FROM THE EVENING OF THE 14TH THROUGH THE EARLY MORNING ON THE 15TH. NEW SNOWFALL REPORTS OF 12 INCHES WERE COMMON FROM BOTH THE SNOWY AND LARAMIE RANGES.							
WYZ016 LARAMIE VALLEY	19-20	0600MST-1200MST			0	0	0	0	HIGH WIND
		FROM THE EARLY MORNING OF THE 19TH THROUGH THE MORNING OF THE 20TH, VEDAUWOO, 30 MILES WEST OF CHEYENNE, HAD A LONG DURATION OF VERY STRONG WINDS. THESE WINDS WERE SUSTAINED FROM 45 TO 55 MPH WITH NUMEROUS GUSTS OVER 60 MPH. A PEAK WIND OF 67 MPH OCCURRED AT 0307MST ON THE 20TH.							
WYZ015 SOUTHERN MOUNTAINS	20	0130 TO 0400MST			0	0	0	0	HIGH WIND
		ON THE EARLY MORNING OF THE 20TH, ARLINGTON, 50 MILES NORTHWEST OF LARAMIE, REPORTED 40 MPH SUSTAINED WINDS WITH PEAK GUSTS UP TO 51 MPH.							
WYZ016 LARAMIE VALLEY	21	0300 TO 0700MST			0	0	0	0	HIGH WIND
		VEDAUWOO, 30 MILES WEST OF CHEYENNE, HAD SUSTAINED 40 TO 50 MPH WINDS DURING THE EARLY MORNING OF THE 21ST.							
WYZALL ENTIRE STATE	21-22	2100MST-0800MST			0	0	0	0	EXTREME COLD
		AS A RESULT OF THE COMBINATION OF CALM WINDS, A BITTERLY COLD ARCTIC AIRMASS AND DEEP SNOW COVER, EXTREMELY LOW MINIMUM TEMPERATURES OCCURRED ACROSS THE COWBOY STATE DURING THE MORNING OF THE 22ND. MANY OF THESE TEMPERATURES WERE NOT ONLY RECORD LOWS FOR THE DATE, BUT ALSO THE COLDEST EVER FOR DECEMBER. THE LOWEST TEMPERATURES WERE GENERALLY OVER THE EASTERN TWO-THIRDS OF WYOMING. RECLUSE, IN THE FAR NORTHEAST CORNER, HAD A LOW OF 50 DEGREES BELOW ZERO. OTHER LOWS INCLUDED 47 BELOW IN REDBIRD, 40 BELOW AT DOUGLAS, 35 DEGREES BELOW AT BOTH SHERIDAN AND GILLETTE, 34 DEGREES BELOW ZERO IN LARAMIE, 28 BELOW AT BOTH CASPER AND CHEYENNE, 23 BELOW IN CODY, 14 BELOW AT FARSON AND 13 DEGREES BELOW ZERO IN LANDER.							
WYZ016 LARAMIE VALLEY	23	1100 TO 1500MST			0	0	0	0	HIGH WIND
		FROM THE LATE MORNING THROUGH THE MID AFTERNOON OF THE 23RD, STRONG WINDS OCCURRED AT VEDAUWOO, 30 MILES WEST OF CHEYENNE. SUSTAINED WINDS FROM 45 TO 55 MPH WITH GUSTS TO 60 MPH WERE REPORTED.							

PLACE	DATE	TIME - LOCAL STANDARD	LENGTH OF PATH (MILES)	WIDTH OF PATH (YARDS)	NO. OF PERSONS KILLED	NO. OF PERSONS INJURED	ESTIMATED† DAMAGE PROPERTY	ESTIMATED† DAMAGE CROPS	CHARACTER OF STORM
—— WYOMING									
WYZ016 LARAMIE VALLEY	25	1130 TO 1400MST			0	0	0	0	HIGH WIND
		VEDAUWOO, 30 MILES WEST OF CHEYENNE, HAD 40 MPH SUSTAINED WINDS WITH GUSTS TO 53 MPH FROM THE LATE MORNING THROUGH THE MID AFTERNOON OF THE 25TH.							
WYZ012-016 EASTERN PLAINS AND LARAMIE VALLEY	26	0300 TO 1200MST			0	0	0	0	HIGH WIND
		ON THE MORNING OF THE 26TH, PARTS OF EXTREME SOUTHEAST WYOMING HAD HIGH WINDS. BORDEAUX, 8 MILES SOUTH OF WHEATLAND, REPORTED WIND GUSTS OF UP TO 60 MPH. VEDAUWOO, 30 MILES WEST OF CHEYENNE, HAD SUSTAINED WINDS OF 45 TO 55 MPH WITH GUSTS OF UP TO 58 MPH.							
WYZ016 LARAMIE VALLEY	31	0400 TO 1200MST			0	0	0	0	HIGH WIND
		DURING THE MORNING OF THE 31ST, VEDAUWOO, 30 MILES WEST OF CHEYENNE, RECORDED 40 TO 50 MPH SUSTAINED WINDS WITH GUSTS AS HIGH AS 65 MPH.							

49 ALASKA, Northern —— NO REPORT RECEIVED

49 ALASKA, Southern

Kodiak Island	01	High Winds
	A large, 956 mb low pressure system in the Gulf of Alaska south of Kodiak Island produced high winds that gusted to 69 mph at Kodiak Airport and 54 mph at the Kodiak Harbormasters Office.	
Alaska Peninsula, Bristol Bay, Kodiak Island, North Gulf Coast, and Cook Inlet	09-11	High Winds
	A strong, 964 mb low pressure system crossed the Alaska Peninsula from south to north and moved into Bristol Bay. The storm produced wind gusts of from 45 to 65 mph from the Alaska Peninsula to the south shore of Bristol Bay, Kodiak Island and along the North Gulf Coast. On December 10th and 11th, southeast winds of 70 to 75 mph hit the Anchorage upper hillside during the night and morning hours, and wind gusts of 40 to 50 mph were reported along the base of the mountains from Turnagain Arm to Birchwood. Peak gusts included: 75 mph at Glen Alps, 70 mph at O'Malley Fire Station, 64 mph at Rabbit Creek Fire Station, 53 mph at Fort Richardson, and 40 to 45 mph at Eagle River and Birchwood.	
Cook Inlet, Anchorage area	27	? High Winds
	High winds buffeted the Anchorage hillside from Turnagain Arm to Birchwood during the afternoon and evening. Peak gust reports included: 88 mph from an upper Rabbit Creek resident, 85 mph at Glen Alps, 70 mph at Potters Marsh, and several reports of 35 to 60 mph gusts along the hillside. There was an unconfirmed report of minor damage in the Eagle River area by Chugach Electric.	
Western Aleutians	29-30	High Winds
	A strong low pressure system southwest of the western Aleutians produced high winds in the western Aleutians. The highest gusts observed were 63 mph at Shemya and 52 mph at Amchitka Island.	
North Gulf Coast	30-31	High Winds
	A strong pressure gradient between interior high pressure and a low pressure area over northern Southeast Alaska produced strong north winds in the Valdez area. Valdez Airport had peak gusts of 70 mph.	

49 ALASKA, Southeastern —— NONE REPORTED

STORM DATA AND UNUSUAL WEATHER PHENOMENA

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	
50 HAWAII									
HIZALL All Islands	09-11				0	0	5	0	Flash Flooding and Wind
A vigorous cold front associated with a low pressure system aloft that deepened to the east of the Hawaiian Islands, brought gusty winds and brief heavy showers to all of the islands. The rains and wind began on Kauai and Oahu early in the day and reached Maui during the early afternoon. Some wind damage occurred just east of Kahului near Paia, where a building was blown apart by a gust. Winds in the Hilo district blew several small boats onto a rocky shore where they were smashed. These winds on the Big Island occurred mostly on the 10th. A nearly island-wide power blackout occurred early on the 11th on the Big Island; it was most likely related to the strong winds.									
51 PUERTO RICO									
PRZ001-003-005-009-011-017-019-027-029-039 North and Northwest Coastal Puerto Rico	26	0800-0900AST			1		?		Swells
A low pressure area in the North Atlantic created 8 to 10 foot swells from the northwest along Puerto Rico's northwest and north coast. One person was killed, slight damage was done to several vessels, and serious damage was done to some coastal properties. A 22 year old woman died in Joyuda, Cabo Rojo when pounding waves caused a wall to collapse on top of her. F220									
52 VIRGIN ISLANDS ——— NONE REPORTED									
53 PACIFIC									
Wake Island	18				0	0	3	0	Surf
A northwest swell from an intense winter storm in the northwest Pacific caused minor damage at Wake Island.									
Marianas Islands	24-27				0	0	?	0	Typhoon
Typhoon JACK remained nearly stationary just east of Guam from December 24th through the 27th, with maximum sustained winds as high as 125 knots near its center over the open ocean. JACK then weakened in place and exhibited very little translation before dissipating. Only minor surf damage was reported in the Marianas during the period.									

FIRST CONFERENCE ANNOUNCEMENT

THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Invites you to attend

OPERATIONAL SATELLITES:
SENTINELS FOR THE MONITORING OF CLIMATE AND GLOBAL CHANGE
OCTOBER 16-19, 1990
HOTEL WASHINGTON, WASHINGTON, D.C.

The changing nature of the Earth and its climate is a growing area of study that is being undertaken by scientists throughout the world. These changes may effect future human activities and habitability. Warming of the global climate, depletion of ozone, redistribution of snow and ice cover, trends in ocean temperatures, deforestation, and drought are but some of the subjects of immediate concern to the scientific and public communities. Certain changes are viewed as anthropogenic in origin while others may be the result of interrelated natural processes. Regardless of the process, the ability to monitor these changes is fundamental to all research and decision making. The National Oceanic and Atmospheric Administration (NOAA) is responsible for in situ and operational satellite observations and climate monitoring within the U.S. Global Change Research Program. This Conference will provide a forum for the exchange of information between the providers of these observations and the user community who are studying climate and global change.

THE CONFERENCE PROGRAM

This is a 3 1/2 day program of general sessions addressing Atmospheric, Land Surface, and Oceanic topics. Sessions on Calibration/Validation and Data Availability/Accessibility are also scheduled. Presentations on both domestic and international operational remote sensing systems, current and planned, are being organized. The Conference will be held at the Hotel Washington in the heart of the Washington, D.C. business district. The Conference registration begins on the morning of October 16th, and sessions will convene at 10:00 A.M.. The conference will conclude with a session, Friday morning, October 19th, that will detail the constellation of future satellite systems that are planned to meet the data requirements for the study of climate and global change. An evening reception is planned on October 16th. A registration fee will be charged. The preliminary program brochure, containing the technical program as well as Conference registration fees and hotel reservation information will be available early in the summer of 1990. Conference papers will be published as post-conference proceedings. For more information, please contact: Dr. Donald B. Miller, NOAA/NESDIS, Satellite Applications Laboratory, E/RA21, World Weather Building Rm. 601, Washington, D.C. 20233.

ANOTHER EVENT OF INTEREST

Washington, D.C. offers many business and vacation opportunities. Conference attendees may wish to extend their visit and participate in the co-sponsored NOAA/NASA/ERIM Conference, Earth Observations and Global Change Decision Making: A National Partnership; to be held the following week, October 23-24, 1990, in Washington, D.C.

STORM SUMMARY

DECEMBER 1989

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
		0			0	0				0				0	0											0	
TORNADOES																											
Number								3																			
Days								1																			
Deaths								0																			
Injuries								0																			
Property Damage								5																			
Crop Damage								0																			
HAIL																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
THUNDERSTORM WINDS																											
Deaths								0	0																		
Injuries								0	0																		
Property Damage								4	4																		
Crop Damage								0	?																		
HIGH WINDS																											
Deaths				0									0					0			0			0			
Injuries				1									0					0			0			0			
Property Damage				4									4					4			?			2			
Crop Damage				?									0					0			?			0			
LIGHTNING																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
FLASH FLOODS																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
FLOODS																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
HEAVY SNOWSTORMS AND BLIZZARDS @																											
Deaths			0				?		0			0	0				0	?						0	0		0
Injuries			?				?		0			0	0				20	?						0	0		0
Property Damage			?				?		?			?	4				5	5						4	1		4
Crop Damage			?				0		?			?	0				0	0						0	1		0
ICE STORMS #																											
Deaths			0						0				0							0							
Injuries			?						1				0							6							
Property Damage			?						?				4							5							
Crop Damage			?						?				0							0							
HURRICANES AND TROPICAL STORMS																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
ALL OTHERS																											
Deaths	5		4					6	1		?	2				5			0	4	1	2	?	1	0		
Injuries	0		4					?	0		?	0				0			0	0	0	0	?	0	2		
Property Damage	?		?					0	0		0	?				6			4	0	0	6	?	0	4		
Crop Damage	?		?					9	0		0	?				?			0	0	0	?	?	0	2		

SEE REFERENCE NOTES FOR STORM DAMAGE CATEGORIES

STORM SUMMARY

DECEMBER 1989

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
TORNADOES		0								0		0			0						0	≠				0	
Number																											
Days																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
HAIL																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
THUNDERSTORM WINDS																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
HIGH WINDS																											
Deaths			0					1						0									0				1
Injuries			0					2						0									0				3
Property Damage			4					5						3									5				
Crop Damage			0					0						0									0				
LIGHTNING																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
FLASH FLOODS																											
Deaths																			0				0				
Injuries																			0				0				
Property Damage																			5				5				
Crop Damage																			0				0				
FLOODS																											
Deaths								0										0									
Injuries								0										1									1
Property Damage								3										6									
Crop Damage								0										0									
HEAVY SNOWSTORMS AND BLIZZARDS @																											
Deaths	0		6	2		0	0		0		0			0		4	4			0							16?
Injuries	0		15	0		0	0		0		0			0		12	9			0							56?
Property Damage	1		6	?		6	?		1		?			5		5	6			?							
Crop Damage	0		?	0		0	?		0		?			0		?	0			0							
ICE STORMS #																											
Deaths					0						0						6										6
Injuries					0						1						41										49?
Property Damage					?						?						6										
Crop Damage					0						?						0										
HURRICANES AND TROPICAL STORMS																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
ALL OTHERS																											
Deaths	0		0	1	0	0	5		10		10		1	3		0				0				0	1		62?
Injuries	0		18	0	0	?	?		0		11		?	4		0				0				0	0		39?
Property Damage	?		5	?	?	?	?		?		7		?	8		5				?				3	?		
Crop Damage	0		?	0	0	0	?		0		?		?	8		?				0				0	0		

SEE REFERENCE NOTES FOR STORM DAMAGE CATEGORIES

STORM DAMAGE CATAGORIES

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

REFERENCE NOTES

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.

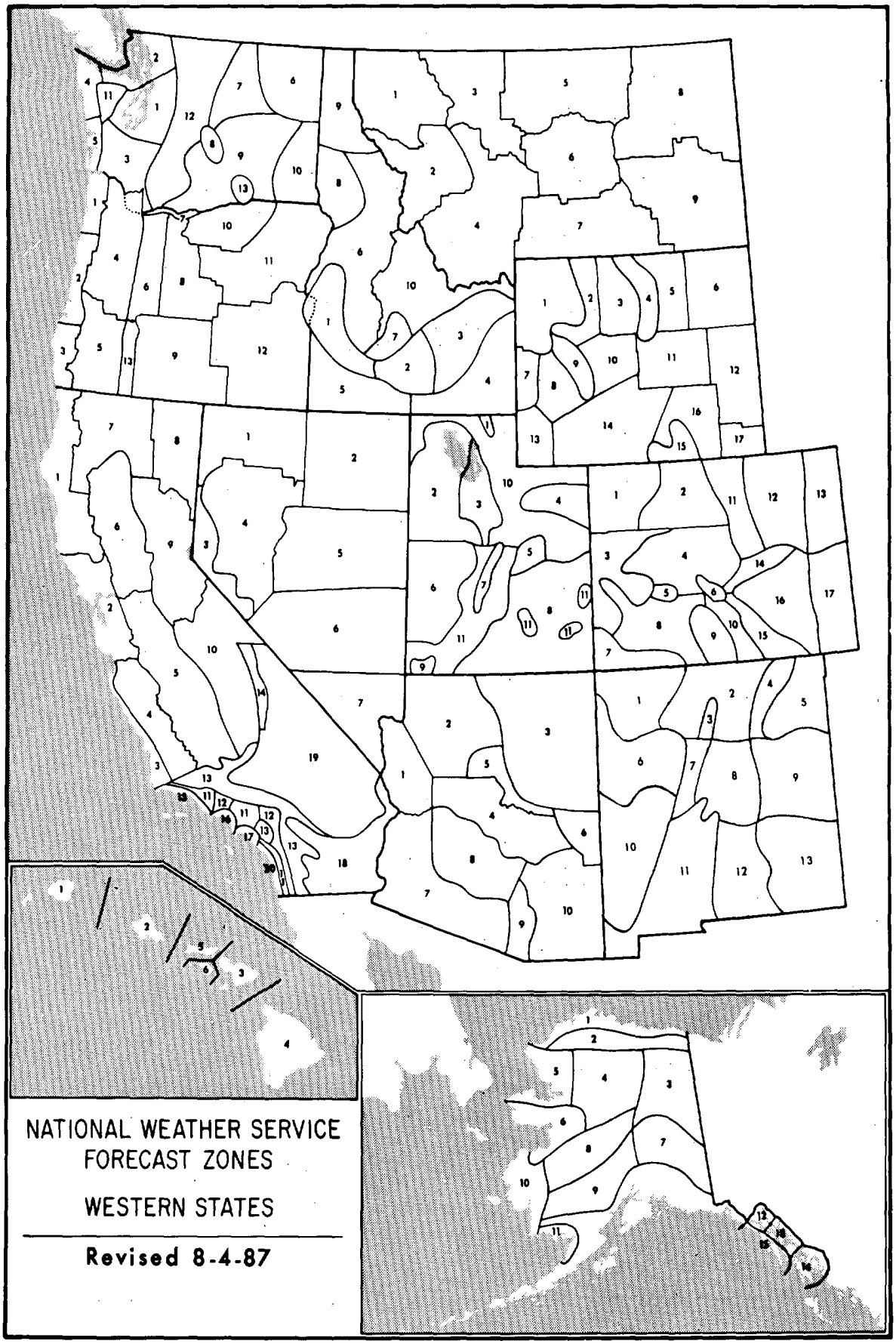
(F5) Incredible tornado (261-318 mph): Incredible damage
Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 m; trees debarked; incredible phenomena will occur.

