

DECEMBER 1991

VOLUME 33

NUMBER 12



STORM DATA

WITH ANNUAL SUMMARIES



**AND UNUSUAL WEATHER PHENOMENA
WITH LATE REPORTS AND CORRECTIONS**



noaa

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION

NATIONAL ENVIRONMENTAL SATELLITE,
DATA, AND INFORMATION SERVICE

NATIONAL CLIMATIC DATA CENTER
ASHEVILLE, N.C.

Cover: Before and after pictures of the Guadalupe River, three miles southwest of Comfort, Texas. Left: Guadalupe River near the normal low flow. Right: On December 20, the river was 19 feet above normal low flow. This site is the same location of the "Bus Tragedy Flood" of July 17, 1987 in which 10 people were killed. The crest of the July 17 flood was 11 feet higher than the flood pictured in this December 20 photo! (Photo courtesy: Robert Blaha, Comfort, Texas.)

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STORM DATA (ISSN 0039-1972)

National Climatic Data Center

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The Storm Data and Unusual Weather Phenomena narratives, as well as, the Hurricane/Tropical Storm summaries are prepared by the National Weather Service. Monthly and annual statistics of tornado and lightning events that resulted in any deaths, injuries, or damage are compiled by the cooperative efforts of the National Climatic Data Center and the National Severe Storms Forecast Center.

STORM DATA contains all confirmed information on storms available to our staff at the time of publication. However, due to difficulties inherent in the collection of this type of data, it is not all-inclusive. Late reports and corrections are printed in each edition.

Maps of the National Weather Service Forecast Zones which are used in the Storm Data and Unusual Weather Phenomena section will be printed in all editions.

Except for limited editing to correct grammatical errors, materials submitted are generally published as received.

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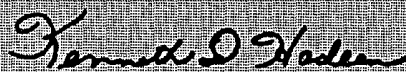
National Climatic Data Center
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37 Battery Park Avenue
Asheville, NC 28801-2733
(704) 259-0682 or (704) CLIMATE

The editor of STORM DATA solicits your help in acquiring photographs (prints or slides; black and white, or color), maps, clippings, etc. of significant or unusual weather events (past or present). These could be for use in the "Outstanding Storms of the Month" or "Et Cetera" sections of STORM DATA. We request our subscribers or other interested persons to mail such items to:

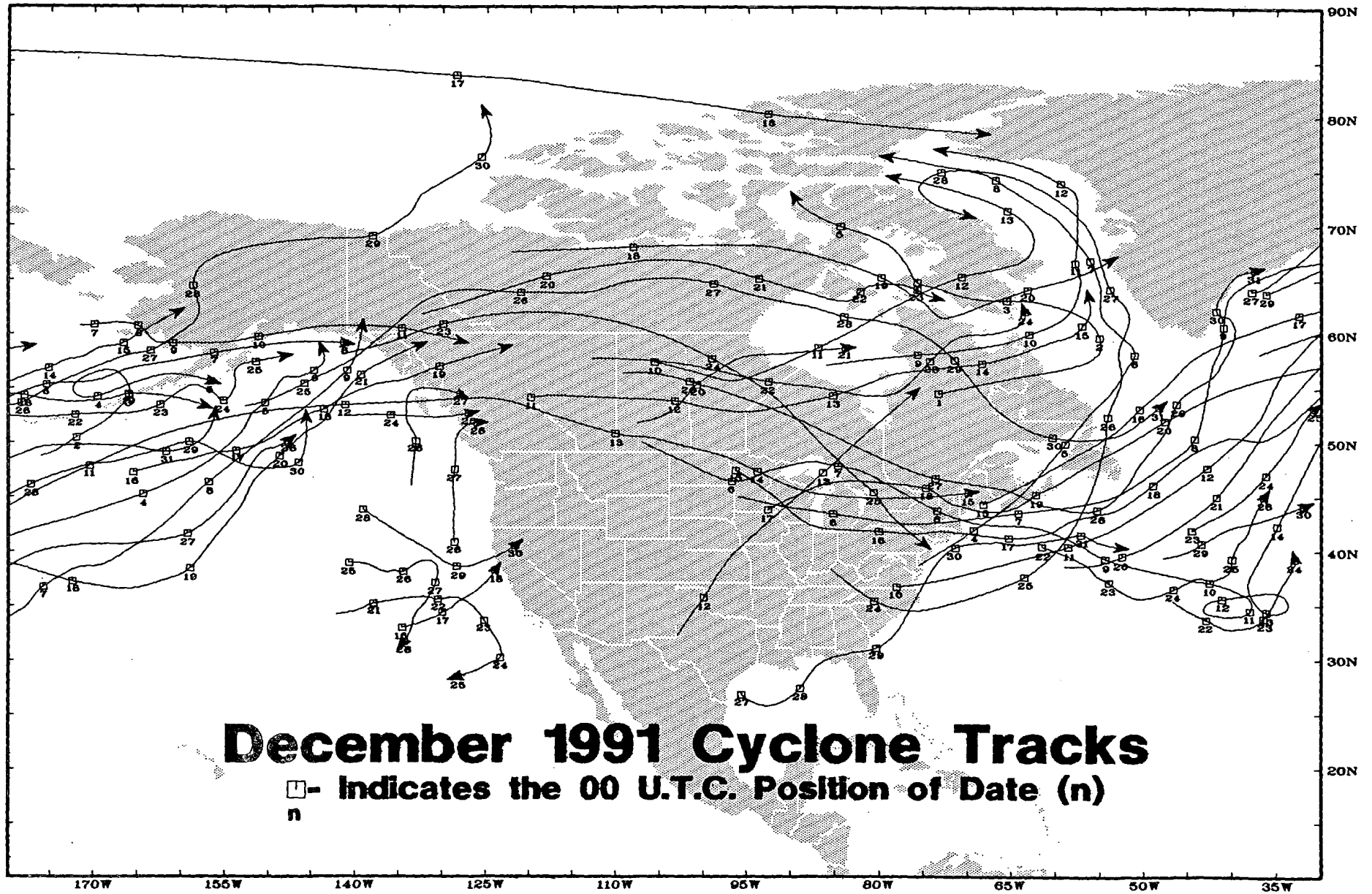
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Any such items received by the editor will be for use in STORM DATA only. Any other use of said items will be with only the permission of the owner. Materials submitted will be returned if requested in the original submission.

"I certify that this is an official publication of the National Oceanic and Atmospheric Administration and is compiled from information received at the National Climatic Data Center, Asheville, North Carolina 28801-2733."



Director
National Climatic Data



December 1991 Cyclone Tracks

□ - Indicates the 00 U.T.C. Position of Date (n)
n

CLIMATIC DATA OF THE MONTH

PRECIPITATION AND TEMPERATURE ANOMALIES - DECEMBER 1991

Table 1 lists the 97-year temperature and precipitation rankings for the nine climatically homogeneous regions in the United States outlined in Figure 1 below.

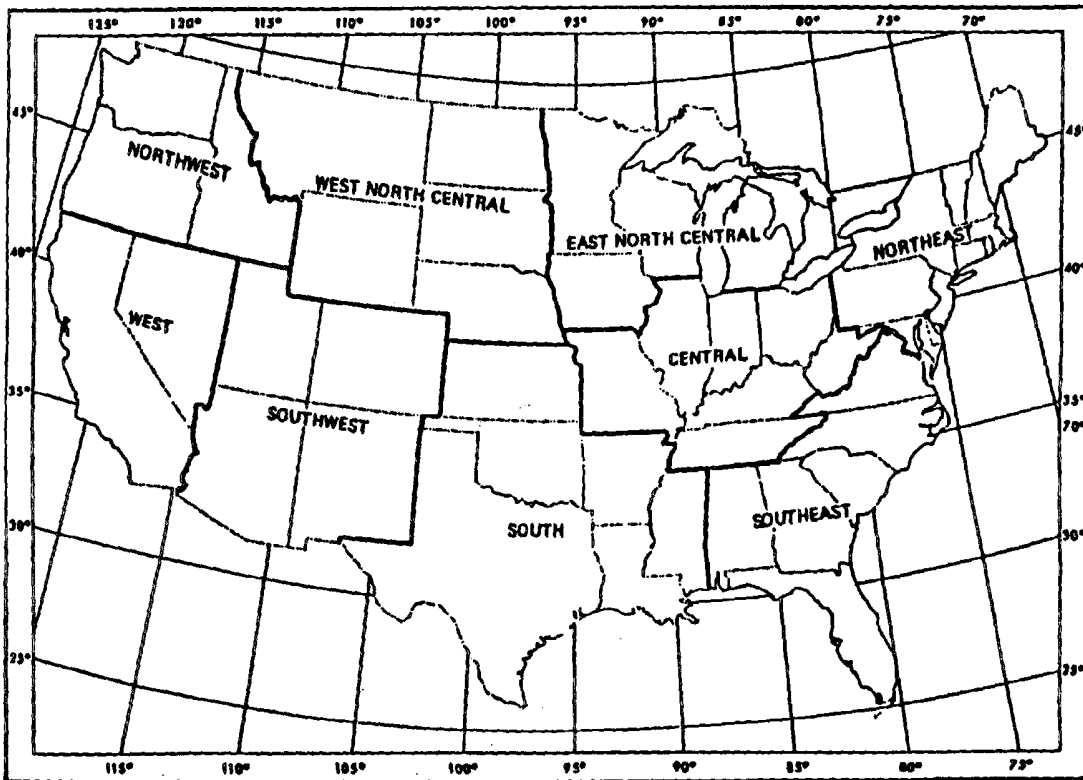
Areally-averaged mean monthly temperatures across the nation ranked December 1991 as the 14th warmest December since 1895. Due to the lack of Arctic outbreaks, temperatures averaged as much as +8°F above normal in the northern Plains. With mild weather prevalent across the United States, most of the country including southern Alaska and Hawaii observed above normal temperatures (>+2°F). In contrast, Maine, north-western Alaska, and the central Rockies averaged at least -2°F below normal. The greatest negative mean monthly temperature departure was -4°F in the central Rockies. (See Figures 2 and 3 on page 5.)