(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

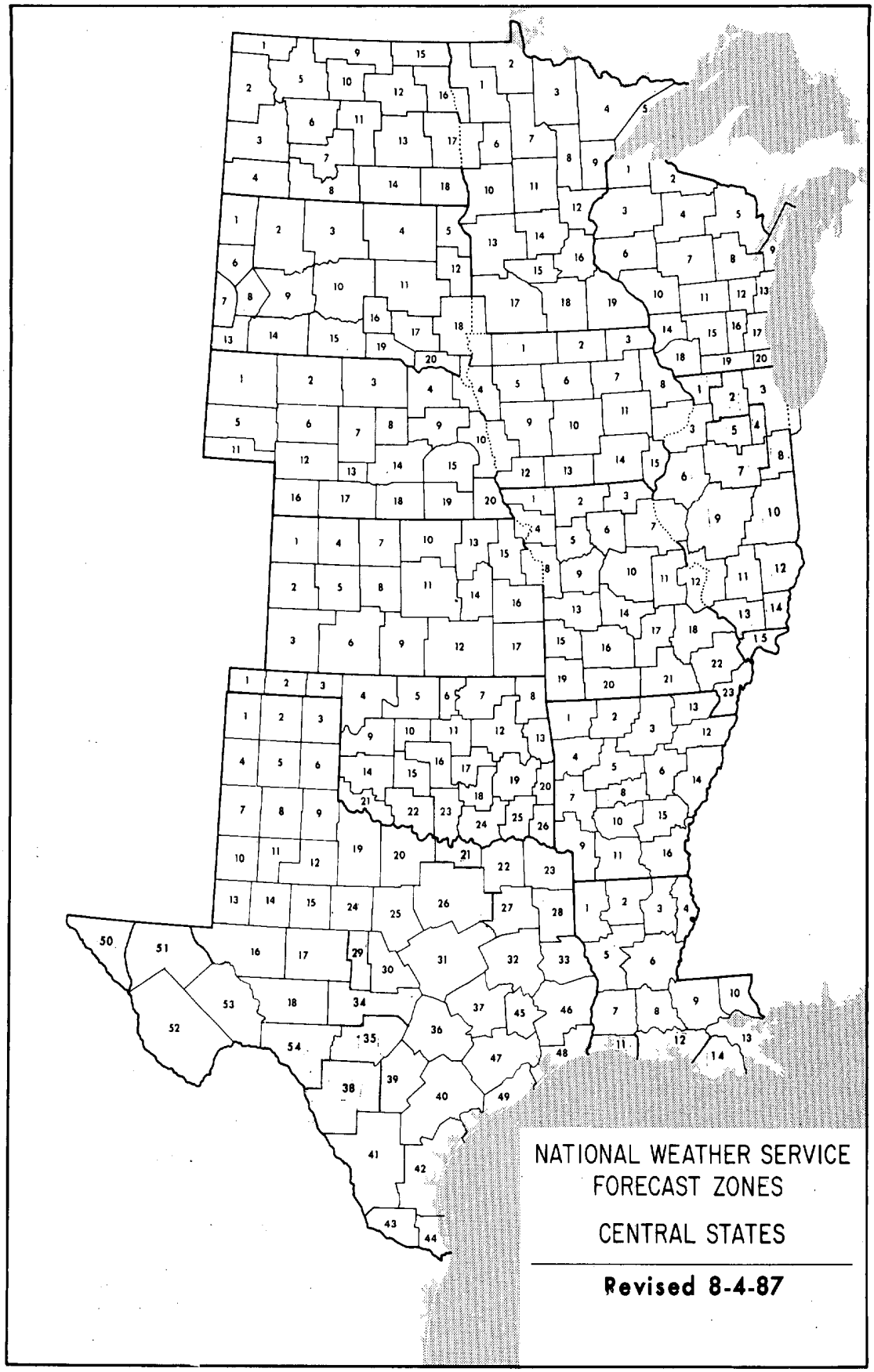
USCOMM-NOAA-ASHEVILLE, N.C. 1989-1800



NATIONAL WEATHER SERVICE
FORECAST ZONES

WESTERN STATES

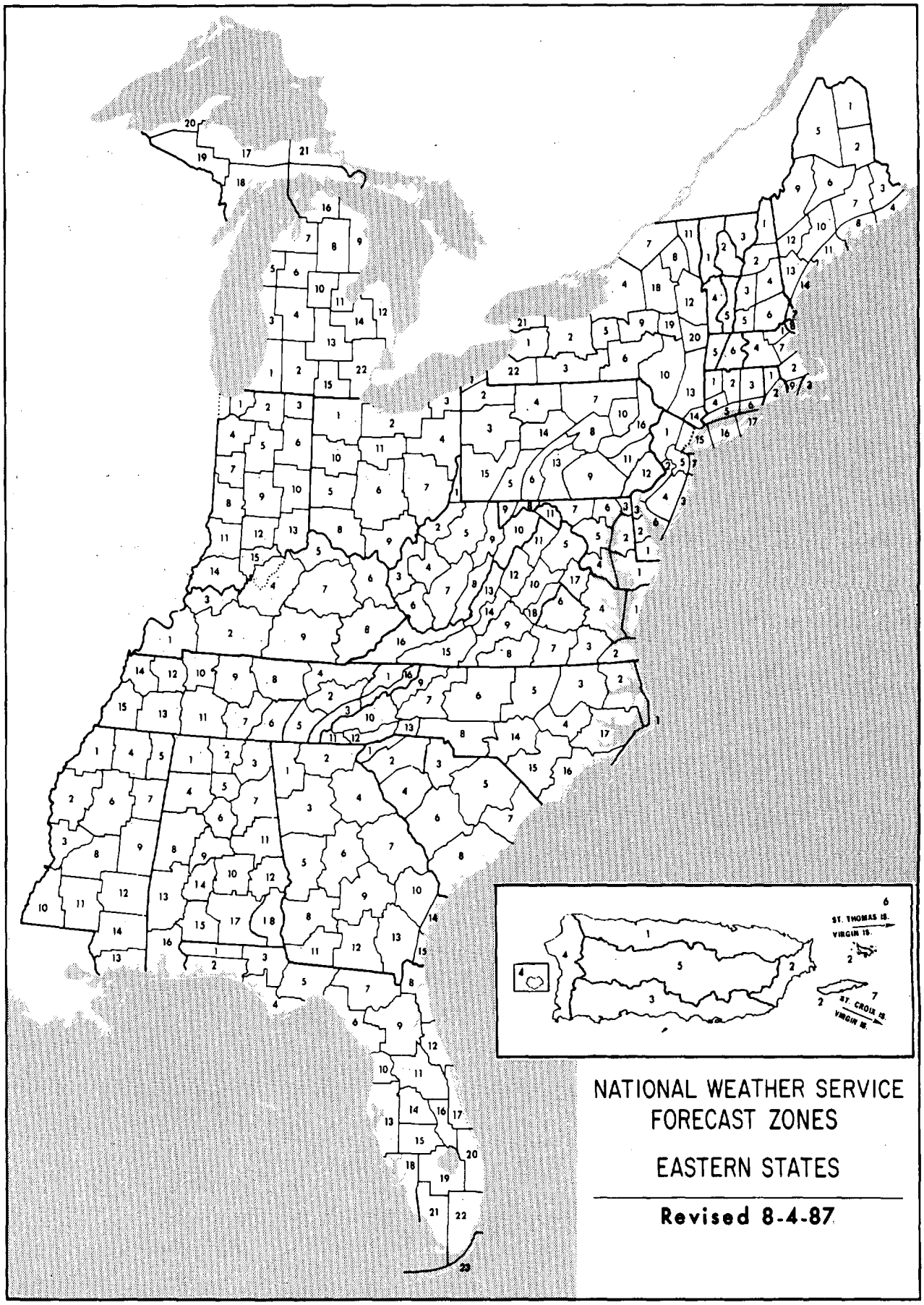
Revised 8-4-87



NATIONAL WEATHER SERVICE
FORECAST ZONES

CENTRAL STATES

Revised 8-4-87

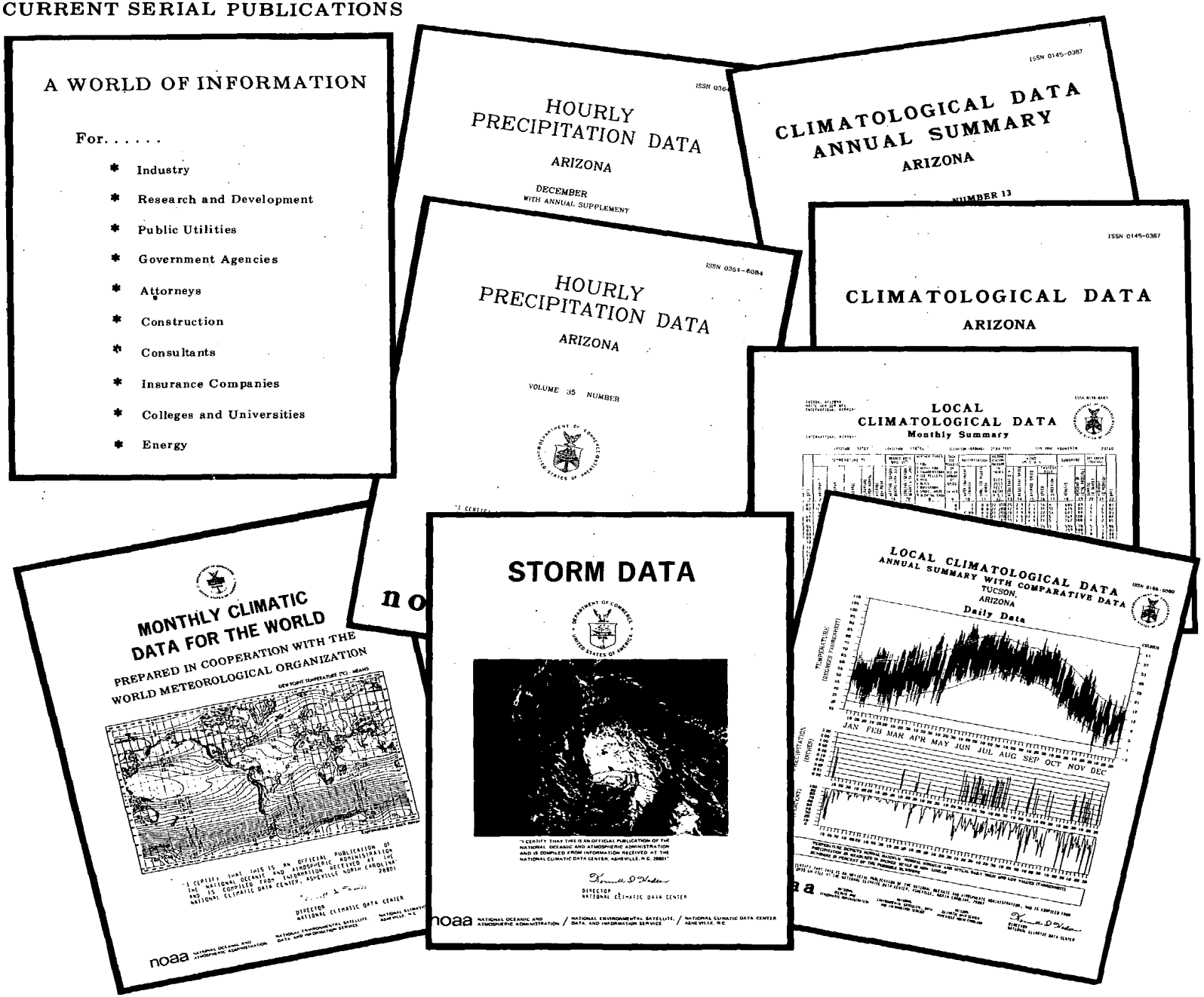


NATIONAL WEATHER SERVICE FORECAST ZONES

EASTERN STATES

Revised 8-4-87

CURRENT SERIAL PUBLICATIONS



NATIONAL SUMMARY OF TORNADOES, 1989

JAY HOLLIFIELD
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER

The 1989 tornado season began on January 4 at 11:00 a.m. when a tornado was observed by National Weather Service personnel at Sky Harbor Airport, Phoenix, AZ. There was some damage to a few homes and businesses near Phoenix. The final tornado of the season occurred December 12 between 11:15 a.m. and 11:30 a.m., near Chipley and Cottondale, FL. Five houses were damaged near Cottondale and one near Chipley. There were 856 tornadoes reported in 160 days, which killed 50 people and injured 1,274. Tornadoes destroyed or damaged more than 700 mobile homes which resulted in 8 deaths and several injuries. There was no tornado activity reported in Alaska and New Hampshire in 1989. Location of killer tornadoes, new monthly records (since 1953) by state and nation, and state-to-state border crossings are shown in the following three tables:

TABLE I. LOCATION OF KILLER TORNADOES

DATE	STATE	COUNTY	TOTAL DEATHS
March 5	Georgia	Heard	1
May 5	North Carolina	Lincoln	4
May 5	North Carolina	Union	1
May 5	South Carolina	Spartanburg	2
May 17	Texas	Williamson	1
May 22	Tennessee	Giles	1
June 8	Florida	Franklin	3
June 8	Louisiana	West Baton Rouge	2
October 1	Georgia	Colquitt	2
October 14	New York	Chenango	2
November 8	Georgia	Wilcox	1
November 15	Alabama	Madison	21
November 16	New York	Orange	9
			50

TABLE II. NEW MONTHLY RECORDS (SINCE 1953)

MONTH	STATE	NEW RECORD	PREVIOUS RECORD (YEAR)
January	Arizona	1	0
	Utah	1	0
March	New Jersey	3	2 (1964)
	Utah	1	0
May	Texas	70	65 (1969)
	Utah	1	0
	Kentucky	8	5 (1965)
	Louisiana	16	12 (1975)
	Virginia	4	3 (1976)
June	Florida	29	21 (1972)
	Louisiana	20	12 (1975)
	North Carolina	7	5 (1977)
	Tennessee	8	3 (1971)
	Texas	62	56 (1962)
	Utah	1	0
	West Virginia	3	2 (1975)
July	New Jersey	3	2 (1975)
	New York	5	3 (1969)
August	Montana	4	2 (1969)
September	Utah	1	0
October	Georgia	7	4 (1972)

TABLE II. NEW MONTHLY RECORDS (SINCE 1953) (Contd.)

MONTH	STATE	NEW RECORD	PREVIOUS RECORD (YEAR)
November	Delaware	1	0
	Georgia	6	5 (1968)
	Michigan	2	1 (1975)
	New Jersey	8	1 (1973)
	New York	8	0
	Pennsylvania	5	3 (1979)
	Tennessee	4	3 (1957)
	West Virginia	1	0

TABLE III. STATE-TO-STATE BORDER CROSSINGS

DATE	STATE		STATE
January 7	Illinois	into	Indiana
March 5	Alabama	into	Georgia
May 5	Georgia	into	South Carolina
May 5	South Carolina	into	North Carolina
May 25	Indiana	into	Ohio
June 9	Pennsylvania	into	New Jersey
November 16	Pennsylvania	into	New Jersey

The first tornado of 1989 occurred on January 4, at 11:00 a.m., 7 miles west of Phoenix, AZ. A few homes and roofs of some businesses were damaged near downtown Phoenix.

A tornado touched down at 4:55 p.m. on January 7, 3 miles southwest of Mill Shoals just west of the Hamilton-White County line, and then proceeded northeast passing just south of Mill Shoals in White County, IL. Six houses were destroyed and 46 other homes were damaged in Mill Shoals. Numerous barns, automobiles, and three oil well tanks were damaged in White County. The tornado damaged three mobile homes near Ellery, IL. There were six reported injuries.

A violent tornado initially touched down about 5:19 p.m. January 7, 4 miles southwest of Allendale, IL. The tornado started out at F2 intensity and escalated to the lower end of F4 intensity about one-half mile southwest of Allendale. The tornado reached its greatest intensity (F4) as it passed through the southern part of Allendale. Two farmhouses were first damaged about 1 mile southwest of Allendale. Four houses were completely swept away from their foundations at the southwest corner of town. The damage path continued off to the northeast, and on up the hill into the main part of town. A well-built frame house at the base of the hill had little damage, but on top of the hill, houses over a seven-block area were leveled. The City Hall lost most of its walls. The Post Office roof was removed. An occupied mobile home 50 yards southwest of the post office was flipped onto an automobile and then onto a second occupied mobile home. Both mobile homes were almost completely destroyed but the occupants survived. Portions of a church east of the post office remained standing while the concrete block firehouse further east was completely destroyed. Ten businesses, 47 homes, and 54 vehicles were destroyed in Allendale. A total of 50 people received injuries.

The tornado that occurred in Illinois at 5:19 p.m. on January 7, crossed into Indiana about 6:30 p.m. There were five injuries and about $250,000 damage reported in Knox County, IN. The total path length in the two states was 22 miles. The intensity of the tornado was F4 in Illinois and F2 in Indiana.

An intense thunderstorm produced a tornado (F1) at 1:00 p.m. on January 25, at Troy, TX. A construction trailer was overturned at the First Baptist Church in Troy injuring two workers who were inside. The tornado overturned a tractor-semitrailer injuring the driver. There was also damage to roofs, trees, storage buildings, automobiles, and two mobile homes.

There were 18 tornadoes reported in the United States in February. There were five in Mississippi, three in Alabama, Louisiana, and South Carolina, two in North Carolina, one in Florida, and one in Hawaii. There were no deaths but one injury was reported.

A tornado touched down on February 20 at 9:30 p.m., 3 miles north of Julligent in Lamar County, AL. A total of 36 homes were partly damaged, six mobile homes received extensive damage, and 36 outbuildings were destroyed or damaged. Three churches received moderate to heavy damage. A grocery store was destroyed. Six vehicles were damaged. A strip of timber about 5 miles long and one-quarter-mile wide was destroyed. Timber damage was estimated at $150,000 and structure damage $750,000.

A tornado of F3 intensity developed in Hinds County, MS on March 4, between 7:15 p.m. and 7:30 p.m. The tornado destroyed nine homes and two barns. Five people were injured, but none seriously. Two hogs and seven cows were killed.

A tornado touched down at Childersburg, AL between 5:16 p.m. and 5:35 p.m. on March 5 and moved northeast about 20 miles to Talladega, AL. Two mobiles homes were turned over at Childersburg. Nineteen unoccupied mobile homes were destroyed in Talladega. Two houses in Talladega were destroyed and 22 houses received major damage, mostly to roofs. Fifty-five other homes in Talladega received minor damage. Several businesses, a car dealership, and a hospital also received major damage at Talladega. There were no deaths, but there were two minor injuries. Damage estimates were placed at two million dollars.

A tornado occurred at 7:30 p.m. in Pike County, AL on March 5, that destroyed a manufacturing company and four buildings. Three tractor-semitrailers were turned over. One mobile home was damaged. Damage estimates were placed at one million dollars.

A tornado entered Georgia from Alabama on March 5 at 9:00 p.m., about 200 feet north of the Troupe/Heard County line. A mobile home was destroyed 2 miles east of Franklin at approximately 9:20 p.m. and a 68-year-old man was killed in the mobile home. This was the first known tornado fatality in Georgia since 1977.

A tornado occurred 2.8 miles north of Grantville, GA on March 5 at 10:12 p.m. There was damage to several homes and outbuildings. The tornado moved northeast near the intersection of Interstate 85 and U.S. Highway 29. A new motel was destroyed and another heavily damaged by the tornado. Eight people were injured in the motel. A total of 86 homes were damaged or destroyed by the storm. Twenty-five outbuildings were destroyed. Sixty-one cars were damaged or destroyed. Twenty-three people were hospitalized, but only one was critically injured.

A tornado touched down on March 30 at 4:45 p.m. 4 miles west-southwest of Jackson, NC and moved to the east-northeast skirting the south part of the town of Jackson. It continued along a path crossing State Highway 35 between Pendleton and Severn. The tornado lifted about 2 miles from the Meherrin River. The tornado destroyed 10 weaker houses and mobile homes and damaged 40 others. Two elementary schools received heavy damage. Eleven people were injured with two requiring hospitalization.

Eight people were injured when a tornado occurred on April 3, near Fort Branch, IN. The tornado touched down at 5:50 p.m., about 1.5 miles west of town and flipped a mobile home. The tornado moved through a mobile home park which received much damage. The tornado destroyed 38 homes, most of which were mobile homes. The tornado (F3) did an estimated $8 million of damage. Additional damage occurred to 119 homes due to large hail that accompanied the storm.

A tornado occurred on April 4, at 1:30 p.m., near Baldwin, GA. A funnel cloud developed along the squall line as the storm complex moved directly over Baldwin. The tornado traveled northeast about 8 miles with a small break in its path. Downburst winds occurred which caused damage outside of the tornado's path, especially to outbuildings, cars, trees, mobile and permanent homes. Damage costs from the tornado and the winds were estimated over 2 million dollars. There were three injuries reported.

Two tornadoes occurred on April 22 in Iowa. The first one occurred at 9:30 a.m. 2 miles west of Bode. As the storm moved south-southeast, a second tornado touched down in southeast Webster County. One injury was reported. Total damage was estimated about $27 million from the storms.

A tornado occurred in the Shawnee Village northeast of Xenia, OH on April 25 at 8:32 p.m. Six houses were destroyed and four received major damage. There were 95 homes that received minor damage. Estimated damage totaled $1.3 million. There were 15 minor injuries and one major injury which required hospitalization for two days.

A tornado touched down about 12:05 p.m. on May 1, near Acree, GA and totally demolished a mobile home. A man inside the trailer received minor injuries. The tornado destroyed one barn and damaged another. The tornado moved northward into the Sandy Hill subdivision of Worth County. Another mobile home was destroyed, three received minor damage, one frame home was severely damaged, and two other houses received minor damage. Damage costs were estimated near $250,000.

A tornado touched down on May 5 at 3:20 p.m., near Gainesville, GA. Eleven persons in automobiles were injured on I-985. Two of the 11 were seriously injured. The tornado moved along Highway 60 and did extensive structural damage to two businesses at 3:30 p.m. The tornado was of short duration but caused considerable damage to permanent and mobile homes and smaller structures in the vicinity of the storm. The estimated cost of the damage was more than $439,500. Another tornado occurred at 4:00 p.m. 2 miles south of Toccoa. The tornado moved northeast to a shopping plaza along Georgia Highway 17 where the most damage occurred. Fifteen people were injured but none very seriously. Estimated damage costs to personal property were near $338,700 and business damage $2,554,000.

A tornado occurred on May 5 in Spartanburg and Cherokee Counties. The tornado moved northeast after touching down 5 miles southwest of Chesnee in Spartanburg County, crossed the Cherokee County line at 5:33 p.m., and continued to the North Carolina border about 2 miles north of Chesnee, crossing it at 5:35 p.m. Property and utility damage was estimated at $2.5 million in Spartanburg County and $250,000 in Cherokee County. There was a total of 2 deaths and 35 injuries. All occurred in Spartanburg County.

A tornado (F4) first touched down 3 miles northwest of Lawndale, NC on May 5 at 5:54 p.m. The tornado's track in Cleveland County was about 7 miles long. There were no deaths and 30 injuries. Thirty-four houses were damaged and 15 were destroyed. Two churches were destroyed and one was damaged. Damage in the county was around $1 million. There was damage along 50% of the track. The track in Lincoln County was 3 miles long, the tornado having crossed the northwest corner of the county from 6:06 p.m. to 6:11 p.m. Nineteen residences were destroyed and 12 were damaged. Nine mobile homes were destroyed and six were damaged. Some vehicles were lifted and carried 200 to 300 yards. Well-constructed houses were completely destroyed. Dollar damage was near $3.9 million. The tornado entered Catawba County at 6:11 p.m. and traveled about 4 miles. There were 13 permanent residences destroyed or damaged and two mobile homes destroyed and two damaged. There were 4 deaths, 52 injuries, and about $5.6 million damage from this storm.

A tornado (F4) touched down 8 miles west of Monroe, NC at 7:01 p.m. An 8-year-old girl was killed in a double-wide mobile home. Six people were injured. Twelve permanent residences and 10 mobile homes were destroyed. Two mobile homes and 22 houses were damaged. There was a total of $8 million damage from this storm.

There were 11 tornadoes reported in North Carolina in May. All occurred on the 5th. There were five deaths and 107 injuries reported from these storms.

A tornado hit Jarrell, TX between 3:02 a.m. and 3:20 a.m. on May 17. There were 35 homes and 12 mobile homes that were heavily damaged or totally destroyed. Sixteen business structures were heavily damaged, a 12-unit apartment complex was destroyed, and two school buildings were destroyed. One woman was killed in her mobile home when it was demolished. She was found crushed under debris and a waterbed. There were a total of 28 persons hospitalized but only two were retained at a hospital.

Severe thunderstorms developed ahead of a cold front during the evening hours of May 24 in Adams, Union, Ringgold, and Decatur Counties, IA. The first storm was over southern Iowa and spawned a tornado 1 mile east of Corning. The tornado lifted a few times along its 50-mile path before lifting a final time 3 miles west of Davis City. It was mostly F3 and occasionally F4, but most intense in Adams County. In Ringgold and Union Counties its maximum intensity was F2. The maximum intensity of F4 occurred near Prescott where the damage path also attained its maximum width of 1 mile. A farm near Prescott was struck and virtually destroyed. Three hundred hogs were strewn one-quarter to one-half mile across a field. The second storm produced a tornado in central Iowa. It touched down 7 miles southeast of Stratford and traversed a distance of 66 miles before lifting 7 miles west of Traer in Tama County. Three injuries resulted near Liscomb where this tornado reached maximum intensity. Two farms just east of Liscomb were destroyed. A car on one of the farms was picked up and thrown several hundred feet, and buildings were completely leveled. There were four other tornadoes that occurred through the remainder of the 24th, but none any stronger in intensity than F1.

A large tornado touched down 10 miles north-northwest of Liberal, KS at 3:58 p.m. on June 6. The tornado did considerable damage to farmsteads and irrigation systems in its path. Large hail, up to baseball size, also did considerable damage to automobiles and broke out windows in homes. Crop damage was extensive in the area from hail.

A tornado touched down west of Anacoco, near Toldeo Bend Reservoir, LA at 9:30 p.m. on June 7, damaging a total of 20 mobile homes and trailers. Damage of $9 million was caused when wind gusts in excess of 70 mph overturned or damaged 30 military helicopters and several hangars ar Fort Polk. Four housing units were damaged on the base, resulting in $71,000 damage. Twelve homes were heavily damaged or destroyed in Beauregard Parish, LA. Six persons had minor injuries in an area north of Longville, LA.

An intense thunderstorm spawned three F2 intensity tornadoes on June 8, between 5:04 a.m. and 5:17 a.m. The tornado moved from west of Grosse Tete across north Baton Rouge into St. Helena Parish, LA. The first tornado touched down just west of Grosse Tete, moved across the small town, and destroyed or severely damaged a total of 32 structures, including mobile homes. Another 47 structures had minor damage. Two persons were killed and 30 were injured, two of which were serious. Total damage in Grosse Tete was $1.3 million. The next tornado started near Lobdell then crossed the Mississippi River into Scotlandville, on the north side of Baton Rouge, and ended northeast of Baton Rouge. About 90 houses and 35 mobile homes had extensive damage. Sixty people were injured, mostly from flying glass and debris. The third tornado occurred in a wooded, sparsely populated area of north Livingston and south St. Helena Parishes.

A tornado occurred on June 8 between 5:00 p.m. and 5:40 p.m. at Eastpoint, FL. Three people, two of whom had taken refuge from a nearby mobile home, were killed after being thrown 500 feet when the frame house they were in was completely demolished. The total damage done by the tornado was valued at $4.5 million. The tornado damaged or destroyed 27 houses, mobile homes, and businesses, and a dozen vehicles and boats. Sixty acres of trees were also destroyed.

A tornado demolished a home and barn and damaged three other homes at 6:30 p.m. on June 8 in Wakulla County, FL. One woman in the home was injured. The tornado lifted a horse from a field and deposited it in a swimming pool.

A tornado touched down on June 15 about 4:50 p.m. on the eastern end of the city of York and made an intermittent path of damage northeastward across the Susquehanna River near Wrightsville to its end point, 2 miles west of Millersville in Lancaster County, PA. The tornado in York County traversed 8 miles of its path length, damaging 16 homes, one business, one church, five garages, and three barns. The tornado was observed crossing the Susquehanna River and drawing up water into its funnel at 5:30 p.m. The tornado continued eastward for another 7 miles across Lancaster County, causing damage in Columbia, Mountville, and just to the west of Millersville. Four homes were destroyed, nine houses were damaged, and an excavating company warehouse was knocked down in Lancaster County. Many trees were uprooted or broken off and many vehicles were damaged or destroyed. Seven people received minor injuries.

Five tornadoes were reported in New York during the month of July. Four of these occurred on July 10 and one on the 19th. Fortunately there were no deaths, but there were 27 reported injuries.

Near midday on July 10, a second wave of thunderstorms rolled through eastern New York, the first having occurred at 9:00 a.m. The thunderstorms produced two tornadoes; the first occurred east of Ames, Montgomery County, moved through the hamlets of Carlisle, Brammerville, Howe Caverns, Central Bridge, Wetsel Hollow, and into the village of Schoharie, then lifted off the ridge east of the village. The tornado touched down again on the other side of the ridge in the hamlet of Rensselaerville, Albany County. The storm remained on the ground for about 1.5 miles. Another touchdown occurred between the hamlets of Greenville and Surprise, Green County. Again the tornado remained on the ground for about 1.5 miles. It appeared that maximum wind speeds occurred near Wetsel Hollow Road and Route 7. This was an area where damage patterns suggested that two cells merged. Estimated winds were about 225 to 250 mph, a minimal F4.

According to local records, this was the most powerful tornado to ever have been recorded in eastern New York.

There were three tornadoes on July 10 in Connecticut. Connecticut, like New York, was also fortunate not to have any deaths, but there were 114 reported injuries.

A major tornado (F4), which is rare for New England, touched down on July 10 at 4:45 p.m. in Hamden, CT. It devastated a part of the community, especially a section known as Highwood. As many as 350 homes and over 40 businesses were destroyed, resulting in the displacement of many hundreds of people. Damage estimated in Hamden alone exceeded $100 million.

A tornado touched down on August 29 at 6:43 p.m. in the town of Keasbey near exit 127 of the Garden State Parkway, NJ. The tornado picked up and tossed a 5-ton trailer nearly 150 feet. Six trailers were damaged and several cars were overturned. A utility pole was broken off about 10 feet above ground level. One minor injury was reported.

A tornado turned over a mobile home on September 1 at 3:35 a.m., and injured three occupants at Bruce Lake, in Pulaski, and Fulton Counties, IN. Several mobile homes were completely destroyed and permanent homes were damaged along the southern and eastern shores of the lake.

A tornado touched down at intervals from west of Thurman to near Randolph, IA on September 8, at 5:35 p.m. A vehicle was blown off I-29. There were three injuries as the RV was blown from the highway. Grain bins were destroyed near Thurman and a mobile home was overturned east of town. High winds caused extensive damage west of Thurman.

A tornado formed 10 miles southwest of Moultrie, GA on October 1 at 12:30 p.m. The tornado destroyed nine mobile homes and caused two deaths and 12 injuries. As the tornado continued along its path, another mobile home was destroyed. The storm moved about 25 yards further and totally demolished a church. Another 500 feet away, the social hall and a roof of another church were heavily damaged. Eight permanent homes and five vehicles were damaged by the tornado. The damage to the autos alone was estimated near $15,000. Agricultural losses were estimated to be at least $9,500 in timber and pecan trees. Damage in the mobile home park was estimated near $350,000.

A tornado occurred on October 14 between 6:15 p.m. and 6:18 p.m., in Chenango County, NY. The tornado lifted a mobile home off its foundation and dropped it some distance away. The trailer struck a car and a pickup truck before coming to rest. Two people were killed and three people were injured from this tornado.

A tornado (F2) occurred on November 8 at 5:35 p.m., at Pineview, GA. Damage occurred at a peanut warehouse at the edge of the storm's path. Several peanut wagons, weighing about a ton each, were pushed hundreds of feet, some causing damage along the way. The tornado destroyed three mobile homes and took three others off their foundations. Two frame homes were totally destroyed, another had severe damage and six others had minor damage. One child was killed and his parents critically injured when their mobile home was lifted at least 200 feet into the air by the tornado.

A devastating tornado (F4) struck the southern portion of the city of Huntsville, AL, on November 15 at 4:30 p.m. The tornado cut a swath of destruction from southwest toward the northeast through a business section and a heavily populated residential area. Twenty-one people died and 463 were injured from the tornado. Eighteen people died in the tornado and three others died later from injuries sustained in the tornado. The estimated damage was placed at around $100 million. The tornado struck, while at peak force, during the rush hour in Huntsville, moved through a business area, and crossed two major north-south highways. Twelve of the 21 deaths occurred in automobiles. The tornado destroyed a number of shopping complexes, office buildings, an apartment complex, and churches. The tornado struck Jones Valley Elementary School. Thirty-seven children, five teachers, and seven painters were in the school when the tornado struck. The children were moved from the second floor of the school building into a small open area under a stairway which saved their lives.

Nine children were killed when a tornado of F1 intensity struck the Coldenham School in Orange County, NY on November 16. There were 18 injuries from this tornado.

A total of three tornadoes were reported in December in the United States. All three occurred in Florida and all were on the 12th.

The final twister of 1989 touched down at 11:15 a.m. on December 12, 5 miles south of Chipley and 3 miles north of Cottondale, FL. Six houses were damaged.

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 1950-1989. 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, 1989

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA													
NUMBER		3	4	1	1	3	2			2	7		23
DAYS		1	1	1	1	1	2			1	3		11
DEATHS											21		21
INJURIES			2			10					466		478
ARIZONA													
NUMBER	1												1
DAYS	1												1
DEATHS													0
INJURIES													0
ARKANSAS													
NUMBER			2	3	2	8	1		1		1		18
DAYS			2	1	2	3	1		1		1		11
DEATHS													0
INJURIES						6							6
CALIFORNIA													
NUMBER			1						3				4
DAYS			1						1				2
DEATHS													0
INJURIES													0
COLORADO													
NUMBER					6	12	4						22
DAYS					4	7	1						12
DEATHS													0
INJURIES						0							0
CONNECTICUT													
NUMBER							3						3
DAYS							1						1
DEATHS													0
INJURIES							114						114
DELAWARE													
NUMBER						1		1			1		3
DAYS						1		1			1		3
DEATHS													0
INJURIES						1					1		2
FLORIDA													
NUMBER	1	1	6	3	9	29	5	4	6	1	3	3	71
DAYS	1	1	4	3	6	11	5	4	4	1	2	1	43
DEATHS						3							3
INJURIES						6	1			1			8
GEORGIA													
NUMBER			6	10	7	1		1		7	6		38
DAYS			2	1	2	1		1		1	2		10
DEATHS			1							2	1		4
INJURIES			29	3	28					14	31		105
HAWAII													
NUMBER		1											1
DAYS		1											1
DEATHS													0
INJURIES													0
IDAHO													
NUMBER					1		1						2
DAYS					1		1						2
DEATHS													0
INJURIES													0
ILLINOIS													
NUMBER	4			4	4	1	1			1			15
DAYS	1			1	2	1	1			1			7
DEATHS													0
INJURIES	56												56
INDIANA													
NUMBER	3			6	9	4	2	1	1				26
DAYS	1			2	2	1	2	1	1				10
DEATHS													0
INJURIES	5			8		3			3				19
IOWA													
NUMBER				13	9	1	1		5				29
DAYS				3	3	1	1		4				12
DEATHS													0
INJURIES				2	6	1			3				12

TORNADO SUMMARY BY STATE AND NATION, 1989

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
KANSAS													
NUMBER				10	4	9	1	2	2	3			31
DAYS				1	3	3	1	2	1	1			12
DEATHS													0
INJURIES									1				1
KENTUCKY													
NUMBER			1	6	8	2					1		18
DAYS			1	3	4	2					1		11
DEATHS													0
INJURIES				1	2						2		5
LOUISIANA													
NUMBER		3	2	1	16	20	1	1	1				45
DAYS		1	2	1	5	5	1	1	1				17
DEATHS						2							2
INJURIES					2	102							104
MAINE													
NUMBER						1							1
DAYS						1							1
DEATHS													0
INJURIES													0
MARYLAND													
NUMBER											1		1
DAYS											1		1
DEATHS													0
INJURIES													0
MASSACHUSETTS													
NUMBER							7						7
DAYS							1						1
DEATHS													0
INJURIES							1						1
MICHIGAN													
NUMBER					6			2	2	3	2		15
DAYS					3			2	1	2	1		9
DEATHS													0
INJURIES					1				1				2
MINNESOTA													
NUMBER					10	1							11
DAYS					2	1							3
DEATHS													0
INJURIES													0
MISSISSIPPI													
NUMBER	2	5	7	3	5	6	3			1	4		36
DAYS	1	1	3	1	3	4	3			1	3		20
DEATHS													0
INJURIES			5			5							10
MISSOURI													
NUMBER				5	5	3							13
DAYS				2	3	2							7
DEATHS													0
INJURIES													0
MONTANA													
NUMBER					1	1		4					6
DAYS					1	1		2					4
DEATHS													0
INJURIES													0
NEBRASKA													
NUMBER				8	4	21	4	4					41
DAYS				2	3	7	1	3					16
DEATHS													0
INJURIES						3							3
NEVADA													
NUMBER						1			1	1			3
DAYS						1			1	1			3
DEATHS													0
INJURIES													0
NEW JERSEY													
NUMBER			3		1	1	3	1			8		17
DAYS			1		1	1	1	1			2		7
DEATHS													0
INJURIES								1			1		2

TORNADO SUMMARY BY STATE AND NATION, 1989

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
NEW MEXICO													
NUMBER					4	8	2	2					16
DAYS					3	4	2	2					11
DEATHS													0
INJURIES													0
NEW YORK													
NUMBER						1	5			1	8		15
DAYS						1	2			1	1		5
DEATHS										2	9		11
INJURIES							27			3	19		49
NORTH CAROLINA													
NUMBER		2	2		11	7	1		1				24
DAYS		1	2		1	5	1		1				11
DEATHS					5								5
INJURIES			11		107	1							119
NORTH DAKOTA													
NUMBER					3	5	3	1					12
DAYS					2	2	2	1					7
DEATHS													0
INJURIES							1						1
OHIO													
NUMBER				1	5	5	2	1		1	2		17
DAYS				1	2	3	1	1		1	2		11
DEATHS													0
INJURIES				16							1		17
OKLAHOMA													
NUMBER			2	1	7	6		1	1	2			20
DAYS			1	1	4	4		1	1	1			13
DEATHS													0
INJURIES					2								2
OREGON													
NUMBER								1			1		2
DAYS								1			1		2
DEATHS													0
INJURIES													0
PENNSYLVANIA													
NUMBER						5	1				5		11
DAYS						3	1				2		6
DEATHS													0
INJURIES						9					4		13
RHODE ISLAND													
NUMBER									1				1
DAYS									1				1
DEATHS													0
INJURIES									3				3
SOUTH CAROLINA													
NUMBER		3	1	4	4	2			2	1	1		18
DAYS		1	1	1	2	1			1	1	1		9
DEATHS					2								2
INJURIES		1			47	1					1		50
SOUTH DAKOTA													
NUMBER						1	2	2					5
DAYS						1	2	1					4
DEATHS													0
INJURIES						4	1						5
TENNESSEE													
NUMBER					1	8					4		13
DAYS					1	3					2		6
DEATHS					1								1
INJURIES					2	2							4
TEXAS													
NUMBER	3		5	3	70	63		6	3	6	1		160
DAYS	2		2	2	12	10		3	1	2	1		35
DEATHS					1								1
INJURIES	3				67	5							75
UTAH													
NUMBER	1		1		1	1	1		1				6
DAYS	1		1		1	1	1		1				6
DEATHS													0
INJURIES													0

TORNADO SUMMARY BY STATE AND NATION, 1989

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
VERMONT													
NUMBER								1					1
DAYS								1					1
DEATHS													0
INJURIES													0
VIRGINIA													
NUMBER			1		4	3					1		9
DAYS			1		2	2					1		6
DEATHS													0
INJURIES													0
WASHINGTON													
NUMBER						1							1
DAYS						1							1
DEATHS													0
INJURIES						1							1
WEST VIRGINIA													
NUMBER						3					1		4
DAYS						2					1		3
DEATHS													0
INJURIES											3		3
WISCONSIN													
NUMBER					10	7							17
DAYS					1	3							4
DEATHS													0
INJURIES						4							4
WYOMING													
NUMBER					6	1	3						10
DAYS					2	1	2						5
DEATHS													0
INJURIES													0
UNITED STATES													
NUMBER	15*	18	44*	82	234*	253*	59	36	31	30	58*	3	856*
DAYS &	6	3	14	13	28	27	19	20	12	7	10	1	160
DEATHS	0	0	1	0	9	5	0	0	0	4	31	0	50
INJURIES	64	1	47	30	264	164	145	1	11	18	529	0	1274

* CORRECTED FOR BOUNDARY-CROSSING TORNADOES.

& TORNADO DAYS FOR COUNTRY AS A WHOLE.

TORNADOES, TORNADO DAYS, AND DEATHS BY STATE AND NATION, 1953-89

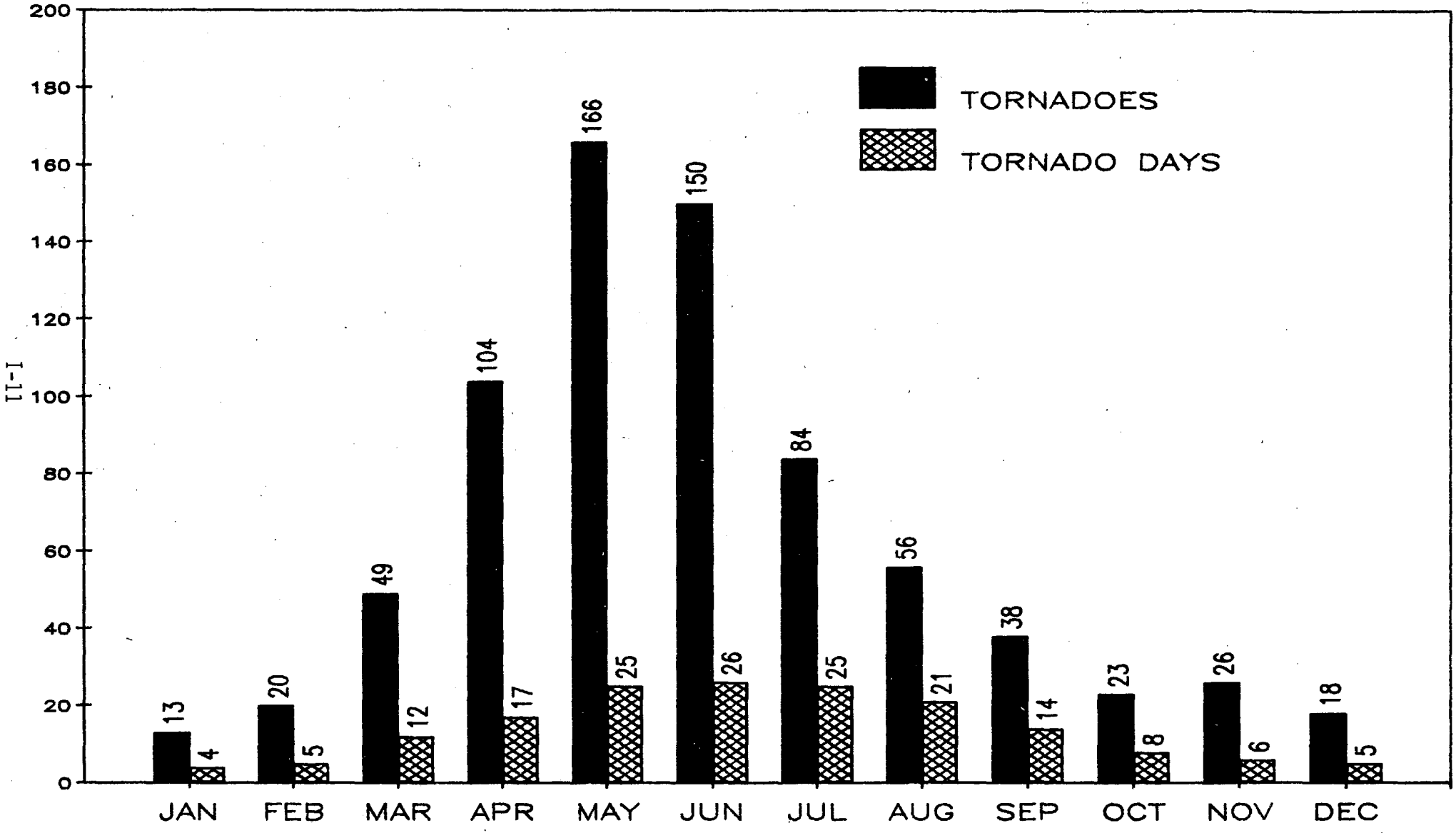
STATE	TORNADOES							DAYS		DEATHS		
	TOTAL	AVERAGE	GREATEST	YEAR	LEAST	YEAR	PER # 10,000 SQ. MI.	TOTAL	AVERAGE	TOTAL	AVERAGE	PER ' 10,000 SQ. MI.
ALABAMA	788	21	45	1983+	5	1956	4.06	415	11	237	6	46
ALASKA	1	0	1	1959	0	1989+	.00	1	0	0	0	0
ARIZONA	123	3	17	1972	0	1965	.26	99	3	3	0	0
ARKANSAS	743	20	78	1982	2	1987+	3.76	339	9	163	5	31
CALIFORNIA	148	4	14	1983	0	1968+	.25	110	3	0	0	0
COLORADO	771	21	58	1982	1	1959	2.02	460	12	2	0	0
CONNECTICUT	49	1	8	1973	0	1988+	2.00	43	1	4	0	8
DELAWARE	35	1	5	1975	0	1987+	5.00	32	1	2	0	10
DISTRICT OF COLUMBIA	0	0	0		0		- -	0	0	0	0	0
FLORIDA	1650	44	97	1975	10	1956	7.50	1052	28	70	2	12
GEORGIA	743	20	46	1974+	2	1987	3.40	408	11	76	2	13
HAWAII	27	1	4	1971	0	1987+	1.56	23	1	0	0	0
IDAHO	77	2	10	1986+	0	1977+	.24	63	2	0	0	0
ILLINOIS	960	26	107	1974	4	1953	4.62	445	12	147	4	26
INDIANA	744	20	48	1973	4	1984	5.52	360	10	206	6	57
IOWA	1105	30	61	1984	7	1956	5.33	488	13	60	2	11
KANSAS	1532	42	97	1955	14	1976	5.07	714	20	168	5	20
KENTUCKY	304	8	34	1974	0	1953	1.98	181	5	102	3	25
LOUISIANA	841	22	64	1983	3	1955	4.60	496	13	96	3	20
MAINE	76	2	11	1971	0	1987+	.60	67	2	1	0	0
MARYLAND	89	2	10	1975	0	1988+	1.90	69	2	2	0	2
MASSACHUSETTS	124	3	12	1958	0	1988+	3.61	87	2	99	3	119
MICHIGAN	611	17	39	1974	2	1959	2.91	353	10	236	7	40
MINNESOTA	652	18	34	1968	5	1988+	2.13	369	10	77	2	9
MISSISSIPPI	870	23	62	1988	1	1979	4.82	431	11	343	10	72
MISSOURI	996	27	79	1973	6	1987+	3.87	436	12	133	4	19
MONTANA	162	4	20	1988	0	1974+	.27	114	3	1	0	0
NEBRASKA	1296	35	78	1975	10	1966	4.52	635	17	51	1	7
NEVADA	38	1	8	1987	0	1985+	.09	34	1	0	0	0
NEW HAMPSHIRE	68	2	9	1963	0	1987+	2.15	59	2	0	0	0
NEW JERSEY	84	2	17	1989	0	1984+	2.56	61	2	0	0	0
NEW MEXICO	299	8	18	1972	0	1953	.66	230	6	3	0	0
NEW YORK	163	4	15	1989	0	1953	.81	122	3	18	0	4
NORTH CAROLINA	461	12	38	1973	2	1970	2.28	281	8	79	2	15
NORTH DAKOTA	669	18	52	1976	2	1961	2.55	364	10	21	1	3
OHIO	514	14	43	1973	0	1988	3.39	268	7	170	5	41
OKLAHOMA	1939	53	107	1957	17	1988	7.57	802	22	200	6	29
OREGON	33	1	4	1984	0	1988+	.10	29	1	0	0	0
PACIFIC ISLANDS	2	0	1	1981+	0	1989+	- -	2	0	0	0	0
PENNSYLVANIA	325	9	33	1985+	0	1959	1.99	211	6	73	2	16
PUERTO RICO	9	0	2	1979	0	1989+	.00	8	0	0	0	0
RHODE ISLAND	6	0	3	1986	0	1988+	.00	5	0	0	0	0
SOUTH CAROLINA	335	9	23	1973	1	1986+	2.89	221	6	42	1	14
SOUTH DAKOTA	925	26	64	1965	1	1958	3.37	438	12	8	0	1
TENNESSEE	410	11	44	1974	1	1987+	2.61	222	6	82	2	19
TEXAS	4599	123	232	1967	32	1953	4.61	1767	48	446	12	17
UTAH	56	1	6	1984	0	1989+	.12	47	1	0	0	0
VERMONT	31	1	5	1962	0	1985+	1.04	28	1	0	0	0
VIRGINIA	211	6	22	1975	1	1982+	1.47	143	4	16	0	4
VIRGIN ISLANDS	2	0	1	1979+	0	1989+	- -	2	0	0	0	0
WASHINGTON	49	1	4	1989+	0	1988+	.15	42	1	6	0	1
WEST VIRGINIA	72	2	6	1980+	0	1988+	.83	56	1	2	0	1
WISCONSIN	714	19	43	1980	3	1953	3.38	370	10	75	2	13
WYOMING	349	9	42	1977	0	1970	.92	234	6	2	0	0
TOTAL: UNITED STATES	27688*	748	1102	1973	421	1953	2.07	6259&	169	3522	95	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.

AVERAGE NUMBER OF TORNADOES AND TORNADO DAYS EACH MONTH IN THE UNITED STATES

(BASED ON 27,688 TORNADOES THAT OCCURRED FROM 1953-1989)



NATIONAL TORNADOES, TORNADO DAYS, DEATHS AND RESULTING LOSSES BY YEARS, 1916-89

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	5	0
1919	64	35	206	59	7	10	2	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	5	0
1923	102	59	110	23	6	21	1	0
1924	130	57	376	85	7	26	11	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	1	0
1932	151	67	394	37	7	23	1	1
1933	258	96	362	34	7	46	9	0
1934	147	77	47	6	6	10	3	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	152	75	91	27	7	21	3	0
1940	124	62	65	18	7	13	2	0
1941	118	57	53	25	6	24	1	0
1942	167	66	384	65	7	42	10	0
1943	152	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	106	65	78	15	7	29	7	0
1947	165	78	313	169	7	46	7	1
1948	183	68	139	33	7	62	11	2
1949	249	80	211	58	7	54	13	0
1950	200	88	70	18	7	47	9	0
1951	262	113	34	6	7	35	11	2
1952	240	98	229	57	7	53	19	0
1953	421	136	515	116	8	63	18	7
1954	550	160	36	6	7	63	8	1
1955	593	152	126	80	7	74	13	1
1956	504	155	83	25	7	83	24	1
1957	856	154	192	44	8	129	26	3
1958	564	166	66	19	7	70	8	1
1959	604	156	58	21	7	70	4	1
1960	616	172	46	16	7	65	11	1
1961	697	169	51	16	7	103	21	1
1962	657	152	28	17	7	51	10	0
1963	464	141	31	5	7	77	15	1
1964	704	156	73	22	7	113	17	5
1965	906	181	299	44	8	126	30	11
1966	585	150	98	58	8	79	13	4
1967	926	173	114	33	8	125	33	8
1968	660	171	131	34	8	82	26	6
1969	608	155	66	32	8	98	16	3
1970	653	171	72	26	8	97	24	6
1971	888	192	156	58	8	71	30	5
1972	741	194	27	6	8	100	28	1
1973	1102	206	87	7	9	219	67	9
1974	947	184	361	34	9	166	82	25
1975	920	204	60	9	9	189	31	11
1976	835	169	44	5	8	145	41	5
1977	852	189	43	22	8	173	40	6
1978	788	173	53	16	9	153	53	6
1979	852	186	84	42	9	169	62	11
1980	866	176	28	5	9	201	79	13
1981	783	175	24	5	9	144	43	12
1982	1046	182	64	10	9	254	79	13
1983	931	190	34	3	9	211	85	10
1984	907	166	122	16	9	193	90	35
1985	684	168	94	18	9	114	55	14
1986	764	168	15	3	9	157	66	9
1987	656	151	59	30	8	112	32	6
1988	702	156	32	5	9	148	48	17
1989	856	160	50	21	9	133	60	18
MEAN	748	169	95	-	-	125	38	8

NOTE: - THE ABOVE ESTIMATED LOSSES ARE BASED ON VALUES AT TIME OF OCCURRENCE.

MEAN WAS DERIVED FROM DATA FOR PERIOD 1953-1989.

$ STORM DAMAGES IN CATEGORIES:

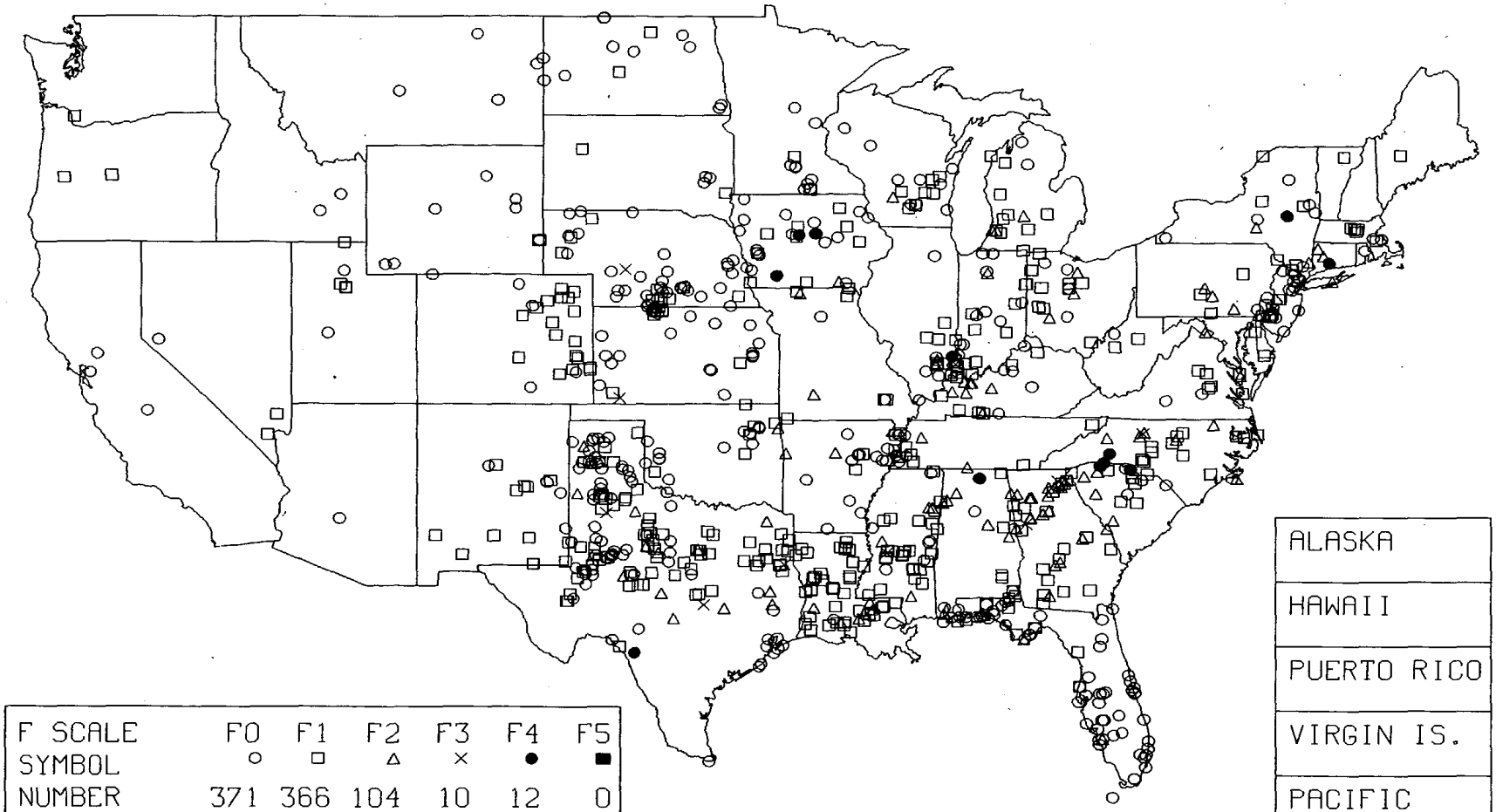
5. $50,000 TO $500,000
6. $500,000 TO $5 MILLION
7. $5 MILLION TO $50 MILLION
8. $50 MILLION TO $500 MILLION
9. $500 MILLION AND OVER