Precipitation varied greatly across the nation in December 1991. Texas was inundated with heavy rain (>8 inches), and brought the South region their third wettest December. In sharp contrast, less than 75% of normal precipitation fell in the Northwest and West North Central regions. These two regions experienced their 10th and 11th driest December, respectively. Nationally, areally-averaged precipitation ranked December 1991 as the 27th wettest December since 1895. (See Figures 4 and 5 on page 6.)

REGION	PRECIPITATION	TEMPERATURE
Northeast	51	59
East North Central	60	73
Central	77	81
Southeast	34	78
West North Central	11	89
South	95	83
Southwest	83	51
Northwest	10	81
West	32	54
National	71	84

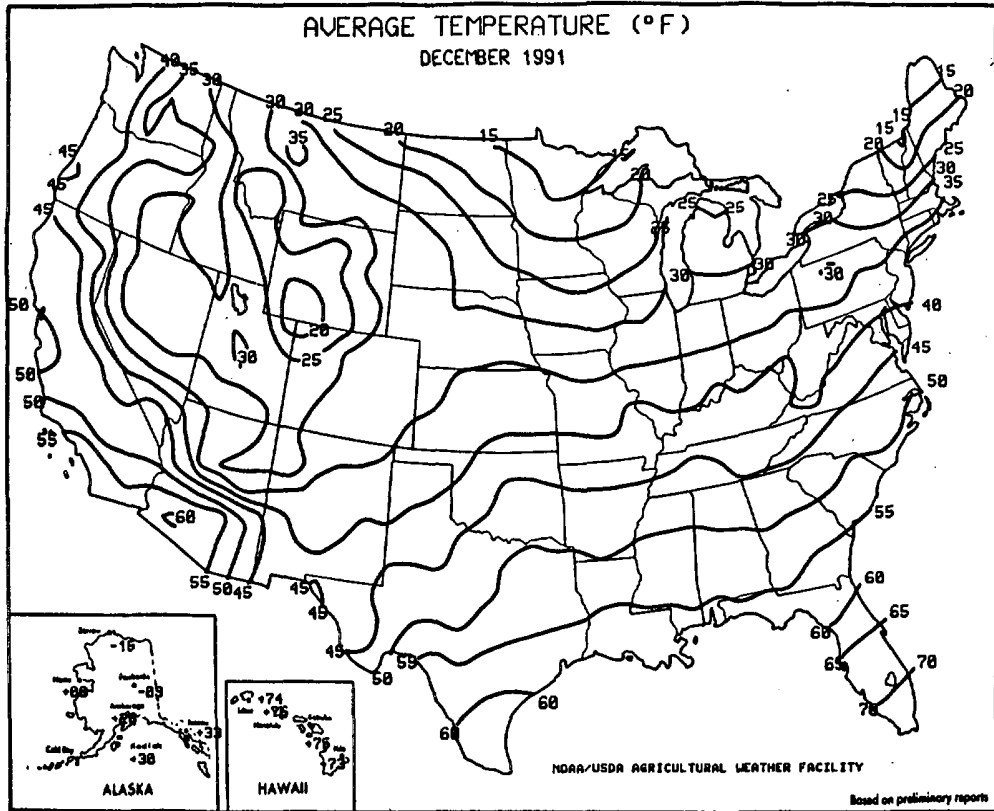
From National Climatic Data Center

Fig. 1



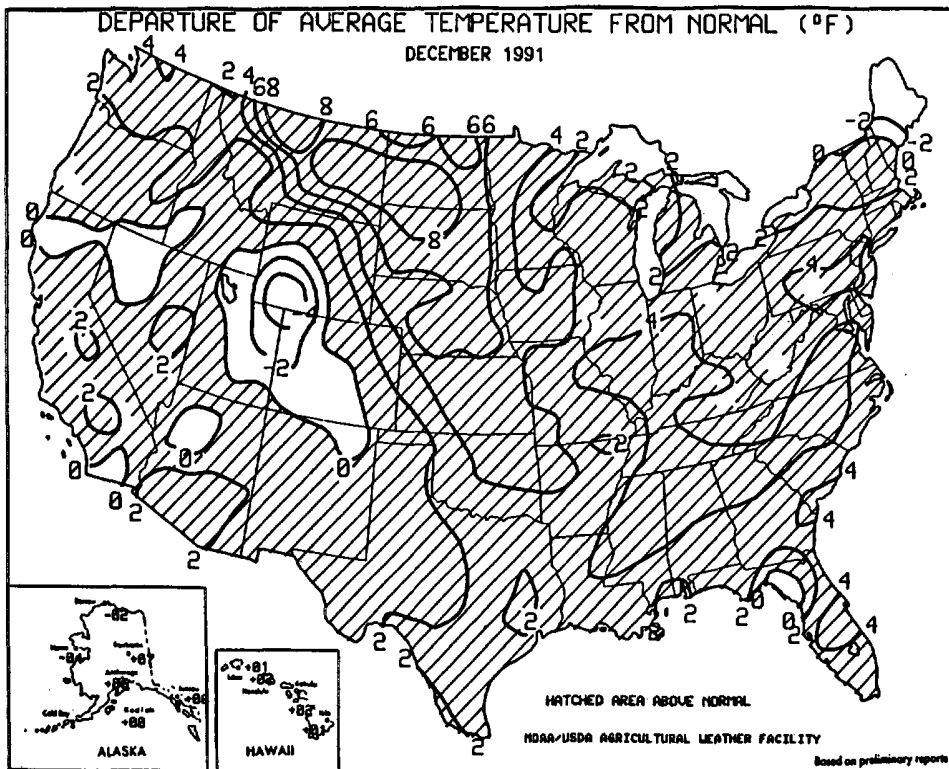
From National Climatic Data Center

Fig. 2



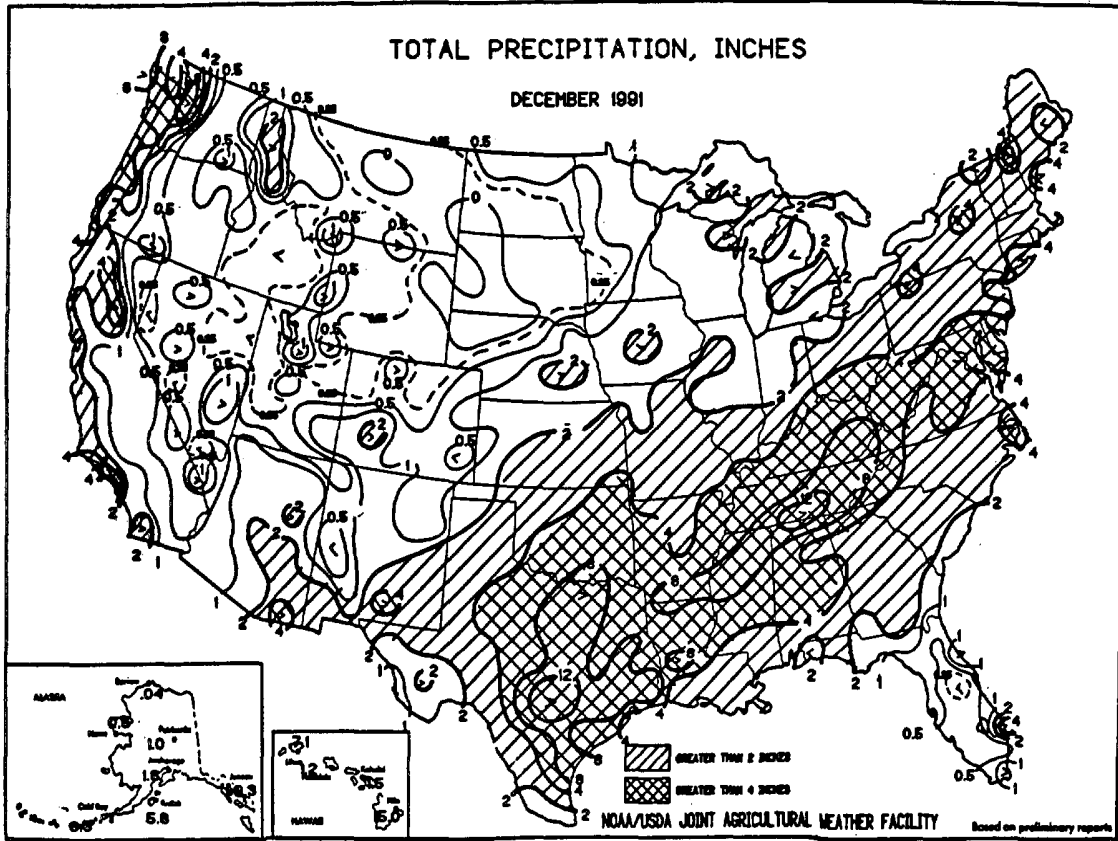
Reprinted from *Weekly Weather and Crop Bulletin* - January 7, 1992

Fig. 3



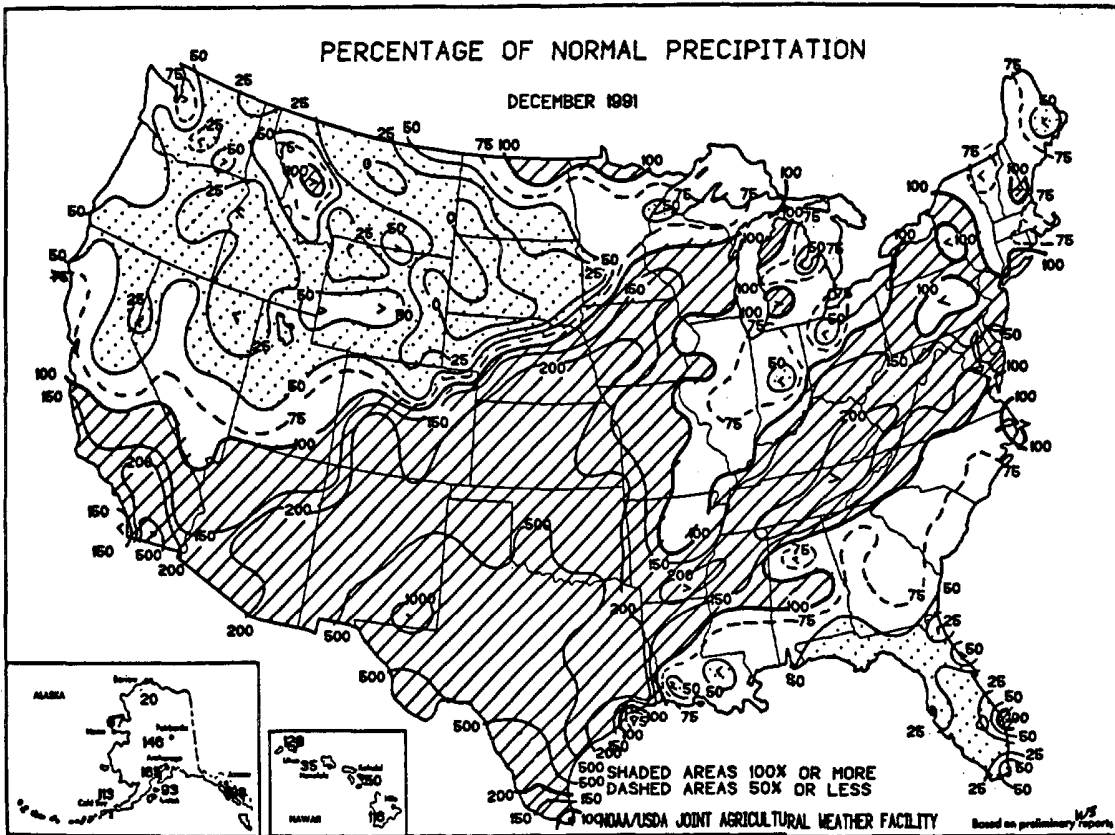
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Fig. 4

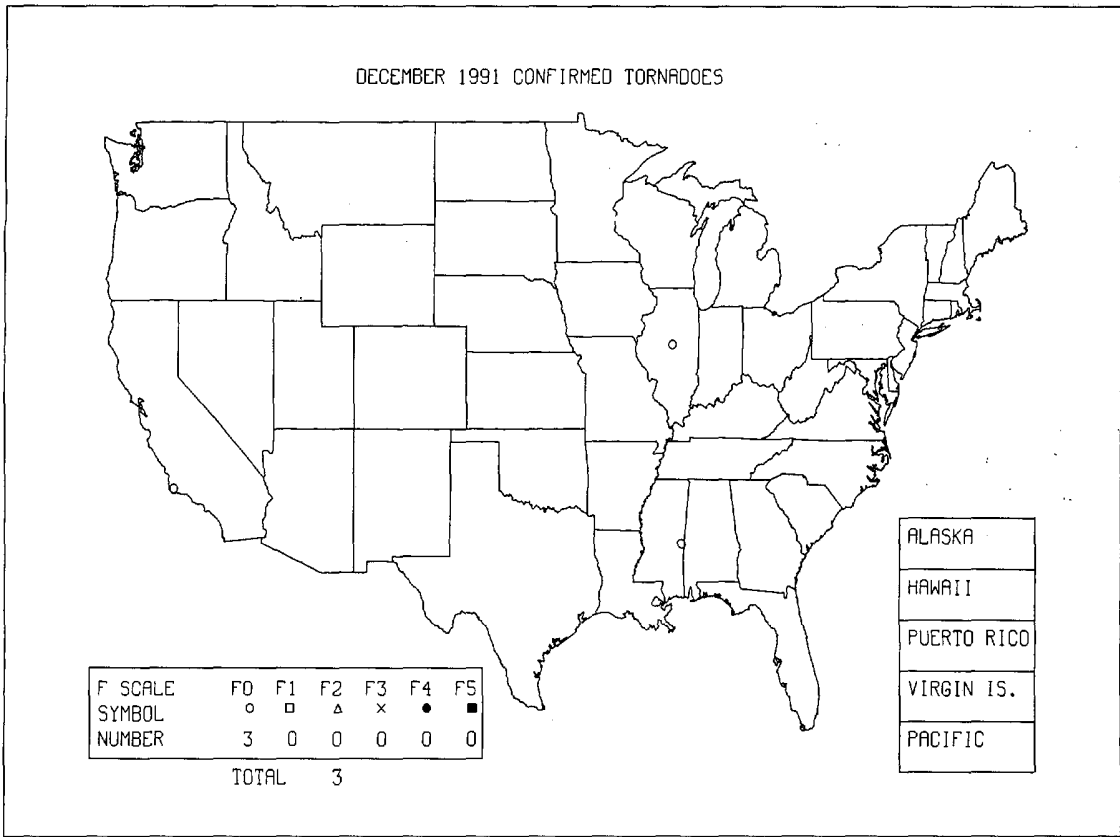


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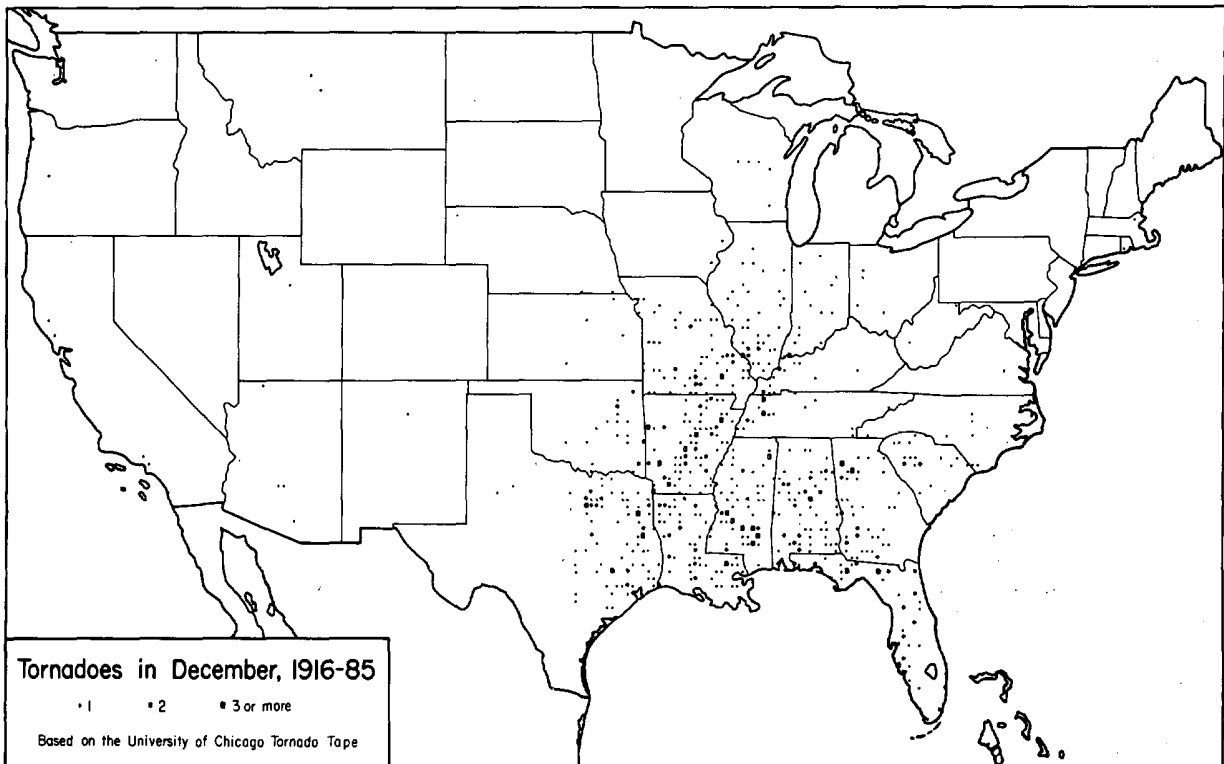
Fig. 5