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

NATIONAL SUMMARY OF TORNADOES, TORNADO DAYS, AND DEATHS BY MONTH AND ANNUAL, 1953-89

	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			ANNUAL		
YEAR	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	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	0	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	6	4	45	6	0	1	1	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	10	0	11	4	0	2	2	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	1	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	3	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	2	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	1	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
1989	15	6	0	18	3	0	44	14	1	82	13	0	234	28	9	253	27	5	59	19	0	36	20	0	31	12	0	30	7	4	58	10	31	3	1	0	856	160	50
POR	491	160	98	734	203	203	1819	446	292	3852	645	1160	6131	917	813	5551	970	484	3104	927	46	2088	771	68	1418	518	64	855	285	70	973	237	109	679	180	115	27688	6259	3522
MEAN	13	4	3	20	5	5	49	12	8	104	17	31	166	25	22	150	26	13	84	25	1	56	21	2	38	14	2	23	8	2	26	6	3	18	5	3	748	169	95

1989 CONFIRMED TORNADOES



F SCALE	F0	F1	F2	F3	F4	F5
SYMBOL	○	□	△	×	●	■
NUMBER	371	366	104	10	12	0

TOTAL 863

ALASKA
HAWAII
PUERTO RICO
VIRGIN IS.
PACIFIC

NATIONAL SUMMARY OF LIGHTNING, 1989

JAY HOLLIFIELD
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER

Sixty-seven people were killed by lightning in the United Stated during 1989, which was 29 percent below the national average of 95 deaths. There were 322 injuries which was 25 percent above the national average of 258. Locations and percentage frequency of lightning deaths and injuries are depicted in the following two figures for 1989, and for the period 1959-1989:

FIGURE 1A - Lightning Deaths

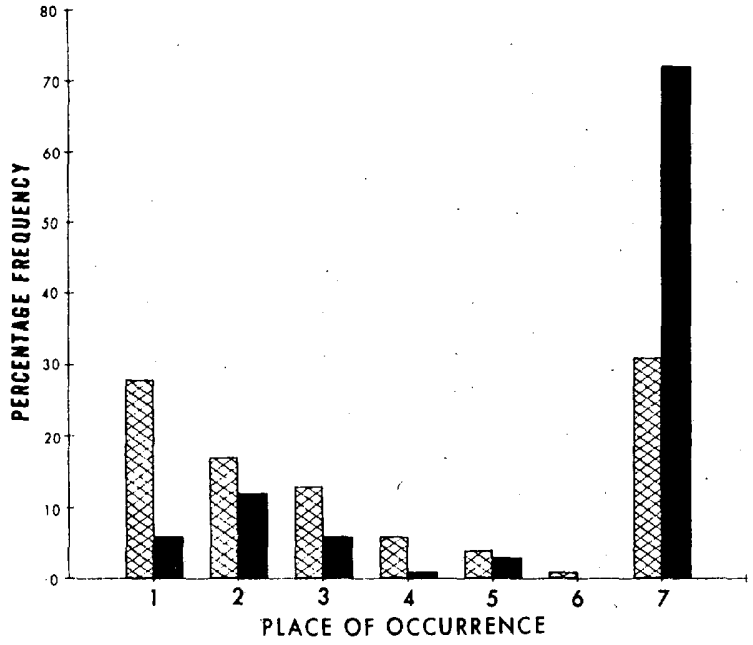
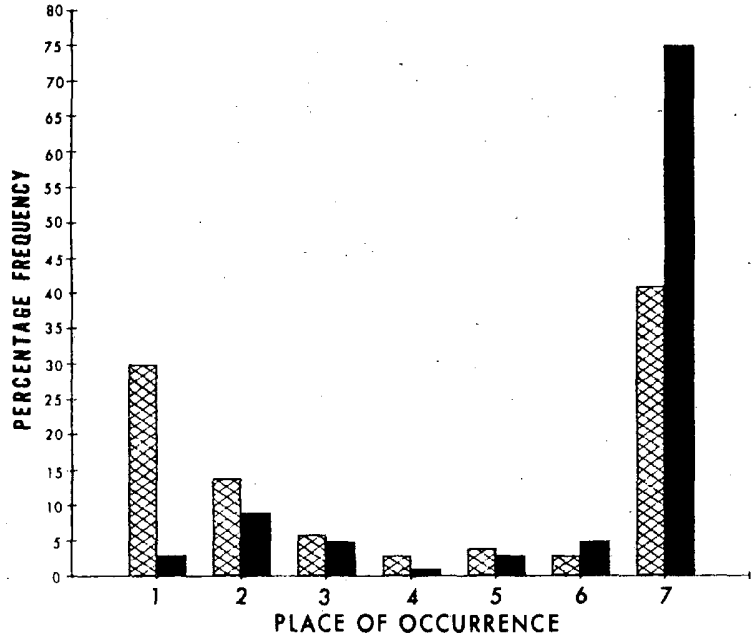


FIGURE 1B - Lightning Injuries



LEGEND

1959-1989

1989

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

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

JANUARY: Lightning severed a power line in Lockport, NY. A 9-year-old boy was knocked to the ground by a bolt of lightning outside of his home in Harris County, TX. He was taken to a hospital for observation. He suffered only a slight burn on his cheek.

FEBRUARY: Lightning struck a Manhattan Beach, CA, home. The bolt apparently followed piping down through the walls, shattering a bathroom window and blowing holes in the stucco on both sides of the house. No one was injured. Lightning started a fire in Gaskin, FL that destroyed a shed and its contents worth $7,000.

MARCH: Two construction workers were injured when a nearby lightning strike knocked them from a building beam in Palm Beach County, FL. A lightning bolt struck the anemometer outside the National Weather Service office in Jackson, MS, and followed a cable into the building. One person received a minor jolt to the foot and another was injured while talking on the telephone. The strike reached into other lines in the building and caused around $100,000 in damage. Lightning struck a tree and a house in Ford's Colony, VA. It narrowly missed but slightly injured a 16-year-old who was in his bedroom; the room was extensively damaged. A horse was struck and killed at a nearby stable.

APRIL: A 9-year-old boy was fatally injured while riding his bicycle in Lakeland, FL. A 35-year-old female was injured while talking on the telephone in Tallahassee, FL. The lightning struck an outside wire then jumped into the telephone line. A fire was started by lightning that burned 4,800 acres of forest and rangeland from the Nebraska National Forest to just west of Dunning in Blaine County, NE. A 28-year-old man was struck and seriously injured by lightning while cutting wood in a rural area of southwest Yadkin County in North Carolina . A 13-year-old boy was slightly injured when lightning struck the ground near him in an open school yard in Portland, OR. At about the same time, a Horizon Commuter Airline plane was struck several times by lightning at 3,500 feet MSL while on its final approach to Portland Airport. Lightning struck on the campus of San Antonio College and slightly injured a woman who lost consciousness when lightning struck the umbrella she was holding. She was treated at the student health center and released. The same lightning bolt struck a nearby chimney of a building and scattered brick and debris. Some of the flying brick broke nearby windows. There were students walking in the area, but no one else was hurt. In another incident in San Antonio, TX, a bolt of lightning struck in the yard of a residence and slightly injured two boys. They were treated at the scene by EMS personnel and released. The boys said they were knocked down by the lightning and thrown 10 feet.

MAY: A 25-year-old man was killed by lightning on a lot next to a building on the north side of Birmingham, AL. An umbrella was found next to the man's body. An elderly woman was injured by lightning while sitting in her house in Texarkana, AR. The lightning apparently came through a vent to a gas wall heater. The woman was hospitalized for three days and then returned home to complete her recovery. Near Ocala, FL, a 12-year-old girl was killed and her mother injured when lightning struck the girl in the neck. The two were at the edge of a lake in a wooded area. A 9-year-old boy was injured when lightning struck him between his shoulder blades while sitting at his dining room table in Leesburg, FL. The bolt tore a 4-foot hole in the ceiling. A 39-year-old man was struck and killed by lightning while outside in Greenfield, IA. Lightning killed a 17-year-old male as his baseball team was leaving the practice field at Pecos, NM. Lightning struck and killed two men softball players as they sought shelter from a thunderstorm under a tree in Randolph, NY. Four other players who ran under the tree were treated for shock and minor injuries. Lightning killed one man and injured another in a boat on Rocky Fork Lake in Highland County, OH. Lightning struck a girl working a restaurant drive-in window in Barnwell County, SC. A woman was injured when lightning struck a nearby tree and then struck her while she was walking the Appalachian Trail near Clingman Dome in Sevier County, TN. Lightning struck and seriously injured a 12-year-old boy as he and his baseball team were heading for shelter in Walla Walla, WA.

JUNE: Two men were struck by lightning while standing inside a two-story open barn in Baldwin County, AL. One man was killed and one was slightly injured. Fourteen pregnant cows were killed by a lightning strike two miles north of Subiaco, AR. One soldier was killed and 12 others injured by lightning strikes while outside on a training exercise at Fort Chaffee, AR. Three lightning strikes injured five people in the area of Colorado Springs, CO. Two men were struck while in the back of a pickup truck at the Air Force Academy. One suffered a shattered ear drum and a burned eye. Another man was struck while training at Fort Carson, CO. Two 10-year-old girls were slightly injured at a window while watching a thunderstorm when lightning struck their house in El Paso County, CO. Lightning injured a 17-year-old boy and a girl of the same age; as they sat under a tree which was struck in Greely, CO. They were hospitalized with burns on their legs; the boy's shoe was split open. Three men were injured by lightning as they sat under a tree that was struck in Wilmington, DE. A sailor was injured by a lightning strike in Jacksonville, FL that also knocked bricks onto a car. A 12-year-old boy was critically injured by lightning after taking cover under a tree in Orlando, FL. A show horse valued at $3,700 was killed by lightning in Floral City, FL. One construction worker was killed and another critically injured by lightning while working on the roof of a house in Boca Raton, FL. A rural Hamilton, IL man was hit by lightning. Lightning struck four people in Lansing, IA. One died and three others were injured. A woman was struck and killed instantly by lightning near Junction City, KS when she got out of her car to take a picture of an approaching thunderstorm. The lightning struck her on the top of the head then exited from her waist. A man was killed in Hart County, KY by lightning as he worked on a car in a metal building. A 39-year-old man in Russell County, KY was struck and killed by lightning as he looked out of a house during a thunderstorm. A couple under a tree at the edge of Balker Lake Near Delton, MI was killed by lightning. A 38-year-old man was struck by lightning in Roswell, NM and died four days later. Two males were struck by lightning at Hickory Park in the town of Owego, NY. They were in the process of setting up a tent when the storm hit. A tree under which they sought shelter was hit by lightning. One of the men was killed. Five persons were injured in Chenango County, NY when they were hit by lightning. One male required CPR in order to be revived. Lightning struck a tree in Red Bud, NC and traveled along the ground where a 32-year-old man was standing. He was knocked unconscious and his heart stopped beating. He was revived by CPR and hospitalized. Also, in North Carolina, a 40-year-old

man fell to his death after he was struck by lightning at an overlook on Grandfather Mountain. Three people who sought shelter in a metal shed on Wadmalaw Island, SC were injured when lightning struck the shed. An 11-year-old boy was struck by lightning while climbing over a fence in Abbeville, SC. Lightning current that surged through a telephone line in Emporia, VA injured an 18-year-old girl talking on the telephone.

JULY: A 13-year-old girl received minor injuries when her home in Cottonwood, AL was struck by lightning. The lightning came into the house through an outside antenna. The lightning left two burn holes in a mirror and through the wall of the basement behind the mirror. The girl was standing in front of the mirror when the lightning bolt came in, striking her on the arm. A truck driver in Flagstaff, AZ was struck and killed instantly by lightning while standing on the flatbed of a semitrailer. A woman was seriously injured when lightning struck a home in Cabot, AR. The surge apparently struck the woman through the kitchen stove. Four miles northwest of Bryant, AR, a man was killed while working on a bulldozer which was struck by lightning. Two men were injured when struck by lightning while fishing on White Oak Lake in Nevada County, AR. Lightning struck a tree then jumped to a metal building striking and killing a 14-year-old male who was camping with a church group in Butte Meadows, Butte County, CA. A man was killed; two women were injured and had to be hospitalized; another man was briefly stunned by a bolt of lightning atop Hahns Peak, about 20 miles north of Steamboat Springs, CO. Lightning killed two men in Arvada, CO who were taking wash from a clothesline when a bolt hit the older man, 39, killing him instantly. The bolt then traveled along the line, which was stretched between two tall trees, and hit his 26-year-old brother who died the next day. Four persons in a speed boat on Doctors Lake, Clay County, FL were injured when lightning struck the water nearby. A stewardess was injured by a nearby lightning strike while escorting passengers to the Jacksonville, FL airport terminal. Twenty miles northwest of Tampa, two construction workers were thrown 4 feet into the air by a nearby lightning strike. An 11-year-old boy sitting on a metal stool in a kitchen was struck by a bolt of lightning that came through an open window in Titusville, FL. A woman out for a walk was killed by lightning at Hialeah Race Track in Florida. A 15-year-old boy playing outside was killed by lightning in Gainsville, FL. Sixty-seven beef cows were killed when they huddled underneath a tree to avoid small hail in Jones County, GA. Lightning struck the tree and dispersed into the ground. The cows, valued over $40,000, were not burned; the surge of electricity burst their hearts. Lightning struck a family of three outside their apartment complex in Woodridge, IL. The wife was critically injured, but made a full recovery. The husband and wife were carrying umbrellas when the lightning struck. Their 4-year-old son was also injured. Lightning struck a telephone pole just outside of a house in a New Virginia, IA. A girl talking on the telephone was injured as the lightning traveled through the telephone. A 22-year-old soldier was killed by lightning at Fort Knox, KY. Two soldiers at Fort Polk, LA, were injured when lightning struck the tent they were occupying. Both suffered entrance and exit burns, and one was rendered unconscious. The soldiers were hospitalized for three days then returned to duty. Four miles west of Crawford, NE, fire ignited by lightning ravaged 100,000 acres of park and private lands. The burn area extended about 15 miles to the west or about 10 miles east of Harrison and was about 11 miles wide. Seven farm and ranch buildings were damaged or destroyed. A fire started by a lightning strike destroyed a barn and 70 hogs 7 miles southwest of Carroll, NE. A man was struck by lightning as he was cutting timber 15 miles northeast of Cuba, NM. In another incident in New Mexico, lightning struck and injured two boys ages 6 and 8 who were playing in their yard. CPR administered by a mother and a neighbor saved their lives. Thirteen persons were injured by a lightning strike in the village of Deposit, NY at the village reservoir on Reservoir Road. Only one person required overnight medical attention. All the victims were in a tent at the time of the lightning strike. Lightning killed a road painter while working on the New York State Thruway in Glen, NY. The resulting bolt dug a 6-inch deep hole into the road surface. One mile northeast of Wishek, ND, two brothers, ages 12 and 19, were struck by lightning while operating separate combines in a open field. The youths were about 100 yards apart when the lightning struck. They were not seriously injured. Lightning struck a tree and traveled into a house where it struck a 15-year-old girl in Lorain County, OH. Lightning also injured a golfer at the Pine Brook County Club in Eaton Township, in Lorain County, OH. Three other golfers were injured by lightning at the Paradise Lake County Club in Suffield, Stark County, OH. Three persons were injured by lightning while outdoors at a fair 20 miles north of Butler, PA. A woman was seriously injured in Germantown, TN, when struck by lightning while walking to her mailbox during a thunderstorm. A man was killed in Gallatin, TN while standing under a tree on a golf course. The man had gone under a tree to seek shelter from heavy rain and a thunderstorm when lightning struck the tree. A bolt of lightning killed 20 cows huddled under a tree at a ranch 10 miles south of Eastland, TX. A bolt of lightning killed 9 dairy cows 2 miles east of Mount Vernon, TX. A man and woman were struck by lighting while fishing at Pass Lake in Duchesne County, UT. The man later died as a result of a cardiac arrest, but the woman sustained only minor burns and recovered fully. Thirty people were injured by lighting, but only three seriously while attending the Salem Fair in Salem, VA. An electrical storm was described as more than an hour of almost continuous lightning in Accomac County, VA. Two buildings, a home in Lee Mont and a historic former Coast Guard station on Parramore Island, VA were destroyed by fires ignited by lightning strikes. A mother and daughter were injured when lightning struck their home in Greenbush, VA.

AUGUST: A 34-year-old man working on the roof of a house in Telluride, CO was hit in the right hip by lightning. The bolt disintegrated his right pant leg and knocked him off the roof. The owner of the house, a doctor, administered CPR on the spot and probably saved the man's life. He suffered burns and a broken pelvis. Lightning killed a man and injured his nephew when it hit a tree they were walking under in the foothills about 5 miles west of Boulder, CO. A 23-year-old woman was seriously injured by lightning while backpacking. She suffered 6 wounds on her legs and back, and third degree burns on her feet. The lightning hit her metal frame backpack, entered her body at each spot where the pack frame touched her, and traveled down her leg. After being temporarily paralyzed, she crawled for two hours to a road and received help. The incident occurred at Red Feather Lakes, Larimer County, CO. Lightning struck four golfers at the Carriage Greens Country Club in Darien, IL. One person died two days later from the injury. The foursome was under an umbrella mounted on a handpulled golf cart when the lightning struck. Three golfers were struck by lightning as they huddled under

a large oak tree at Arrowhead Golf Club in Wheaton, IL. Seven persons were injured by lightning while attending a picnic at a forest preserve in North Riverside, IL. They were gathered around picnic tables that were between two tall trees. Near Chase, IL, lightning set fire to a rural farm home. Two people died in the fire that destroyed the home. Lightning caused a fire that totally destroyed a house four miles south of Cottonwood Falls, KS. A man and his wife were killed in the fire. An 11-year-old boy was struck and killed by lightning at Silver Pond, Whitley County, KY. A 16-year-old girl in Lexington, KY, was struck and killed by lightning while raking leaves in her yard. A woman in Willisburg, KY, was struck and killed by lightning while trying to cover articles on a clothesline. Lightning struck a boat on the Tickfaw River, Killian, LA, knocking two of the four occupants into the river. One of the victims was pulled from the river unconscious and responded to CPR treatment, but died the following day. The other victim's body was not recovered until the following day. Drowning was listed as the cause of death in both instances, though the lightning strike precipitated the drownings. The two other boat occupants were not injured. Lightning struck a trailer, or one of the electrical wires leading into the trailer in Springfield, LA and electrocuted a man leaning against one of the metal walls. Investigators found the electrical system not grounded. Lightning struck a home in the town of Veazie, ME, causing damage to the portions of the interior. The same bolt struck an elderly woman in the house causing injury to the head area. The injury was not life threatening and she recovered rapidly. A jogger was hit by lightning and knocked unconscious in Newton, MA. His life was saved when he was resuscitated by a passerby. Soccer players took refuge from the rain under a tree in Ann Arbor, MI. Four were hospitalized with injuries after lightning struck the tree. One of the men later died. Lightning struck and killed two men sitting on metal lounge chairs in Sardis Lake Dam, Pinola County, MS. Two people were struck by lightning in Taos County, NM; one was knocked unconscious, the other received burns on 5% of his body. Lightning started a prairie fire that burned 1,000 acres of grassland and trees in McKenzie County, ND. Lightning struck three people in a parking lot at Kings Island Amusement Park, near Foster, in Warren County, OH. One man died and two men were injured. A teenage boy was killed by lightning while cutting tobacco in a field near Baxter, TN. A Preston County, WV boy was struck and killed and another person was injured by lightning as his football practice was ending.

SEPTEMBER: Lightning struck and killed a high school football player after practice in Cape Coral, FL. A 54-year-old man was injured by lightning while on a lawn mower in Spring Hill, FL. A 10-year-old boy was struck by lightning in Baldwin, KS while he was walking home from school. His hands were clinched and his legs shook for a few seconds after being struck. He also complained that the back of his head hurt for more than an hour, but suffered no other injury. A man was struck and killed by lightning while dove hunting 3 miles southwest of Cleveland, MS. A policeman and a dispatcher suffered minor injuries when lightning struck the Apache Police Station in Apache, OK. Lightning struck two men who were pouring cement in Ashland, OR. They were both knocked to the ground with a strong shock but survived with only minor injuries.

OCTOBER: A South Windsor, CT teenager was slightly injured by a bolt of lightning while standing under a tree. A man was seriously injured when struck by lightning in Ledgard, CT. Lightning struck a DC-9 aircraft at Orlando International Airport in Florida killing a ground crewman standing near the nose of the aircraft. A man in a boat was injured when lightning struck nearby mangrove plants in Venice, FL. Lightning left a family of three seriously injured when it struck near their apartment in Woodridge, IL. The three were apparently carrying open umbrellas when the lightning struck.

NOVEMBER: A lightning initiated fire completely destroyed an unoccupied $200,000 house in Citrus County, FL. Lightning also started a fire which destroyed a boat, two cars, and a carport in the same county. A fire started by a lightning strike heavily damaged Hathaway High School, Hathaway, LA. A man was injured in Marengo, Morgan County, OH, when he was struck by lightning. A man was struck and injured by lightning near Joanna, SC.

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 1959-1989. 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 1989

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	0	1	1	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	2	0	0	0	0	0	2
ARKANSAS	0	0	0	0	0	1	1	0	0	0	0	0	2
CALIFORNIA	0	0	0	0	0	0	1	0	0	0	0	0	1
COLORADO	0	0	0	0	0	0	3	1	0	0	0	0	4
CONNECTICUT	0	0	0	0	0	0	0	0	0	0	0	0	0
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	1	1	1	2	1	2	1	0	0	9
GEORGIA	0	0	0	0	0	0	0	0	0	0	0	0	0
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	1	0	1	0	0	0	0	2
INDIANA	0	0	0	0	0	0	0	0	0	0	0	0	0
IOWA	0	0	0	0	1	1	0	0	0	0	0	0	2
KANSAS	0	0	0	0	0	1	0	4	0	0	0	0	5
KENTUCKY	0	0	0	0	0	2	1	3	0	0	0	0	6
LOUISIANA	0	0	0	0	0	0	0	1	0	0	0	0	1
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	1	0	0	0	0	0	1
MICHIGAN	0	0	0	0	1	2	0	1	0	0	0	0	4
MINNESOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
MISSISSIPPI	0	0	0	0	0	0	0	2	1	0	0	0	3
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	0	0	0	0	0	0	0	0
NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW HAMPSHIRE	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW JERSEY	0	0	0	0	0	0	1	0	0	0	0	0	1
NEW MEXICO	0	0	0	0	1	1	0	0	1	0	0	0	3
NEW YORK	0	0	0	0	2	1	1	0	0	0	0	0	4
NORTH CAROLINA	0	0	1	0	0	1	2	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	0	0	0	0	0	0
OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	0	0	0	0	0	0	0	0	0	0	0	0	0
PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0
RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	0	0	0	0	0	0	1	1	0	0	0	0	2
SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
TENNESSEE	0	0	0	0	0	0	1	1	0	0	0	0	2
TEXAS	0	0	0	0	1	1	0	0	0	0	0	0	2
UTAH	0	0	0	0	0	0	2	0	0	0	0	0	2
VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0	0	1	0	0	0	0	1
WISCONSIN	0	0	0	0	0	0	0	0	0	0	0	0	0
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	0	0	1	1	9	14	19	18	4	1	0	0	67

TOTAL INJURIES BY STATE AND NATION FOR YEAR 1989

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	0	1	4	1	0	0	0	0	0	6
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	0	0	0	2	0	0	0	0	2
ARKANSAS	0	0	0	0	1	13	3	0	0	0	0	0	17
CALIFORNIA	0	0	0	0	0	0	0	0	0	0	0	0	0
COLORADO	0	0	0	0	1	9	4	3	1	0	0	0	18
CONNECTICUT	0	0	0	0	0	0	3	0	0	2	0	0	5
DELAWARE	0	0	0	0	0	3	2	0	0	0	0	0	5
DISTRICT OF COLUMBIA	0	0	0	0	0	0	0	0	0	0	0	0	0
FLORIDA	0	0	2	3	2	4	19	5	5	1	0	0	41
GEORGIA	0	0	0	3	1	0	1	0	0	0	0	0	5
HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0
IDAHO	0	0	0	0	0	0	0	1	0	0	0	0	1
ILLINOIS	0	0	0	0	0	3	3	16	0	0	0	0	22
INDIANA	0	0	0	0	0	0	1	0	0	0	0	0	1
IOWA	0	0	0	2	0	3	1	0	0	0	0	0	6
KANSAS	0	0	0	1	1	0	3	1	1	0	0	0	7
KENTUCKY	0	0	0	0	0	1	0	0	0	0	0	0	1
LOUISIANA	0	0	0	0	0	0	2	0	0	0	0	0	2
MAINE	0	0	0	0	0	0	0	1	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	0	0	1	0	0	0	0	1
MICHIGAN	0	0	1	0	2	6	0	5	0	0	0	0	14
MINNESOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
MISSISSIPPI	0	0	2	0	0	0	2	0	0	0	0	0	4
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	0	0	0	0	0	0	0	0
NEW HAMPSHIRE	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW JERSEY	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW MEXICO	0	0	0	0	0	0	3	2	0	0	0	0	5
NEW YORK	0	0	0	0	7	8	15	0	0	1	0	0	31
NORTH CAROLINA	0	0	2	1	0	5	6	2	0	0	0	0	16
NORTH DAKOTA	0	0	0	0	0	0	2	0	0	0	0	0	2
OHIO	0	0	0	0	1	1	5	4	0	0	1	0	12
OKLAHOMA	0	0	0	0	1	0	0	0	2	0	0	0	3
OREGON	0	0	0	1	0	0	0	0	2	0	0	0	3
PENNSYLVANIA	0	0	0	0	0	1	3	0	0	0	0	0	4
PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0
RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	0	0	0	0	1	6	4	5	0	0	1	0	17
SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0
TENNESSEE	0	0	0	0	1	0	7	2	0	0	0	0	10
TEXAS	1	0	0	3	0	0	0	0	0	0	0	0	4
UTAH	0	0	0	0	0	0	1	0	0	0	0	0	1
VERMONT	0	0	0	0	0	0	1	0	0	0	0	0	1
VIRGINIA	0	0	1	0	0	2	35	0	1	0	0	0	39
WASHINGTON	0	0	0	0	1	0	0	0	0	0	0	0	1
WEST VIRGINIA	0	0	0	1	0	0	0	1	0	0	0	0	2
WISCONSIN	0	0	0	1	2	0	7	0	0	0	0	0	10
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	1	0	8	16	23	70	135	51	12	4	2	0	322