Reprinted from *Weekly Weather and Crop Bulletin* - January 7, 1992



Three F0 tornadoes (as defined by the Fujita Tornado Scale) were observed in December 1991. One tornado began as a waterspout and moved onshore in southern California. It resulted in two injuries from flying glass. The other two tornadoes occurred in Mississippi and Illinois. In all, damage from the tornadoes was very light. (See map above.) Additional information on tornadoes that occurred in 1991, is available in the National Summary of Tornadoes, 1991 on page 66 of this issue of *Storm Data*.



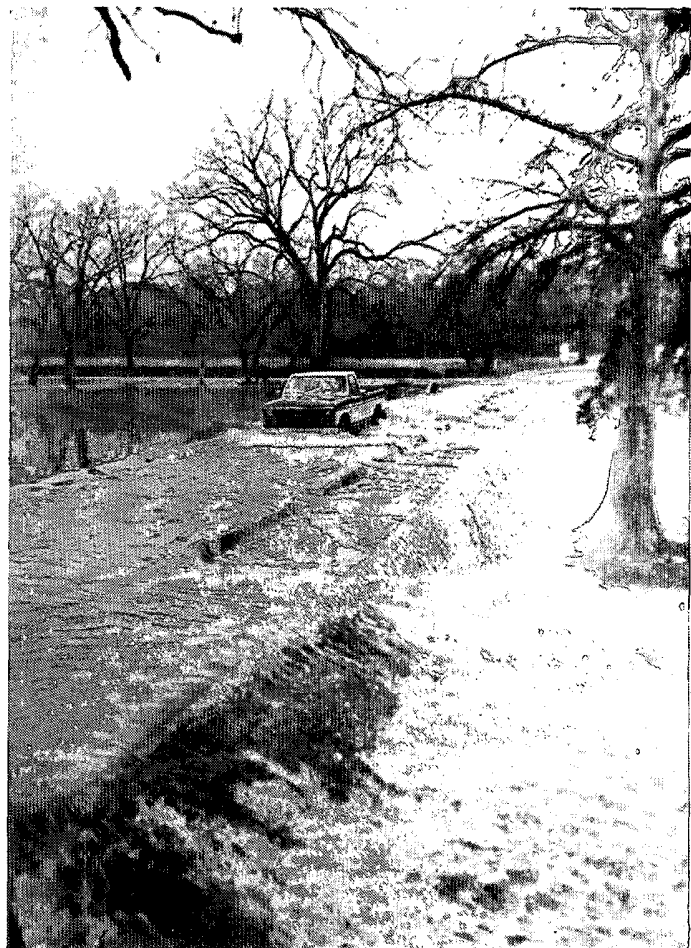
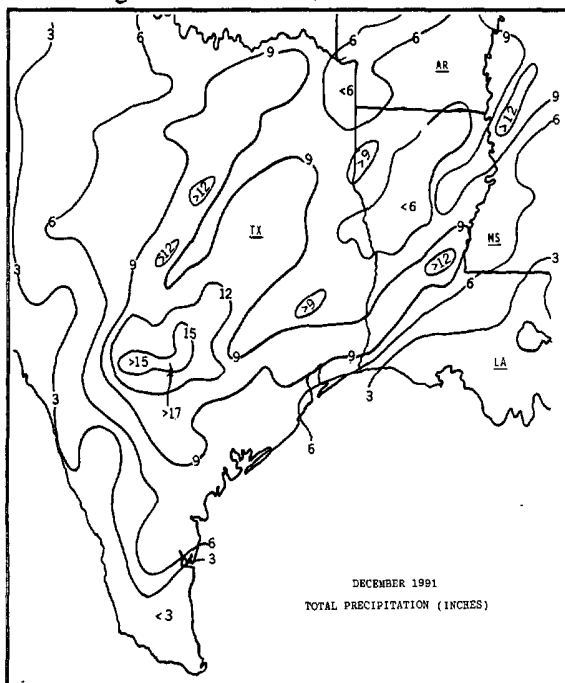
OUTSTANDING STORMS OF THE MONTH

1. Heavy Rains Cause Flooding in Texas

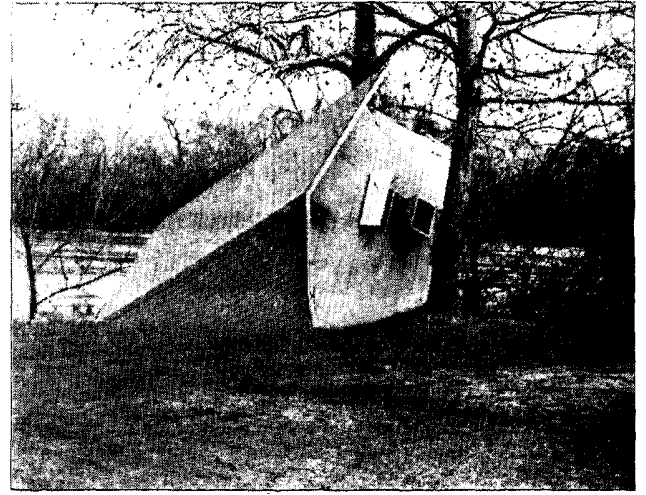
The eastern-half of Texas experienced heavy rains from December 18th to the 22nd which resulted in both flash flooding and river flooding. The heavy rains fell over a large portions of the northern, central, and south central regions of Texas. Average rainfall for the five days ranged from 12 to 16 inches!

On December 18, a warm, moist, tropical air mass moved into the southern third of Texas. The depth of the moist layer was further enhanced at mid-levels by the sub-tropical jet stream drawing moisture out of the Pacific. This overall pattern remained in place into the 22nd and as a result, heavy rains fell over much of the State (see map). Heaviest totals fell along the southern escarpment of the Edwards Plateau (north of San Antonio) where 12 to 16 inch amounts were common. Medina received 15.59 inches as a five day storm total. Other storm totals included 14.91 inches at Boerne, and 14.09 inches at Fredericksburg. New Braunfels located 25 miles NE of San Antonio, received the greatest total precipitation for the month with 17.51 inches.

Most rivers in north and central Texas were at or above flood stage at the end of December. Several areas in southern Texas had flood conditions lasting into February 1992. Eleven people lost their lives in the floodwaters. Estimated total damage was more than \$150 million!



Above: A motorist crosses flood-swollen Cypress Creek in Wimberley, Texas. Lightning associated with the storms damaged two homes in the area. (Photo courtesy: Wimberley View, Wimberley, Texas; photographer, Pat Patton of the Wimberley View.) Left: Flooding continued into February. Photograph was taken on February 11, 1992. (Photo courtesy: Joe Irvin, Lower Colorado River Authority, Austin, Texas.) Rainfall map provided by National Climatic Data Center.



Above(left): Floodwaters in this house reached six feet. The occupants of the house removed their furniture and other possessions prior to the flood. **Above(right):** A home damaged by the flood. Damage in Bastrop County topped \$5 million. (Photo courtesy: *Times, Smithville, Texas*; photographer, H.H. Krusekopf.) **Left:** Corpus Christi International airport received 6.77 inches on December 21st. Precipitation began about 1:30 p.m. CST and ended shortly after midnight. The greatest rainfall amount for any one-hour occurred between 3:30 and 4:30 p.m. CST with 2.10 inches.

Special thanks to Mario D. Valverde, WPM, San Antonio, Texas, for research and materials used in this section.

2. Snow in Minnesota

Snow and ice began falling over Minnesota on December 3 behind a surface low pressure system. Snowfall amounts of one to three inches were common. With winds gusting to 50 mph, wind chill values ranged from 30 to 50 below zero. Power outages occurred when power lines were downed by accumulated ice and strong winds.