TOTAL DEATHS BY STATE AND NATION FOR PERIOD 1959-89

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	2	2	5	22	26	18	1	1	0	0	77
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	2	1	19	15	11	1	0	0	49
ARKANSAS	0	0	8	0	13	31	28	20	4	0	0	0	104
CALIFORNIA	0	0	0	0	0	2	7	5	3	0	0	0	17
COLORADO	0	0	0	2	10	19	36	16	0	1	0	0	84
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	4	24	70	80	73	37	4	1	1	298
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	23	12	13	10	2	0	0	73
INDIANA	0	0	1	2	7	21	15	12	5	2	0	0	65
IOWA	0	0	1	3	11	19	6	13	4	4	0	0	61
KANSAS	0	0	0	4	10	6	14	12	4	2	2	0	54
KENTUCKY	1	0	0	3	9	21	17	14	10	0	0	0	75
LOUISIANA	0	0	1	5	10	20	40	16	11	0	3	1	107
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	6	9	1	0	0	0	24
MICHIGAN	0	0	0	1	7	24	27	22	7	0	0	0	88
MINNESOTA	0	0	0	3	3	10	11	13	10	1	0	0	51
MISSISSIPPI	1	0	4	2	12	11	26	21	6	0	0	0	83
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	22	14	6	0	0	0	54
NEW MEXICO	0	0	0	1	5	11	23	29	5	0	0	0	74
NEW YORK	0	0	0	0	9	19	59	26	5	2	0	0	120
NORTH CAROLINA	0	1	5	3	23	33	51	34	4	0	0	0	154
NORTH DAKOTA	0	0	0	0	0	4	4	3	0	0	0	0	11
OHIO	0	0	0	3	10	22	40	17	8	2	2	0	104
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	31	13	7	0	0	0	69
SOUTH DAKOTA	0	0	0	0	4	1	6	1	3	3	0	0	18
TENNESSEE	0	1	1	7	14	31	24	19	14	2	3	0	116
TEXAS	0	0	0	14	27	17	39	21	15	7	1	0	141
UTAH	0	0	0	3	1	5	7	6	2	1	0	0	25
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	3	1	0	0	0	18
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	36	89	317	619	852	623	244	50	15	84	2936

* 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 1959-89

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	6	1	10	3	8	23	57	44	2	4	0	0	158
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	2	0	0	0	6	1	28	24	17	3	0	0	81
ARKANSAS	1	2	2	11	30	37	37	59	10	1	0	1	191
CALIFORNIA	1	0	0	13	0	2	15	7	1	1	1	1	42
COLORADO	0	0	0	1	28	65	67	49	9	0	0	0	219
CONNECTICUT	0	0	2	0	7	19	17	11	6	2	0	0	64
DELAWARE	0	0	0	0	8	12	3	2	2	0	0	0	27
DISTRICT OF COLUMBIA	0	0	0	0	0	4	1	1	0	0	1	0	7
FLORIDA	0	2	17	15	30	184	206	184	146	28	0	1	813
GEORGIA	0	0	5	7	22	65	117	33	3	5	0	0	257
HAWAII	0	0	0	0	0	0	0	1	0	0	0	0	1
IDAHO	0	0	0	1	6	17	15	18	4	1	0	0	62
ILLINOIS	0	0	0	2	16	42	62	48	28	2	0	0	200
INDIANA	0	0	2	4	21	32	29	24	1	0	0	0	113
IOWA	0	0	2	9	22	44	40	18	16	3	1	0	155
KANSAS	0	0	5	11	18	23	44	31	29	5	1	0	167
KENTUCKY	0	0	0	2	20	60	59	35	10	1	0	0	187
LOUISIANA	1	0	6	2	13	13	97	38	14	2	2	1	189
MAINE	0	0	0	0	4	5	25	51	0	0	1	0	86
MARYLAND	0	0	0	0	35	17	35	20	6	2	0	0	115
MASSACHUSETTS	0	0	1	11	20	44	108	75	26	4	2	1	292
MICHIGAN	0	0	2	9	39	141	127	199	47	6	0	0	570
MINNESOTA	0	0	0	0	15	17	22	19	9	4	0	0	86
MISSISSIPPI	1	2	6	3	13	13	106	40	10	2	3	1	200
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	7	9	16	6	0	0	0	56
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	57	51	6	0	0	0	149
NEW YORK	0	0	0	1	17	63	145	127	24	4	1	0	382
NORTH CAROLINA	0	2	29	14	40	74	116	111	25	2	1	0	414
NORTH DAKOTA	0	0	0	0	2	0	2	5	4	0	0	0	13
OHIO	0	0	32	3	55	52	62	106	49	4	12	0	375
OKLAHOMA	1	1	3	14	32	38	33	37	23	19	5	2	208
OREGON	0	0	0	1	2	2	0	9	5	0	0	0	19
PENNSYLVANIA	0	6	0	0	22	113	117	134	41	2	0	0	435
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	21	22	98	34	20	1	1	0	200
SOUTH DAKOTA	0	0	0	1	4	18	15	9	1	2	0	0	50
TENNESSEE	0	1	4	6	31	52	109	52	20	4	0	0	279
TEXAS	1	2	5	39	43	47	37	42	30	10	2	0	258
UTAH	0	0	0	1	4	18	17	14	4	2	0	0	60
VERMONT	0	0	0	0	0	3	11	2	0	0	0	0	16
VIRGINIA	0	0	1	2	8	17	86	30	7	0	0	0	151
WASHINGTON	0	0	0	0	5	1	7	8	0	1	0	1	23
WEST VIRGINIA	0	0	0	1	0	3	23	26	1	1	0	0	55
WISCONSIN	0	1	2	4	18	26	59	30	7	2	2	0	151
WYOMING	0	0	0	0	4	32	18	21	6	0	0	0	81
TOTAL: UNITED STATES	14	23	139	207	755	1553	2451	1960	703	133	41	9	7988

NATIONAL TOTAL DEATHS BY YEAR FOR PERIOD 1959-89

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
1989	0	0	1	1	9	14	19	18	4	1	0	0	67
TOTAL	3	4	36	89	317	619	852	623	244	50	15	84	2936
MEAN	0	0	1	3	10	19	27	20	8	2	0	3	95

* 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 1959-89

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
1989	1	0	8	16	23	70	135	51	12	4	2	0	322
TOTAL	14	23	139	207	755	1553	2451	1960	703	133	41	9	7988
MEAN	0	1	4	7	24	50	79	63	23	4	1	0	258

LIGHTNING DEATHS BY STATE, RANK, AND LOCATION OF OCCURRENCE

		1959-1989													1989											
	RANK	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	
STATE		NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
ALABAMA	15	19	25	17	22	8	10	4	5	1	1	2	3	26	34											2	100
ALASKA	52																										
ARIZONA	26	21	43	6	12	5	10			3	6	3	6	11	22											2	100
ARKANSAS	8	34	33	19	18	11	11	8	8	3	3			29	28											2	100
CALIFORNIA	40	5	29	3	18	2	12	1	6					6	35											1	100
COLORADO	14	43	49	18	22	4	5	3	4	5	6			11	14											4	100
CONNECTICUT	42	3	23	2	16					3	23			5	38												
DELAWARE	43	4	36			4	36	1	9					2	18												
DISTRICT OF COLUMBIA	48	1	25	2	50					1	25																
FLORIDA	1	84	28	38	13	74	25	20	7	9	3			73	24	1	11							1	11	7	78
GEORGIA	20	20	27	19	26	11	15	1	1	5	7	2	3	15	21												
HAWAII	51																										
IDAHO	36	11	58	3	16	2	11	2	11	1	5																
ILLINOIS	17	16	22	12	16	3	4	7	10	7	10	1	1	27	37									1	50	1	50
INDIANA	22	9	14	19	29	5	8	6	9	1	2	2	3	23	35												
IOWA	23	8	13	8	13	1	2	5	8	2	3			37	61											2	100
KANSAS	25	15	28	1	2	4	7	10	19	2	4			22	41											5	100
KENTUCKY	16	21	28	10	13	4	5	3	4	1	1	1	1	35	47											6	100
LOUISIANA	7	15	14	30	29	34	32	8	7					20	19											1	100
MAINE	39			2	12	6	35							9	53												
MARYLAND *	6	9	8	5	5	13	12							84	76												
MASSACHUSETTS	33	4	17	3	13	1	4			1	4	1	4	14	58											1	100
MICHIGAN	11	24	27	23	26	10	11	2	2	10	11	2	2	17	20			3	75	1	25						
MINNESOTA	27	16	31	14	27	3	6	6	12	1	2	2	4	9	18												
MISSISSIPPI	12	29	35	19	23	9	11	5	6					21	25											3	100
MISSOURI	18	16	22	16	22	10	14	5	7	3	4	2	3	21	29												
MONTANA	35	7	37	2	11	2	11	4	21					4	21												
NEBRASKA	30	16	44	2	6	3	8	9	25					6	17												
NEVADA	49					1	25							3	75												
NEW HAMPSHIRE	46	2	33			1	17			1	17			2	33												
NEW JERSEY	24	18	33	5	9	13	24	2	4	4	7	2	4	10	19											1	100
NEW MEXICO	19	35	47	13	18	6	8			1	1			19	26	1	33									2	67
NEW YORK	5	20	17	31	26	16	13	4	3	5	4	1	1	43	36			3	75							1	25
NORTH CAROLINA	2	34	22	20	13	20	13	6	4	5	3	1	1	68	44	1	25			1	25					2	50
NORTH DAKOTA	44	2	18					3	27					6	55												
OHIO	9	33	32	19	18	15	14	4	4	7	7	1	1	25	24					1	50					1	50
OKLAHOMA	13	30	37	11	14	14	17	5	6	1	1	2	3	18	22												
OREGON	45	3	50											3	50												
PENNSYLVANIA	10	30	31	11	11	3	3	3	3	11	11	1	1	38	39												
PUERTO RICO	31	11	39	8	29	1	4							8	29												
RHODE ISLAND	47					1	25							3	75												
SOUTH CAROLINA	21	15	22	14	20	6	9	7	10	1	1	3	4	23	33											2	100
SOUTH DAKOTA	38	5	28	1	6	2	11	8	44	1	6			1	6												
TENNESSEE	4	32	28	31	27	8	7	9	8	7	6	2	2	27	23			1	50			1	50				
TEXAS	3	62	44	24	17	20	14	5	4	4	3			26	18											2	100
UTAH	32	11	44	6	24	2	8			1	4	1	4	4	16					1	50					1	50
VERMONT	41	1	8	1	8	4	31							7	54												
VIRGINIA	28	8	19	9	21	5	12	3	7	2	5			15	36												
WASHINGTON	50	1	100																								
WEST VIRGINIA	37	6	33	2	11	2	11			1	6			7	39	1	100										
WISCONSIN	29	7	16	3	7	9	21	4	9	6	14			14	33												
WYOMING	34	11	52	2	10	3	14	1	5					4	19												
UNITED STATES		827	28	504	17	381	13	174	6	117	4	32	1	901	31	4	6	7	12	4	6	1	1	2	3	49	72

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

LIGHTNING INJURIES BY STATE, RANK, AND LOCATION OF OCCURRENCE

1959-1989 | 1989

STATE	RANK	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	33	22	14	3	2	1	1	1	1	10	6	69	44													6	100
ALASKA	52																												
ARIZONA	32	48	59	5	6	2	2	5	6	1	1			20	25													2	100
ARKANSAS	16	42	22	25	13	12	6	7	4	4	2	11	6	90	47					2	12					1	6	14	82
CALIFORNIA	42	10	24	10	24	5	12							17	40														
COLORADO	14	92	42	18	8	15	7	6	3	16	7	3	1	69	32			2	11							1	6	15	83
CONNECTICUT	34	6	9	22	34	4	6			3	5	3	5	26	41			1	20	3	60							1	20
DELAWARE	43	8	30	10	37					1	4	2	7	6	22			3	60									2	40
DISTRICT OF COLUMBIA	48	1	14	3	43			1	14	1	14			1	14														
FLORIDA	1	276	34	83	10	115	14	23	3	30	4	21	3	265	33			2	5	5	12			2	5	1	2	31	76
GEORGIA	10	95	37	33	13	14	5	3	1	21	8	4	2	87	34													5	100
HAWAII	51	1	100																										
IDAHO	33	9	15	7	11	2	3	2	3	2	3	4	6	36	58													1	100
ILLINOIS	12	72	36	55	28			5	3	16	8	7	4	45	22			10	45					1	5	3	14	2	9	6	27
INDIANA	26	16	14	26	23	12	11	3	3	8	7	3	3	45	40															1	100
IOWA	21	27	17	20	13	1	1	1	1	2	1	2	1	102	66											1	17	5	83
KANSAS	19	26	16	14	8	2	1	7	4	10	6	7	4	101	60	3	43									2	29	2	29
KENTUCKY	18	55	29	23	12	7	4	3	2	11	6	7	4	81	43													1	100
LOUISIANA	17	94	49	30	16	18	9	4	2			2	1	41	22													2	100
MAINE	28	3	3	31	36	3	3			1	1	1	1	47	55													1	100
MARYLAND *	25	45	39	16	14	15	13	4	3	3	3	1	1	31	27													1	100
MASSACHUSETTS	7	58	20	12	4	9	3	5	2	2	1	5	2	201	69													1	100
MICHIGAN	2	219	38	99	17	26	5	13	2	30	5	17	3	166	29			4	29							1	7	9	64
MINNESOTA	29	14	16	14	16	6	7	1	1	8	9	11	13	32	37														
MISSISSIPPI	13	71	35	38	19	27	13	2	1	4	2	11	5	48	24											2	50	2	50
MISSOURI	31	23	30	16	21	1	1	1	1	1	1	3	4	31	41														
MONTANA	41	14	38	5	14	3	8	1	3	3	8			11	30														
NEBRASKA	36	21	38	1	2			5	9	5	9	5	9	19	34													1	100
NEVADA	49	2	40	1	20									2	40														
NEW HAMPSHIRE	35	11	19	1	2					4	7			43	73														
NEW JERSEY	27	49	47			8	8	1	1	5	5	2	2	39	38														
NEW MEXICO	24	93	62	21	14	2	1	3	2	3	2	1	1	26	17													5	100
NEW YORK	6	44	12	81	21	20	5	22	6	6	2	9	2	200	52			5	16									26	84
NORTH CAROLINA	3	137	33	34	8	23	6	9	2	21	5	7	2	183	44	2	13	1	6	2	13							11	69
NORTH DAKOTA	47	5	38	1	8	1	8	2	15			1	8	3	23													2	100
OHIO	5	90	24	80	21	10	3	4	1	32	9	11	3	148	39					1	8			4	33	1	8	6	50
OKLAHOMA	11	78	38	12	6	9	4	10	5	5	2	16	8	78	38													3	100
OREGON	45	6	32					1	5			1	5	11	58	1	33											2	67
PENNSYLVANIA	4	153	35	19	4	5	1	2	1	9	2	4	1	243	56													4	100
PUERTO RICO	50	1	17	1	17									4	67														
RHODE ISLAND	40	9	20	15	34					2	5			18	41														
SOUTH CAROLINA	15	56	28	9	5	10	5	7	4	2	1	5	3	111	56			1	6									16	94
SOUTH DAKOTA	39	10	20	5	10	2	4	9	18			1	2	23	46														
TENNESSEE	8	88	32	80	29	4	1	7	3	8	3	11	4	81	29									1	10			7	70
TEXAS	9	109	42	36	14	32	12	4	2	4	2	3	1	70	27													4	100
UTAH	38	24	40	11	18	3	5	1	2	4	7	3	5	14	23					1	100								
VERMONT	46	4	25	1	6									11	69													1	100
VIRGINIA	22	14	9	35	23	7	5	1	1	7	5	3	2	84	56											1	3	38	97
WASHINGTON	44	3	13	4	17							2	9	14	61	1	100												
WEST VIRGINIA	37	15	27	9	16	3	5	1	2	2	4	1	2	24	44	1	50											1	50
WISCONSIN	23	57	38	8	5	4	3	3	2	6	4	5	3	68	45									2	20			8	80
WYOMING	30	39	48	3	4	13	16	8	10	4	5			14	17														
UNITED STATES		2495	31	1105	14	458	6	198	2	308	4	226	3	3199	40	8	2	29	9	14	4	4	1	9	3	15	5	243	75

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Spring 1990, Vol.34, No.2

North Atlantic Tropical Cyclones, 1989

Max Mayfield and Bob Case
National Hurricane Center

Out of Africa— This season the recent trend for large, Cape Verde type hurricanes continued. One of these, Hurricane Hugo, became the most costly hurricane in history.

While tropical cyclone activity for the Atlantic, Caribbean and Gulf of Mexico was just slightly above normal, the trend for large, strong Cape Verde hurricanes continued. Hurricane Hugo reached category five on the Saffir/Simpson Scale and caused an estimated $7 billion damage in the U.S. and $3 billion elsewhere. Gabrielle was another large Cape Verde type that reached category four, but remained at sea.

It appears from the relatively small number of ships reporting 50 knots or greater that shipping was able to avoid this season's intense tropical cyclones. Although routinely available satellite imagery is one of the primary observational tools, ship reports retain their significance to tropical weather forecasters, particularly during the initial development phase of cyclones where surface truth is important in documenting the correct intensity.

Elaine Barto (right) and her daughter Mellisa show a moment of shock as they look at the remains of their home in Folly Beach, SC. The beach front home was destroyed by Hurricane Hugo on the 21st of September when Hugo hit the South Carolina coast. Boston Globe photo by Barry Chin.

Max Mayfield and Bob Case are forecasters at the National Hurricane Center, Miami, Florida.

Tropical Storm Allison

Tropical Storm Allison developed from the remnants of eastern Pacific Hurricane Cosme and a tropical wave. Based upon observations from offshore oil rigs and coastal surface data, a tropical depression formed on the 24th. It was upgraded to tropical storm status on the 26th based on a wind report of 35 knots with gusts to 45 knots from the *M/T Jacinth*, some 100 nautical miles northeast of the center. Allison moved inland over the mid Texas coast, near the northeast end of Matagorda Bay, with a central pressure of 1002 millibars but continued to strengthen slightly over the next 12 hours as the central pressure dropped to 999 millibars on the 27th.

Torrential rains accompanying Allison fell along the upper Texas coast and over the western two-thirds of Louisiana. Nearly 30 inches of rain fell in a 6-day period at a few locations in north-central Louisiana. The death toll in Allison was 11, all attributed to drowning. Estimated damage is near one half billion dollars, due mainly to flooding.

Monthly Summary of 1989 Atlantic Tropical Cyclones

	Jun	Jul	Aug	Sep	Oct	Nov	Total
Tropical Depressions	1	0	2	0	1	0	4
Tropical Storms	1	1	0	1	0	1	4
Hurricanes	0	2	3	1	1	0	7
Total	2	3	5	2	2	1	15

(Tropical cyclones are assigned to the month in which they first became a tropical depression)

Wide World

Tropical Storm Barry

A tropical depression developed on the 9th of July, while located midway between Africa and the Lesser Antilles. The depression tracked northwestward and was upgraded to tropical storm strength on the 11th based on satellite intensity estimates. A 35-knot wind reported later by the *Sirius*, located 15 nautical miles north northeast of the center, confirmed the tropical storm status. Barry weakened to a depression on the 13th.

Hurricane Chantal

Chantal, the first hurricane of the season, was detected on the 24th of July as a disturbance near Trinidad. Ships and satellites indicated that a tropical depression formed on the 30th. The depression became a tropical storm on the 31st, when an Air Force reconnaissance plane estimated maximum surface winds of 45 knots, while the *Saudi Diriyah* reported a 50-knot wind on the east side of the storm center. Chantal continued strengthening while moving northwest toward the upper Texas coast and was upgraded to a hurricane by the 1st of August. Chantal reached its peak, just prior to the center making landfall at High Island, Texas with top winds of 70 knots.

Thirteen deaths were attributed to Chantal and, just as in Allison, all were the result of drowning. The main effects were flooding, by torrential rains, and beach erosion. Total damage is estimated to be near $100 million.

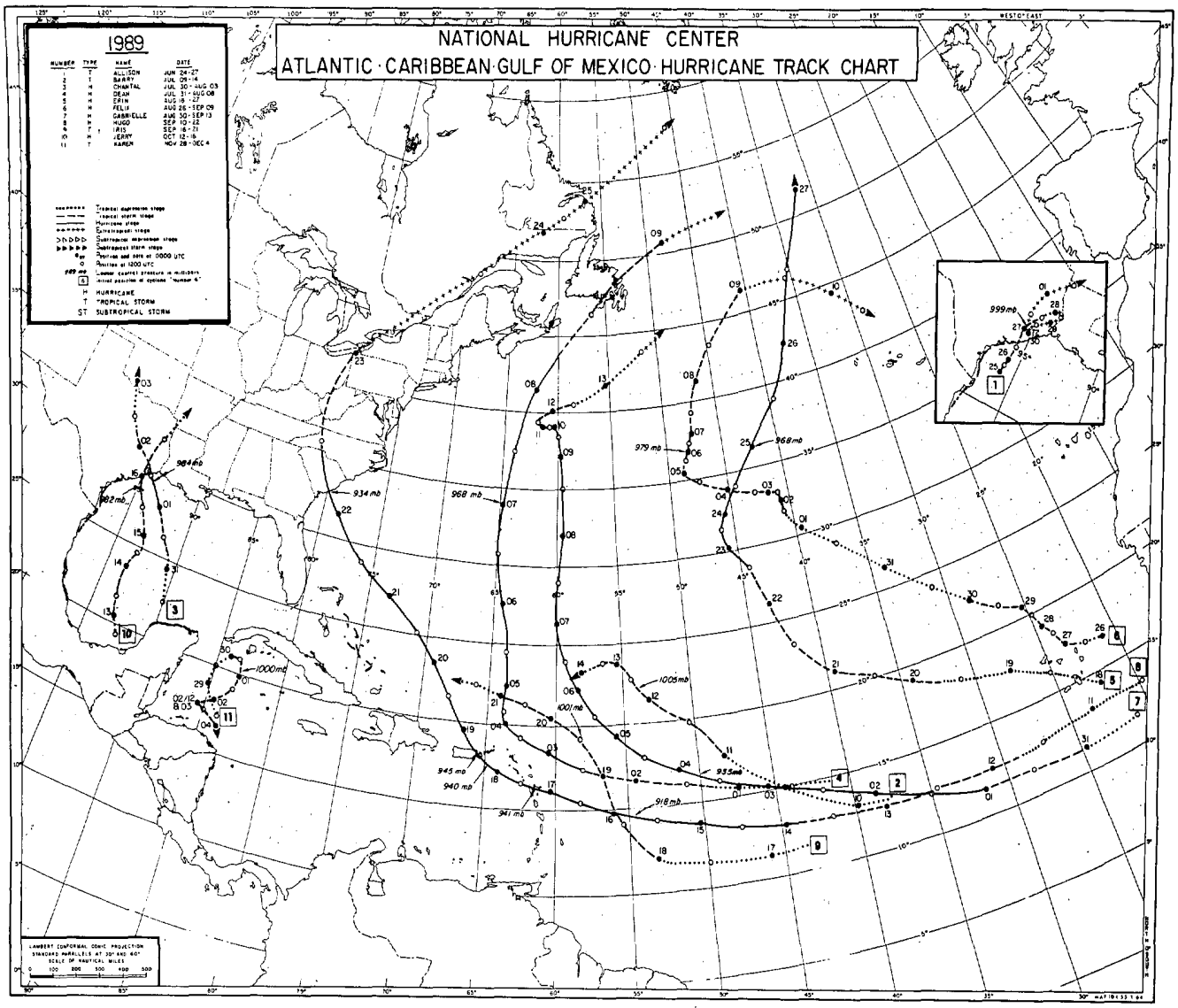
Hurricane Dean

A tropical depression developed from a westward-moving tropical wave, on the 31st of July, midway between the Cape Verde Islands and the Lesser Antilles. It attained tropical storm strength by the 1st of August and was upgraded to a hurricane on the 2d.