Photo courtesy: Norman Peterson, *Owatonna People's Press, Owatonna, Minnesota.*

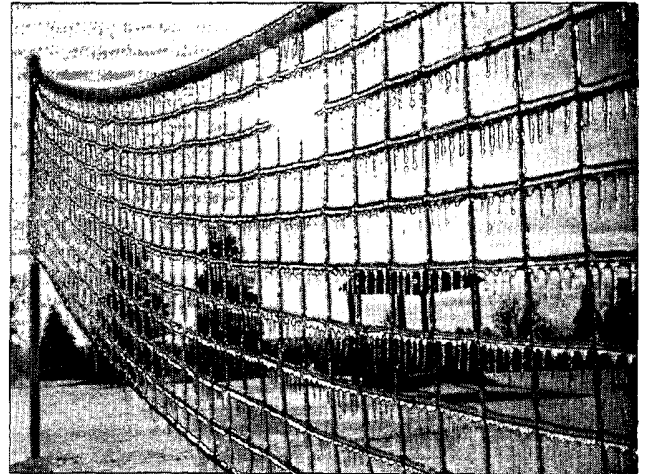


Photo courtesy: Mike Oldenburg, *Owatonna People's Press, Owatonna, Minnesota.*

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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ALABAMA

ALZ001-002-003-004-008	01 03	0030CST- 2300CST			1	0	?	?	Flood Flash Flood
------------------------	----------	---------------------	--	--	---	---	---	---	----------------------

During the first two days of December heavy rains occurred over northern and western Alabama which includes Colbert, DeKalb, Fayette, Franklin, Greene, Hale, Jackson, Lamar, Lauderdale, Lawrence, Limestone, Madison, Marion, Marshall, Morgan, Pickens, Sumter, Tuscaloosa, Walker, and Winston Counties. Rainfall in northwestern Alabama and the Tennessee Valley was 7 to 11 inches. Lesser amounts in the general range of 3 to 7 inches over portions of west Alabama. Widespread flash flooding occurred over the Tennessee Valley of north Alabama, especially in areas in and around Owens Crossroads and Muscle Shoals and Florence. In addition, significant rises and flooding occurred along the Tombigbee River in west-central Alabama as the runoff flowed downstream. One death occurred in Lauderdale County where a 54-year-old man drowned on December 2nd, when his car was washed into a creek by swirling flood waters. Many roads were inundated or washed out across northern Alabama, and at least seven families were forced from their homes in Colbert County by rising flood waters. In west-central Alabama the Tombigbee River rose above flood levels during the first week of December, as runoff flowed downstream. Flooding was confined to overflow of low-lying farm and pasture lands along the river, although some minor residential flooding occurred in the Pickensville area of Pickens County. Damage estimates were not available. (M54V)

Tuscaloosa County	02	1921CST			0	0	0	0	Thunderstorm Winds
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Several trees were blown down by thunderstorm winds at Coker.

ARIZONA

Maricopa County Phoenix Metro- politan Area	19	1100MST			0	0	?	0	Flash Flood
---	----	---------	--	--	---	---	---	---	-------------

A strong Pacific cold front and abundant moisture left over from a previous storm produced very heavy rains and some flooding. About 0.50 inch of rain fell in only 10 minutes. Storm total rainfall amounts were as high as 1.78 inches with many streets flooded in Phoenix.

Phoenix	19	1134MST			0	0	0	0	Funnel Cloud
---------	----	---------	--	--	---	---	---	---	--------------

A local television station relayed a report of funnel cloud moving northeast.

W Phoenix	19	1136MST			0	0	?	0	Hail (0.75)
-----------	----	---------	--	--	---	---	---	---	-------------

Widespread hail reported to be marble- to dime-size covered the ground to depths of 1 to 3 inches. Continuous lightning in the clouds accompanied the hail and heavy rain.

N Phoenix	19	1150MST			0	0	0	0	Funnel Cloud
-----------	----	---------	--	--	---	---	---	---	--------------

Cochise County Douglas Airport	19	1337MST			0	0	0	0	Funnel Cloud
-----------------------------------	----	---------	--	--	---	---	---	---	--------------

Maricopa County Phoenix	30	1225MST			0	0	0	0	Funnel Cloud
----------------------------	----	---------	--	--	---	---	---	---	--------------

Control tower personnel reported funnel cloud north of the Falcon Field Airport. Weather spotters reported three funnel clouds at 40th Street north of the Carefree Highway.

ARKANSAS

None reported.

CALIFORNIA, Northern

CAZ005 Central and Southern San Joaquin Valley	27 28	0700PST- 0200PST			0	8	5	0	Blowing Dust
---	----------	---------------------	--	--	---	---	---	---	--------------

A strong cold front was preceded by winds out of the southeast which gusted as high as 48 knots. The strong winds caused blowing dust which in turn limited driving visibilities to near zero along Interstate 5 and other major highways. Roads were closed until rain finally began and visibilities improved. In contrast to a similar incident just a month earlier, only minor accidents and injuries were reported.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
CALIFORNIA, Southern									
CAZ013 Northern Portions	08	0930PST			0	0	0	0	High Winds
	High winds hit many mountain areas, with gusts to 50 mph at Sandberg, in the Tehachapi Mountains. The winds were caused by an upper level disturbance west of Los Angeles.								
San Diego County West of Oceanside	17	0940PST	?	?	0	0	0	0	Waterspout
	A waterspout was sighted west of Oceanside between 0940 PST and 0950 PST.								
CAZ011 > 016-019-021	19 21	0330PST- 0330PST			0	0	?	0	High Winds Snow
	An upper low moving southeast through the Mojave Desert caused strong winds and some mountain snow. Santa Monica had gust to 63 mph, Van Nyes 52 mph, Mt. Wilson 49 mph and Los Angeles Airport 36 mph. Snowfall in the mountains was from 2 to 5 inches, with Big Bear Lake receiving 6 inches of snow factor.								
CAZALL	27 28	0310PST- 1430PST			1	0	?	0	Winter Storm
	A major winter storm moved into southern California from the northwest, with heavy rain, strong winds and mountain snows. Up to 2 feet of snow fell in the mountains, with 1 to 3 inches of rain common along the coast and in the mountains. One person was killed on the rain slickened Santa Ana Freeway in Irvine. There was also, some minor flooding of highways and intersections. Pacific Coast highway between Malibu Canyon and Kanan Dume Roads was closed for a time because of mudslides and flooding. In Ventura County, State Route 33 was closed by snow, near Wheeler Grove.								
CAZALL	28 29	2030PST- 2359PST			1	0	?	0	Winter Storm
	Another major storm moved into southern California from the northwest, with wind, rain and mountain snow. Heavy rainfall in the coastal areas caused some minor street flooding and mudslides. Rainfall along the coast and in the mountains ranged from about 0.50 inch to over 4 inches. Mt. Wilson had 4.21 inches of rain with 8 inches of snow. Big Bear Lake had 2 inches of snow. The cold, wet weather was responsible for the death of a homeless man, who died of hypothermia, in Granada Hills which is in the city of Los Angeles. (M350)								
Santa Barbara County Gaviota State Park	29	1000PST	?	10	0	2	2	0	Waterspout- Tornado (F0)
	A waterspout moved onshore at Gaviota State Park and broke windows of a parked motorhome, injuring two persons from broken glass. The waterspout occurred during a heavy rainstorm.								
Santa Ynez Carpenteria	29 29	1300PST 1300PST			0 0	0 0	2 2	0 0	Flood Flood
	Heavy rains caused minor flooding of street. Some businesses reported minor damage.								
Orange County Buena Park	29	2015PST			0	0	?	0	High Winds
	High winds along with a heavy rainstorm hit Buena Park. There was some damage along valley view street near La Palma Avenue. A roof was blown off one house and several trees were uprooted, causing some damage to other houses. Some power lines were also knocked down. Some residents said they thought it was a tornado, but it could not be confirmed by the authorities.								

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
----------	------	----------------------------	---------------------------	--------------------------	--------------------------------	---------	---------------------------------	-------	--------------------

COLORADO

COZ009
San Luis Valley

01- 30					0	0	?	?	Record Cold
-----------	--	--	--	--	---	---	---	---	-------------

December was a record cold month for the San Luis Valley as temperatures were frequently below freezing. Only 3 days saw the mercury rise to or above 32°F. Nighttime temperatures were consistently below zero, with only five overnight lows above zero. The average monthly temperature of 5.2°F broke the old record of 6.7°F set in 1964 and was 12.8°F below the normal of 18°F. Two record low temperatures were broken and one was tied.

COZ002-004-008-007
Mountains and Four-Corners

01	1600MST-				0	0	?	?	Snow
02	1800MST								

An upper level low moving across the southwestern United States produced snow in the mountains and the Four-Corners region. Snow amounts ranged from 3 to 10 inches, including 10 inches at Steamboat Springs and Mary Jane Ski Area, and 9 inches at Telluride.