By the 3d, the hurricane slowed and began to turn toward the north. This brought the eastern eyewall over Bermuda on the 6th. The highest sustained wind was 70 knots with gusts to 98 knots at the U.S. Naval Annex on the western end of Bermuda.

After Bermuda, Dean accelerated toward the northeast. It passed over Sable Island, Nova Scotia, generating winds of 66 knots with gusts to 77 knots. Dean began to lose tropical characteristics as it moved over southeastern Newfoundland, and became extratropical over the North Atlantic.

There were no reported deaths due to Hurricane Dean. However, 16 people were injured on Bermuda, and damage estimated there was nearly $9 million.



Hurricane Erin

This system became a tropical depression near the Cape Verde Islands on August 18th. Steering currents guided it toward the northwest, and it was upgraded to Tropical Storm Erin on the 19th based on satellite imagery. A 65–knot wind reported by the Portuguese ship ***Montemuro*** resulted in Erin being upgraded to a hurricane on the 22d. Satellite intensity estimates indicated Erin strengthened to a 968–millibar hurricane with peak winds of 90 knots on the 25th. Thereafter Erin accelerated toward the northeast, weakened to a tropical storm on the 27th, and soon became extratropical.

Hurricane Felix

Felix persevered mostly in the shadow of the much larger and more intense Hurricane Gabrielle to become the longest lasting tropical cyclone of the season.

After emerging from the African coast, on the 25th of August, Felix turned northwestward. From the 26th of August to the 5th of September, Felix strengthened to a storm, weakened to a tropical depression, regained storm status, and finally attained hurricane strength.

Based on satellite imagery, the hurricane's minimum central pressure of 979 millibars with maximum sustained winds of 75 knots occurred from late on the 5th to early on the 6th. Ship reports were rather sparse around Felix with the only significant weather observation from the ***OOCL Atlantic***, which observed 40–knot winds with heavy rain just north of the center on the 8th. As Felix came under the influence of the westerlies and moved over the cooler waters, it became extratropical on the 9th. This system became a large non–tropical storm during the next few days and eventually dissipated southeast of the Azores by the 15th. Several ships observed winds near 50 knots around the circulation during the extratropical stage.

Hurricane Gabrielle

A tropical wave moved off the African coast on the 28th of August. It reached tropical depression strength on the 30th and was upgraded to Tropical Storm Gabrielle on the 31st.

The first reconnaissance aircraft into Gabrielle found a central pressure of 935 millibars on the 3d of September. The hurricane's central pressure remained in the low 940–millibar range for the next 3 days, with the strongest surface winds estimated to be near 125 knots.

After the 4th of September, Gabrielle turned toward the north, passing about 300 nautical miles northeast of the northeastern Caribbean islands. On the 10th Gabrielle became nearly stationary about 475 nautical miles east southeast of Cape Cod, Massachusetts. It drifted slowly westward and dropped to tropical storm strength on the 10th and to a depression by the 12th. The following day it lost most of its tropical characteristics and merged with a developing North Atlantic storm off Newfoundland.

Gabrielle was a very large hurricane. The eye diameter was never less than 20 nautical miles, and, while the hurricane was most intense, this diameter ranged from 40 to 50 nautical miles. Hurricane–force winds frequently extended in excess of 100 nautical miles from the center. Reports of 50– to 60–knot winds were received from the EOC3 and ***Mikhail Stelmakh***, on the 7th and 8th, some 125 to 160 nautical miles from the center. Gabrielle's powerful winds covered a large area of the Atlantic and generated large ocean swells, which pounded the shores of the northeastern Caribbean islands, Bermuda and the North American mainland from central Florida to the Canadian Maritimes. Swells ranged from 10 to 15 feet along portions of the U.S. East Coast and were as high as 20 to 30 feet along the south coast of Nova Scotia. These swells were responsible for eight deaths along the mid–Atlantic and New England coasts. Accidents ranged from people being swept from jetties while watching the large swells to boats capsizing while trying to enter or leave inlets.

Hurricane Hugo

Hugo, the strongest hurricane of 1989, left a path of death and destruction across the Leeward Islands, the Virgin Islands, Puerto Rico, and South and North Carolina.

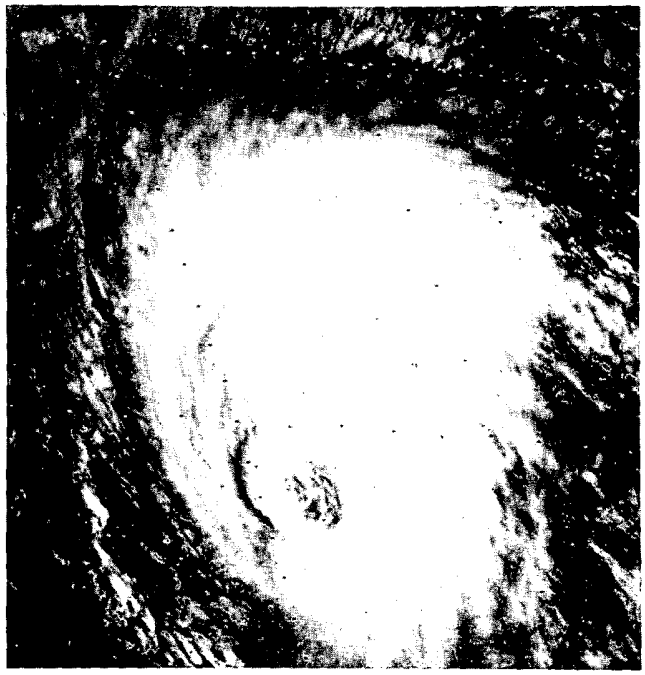
Hugo was first detected by satellite, on the 9th of September, as a cluster of thunderstorms off the coast of Africa. A tropical depression formed southeast of the Cape Verde Islands and moved westward across the tropical Atlantic Ocean at 18 knots. It became a tropical storm on the 13th about 1100 nautical miles east of the Leeward Islands.

Hugo gradually turned toward the west northwest and slowed. On the 15th, Air Force and NOAA reconnaissance aircraft reached the hurricane several hundred miles east of the Leeward Islands and reported a central pressure of 918 millibars, a wind speed of 165 knots at an altitude of 1500 feet, and an estimated surface wind speed of 140 knots. This was Hugo's maximum intensity and earned the hurricane a category five rating.

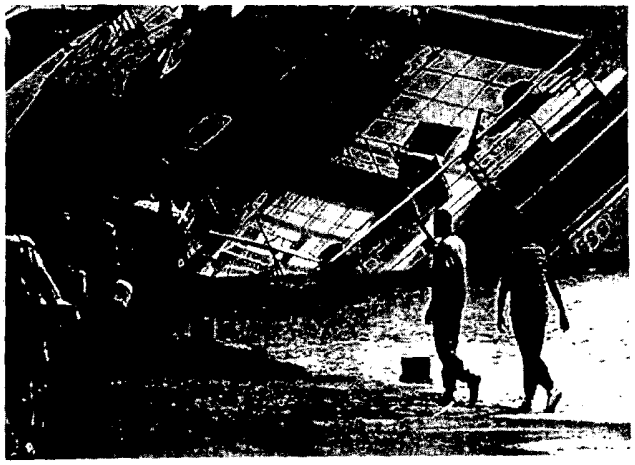
Hugo crossed Guadeloupe on the 17th with a central pressure of 941 millibars and 120–knot winds. The hurricane turned northwestward and hit St. Croix the next day, with maximum surface winds remaining near 120 knots.

Accelerating, the eye moved over the island of Vieques, Puerto Rico, and then over the extreme eastern tip of mainland Puerto Rico on the 18th. Maximum winds were estimated at 110 knots. The lowest recorded surface pressure on the island was 946.1 millibars at Roosevelt Roads.

Hugo then took aim on the South Carolina coast. It made its final landfall on the 22d at Sullivan's Island, near Charleston. Based on a reconnaissance aircraft measurement of 934 millibars and 140–knot winds at an altitude of 12,000 feet just before landfall, the surface wind at landfall was estimated to be 120 knots. A report of 76 knots with a gust to 94 knots was received from downtown Charleston. However, the strongest winds probably occurred 20 nautical miles or so to the northeast of Charleston, near Bulls Bay. The strongest sustained surface wind measured was 104 knots from the ship *Snow Goose*, anchored in the Sampit River, a few nautical miles west of Georgetown, South Carolina. This



To the right is a GOES Visible image of Hurricane Gabrielle at 1231 UTC on the 6th of September 1989, over the open Atlantic.



A large passenger craft is beached at Pointe-a-Pitre, Guadeloupe (left) on the 18th during Hugo. At far right, Hugo leaves little untouched on the barrier island of Isle of Palms, South Carolina after it passed on the 22d.

Wide World

measurement was taken from a three-cup Tradewind anemometer located on the ship's mast at an elevation of 61 feet.

Moving inland and weakening, the center passed between Columbia and Shaw Air Force Base prior to sunrise on the 22d. The air base reported a sustained wind of 58 knots with a gust to 95 knots. By sunrise Hugo was a tropical storm and had passed just west of Charlotte, North Carolina, with winds of 60 knots and gusts to 86 knots. Moving northward across extreme western Virginia, West Virginia, and eastern Ohio, Hugo became extratropical near Erie, Pennsylvania, on the 23d. During the next 2 days it moved across eastern Canada and into the far northern Atlantic Ocean.

Storm tides along the South Carolina coast ranged from 8 to 10 feet in the Charleston-Folly Beach area to near 20 feet in the south end of Bulls Bay and down to 7 feet at Winyah Bay. The storm surge was reported at 4 feet above the predicted tide as far north as Hatteras, North Carolina.

Rainfall totals ranged from a trace at Jacksonville, Florida, to 6.10 inches at Savannah, Georgia, to a maximum of 8.10 inches at Mt. Pleasant, South Carolina (near Charleston), to 2.30 inches at Myrtle Beach, South Carolina, and 0.58 inches at Hatteras, North Carolina. A 150-nautical-mile-wide swath of 3 to 8 inches of rain spread inland across South Carolina and continued over western North Carolina, with a maximum of 6.91 inches reported at Boone. Rainfall totals were in the 2- to 4-inch range across western Virginia, West Virginia, western Pennsylvania, eastern Ohio, and western New York.

The total number of deaths associated with Hugo is estimated at 49, 21 on the U.S. mainland. The $10-billion damage estimate makes Hugo the most costly hurricane in history.

1989 Atlantic Hurricane Season Statistics

no.	name	class[1]	dates[2]	maximum sustained wind (knots)	lowest press. (mb)	U.S. damage ($millions)	deaths
1	Allison	T	24-27 Jun	45	999	500	11
2	Barry	T	9-14 Jul	45	1005		
3	Chantal	H	30 Jul-3 Aug	70	984	100	13
4	Dean	H	31 Jul-8 Aug	90	968		
5	Erin	H	18-27 Aug	90	968		
6	Felix	H	26 Aug-9 Sep	75	979		
7	Gabrielle	H	30 Aug-13 Sep	125	935		8
8	Hugo	H	10-22 Sep	140	918	7000	49
9	Iris	T	16-21 Sep	60	1001		
10	Jerry	H	12-16 Oct	75	982	70	3
11	Karen	T	28 Nov-4 Dec	50	1000		

1 T: tropical storm, wind speed 34-63 kt.
H: hurricane, wind speed 64 kt or higher.

2 Dates begin at 0000 UTC and include tropical depression stage.

Tropical Storm Iris

The tropical wave that spawned Iris was immediately behind the wave that spawned Hugo. Although the system remained in the unfavorable environment of Hugo's wake, a tropical depression formed on the 16th of September and reached tropical storm strength, 390 miles east of Barbados on the 18th. Iris turned northwestward and reached its maximum strength of 1001 millibars, with estimated 60-knot surface winds, on the 19th. Thereafter, increased outflow from the powerful and strengthening Hugo resulted in Iris' weakening, with satellite images eventually showing the low-level center exposed from the deep convection.

Hurricane Jerry

Jerry originated from a tropical wave that moved across the tropical Atlantic and Caribbean Sea. There were no additional signs of organization before it developed into a tropical depression on the 12th of October as it moved into the Bay of Campeche.

Wide World

The depression attained tropical storm strength on the 13th. After some hesitation, shearing and a temporary turn to the northeast, Jerry turned toward the north northwest on the 15th and strengthened to a hurricane.

Jerry made landfall on Galveston Island, near Jamaica Beach, on the 16th. No hurricane had ever made landfall on the upper Texas coast so late in the season. Once inland, Jerry moved over eastern Texas, weakened rapidly, and was absorbed by a frontal trough late on the 16th.

Maximum sustained surface winds of 65 knots with gusts to 87 knots were measured at Scholes Field on Galveston Island as the eyewall passed over the airport. The observation site lost power near this time, and the observer–estimated maximum sustained winds reached 70 knots with gusts of 90 to 100 knots. An extrapolated minimum pressure of 982 millibars was reported by a NOAA aircraft and by an Air Force plane just prior to landfall.

Three people were reported killed, all by drowning. Damage estimates for the hurricane are near 70 million dollars.

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

Tropical Cyclone	Vessel Name	Date Mo/Da	Time UTC	Ship Position Lat N	Ship Position Lon W	Wind Dir/Speed (kn)	Pressure (mb)
Chantal	***Saudi Diriyah***	7/31	1200	26.1	89.2	130/50	1009.3
Erin	***Montemuro***	8/22	1200	28.5	45.0	270/65	1000.3
	Merida	8/24	1200	32.1	43.5	200/55	1011.5
	Maris Gorthon	8/26	1800	49.0	32.0	160/50	1003.5
Gabrielle	**EOC3**	9/07	1200	29.9	57.4	150/57	997.0
	Mikhail Stelmakh	9/08	0600	34.6	56.8	160/50	993.0
	Yan Kalnberzine	9/12	1200	36.7	58.3	210/50	1018.0
	Trudy	9/13	1200	44.5	56.3	330/52	1014.6

Tropical Storm Karen

Satellite imagery indicated, and aircraft reconnaissance confirmed, a tropical depression formed in the northwest Caribbean on the 28th of November. It was upgraded to Tropical Storm Karen near the Isle of Youth, Cuba, early on the 30th. Karen became the eighth named tropical cyclone to form in November during the past 10 years. This is double the long–term average.

A minimum central pressure of 1000 millibars, with strongest winds of 50 knots, was reached later on the 30th. Karen was a wet storm that dropped 10 to 15 inches of rain over portions of western Cuba.

A strong high pressure system over the Gulf of Mexico forced Karen to move to the south and southwest from late on the 30th to the 3d of December. The last advisory of the 1989 Atlantic hurricane season was issued on the 4th of December after an Air Force plane was unable to locate a circulation center.

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Eastern North Pacific Tropical Cyclones, 1989

Miles Lawrence
National Hurricane Center

This year Hurricanes Cosme and Kiko made landfall in Mexico as did Tropical Storm Raymond. Octave's remnants were tracked across southern California.

The origins of all but one of this year's storms and hurricanes were associated with westward-moving tropical waves which came from the Atlantic basin. Kiko, which developed within a cloud system that originated over mainland Mexico, was the only exception.

This season's eight tropical storms and nine hurricanes were near the long-term average of 7.4 storms and 8.2 hurricanes.

Eastern Pacific tropical cyclones ordinarily move on a west through northwestward heading and dissipate over cold water without affecting land. This year, Hurricanes Cosme and Kiko and Tropical Storm Raymond made landfall in Mexico, while the remnants of Octave were tracked over southern California.

There are no damage estimates available from Mexico. However, it is estimated that Cosme caused 10 deaths in Mexico from heavy rain which produced inland flash flooding. Ismael, in addition, was responsible for 3 deaths.

Hurricane Barbara

Barbara developed from a slow-moving tropical wave which crossed Central America on June 8th. Eventually, on the 15th, the wave was upgraded to a tropical depression several hundred miles south of Puerto Vallarta, Mexico and was then named Tropical Storm Barbara on the 16th.

The storm strengthened as it moved northwestward and was upgraded to a hurricane on the 18th. Barbara remained a minimal hurricane for 24 hours and then weakened as air moving over cooler water was entrained into the system from the northwest. By the 20th, all that remained of Barbara was a westward-moving swirl in the low-level stratocumulus clouds.

Hurricane Cosme

While Barbara was weakening, a tropical depression formed to the south of Acapulco, Mexico, on June 18. It was associated with a 2-week old African tropical wave. During June 17-18, several different centers were observed before a single center became well organized. The depression was designated Tropical Storm Cosme on June

Monthly Summary of 1989 Tropical Cyclones

	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Tropical Depressions	0	0	3	0	1	3	0	7
Tropical Storms	1	0	2	3	2	0	0	8
Hurricanes	0	2	2	3	2	0	0	9
Total	1	2	7	6	5	3	0	24

(Tropical cyclones are assigned to the month in which they first became a tropical depression)

Miles Lawrence is a forecaster at the National Hurricane Center, Miami, Florida.

20 and Cosme attained hurricane strength the following day.

During the 19th and 20th, the hurricane remained nearly stationary as the circulation gradually organized. After attaining hurricane status, it accelerated northward and moved onshore just east of Acapulco on the night of the 21st. The weakening remnants of Cosme accelerated northward through eastern Mexico. The circulation was last identified as a cloud swirl south of Brownsville, Texas, on the 23d and assisted in the development of Tropical Storm Allison.

Maximum sustained winds of 75 knots and a lowest sea-level pressure of 979 millibars were estimated just prior to landfall, based on satellite data. The highest recorded winds in Acapulco were 30 knots with gusts to 40 knots. Winds gusted to 50 knots at Puerto Escondido, Mexico, some 150 nautical miles east of where Cosme made landfall. The maximum wind observed by a ship was 55 knots, reported from the ***Keystoner***, just east of the center, at 0000 UTC on the 22d. Two other ships, ***Sammi Super Stars*** and ***Toyofuji No. 10***, reported gale-force winds.

Heavy rains accompanied the hurricane over southern Mexico with reports of flash floods and mudslides over the coastal mountains. Rainfall amounts in excess of 5 inches during a 12-hour period were recorded along the coast of Acapulco during the night of the 21st.

The Mexican government reported 10 deaths due to drowning. Many adobe houses were destroyed by floods.

Hurricane Dalilia

Dalilia began when an area of thunderstorms in the Intertropical Convergence Zone became separated from its surrounding cloudiness on July 9th. Moving westward, this low-latitude system became a tropical depression on the 11th about 750 nautical miles south of the southern tip of Baja California.

Hurricane Ismael is southwest of the Baja Peninsula on the 19th of August, at about 1630 UTC. At this time the well-developed storm was generating 105-knot winds near its center.

It strengthened to a storm on the 12th and to a hurricane on the 13th.

Dalilia reached peak strength on the 16th when its maximum one-minute wind speed was estimated at 80 knots, based on satellite observations. Reconnaissance aircraft flew into Dalilia on the 18-20th, when Hawaii was being threatened, but by this time Dalilia had weakened to a tropical storm.

Hurricane Gil

Gil originated from an area of disturbed weather, on July 27th, south of Mexico and Guatemala. At first, a weak circulation formed on the 28th and was tracked to the Gulf of Tehuantepec where it dissipated. Then a new circulation formed about 200 nautical miles south of Acapulco on the 30th and Gil's track began.

The circulation paralleled the coast of Mexico, from the 30th through August 5th, when it dissipated about 250 nautical miles west of Baja California. Based on satellite estimates, it became a hurricane late on the 31st and remained so for 30 hours, with highest winds of 75 knots. The center of Gil passed 75 nautical miles northeast of Socorro Island on the 1st. Even though Gil was estimated to be a hurricane at the time, the few surface wind reports from the island indicated that the winds there remained under 10 knots. However, rainfall on the island totalled 4.8 inches for a 12-hour period on the 1st. Also, the ***Continental Wing*** reported 33 knots at 1800 UTC on the 2d, 90 nautical miles northeast of Gil's center.

Hurricane Ismael

Ismael came to life on August 14th about 250 nautical miles south southeast of Acapulco. Initially moving northwestward, it strengthened to a tropical storm on the 15th while producing heavy rainfall and flash flooding along the southwestern coastal sections of Mexico. On the 16th, Ismael turned toward the west and further strengthened to a hurricane.

During the 7 days that Ismael was a hurricane, it went through several fluctuations in strength. Colder sea surface temperatures and upper level shearing took their toll and Ismael weakened to a tropical storm on the 23d and to a depression on the 25th.

Ismael reached maximum intensity on the 19th with 105-knot sustained winds based on satellite estimates. The highest observed wind speed was 33 knots from the ***Izola***, about 75 nautical miles northeast of the center on the 16th when Ismael was still a tropical storm. Three deaths were attributed to Ismael.

Hurricane Kiko

On August 23d satellite imagery revealed a large mesoscale convective system developing over northwest Mexico. It moved southward and a tropical depression formed on the 25th just west of the Islas Marias.

Kiko reached hurricane status on the 26th when an eye embedded within a small central dense overcast was spotted by satellite. Rapid development continued and a maximum wind of 105 knots was estimated at 0000 UTC on the 27th, while Kiko was centered just east of the southern tip of Baja California. It made landfall near Punta Arena, about 6 hours later.

Because the hurricane was small and slow, it weakened rapidly over the mountainous terrain of the Baja. Kiko was downgraded to a tropical storm on the 27th and to a tropical depression on the next day as the center emerged off the west coast of Baja. Turning southwestward, it began to interact with Tropical Storm Lorena to the southeast. The depression diminished and was eventually absorbed within the circulation of Tropical Storm Lorena.

A hotel owner on Cabo San Lucas relayed ship reports from outside the Cabo San Lucas harbor of northwest winds of 25 to 30 knots at 1900 UTC on the 26th. A ham radio report from near Punta Arena at 0130 UTC on the 27th listed northerly winds of 35 to 40 knots with gusts to 55 knots while Kiko was just offshore. The hurricane made landfall during the night in an area with limited observations, although torrential rains were reported from Cabo San Lucas and Todos Santos during the 27th.

Hurricane Lorena

Lorena developed about 300 nautical miles south southwest of Manzanillo, Mexico on August 27th. A depression strengthened to Tropical Storm Lorena about 24 hours later. Lorena moved west northwestward for several days and

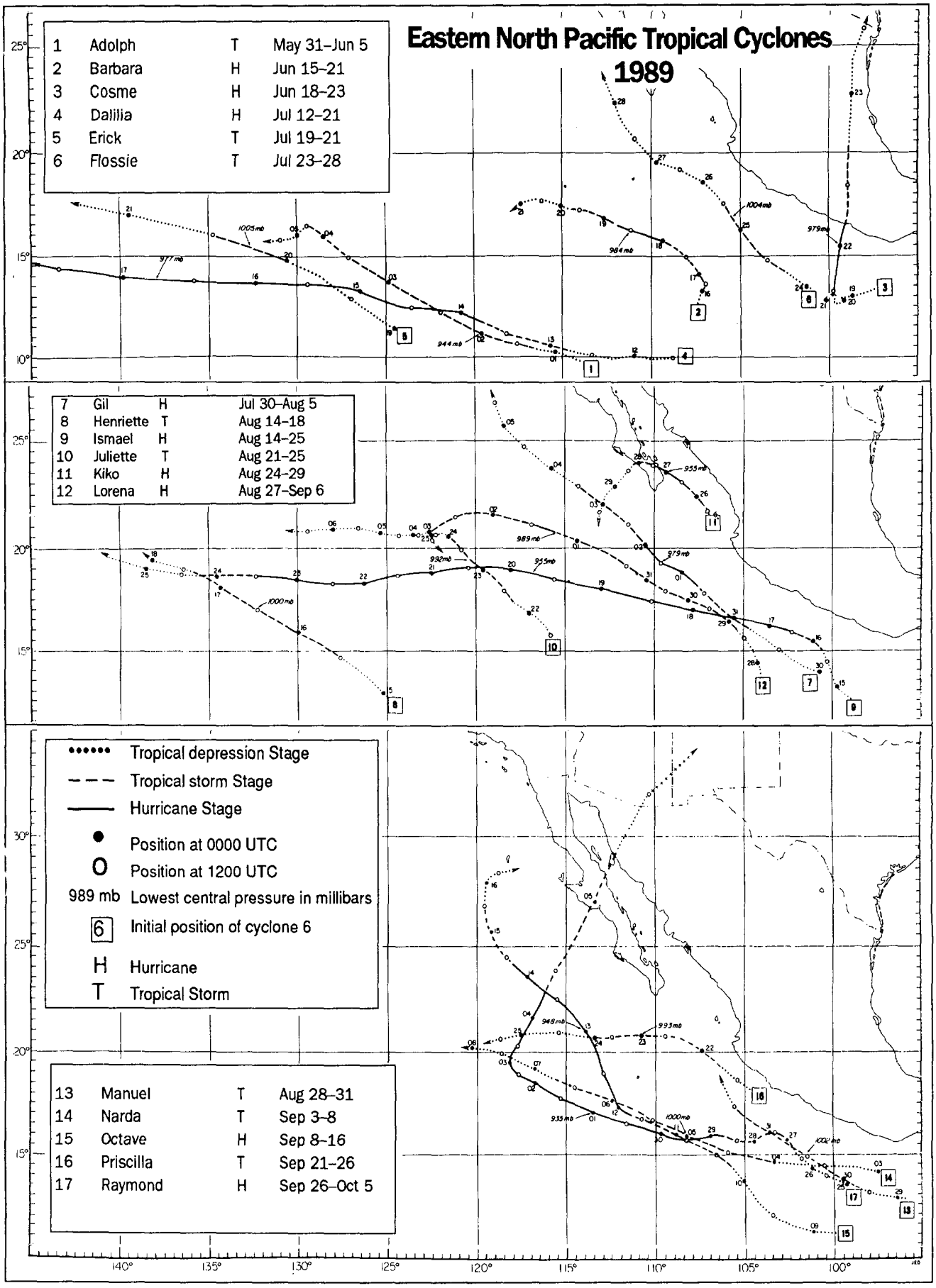
Hurricane Kiko is caught near the southern tip of Baja California at about 2230 on the 26th of August. The maximum sustained winds at the time were estimated at 105 knots. Kiko was the only home grown hurricane in the eastern North Pacific this year. All the rest were seedlings in the North Atlantic before being transplanted.