COZ002-004
Northern and Central Mountains

02	0000MST- 0900MST				0	0	?	?	High Winds
----	---------------------	--	--	--	---	---	---	---	------------

Strong northwesterly flow aloft across the northern part of the state produced high winds in the mountains and foothills east of the Continental Divide in the Northern and Central mountains. A National Weather Service mesonet station on Fritz Peak near Rollinsville recorded gusts above 65 mph (57 knots) with a peak gust to 79 mph (70 knots) shortly after midnight. Mesonet stations at Squaw Mountain, near Idaho Springs, and at Ward recorded gusts to 59 mph (51 knots). The wind died down by late morning.

COZ002-004
Northern and Central Mountains

03	0500MST- 1500MST				0	0	?	?	High Winds
----	---------------------	--	--	--	---	---	---	---	------------

Strong northwesterly flow aloft continued across northern Colorado causing high wind in the Northern and Central Mountains. Shortly before sunrise, a gust to 71 mph (62 knots) occurred at the National Weather Service mesonet station on Squaw Mountain near Idaho Springs. Wind speeds averaged 40 to 50 mph (34 to 43 knots) much of the morning. Around noon, instruments on Fritz Peak near Rollinsville recorded a gust of 86 mph (75 knots). The gusty wind eventually reached the lower elevations but had weakened considerably.

COZ002-004
Northern and Central Mountains

05	2100MST-				0	0	?	?	High Winds
06	0600MST								

Strong wind again blew across the mountains and foothills east of the Continental Divide. Gusts in excess of 60 mph (52 knots) occurred much of the night. Wind were generally restricted to the higher peaks and passes. Fritz Peak near Rollinsville recorded a gust of 91 mph (79 knots). A cooperative observer, 9 miles west-southwest of Rustic reported a gust of 62 mph (53 knots). Squaw Mountain near Idaho Springs had a gust to 60 mph (52 knots).

COZ002-003-004-008-009-010-001-015
Mountains, San Luis Valley, Front Range and Southern Foothills

11	0000MST-				0	0	?	?	Snow
12	1800MST								

Snow came to Colorado as another southwestern United States low moved through Arizona and New Mexico. A cold front pushed through the state late on the 11th and produced upslope snows for the Front Range and southeastern Colorado. Mountain snows were not more than a few inches. The higher amounts in the High Country included 11 inches at Wolf Creek; 10 inches at Irwin Ski Area; and 7 inches at Purgatory and Powder Horn Ski Area. In the lower elevations, snows ranged from a trace to 6 inches. The San Luis Valley received the heavier snow of the mountain valleys with Alamosa topping the list at 6 inches. Antonito measured 5 inches. In the east, 5 inches fell at Pueblo, Rye, Trinidad and Cuchara. Denver received almost 5 inches and 4 inches fell at Walsenburg.

COZ002-004-008
Mountains

12	1200MST-				0	0	?	?	Snow
13	1800MST								

Snow fell across the mountains with the northern and central mountains reaping the benefits this

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

COLORADO Cont'd

time. Snow amounts ranged from 1 to 10 inches. Mary Jane Ski Area led the pack with 10 inches. Winter Park and Irwin Ski Area each had 8 inches. At Arapahoe Basin and Berthoud Pass 6.5 inches of snow fell. Six inches fell at Copper Mountain and Lake Eldora.

COZ002-004-011
Northern and
Central Mountains
and Front Range

14	0600MST- 1500MST				0	0	?	?	High Winds
----	---------------------	--	--	--	---	---	---	---	------------

High wind blew across the mountains and foothills east of the Continental Divide as strong northwesterly flow aloft returned to northern Colorado. Wind speeds were generally 35 to 45 mph (31 to 39 knots) with gusts as high as 93 mph (81 knots) recorded at Fritz Peak near Rollinsville. At midmorning, reports from Horse Tooth Reservoir west of Fort Collins indicated wind gusts to 70 mph (61 knots). A gust to 60 mph (50 knots) occurred at Wellington on the plains.

COZ003-004-006-008
West Central Valleys
Central and San Juan
Mountains and Upper
Arkansas Valley

18	1200MST-				0	0	?	?	Snow
19	1800MST								

A weak upper level disturbance moved across Colorado from the southwest with enough muscle to produce some snow over the southwestern mountains and the western valleys. Snow amounts were generally 4 to 9 inches, but Wolf Creek received a whopping 18 inches. Other snow amounts included 9 inches at St. Paul Ski Area; 8 inches at Irwin Ski Area, Purgatory and Crested Butte; 7 inches at Gothic and Cedaredge; 6 inches at Powder Horn Ski Area; 5 inches at Grand Junction, Palisade and Eckert; and 4 inches at Telluride, Buena Vista and Nathrop.

COZ012-013
Northeast Plains
and Border

22	1200MST- 2100MST				0	0	?	?	Heavy Snow
----	---------------------	--	--	--	---	---	---	---	------------

An upper level low over Kansas produced a very narrow band of heavy snow in northeast Colorado. The snow began around noon and ended by midevening. Snowfall ranged from a trace to 16 inches. The counties affected were Sedgwick, Phillips, Washington, Yuma, northern Lincoln and northwestern Kit Carson counties. The higher snow amounts were in Washington and Yuma Counties. Sixteen inches of snow fell just 18 miles south of Akron, but only 2 inches was measured in Akron itself. Other snow totals included 12 inches at Otis; 10 inches 5 miles north of Otis and at Yuma; and 8 inches at Lindon. Strong north wind at 25 to 35 mph produced widespread blowing and drifting snow conditions.

COZ002-003-004-007-008-010-011-012-013-014
Mountains, West
Central Valleys,
Four-Corners and
Northeastern

30	1800MST-				0	0	?	?	Snow
31	2400MST								

An upper level closed low moved through the state bringing snow to the southwest on the 30th and to the northeast on New Year's Eve. One to three inches fell in the Four-Corners region and the west-central valleys and 3 to 15 inches fell in the mountains. Snow amounts included 15 inches at Telluride; 9 inches at Monarch; 8 inches at Mary Jane Ski Area and Aspen Mountain; 7 inches at Purgatory; 6 inches at Wolf Creek; 5 inches at Snowmass and Winter Park; and 3 inches at Eckert. In the northeast, snow began along the eastern border during the morning of the 31st and moved toward the Front Range by the evening rush hour. Two to eight inches fell during the day and evening with higher amounts around the eastern border region. Snow along the Front Range continued through the night into New Year's Day.

CONNECTICUT

CTZ005

03	0800EST- 1000EST				0	0	?	0	Coastal Flood
----	---------------------	--	--	--	---	---	---	---	---------------

Strong to gale force southeasterly and southerly winds pushed the morning high tide to 10.5 feet at Bridgeport Harbor at 0851 EST. Coastal flooding occurred along section of the western Connecticut coast. In Milford, several homes were flooded and there were other reports of flooding in East and West Haven as a result of tides running about 3.5 feet above normal.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

CONNECTICUT Cont'd

CTZ001-002-003	02 03	2300EST- 2300EST			0	0	5	0	Ice Storm
----------------	----------	---------------------	--	--	---	---	---	---	-----------

The northwestern and north-central portion of the state received periods of freezing rain with temperatures in the upper 20's to low 30's resulting in an accumulation of glaze on trees and power lines. Up to 9,000 electric customers lost power at various times throughout the day and into the evening. There was even a thunderstorm with heavy freezing rain in Norfolk around mid-afternoon and tree limbs and power lines were reported down in Litchfield.

DELAWARE

DEZ001 > 003	14	1830EST- 2030EST			0	0	4	0	High Winds
--------------	----	---------------------	--	--	---	---	---	---	------------

Strong winds following a cold front caused widespread damage to trees and power lines. Typical wind speeds during this event were those recorded at Wilmington: 30 to 35 mph sustained with a peak wind of 52 mph.

FLORIDA

FLZ017-020-022 Broward, Dade, Martin, and Palm Beach Counties	19 20	0600EST- 2200EST			0	0	5	0	High Winds
--	----------	---------------------	--	--	---	---	---	---	------------

Strong easterly winds and heavy surf pounded the lower Florida eastern coast. Winds gusted to 44 mph at Fort Lauderdale/Hollywood International Airport, causing significant beach erosion due to the pounding surf, and forcing the closing of parts of coastal Highway A1A as sand blew across the roadway.

Monroe County
5 S Key West

	22	1359EST	?	?	0	0	0	0	Waterspout
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A waterspout was sighted over the straits 5 miles south of the Key West Airport.

GEORGIA

Floyd County Lindale Silver Creek	23	1815EST			0	0	3	?	Thunderstorm Winds
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Scattered trees were uprooted and power lines were downed by thunderstorm winds at Lindale and Silver Creek.

Newton County
Southern Portion

	23	2030EST			0	0	?	?	Small Hail
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Event time given is estimated.

Chattooga County
Summerville

	23	2140EST			0	0	?	?	Small Hail
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Cherokee County
Ball Ground

	23	2250EST			0	0	?	?	Hail (1.50)
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Fulton County
Alpharetta

	23	2255EST			0	0	?	?	Small Hail
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Cherokee County
Eastern Portion

	23	2300EST			0	0	3	?	Thunderstorm Winds Small Hail
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Thunderstorm winds uprooted trees and tore down power lines over eastern Cherokee County. The ground was covered by small hail at several areas.