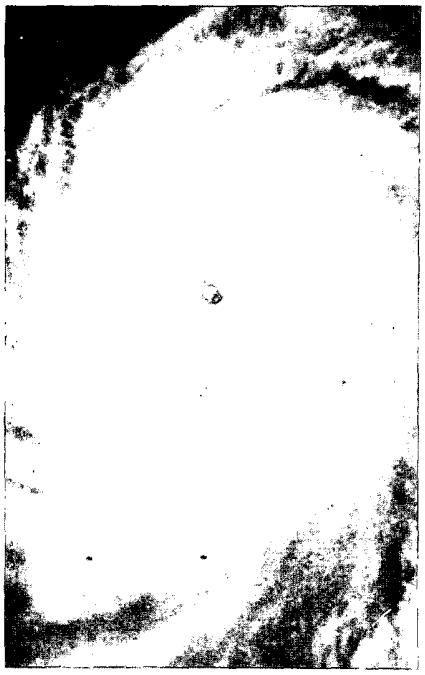
1989 Eastern North Pacific Named Tropical Cyclones

No.	Name	Class[1]	Dates[2]	Max. Wind 1-min (knots)	Min. pressure (mb)	Damage ($millions)	Deaths
1	Adolph	T	May 31–Jun 5	55	994		
2	Barbara	H	Jun 15–21	70	984		
3	Cosme	H	Jun 18–23	75	979		10
4	Dalilia	H	Jul 12–21	80	977		
5	Erick	T	Jul 19–21	35	1005		
6	Flossie	T	Jul 23–28	35	1004		
7	Gil	H	Jul 30–Aug 5	75	979		
8	Henriette	T	Aug 14–18	45	1000		
9	Ismael	H	Aug 14–25	105	955		3
10	Juliette	T	Aug 21–25	55	992		
11	Kiko	H	Aug 24–29	105	955		
12	Lorena	H	Aug 27–Sep 6	65	989		
13	Manuel	T	Aug 28–31	40	1002		
14	Narda	T	Sep 3–8	45	1000		
15	Octave	H	Sep 8–16	115	948		
16	Priscilla	T	Sep 21–26	55	993		
17	Raymond	H	Sep 26–Oct 5	125	935	1.5	

1 T: tropical storm, wind speed 39–73 knots
H: hurricane, wind speed 64 knots or higher

2 Dates begin at 0000 UTC and include tropical depression stage


Eastern North Pacific Tropical Cyclones
1989
1 Adolph T May 31–Jun 5
2 Barbara H Jun 15–21
3 Cosme H Jun 18–23
4 Dalilia H Jul 12–21
5 Erick T Jul 19–21
6 Flossie T Jul 23–28
7 Gil H Jul 30–Aug 5
8 Henriette T Aug 14–18
9 Ismael H Aug 14–25
10 Juliette T Aug 21–25
11 Kiko H Aug 24–29
12 Lorena H Aug 27–Sep 6
Tropical depression Stage
Tropical storm Stage
Hurricane Stage
Position at 0000 UTC
Position at 1200 UTC
989 mb Lowest central pressure in millibars
6 Initial position of cyclone 6
H Hurricane
T Tropical Storm
13 Manuel T Aug 28–31
14 Narda T Sep 3–8
15 Octave H Sep 8–16
16 Priscilla T Sep 21–26
17 Raymond H Sep 26–Oct 5
25°
20°
15°
10°
30°
140°
135°
130°
125°
120°
115°
110°
105°
100°



Hurricane Raymond was generating 125–knot winds at 2200 on the 30th, making it the strongest hurricane of the season in this basin.

strengthened to a 65–knot hurricane on September 1st some 350 nautical miles west southwest of the southern tip of Baja California.

Lorena was a minimal hurricane for only 6 hours and then weakened to a tropical storm. It was downgraded to a tropical depression on the 3d about 700 nautical miles west southwest of the southern tip of Baja California. The ***Golden Grampus*** reported 42–knot easterly winds at 0000 UTC on the 30th some 180 nautical miles north of Lorena's center. Lorena passed directly over Socorro Island, where wind reports were below storm force, but the surface pressure dropped to 1000.2 millibars.

Hurricane Octave

Octave formed on September 8th, about 400 nautical miles south of Acapulco and as a depression it paralleled the coast of Mexico. It became a tropical storm on the 9th and a hurricane on the 11th. The hurricane's maximum intensity was estimated at 115 knots at 0000 UTC on the 13th, some 200 nautical miles northwest of Socorro Island.

When Octave passed south of Socorro Island on the 12th, the highest one–minute wind speed reported was 35 knots and the lowest pressure reported was 1003.6 millibars. Colder sea–surface temperatures and an increase in vertical wind shear over Octave caused weakening on the 14th and 15th. A circulation was last located on the 16th near Guadalupe before dissipating.

Hurricane Raymond

Raymond began on September 25th when a tropical depression formed to the south of Acapulco. It became Tropical Storm Raymond on the 26th. Raymond moved toward the northwest for 24 hours when high pressure developed to the north and the cyclone turned westward.

Raymond then continued strengthening over warm waters and was upgraded to a hurricane on the 28th. Satellite images eventually showed a distinct eye and a well–defined outflow pattern. Its estimated maximum wind speed was 125 knots at 0000 UTC on October 1st. This makes Raymond the strongest hurricane of the 1989 eastern Pacific season.

Raymond headed west northwestward and on the 2d the slowly weakening hurricane slowed and turned toward the northwest in response to a downstream trough. By the 3d Raymond had recurved toward Mexico.

While Raymond accelerated northeastward over cooler waters, vertical shear also increased, assisting the weakening. It was downgraded to a tropical storm by 1200 UTC on the 4th, and within the next 24 hours moved rapidly across Baja California and into the mainland Mexican state of Sonora. The mountains further weakened Raymond, resulting in a tropical depression being tracked across southeastern Arizona into western New Mexico.

On the 26th, the ***Lircay*** reported an east wind at 37 knots about 75 nautical miles northwest of the center. On the 27th, the ***Pacific Crane*** reported an east southeast wind at 35 knots some 100 nautical miles north of the center. A wind of 35 knots was reported at Guaymas at 0000 UTC on the 5th when Raymond was over the Baja Peninsula.

Flash floods were reported over portions of southeast Arizona, where maximum rainfall amounts ranged from 2 to 5 inches. The most extensive damage reports came from Nogales and Wilcox. There were no casualties in the United States and the damage estimate in southeast Arizona is placed at $1.5 million.

Tropical Cyclone Winds
(Ship encounters of 35 Knots or more)

Tropical cyclone	Ship Name	Date Mo/Da	Time UTC	Position LatN,LonW	Wind(kn) Dir/Speed	Pressure (mb)
Cosme	***Sammi Super Stars***	6/20	1800	14.5, 96.4	100/36	1012.0
	Toyofuji No. 10	6/21	1800	15.5, 97.8	090/43	1007.5
	Keystoner	6/22	0000	16.1, 98.4	120/55	1003.0
Flossie	SHIP	7/24	0600	11.5,104.0	220/39	1011.1
Lorena	***Golden Grampus***	8/30	0000	20.1,107.2	090/42	1007.0
Raymond	SHIP	9/25	1200	13.2,101.7	270/35	1007.2
	Lircay	9/26	1200	15.5,102.6	090/37	1007.0
	Pacific Crane	9/27	0600	17.7,103.2	120/35	1007.6

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Central North Pacific Tropical Cyclones, 1989

A.K.T. Chun, R. T. Martin and H.E. Rosendal
Central Pacific Hurricane Center

Dalilia was the only tropical cyclone above tropical depression strength to be spotted in the central region this past season.

In a normal year, usually one tropical storm or hurricane will develop in central North Pacific waters. This is most likely from August through November. However, this season only two tropical depressions formed in July and a couple of outsiders moved through the region.

Tropical Depression Four-E

Tropical Depression Four-E developed east of the Central Pacific Hurricane Center's (CPHC) area of responsibility on July 9th. It crossed into the CPHC's area near 12.3°N,140.0°W moving in a west northwesterly direction at about 10 knots. Four-E remained a tropical depression the whole time that it was in the central Pacific and finally dissipated south of South Point, Hawaii, while moving westward along 15°N on the 14th.

Tropical Depression Five-E

Tropical Depression Five-E formed on July 12 in the same general area where Four-E came into being a few days earlier. Five-E first moved westerly and later toward the west southwest at an increased forward speed of 15 to 20 knots. It crossed into the Central Pacific Hurricane Center's (CPHC) area of responsibility near 11°N at 0000 UTC on the 14th, and dropped as far south as 9°N while weakening. The final advisory on a dissipating Five-E was issued by the CPHC at 2100 UTC the same day. Remnants moved westward and passed far to the south of South Point, Hawaii on the 16th.

Hurricane Dalilia

Hurricane Dalilia developed in the eastern Pacific on July 13. Dalilia moved slowly westward and crossed into the central region near 14°N at 0000 UTC on the 17th. Dalilia, moving west northwesterly, gradually increased its forward motion to near 20 knots and took aim at the Hawaiian Islands as a hurricane with maximum sustained winds of 65 knots.

Waves, generated by the strong

1989 Central North Pacific Tropical Cyclones

No.	Name	Class[1]	Dates[2]	Max Wind 1-min (knots)	Min. pressure (mb)
1	Four-E	Td	July 11-14	30	N/A
2	Five-E	Td	July 14-16	30	N/A
3	Dalilia	H	July 17-21	65	989[3]
4	Ismael	Td	Aug.24-25	30	N/A

1 Highest Classification in Central Pacific
Td: tropical depression, wind speed less than 39 knots
T: tropical storm, wind speed 39-73 knots
H: hurricane, wind speed 64 knots or higher
2 Dates begin when the tropical cyclone enters the central region.
3 Reconnaissance flown after system reached its peak.

Most of the action came in a bunch in mid July in the central North Pacific. Here on the 13th at about 2200, is (1) TD Four-E. (2) TD Five-E amd (3) Hurricane Dalilia, which is still in eastern waters. Below, left is Dalilia on the 17th at about 1800, with sustained winds of 65 knots.

easterly winds north of the center, moved along with the storm at a rate of 20 knots. This resulted in a concentration of the swell traveling in a narrow path along the direction of the storm motion and caused 10–to 15–foot surf along the Puna and Kau coasts of the Big Island of Hawaii. These waves arrived slightly ahead of the weakening cyclone as it passed less than 100 miles to the south of South Point, Hawaii at about 0300 UTC on the 20th.

Dalilia was downgraded to a tropical storm at 1800 UTC on the 19th. At 0600 UTC on the 20th its center was located by U.S. Air Force reconnaissance about 60 miles southwest of the Kau and South Kona coastlines, moving in a northwest direction paralleling the Hawaiian Island chain. Winds over land areas gusted to 40 knots at South Point and other spots in the Kau and South Kona districts. Wind damage was minimal, mostly in the form of downed trees and power lines.

Rainfall was heavy over the southeast slopes of Mauna Loa from South Point across the Volcano National Park and into the Puna district, where 6 to 9 inches of rain fell overnight between the 19th and 20th.

During the passage of Dalilia, the 24–hour rainfall recorded at Honolulu International Airport was 2.18 inches on July 20. The unusual nature of this heavy rain in July over the lowlands of Oahu can be seen in the fact that this the wettest July recorded, with a rainfall total of 2.33 inches. Honolulu's previous July record (records kept since 1947) was 2.01 inches in 1970.

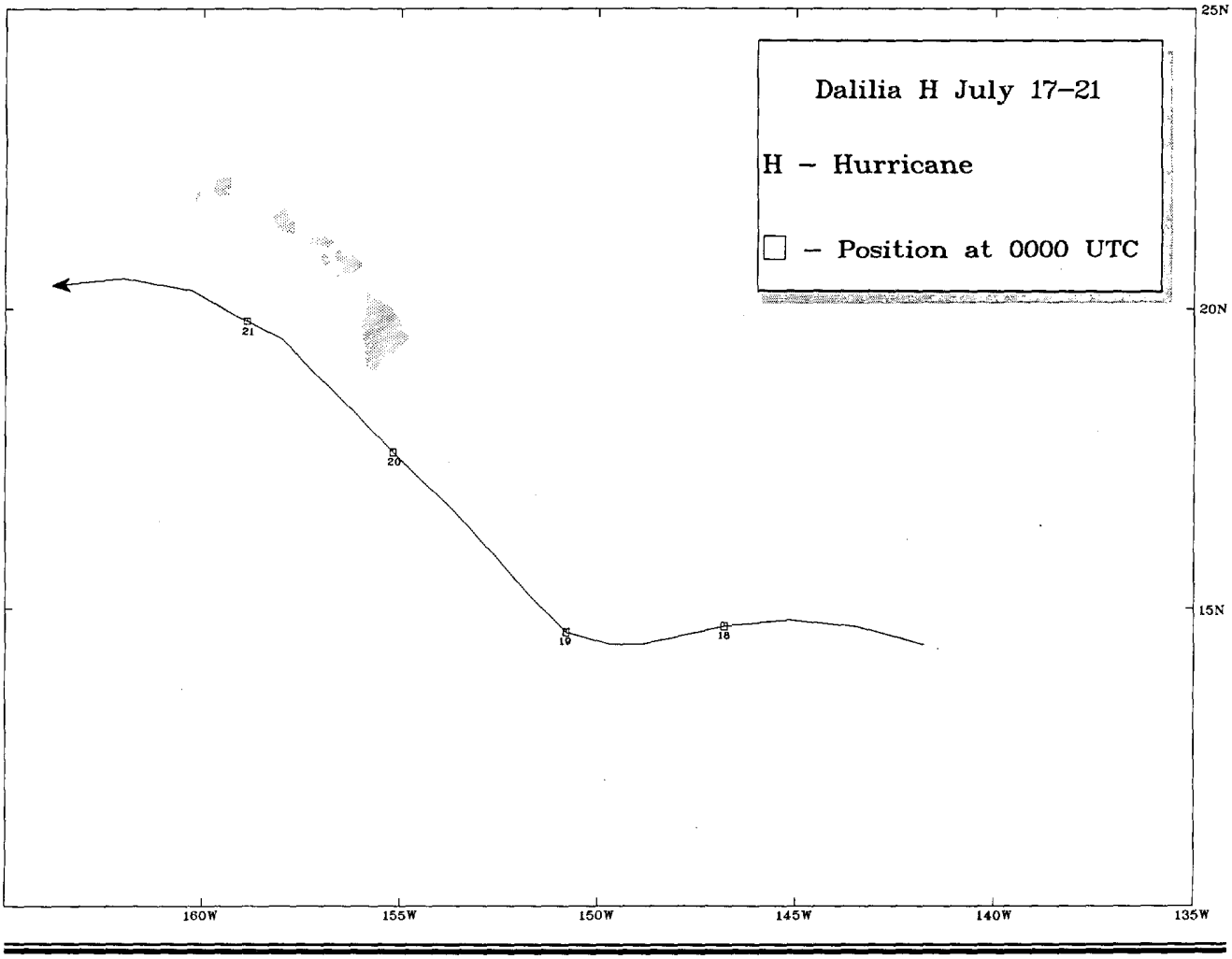
Dalilia weakened as it moved west northwestward away from the main Hawaiian Islands group and became involved with a cold core trough in the upper westerlies. The fast moving remnants of Tropical Storm Erick caught up to the dissipating circulation of Dalilia and the added moisture caused another burst of heavy rains, this time over the islands of Kauai and Niihau. The two islands were drenched on July 23 as 3 to 6 inches fell over the area and in particular the normally dry western areas of Kauai. Some amounts of more than 10 inches, with localized flooding, were reported.

The remnants of Dalilia drifted west northwestward along the Northwestern Hawaiian Islands (Nihoa to Kure Atoll) and dropped some unusual heavy summer rains over French Frigate Shoals and other islets. These heavy showers plus the infusion of additional moisture from Erick led to the warming of the circulation and it regained some of its tropical characteristics on July 24 and 25 on approach to Midway Island and Kure Atoll. The rejuvenated cyclone may have reintensified into a tropical storm for a short period of time while recurving just east of Midway Island on the 26th and 27th. On the 28th, the remnants accelerated northward toward the Aleutian Islands.

Tropical Depression Ismael

Ismael was a rapidly weakening tropical storm when it crossed into the central Pacific near 19°N on August 25 at 0000 UTC. The Central Pacific Hurricane Center (CPHC) downgraded Ismael to a tropical depression with maximum sustained winds of 30 knots on its first advisory. Ismael continued to weaken as it moved westward at 10 knots. The last advisory on the dying depression was issued only 12 hours after it crossed into the CPHC's area of responsibility.

Central North Pacific Tropical Cyclones, 1989



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Western North Pacific Tropical Cyclones, 1989

Staff, Joint Typhoon Warning Center

Over the Philippines— Eleven tropical cyclones moved across the Philippine Islands this season and a severe typhoon made it into the Bay of Bengal.

The 1989 season was unusual in many regards. The variety of synoptic influences made it one of the most unique and challenging in the Joint Typhoon Warning Center's 30-year history. The monsoon trough was very active, even into November. Because the trough was broad and there were abnormally large diurnal fluctuations in convection, disturbances were slow to intensify above 30 to 40 knots. Several tropical cyclones stalled for prolonged periods of time. In fact, Jack sat 175 nautical miles directly east of Guam for nearly 2 days. An active Tropical Upper-Tropospheric Trough (TUTT) played a major role in the development, intensification and movement of numerous tropical cyclones. Of particular interest was Typhoon Gordon, which actually developed explosively from a thunderstorm that built beneath, and directly up into a cold-cored TUTT aloft. Finally, 1989 had a large number of very compact, yet very intense typhoons. The presence of Tropical Cyclone 32W (Gay) with super typhoon intensity in the Bay of Bengal was a rare occurrence.

January through June

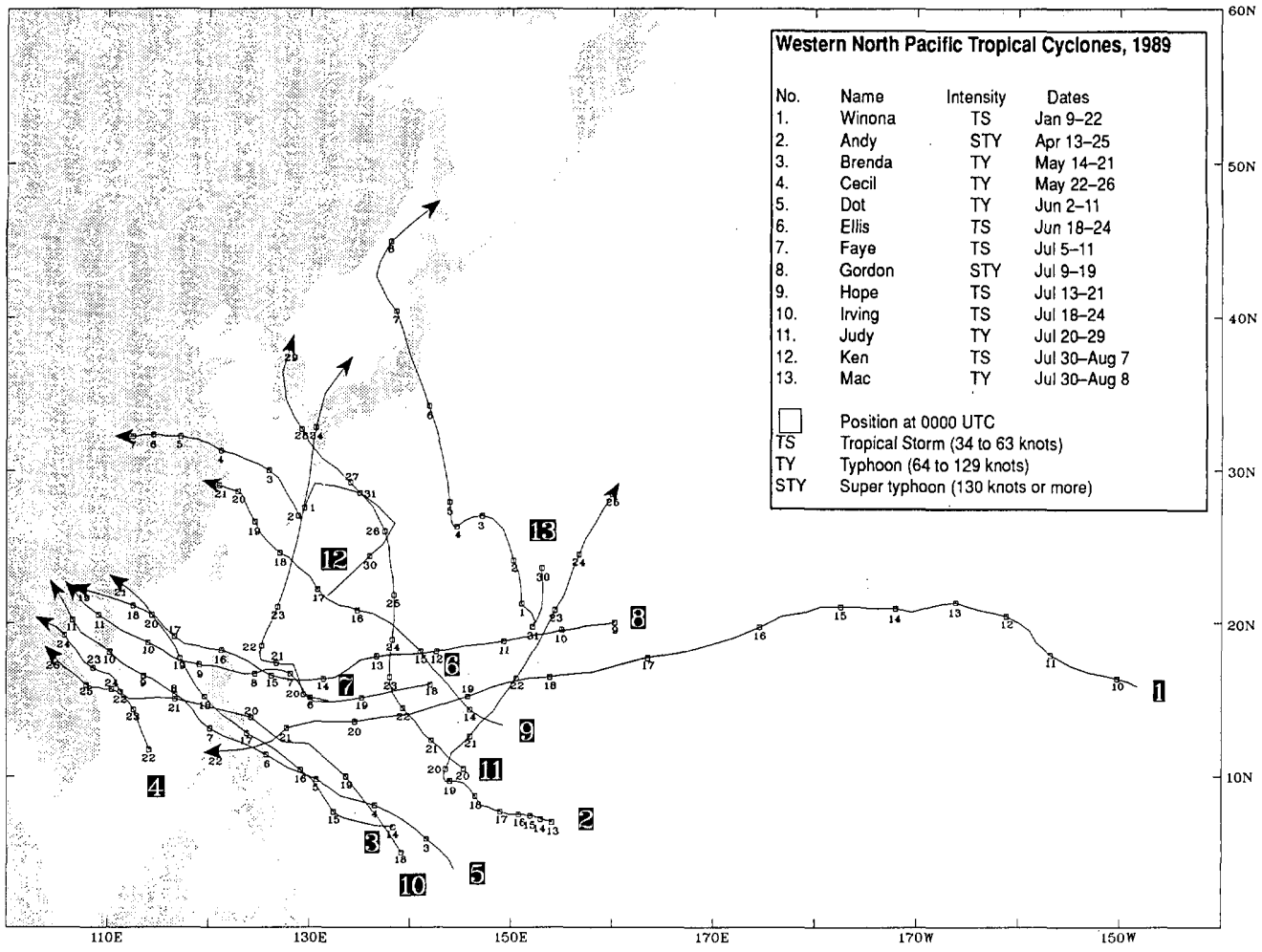
Winona, the season's first tropical cyclone, began quietly southeast of the Hawaiian Islands. The system was unusual because of its compact size and persistence. In 2 weeks it traveled over 5500 nautical miles before finally dissipating in the Philippine Islands. Following Winona, there was a long break in activity until mid-April when Super Typhoon Andy became the second typhoon in the past 9 years to form in April. It developed very slowly and, after recurving at the extremely low latitude of 10°N, passed 70 nautical miles southeast of Guam. A month later Brenda, the first of two May typhoons, came to life in the western Caroline Islands, moved northwestward across the central Philippines, and then made landfall in China. It was the second of eleven tropical cyclones to cross the Philippines during the year. Typhoon Brenda formed at the end of an extensive monsoon trough, which spread across the Bay of Bengal into the South China Sea. It moved northwestward and dissipated over southern China, leaving behind an area of enhanced low-level southwesterly flow. Typhoon Cecil developed in the South China Sea in the wake of this enhanced flow. After Cecil churned across the South China Sea and into Vietnam during the last week of May, the tropics were relatively quiet for 2 weeks. Then came Typhoon Dot, which formed in low latitudes south of the central Caroline Islands, moved steadily west northwestward, and crossed the Philippine Islands. It reached typhoon intensity in the South China Sea and eventually dissipated over northern Vietnam. The second June storm, Tropical Storm

Monthly Summary of 1989 Western North Pacific Tropical Cyclones

	Jan	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Tropical depressions					1	2				1	4
Tropical storms	1			2	4	1	2				10
Typhoons			2	1	2	2	4	2	2	1	16
Super typhoons*		1			1		1	1	1		5
Totals	1	1	2	3	8	5	7	3	3	2	35

*Super typhoon Winds of 130 knots or greater

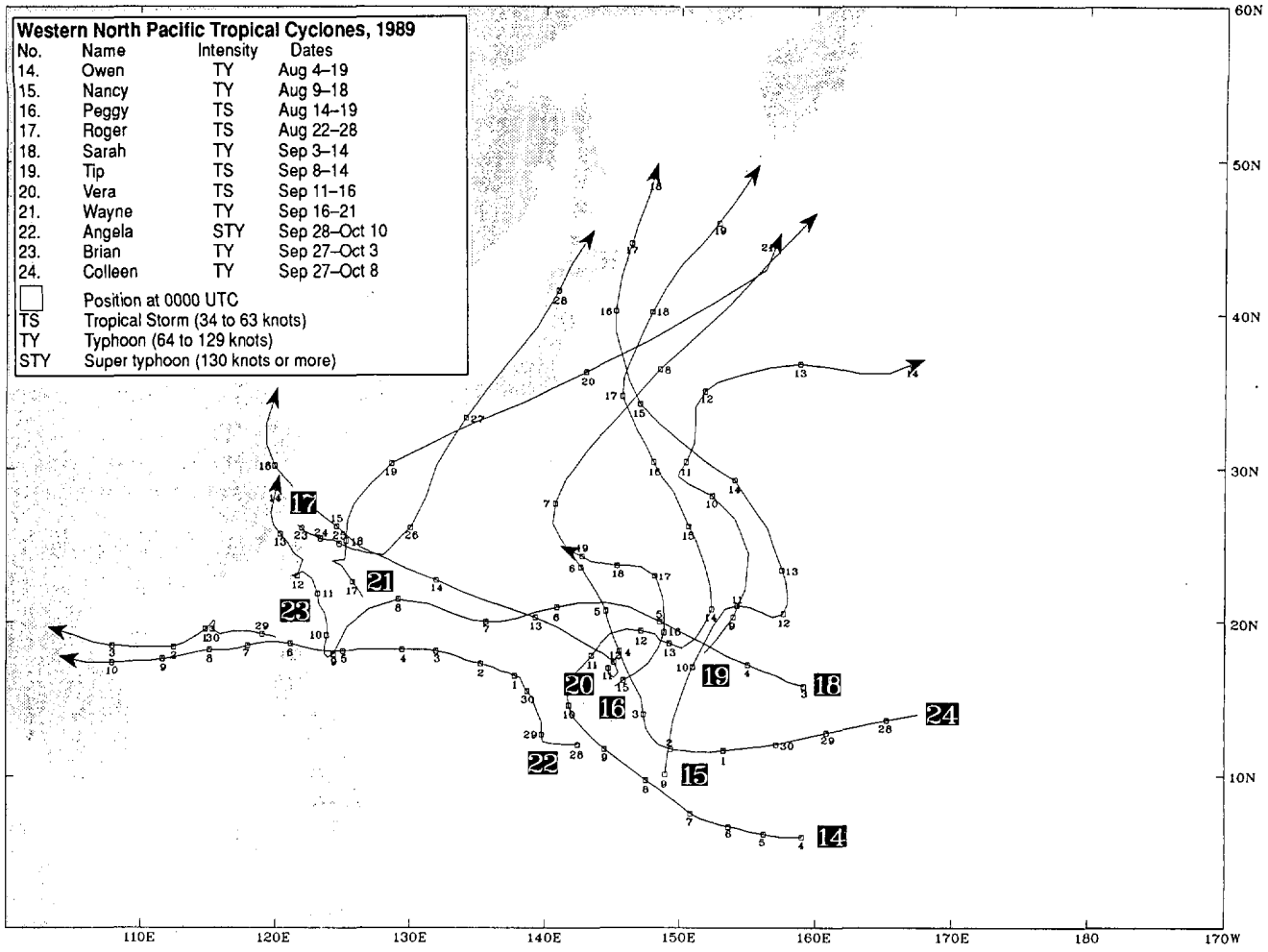
This is an excerpt from the Joint Typhoon Warning Center Annual Report. Frank Wells was instrumental in preparing and submitting this summary.