Forsyth County	23	2300EST			0	0	4	0	Thunderstorm Winds
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Forsyth County	24	2315EST			0	0	?	?	Hail (1.00)
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Scattered trees and power lines were torn down by the winds in many sections in Forsyth County. Trees fell onto a few houses. Quarter-size hail was reported at several locations.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
GEORGIA Cont'd									
Fulton County Northern Portion Alpharetta	23	2315EST			0	0	?	?	Hail (1.00)
Quarter-size hail developed at Alpharetta and at several locations in northern Fulton County.									
IDAHO									
IDZ012 Southeastern Idaho	01 02	2130MST- 0930MST			0	0	0	0	Heavy Snow
Eight inches of snow fell at Island Park.									
IDZ012 Southeastern Idaho	07	0100MST- 1100MST			0	0	0	0	Heavy Snow
Six inches of snow fell at Island Park.									
IDZ009 Idaho Panhandle	09	0600PST- 1000PST			0	0	3	0	High Winds (G61)
Ski resorts closed due to 70 mph wind gusts on mountain tops.									
IDZ008-011-009 Idaho Panhandle	12	1100PST- 1700PST			0	0	5	0	High Winds (G55)
Cold front wind damage was reported in Post Falls, Carlin Bay on Lake Coeur d'Alene, Lewiston Orchards, Lewiston, and Moscow. Downed trees or large broken limbs fell on automobiles, blocked highways, and broke power lines causing power outages lasting about 6 hours. Restaurants boiled water on gas stoves for coffee and used candles for light in order to accommodate a surge of customers. Gusts to 63 mph were observed about 1130 PST in Lewiston associated with lightning.									
IDZ002 South-central Idaho	12	1900MST- 2100MST			0	0	3	4	High Winds
Wind blew down a tree that cut power lines serving 148 customers near Murtaugh.									
ILLINOIS									
ILZ001-007	02 03	1400CST- 0200CST			0	0	?	0	Heavy Snow
Heavy snow fell across the northwestern third of Illinois. Four to six inches fell from DuBuque to Moline to Peoria to downtown Chicago. The heaviest snow fell in extreme north central and northeast Illinois. Ten inches fell at Rockford, Lake Zurich, Wauconda and Lincolnshire.									
Mason County Manito	08	1415CST			0	0	?	0	Hail (2.75)
Peoria County Princeville	08	1421CST			0	0	?	0	Hail (1.00)
Tazewell County Tremont	08	1422CST			0	0	3	0	Hail (2.75)
One-inch-size hail fell at Manito at 1415 CST. Five minutes later the hail was up to baseball-size. One-inch-size hail fell at Princeville. Golfball-size hail fell at Tremont at 1422 CST. At 1429 CST hail increased to baseball-size.									
Menard County Petersburg	08	1439CST			0	0	6	0	Hail (2.50)
Golf ball- to tennis ball-size hail occurred in Petersburg. The hail caused extensive damage to numerous automobiles and building windows throughout Petersburg.									
Sangamon County 2 E Williamsville	08	1500CST			0	0	5	0	Thunderstorm Winds
One-third of a 60-foot-machine shed was destroyed, and storm windows were pulled out of a farm house 11.5 miles east of Williamsville. The time of the event was estimated since there were no eye witnesses.									

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

ILLINOIS Cont'd

LaSalle County 3.5 E Streator	08	1510CST			0	0	4	0	Thunderstorm Winds
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Thunderstorm winds caused \$10,000 damage to a farm near Streator. Heavy metal doors were blown off a barn, a shed roof was blown off, a barn roof was damaged, a storage tank was knocked over and a tree was snapped off.

McLean County 1 S McLean 1 W Heyworth	08	1513CST- 1530CST	8.0	50	0	0	5	0	Tornado (F0)
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A tornado touched down 1 mile south of McLean near Interstate 55 and traveled east along Highway 136 to just a mile west of the town of Heyworth. A small manufacturing plant was heavily damaged, a mobile home was heavily damaged, and several agricultural outbuildings and equipment sheds were damaged at farms along the northern and southern sides of Highway 136.

McLean County Bloomington	08	1528CST			0	0	5	0	Thunderstorm Winds
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Winds damaged several empty railroad cars in a rural area on the southeast side of Bloomington.

ILZ004	20	0400CST- 1600CST			0	?	4	0	Ice Storm
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Freezing rain moved into northwestern Illinois during the early morning hours of December 20. The event caused most damage to area motorists on the way to work. No fatalities were reported but a few minor injuries were reported. Around 5 AM sleet started to mix in with the freezing rain. Rain and snow mixed began to fall about 1200 CST. At 1600 CST, snow had become light after leaving behind about 1 inch. Most highways were back to normal after 1600 CST.

INDIANA

INZ001-002- Far Northwestern to Far North-central Indiana	03 04	1600EST- 1330EST			0	0	?	?	Heavy Snow
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Lake effect snow in the wake of a low pressure system moving through the Great Lakes left 6 inches of snow over extreme northern Indiana from LaPorte and Michigan City to South Bend. Snow depths diminished to only 1 to 2 inches along U.S. Highway 30.

IOWA

IAZ002-006-007- 008-009-010- 011-ILZ004 Northeast Iowa	01 16	0600CST- 1800CST			0	0	4	0	Flood
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December started out cold, resulting in many of the rivers in Iowa freezing. This resulted in ice jams along many of the rivers in northeast Iowa during the first part of the month. Rainfall of half to one inch occurred on the 12th and 13th, causing additional rises. All of the flooding was minor and caused little damage.

IAZ001-002-003- 004-005-006- 007-008-010- 011-SDZ018 Northern Iowa	03	0800CST- 1700CST			0	0	3	0	Snow Blowing Snow
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An arctic cold front swept through Iowa during the morning of the 3rd. Behind it, temperatures fell with 20 to 40 mph northwesterly winds. Occasional gusts to 50 to 55 mph were reported. Snow fell in the arctic air. Accumulation was generally under 1 inch, with a couple inches in parts of north-central and northeast Iowa. Near Blizzard conditions resulted from the wind driven snow. Whiteouts were reported in rural areas. Many small towns were paralyzed. The whiteouts and snowfall caused numerous accidents. Wind chill indices fell to the 35 to 50 degree below zero range.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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IOWA Cont'd

IAZ001-002-003- 004-005-006- 007-008-009- 010-011-012-013 014-015-SDZ018- NEZ010-ILZ004 All of Iowa	19 20	1400CST- 1300CST			0 0	0 0	6 0	0 0	Ice Storm
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A storm system moved into the central United States from the southern Rockies. Precipitation was widespread over the middle of the country. Since surface temperatures were below freezing, most of the precipitation fell in the form of freezing rain. Most of the southeastern two-thirds of Iowa received between 0.25 and 0.75 inch of freezing rain. A few areas received nearly an inch. Winds were quite light, under 15 mph, during the heaviest icing. Due to this fact, damage was not as severe as it could have been. Many trees and power lines were downed. Accidents were numerous, with travel not recommended in many areas during the night time hours.

KANSAS

KSZ003-006 Southwestern Kansas	12 18	2235CST-			0 0	0 0	4 0	0 0	Ice Storm
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Freezing rain resulted in ice accumulations around 0.25 inch across southwestern Kansas during the night. This made travel very hazardous and caused havoc for southwestern Kansas area power companies. Power outages encompassed an area within 25 miles of and including Dodge City. Flickering lights and downed power lines were also a common occurrence across all of southwestern Kansas. One school district cancelled classes because of hazardous road conditions.

KENTUCKY

Harlan County	01	2030EST			1 0	0 0	0 0	0 0	Flash Flood
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Janice Patterson of Putney slipped into the flooded Poor Fork River and drowned. Her body was found 7 days later and 20 miles down stream. She was 51-years-old. (F51O)

Bell, Breathitt, Clay, Floyd, Knox, Harlan, Knott, Perry, Leslie, Letcher, Pike, and Magoffin Counties	02	1545EST- 2350EST			0 0	0 0	7 3	3 0	Flash Flood
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Rainfall amounts ranging from 4 to 8 inches fell on the coalfields of southeastern Kentucky on the 2nd of December, creating widespread flash flooding and river flooding. At Middlesboro in Bell County, numerous evacuations were required in the area around Gree Camp and Arjay. Most streams were flooded with a report of 15 to 20 feet of water over a road at Greasy Creek. In Harlan County, several houses were flooded in the city of Harlan while in Knott County the city jail was flooded. All counties reported water over roads and bridges and many evacuations were required.

Grayson County	02	1530CST			0 0	0 0	4 0	0 0	Flash Flood
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Heavy rains flooded city streets in Leitchfield and Clarkson. Bear Creek overflowed its banks, flooding a highway south of Leitchfield with 3 feet of water.