Ellis, interrupted the series of *straight runners* that occurred from Brenda through Dot. The asymmetric displacement of a broad area of gale force winds, away and to the east of the low-level circulation center, accompanied Ellis. After 5 days as a poorly defined system, Ellis briefly peaked at tropical storm intensity before becoming extratropical and making landfall in Japan.

July

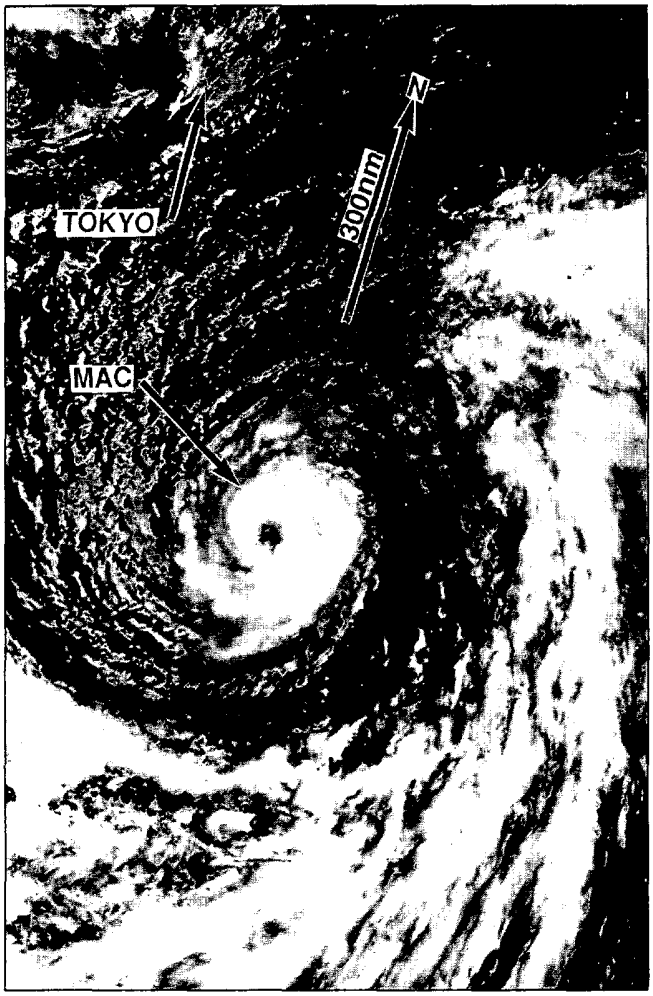
After another 2-week break in activity, a surge in the southwest monsoon caused widespread convective activity in the area west of the Mariana Islands, culminating in the genesis of Faye, the first of eight tropical cyclones to form in July. Faye intensified at a normal rate as it tracked west northwestward toward the Philippines. The cyclone weakened as it crossed north-central Luzon and reintensified slightly in the South China Sea. It weakened again in the central South China Sea, and crossed the island of Hainan before making landfall on the coast of northern Vietnam. At the start of the second week of July, while Tropical Storm Faye was affecting the Philippine Islands and the Tropical Upper-Tropospheric Trough (TUTT) was influencing weather near Wake Island, the second super typhoon of the year, Gordon, developed. It was unique in that it developed from a single cumulonimbus directly beneath a cyclonic cell in the TUTT. The cumulonimbus was initially small, but underwent a dramatic rapid, almost explosive, deepening phase. Hope generated in the wake of Gordon but failed to develop to typhoon intensity as a result of the upper-level shear caused by the outflow from Super Typhoon Gordon. During its life, Hope moved generally northwestward, occasionally *stair-stepping* in response to the passage of a series of mid-latitude short-wave troughs. Although no binary interaction was apparent, the tropical cyclone tracked along the periphery of Gordon's low-level circulation for most of its lifetime. As Super Typhoon Gordon was about to make landfall on the coast of China and Tropical Storm Hope was reaching peak intensity, Irving formed in the monsoon trough near the southwestern Caroline Islands. Tropical Storm Irving was the fourth tropical cyclone of 1989 to cross the South China Sea, but the last until Typhoon Brian late in September. Irving was short-lived and actually reached its maximum intensity as it made landfall on the coast of northern Vietnam. The day after Irving came to life, Judy devel-



oped in the monsoon trough just west of Guam. Judy followed a northward-oriented track with a critical turn to the northwest, just to the south of Honshu. It brushed the southern coast of Kyushu, made landfall on the south coast of the Korean Peninsula and dissipated rapidly. While Typhoon Judy was tracking northwestward toward Korea, an associated area of deep convection became persistent to the south southeast in the monsoon trough that had already proven itself the most active since July 1973. The disturbance became Ken-Lola, which took an elongated cycloidal track, passing close to Okinawa before making landfall on the coast of eastern China. JTWC considered the system as two separate tropical cyclones but a detailed post analysis, strongly suggested that Ken and Lola were most probably the same system. Tropical Storm Ken-Lola underscored the limitations of remote sensing for locating some poorly organized systems. Synoptic data proved invaluable in identifying and classifying the system while in warning status and in post analysis.

August

As the most active July since 1973 came to a close, Judy was dissipating over Korea and Tropical Storm Ken-Lola was threatening Okinawa. During this time, Mac developed northeast of Saipan in an extremely active monsoon trough. Typhoon Mac also developed at a higher than normal latitude. In addition, its track and intensity were influenced by a complex mid-latitude synoptic regime complicated by a multi-storm environment. The typhoon had a general northwesterly track, interrupted by 48 hours of westward movement before it resumed a northerly motion, and made landfall east of Tokyo. Mac weakened rapidly as it moved across the Sea of Japan and dissipated over southern Sakhalin Island. Soon thereafter, Typhoon Owen slowly spun up in the monsoon trough while moving on a general northwestward to northward track. Due to the proximity of Nancy, which developed at the extreme eastern end of the monsoon trough and was intensifying to the east, Owen took more than a week to reach tropical storm intensity. Later, 3 days of binary interaction with Typhoon Nancy resulted in an unusual southeasterly track during its developing stage. Then the tropical cyclone followed Nancy through recurvature and extratropical transition into high latitudes. The third tropical cyclone to develop in the monsoon trough was Peggy. Although there was a brief



At peak intensity Mac (right) is surrounded by a ring of subsidence. The DMSP visual image was taken on August 3d at 2304 UTC. Below right Typhoon Angela is generating winds of 115 knots on the 2d of October at around 0100 UTC.

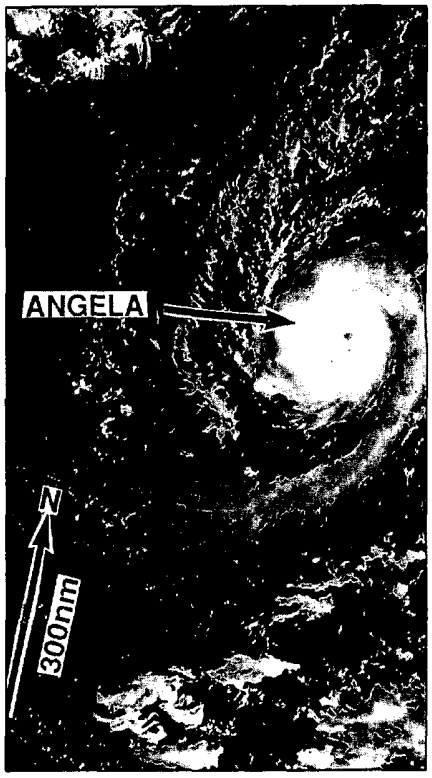
interaction with Owen, Peggy was short-lived and only reached minimal tropical storm intensity. Forming just north of Taiwan, Roger moved southeastward into the southern Ryukyu's, abruptly turned northeastward, and made landfall on Honshu.

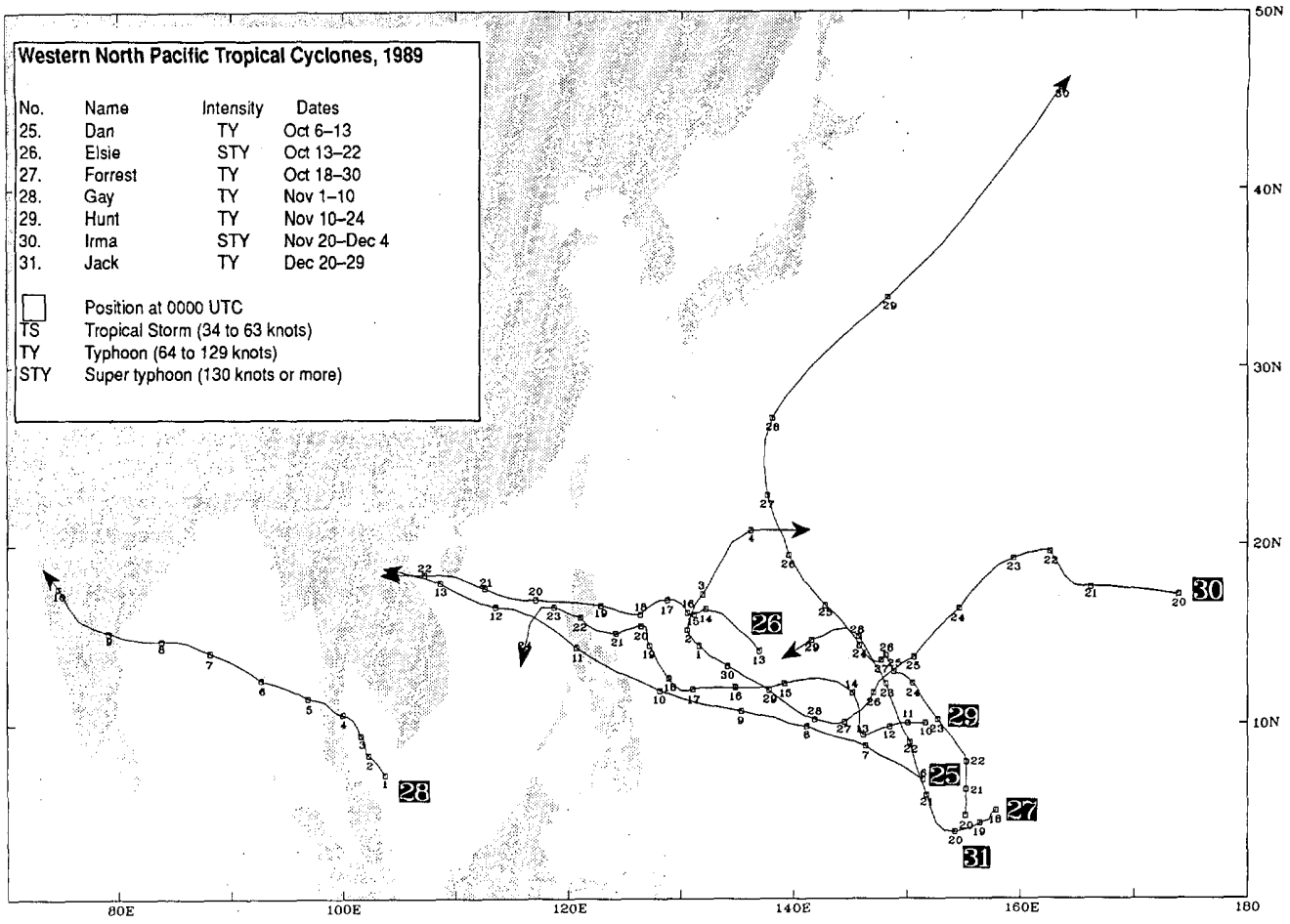
September

The first of the September tropical cyclones, Sarah, apparently underwent a binary interaction with a secondary low east of Luzon and later, when it stalled east of Luzon, was involved with the development of a sympathetic low on the lee side of Luzon. From genesis involving two distinct cloud masses to accelerating toward the Philippines, stalling just east of Luzon, moving north and rapidly reintensifying, then looping over eastern Taiwan, Sarah was one of the most difficult storms of the year to forecast. Sarah finally moved northwestward across northern Taiwan and dissipated in China. Generating in early September at the eastern end of the monsoon trough, Tip executed an unusual track to the northeast, then recurved around the subtropical ridge, and finally tracked eastward with the polar westerlies. Tropical Storm Tip reached its peak intensity at 37°N, 2 days after recurvature. Developing in the monsoon trough north of Guam, Tropical Storm Vera, after some initial erratic motion, moved on a west northwestward track, threatened Okinawa, and made a devastating landfall just south of Shanghai. About 24 hours after Vera had dissipated, the first warning on Wayne was issued. Typhoon Wayne was the last tropical cyclone of 1989 to affect Japan. It was unique in that it intensified after recurvature, partly as a result of its rapid acceleration. Wayne caused considerable destruction, mudslides and some deaths in Japan.

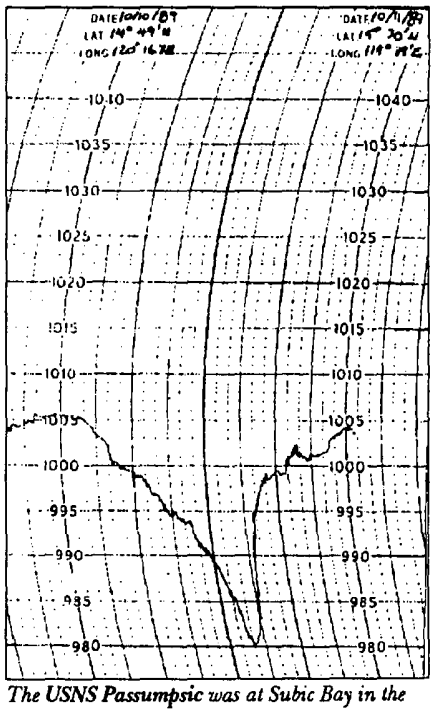
October

During late September the monsoon trough became very active. The first storm of a three-cyclone outbreak in 3-days, Angela had the distinction of being in warning status longer than any other tropical cyclone in the western North Pacific this year— 12 days. Angela was also one of five tropical cyclones to reach super typhoon intensity in 1989. Developing south of Guam, Angela tracked slowly westward and struck northern Luzon with super typhoon intensity, causing a large number of casualties and widespread destruction. It then reintensified in the South China Sea and finally made landfall in central Vietnam. As Angela developed, the monsoon trough became active across the South China Sea from western Luzon to Vietnam and spawned typhoon Brian. Cecil in May and Brian in late September-early October were the only tropical cyclones to develop and spend their entire lifetimes within the confines of the South

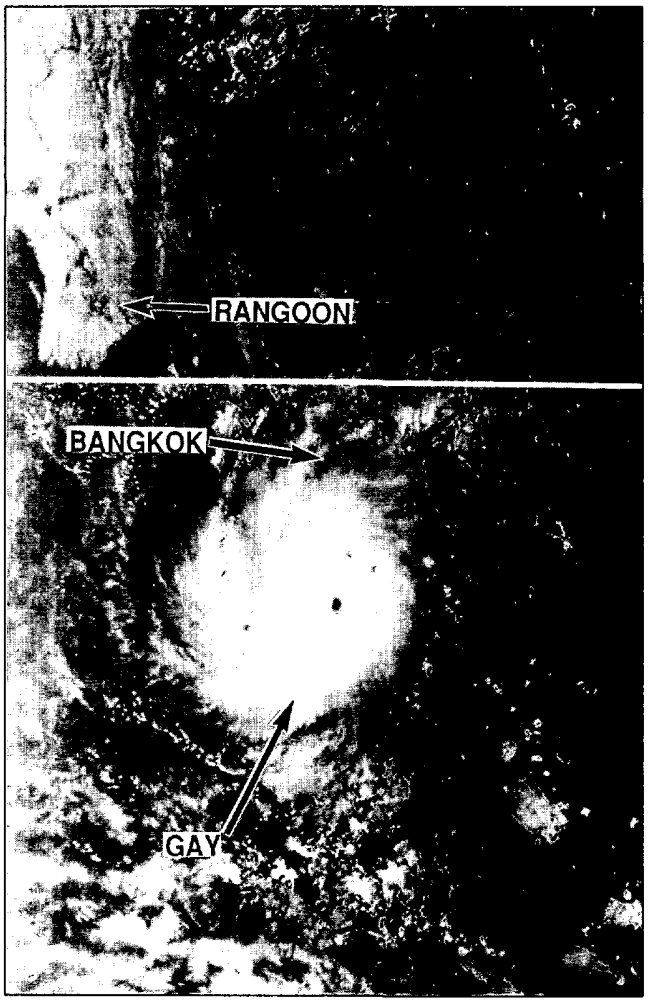


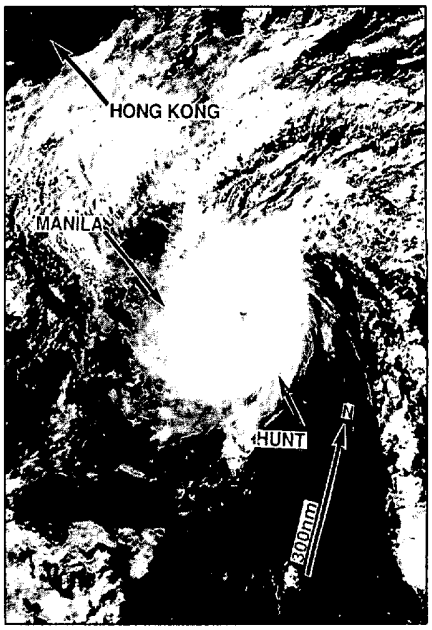


China Sea. Nearly 4000 nautical miles to the east, a deep trough penetrated the tropical western North Pacific near the dateline and Colleen formed at its base. Colleen passed through the northern Mariana Islands before recurving south of Japan. It maintained typhoon intensity until it turned extratropical, threatening PACEX 89—the largest U.S. Navy exercise conducted in the Pacific since the Korean War. Forming from a disturbance in the monsoon trough near Truk, Dan followed a steady west northwestward track and crossed the central Philippine Islands. Coming just days after Typhoon Angela's destructive passage across northern Luzon, Dan added to the misery. The cyclone reintensified in the South China Sea and made landfall on the coast of central Vietnam where it caused more destruction. In the wake of Angela and Dan, Super Typhoon Elsie became the third tropical cyclone to hit the Philippine Islands within 12 days. Elsie developed from a TUTT-induced wave in the easterlies and tracked westward throughout its life. In the Philippine Sea, Elsie rapidly intensified and struck central Luzon with an intensity of 140 knots. It was cited as the most intense cyclone to strike the Philippine Islands this year. Because of its small size, Elsie weakened dramatically as it moved across the Philippines, and did not reintensify as it traversed the South China Sea. The cyclone dissipated after making landfall in central Vietnam. The last of six October tropical cyclones, Forrest was slow and erratic in its development. Throughout its early life, Forrest was a sloppy, broad system. After passing Guam, it finally intensified and ultimately became a respectable 95-knot typhoon. Soon thereafter, it recurved



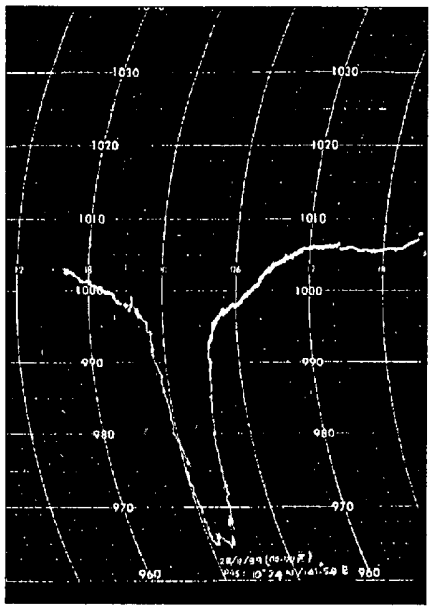
The USNS Passumpsic was at Subic Bay in the Philippines when typhoon Dan went through on October 10th, as their barograph shows.





Typhoon Gay (right) makes landfall on the Malay Peninsula on November 4th at 0042 UTC. More than 1000 people were reported dead or missing in Gay's aftermath. This was the worst storm to affect the Malay Peninsula in 35 years. The photograph is a NOAA visual image. Below is a view from the bridge of the M.V. Goldensari Indah, which sailed through Typhoon Irma on the 28th of November at about 0000 UTC. At far right Typhoon Hunt poses for a portrait about 9 hours before landfall over central Luzon. The DMSP visual image was made at 1130 UTC on the 21st of November.

and accelerated rapidly to the northeast becoming one of the year's strongest extratropical cyclones.



November through December

The first tropical cyclone of November turned out to be the worst tropical cyclone to affect the Malay Peninsula in 35 years. Gay generated in the Gulf of Thailand, sank numerous ships, crossed the Malay Peninsula into the Bay of Bengal and slammed into India with peak sustained winds of 140 knots. Unique because of its small size, great intensity, and point of origin, Gay crossed two different tropical cyclone basins and almost entered a third. Except for Typhoon Gay, early November was relatively inactive in the western North Pacific. In mid-November, Hunt initially appeared as a weak tropical disturbance in the monsoon trough. Hunt was the fourth typhoon to strike the Philippine Islands within 6 weeks. Generally a westward moving system, Hunt was slow to develop, but intensified rapidly in the western Philippine Sea. As it approached the Philippines, the cyclone underwent a *stair-step* move before resuming a westward course into central Luzon. Unlike its predecessors, Hunt dissipated in the South China Sea after crossing Luzon. Irma was the third and final tropical cyclone to form in November. It's development and track were dictated by complex mid-latitude and monsoonal regimes. Initially, Irma was slow to develop, however, rapid intensification followed once it entered in the Philippine Sea. As Super Typhoon Irma weakened in the Philippine Sea, Tropical Depression 35W was detected on the first day of December in the western Marshall Islands. The depression lasted more than a week as a discrete system. The second tropical cyclone to form in December, Jack was the twenty-first tropical cyclone of the year to attain at least typhoon intensity, and was the final tropical cyclone of the season. Typhoon Jack was noteworthy for the unusually long period it remained stationary. Not surprisingly, the unusual motion of Jack was accompanied by an equally unusual intensification and dissipation pattern. The cyclone rapidly intensified from 30 to 125 knots in 3½ days, then fell apart completely. In this remarkable dissipation, Jack's maximum winds dropped from 105 to 30 knots in 24 hours.

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