Hardin and Nelson Counties	02	1745EST			0 0	0 0	4 0	0 0	Flash Flood
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Heavy rain closed many roads in both counties. In Hardin County, two people were rescued from a partially submerged car, and in Nelson County, a day care center was flooded. Seven children and a teacher were rescued.

Barren County	02	1738CST- 2245CST			0 0	0 0	4 0	0 0	Flash Flood
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Several streets in Glasgow were flooded after heavy rain moved through the area.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
KENTUCKY Cont'd									
Adair, Cumberland, Casey, Green, Marion, Taylor and Washington Counties	02	1900EST-2300EST			0	0	5	3	Flash Flood
									Between 5 and 8 inches of rain fell over the region forcing many streams and creeks out of their banks. Several homes were evacuated and water was reported in some houses and businesses. Many streets and roads were covered with water.
Christian County	02	1805CST-2200CST			0	0	3	0	Flash Flood
									Fourteen roads were closed after a prolonged period of heavy rain.
Grayson County	02	1838CST			0	0	4	0	Flash Flood
									Heavy rains caused a rock and mud slide that closed the eastbound lane of the western Kentucky Parkway near Leitchfield. Several other roads were covered with water.
Hart County	02	1840CST			0	0	3	0	Flash Flood
									Several roads were covered by high water after heavy rain fell over the region.
Clinton and Russell Counties	02	1945EST			0	0	4	0	Flash Flood
									Heavy rains forced many streams and creeks out of their banks. Streets and roads were covered with water and several bridges were washed out.
Fayette, Anderson, Madison, Powell, Menifee, Mercer, Rowan, and Bath Counties	02	2045EST-2345EST			0	0	6	0	Flash Flood
									Between 4 and 7 inches of rain fell over the region forcing many streams and creeks out of their banks. Several homes were evacuated and some houses and businesses were flooded. Several bridges were covered with water.
Mason County	02	2135EST			0	0	5	0	Flash Flood
									Heavy rains caused flooding of streets and highways across the county. Several people were rescued from cars that stalled in high water.
Wayne and Pulaski Counties	02	2145EST			0	0	4	0	Flash Flood
									Heavy rain forced many streams and creeks out of their banks. Several bridges were washed out and many streets and roads were covered with water.
Rockcastle County	02	2145EST			1	0	3	0	Flash Flood
									Heavy rains forced many creeks and streams to overflow. A Mt. Vernon woman was killed when her car was swept away in a creek. Betty Brogan, 35-years-old, was found 2 days later and 10 miles downstream. Several homes in the county were flooded as well.
Spencer County	02	2145EST			0	0	4	0	Flash Flood
									Heavy rains forced Simpson Creek out of its banks causing several homes to flood. Many roads were also flooded.
McCreary, Whitley, and Laurel Counties	02	2230EST			0	0	3	0	Flash Flood
									High water closed several roads and a few bridges were washed out.
Boyd, Carter, Elliott, Greenup, and Lewis Counties	02	2310EST			0	0	5	0	Flash Flood
									High water flooded several homes and businesses. Many streets and roads were clovered with water after 2 inches of rain fell in a short period of time.
Harlan, Bell, Knox, and Whitley Counties	02 05	2330CST-1300EST			0	0	3	0	Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons	Estimated Damage	Character of Storm
					Killed	Injured	Property
							Crops

KENTUCKY Cont'd

		The Cumberland River rose into flood after a day of heavy rain. At Baxter, the river rose to 24 feet; 8 feet above flood stage.					
Breathitt and Perry Counties	02	2355EST			0	0	3 0 Flood
			The North Fork of the Kentucky River at Hazard and Jackson rose into flood. At Jackson, the river rose 7 feet above flood stage.				
Warren County	03	0400CST			0	0	0 0 Flood
			The Barren River at Bowling Green rose to 30 feet; 2 feet above the flood stage.				
Powell County	03	0500EST			0	0	0 0 Flood
			The Red River at Clay City rose into flood.				
Lee County	03	0500EST			0	0	0 0 Flood
			The Kentucky River at Heidelberg rose into flood.				
Bourbon County	03	0600EST			0	0	3 0 Flood
			Stoner Creek at Paris rose into flood and forced several evacuations in the city.				
Edmonson and Butler Counties	04	0800CST			0	0	2 0 Flood
			The Green River rose into flood at Brownsville and Woodbury.				
Nelson County	04	0900EST			0	0	0 0 Flood
			The Rolling Fork River at Boston rose to 40 feet, 5 feet above the flood state.				
Magoffin County	04	1000EST			0	0	0 0 Flood
			The Licking River at Salyersville rose into flood.				
Powell County	04	2130EST			1	0	0 0 Flood
			Former Kentucky Governor, Burt Combs who was 82-years-old, drowned when he tried to cross the swollen Can Creek.				

LOUISIANA

Beauregard Parish Northern Portion	13	0445CST- 1545CST					
			0	0	5	0	Flash Flood
Rapides Parish Woodworth Pineville	13	0937CST- 13 1445CST			0	0	4 0 Flash Flood
			A stationary line of numerous thunderstorms produced 4 to 7 inches of rain across parts of Beauregard, Allen and Rapides Parishes. A parish by parish summary follows.				
			Beauregard Parish: Most homes were flooded with about 6 inches of water or less in the following locations: three homes in Deridder, four homes in the Lake Bundrick area which is about 12 miles southeast of Deridder and one home just to the south of Merryville.				
			Rapides Parish: Three families were evacuated from their flooded homes in Woodworth; a few cars were flooded in Pineville.				
East Carroll Parish Lake Providence	13	0745CST- 1015CST			0	0	0 0 Flash Flood
			A slow moving line of numerous thunderstorms produced around 4 inches of rain in Lake Providence where a few homes were flooded.				

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

MAINE

MEZ001-002-003- 004-005-006-007- 008-009-010-011- 012-013-014	03	0800EST-							
	04	1400EST			0	0	?	0	Heavy Snow Glaze

Low pressure moved northeast from the Ohio Valley during the day on December 3rd and moved into the Gulf of Maine during the morning hours on the 4th. Precipitation began in the form of snow statewide, but enough warm air was able to push into the state causing freezing rain and drizzle to develop. Four to eight inches of snow fell over the state before the changeover to freezing rain and drizzle occurred. State police reported 80 accidents and incidents over portions of Maine of cars and trucks sliding off the roads and highways. Damage occurred to all vehicles involved in the accidents and incidents. Several injuries were reported, but all were of the cuts and bruises variety.

MEZ006-010-014	06	1100EST- 1800EST			0	2	?	0	Snow
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A fast moving low pressure system tracked from New York state to southern Maine during the morning and early afternoon hours on the 6th. A few inches of snow fell across southern and central Maine from this system. Numerous accidents were reported in York and Kennebunkport of York county, in Richmond of Kennebec County, in Falmouth of Cumberland County, and in Millinocket and Bangor of Penobscot County. Two women suffered injuries in two separate accidents in Bangor. Damage was sustained to all vehicles involved in the accidents.

MEZ002-003- 004-005-006	07	1100EST-							
	08	1300EST			0	0	0	0	Heavy Snow

Heavy snow fell over all but the extreme southern and far northern tips of Maine as a couple of low pressure systems moved east along a warm front situated over southern Maine. Four to eight inches of snow were common over most of Maine with up to 12 inches of snow being reported in the mountains.

Cumberland County Cumberland	11	1000EST- 1200EST			0	2	?	0	Glaze
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Hancock County Mt. Desert Trenton	11	1100EST			0	0	?	0	Glaze
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Patchy light freezing rain and drizzle across portions of Maine during the early morning hours on the 11th, led to a few accidents and injuries. Two injuries were reported with a two car collision in Cumberland while two cars were reported to have skidded off the road in Mt. Desert and Trenton.

MEZ002-003- 004-006-007- 008-009-010- 011-012-013- 014	17	2200EST-							
	18	0400EST			1	9	?	0	Heavy Snow

The first major snowstorm struck all but the far northern portions of Maine during the late afternoon hours on the 17th and continued into most of the day on the 18th. A low pressure system centered near Long Island, New York during the evening hours on the 17th strengthened as it moved into the Gulf of Maine on the 18th. Eight to fourteen inches of snow fell over a good portion of the state with as much as 18 inches being reported in some spots. Lightning and thunder were even reported with the snowfall in the towns of Hope and Bar Harbor. The heavy snow led to more than 100 reports of accidents throughout the state during the snowstorm. Nine injuries were reported with one fatality occurring in Howland in Penobscot County where whiteout conditions prevailed. (M43V)

Hancock County Bar Harbor Salisbury	21	1100EST- 1600EST			0	0	?	0	Glaze
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Penobscot County Bangor	21	1300EST			0	4	4	0	Glaze
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Rain changed to a combination of snow and ice during the morning hours on the 21st causing

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
MAINE Cont'd									
MEZ006-009-011-012-013-014	29	0900EST- 2300EST			0	17	?	0	Glaze
<p>several accidents and four injuries. Numerous cars also skidded off the road in Bar Harbor and Salisbury Cove.</p> <p>Warm air moving north across Maine moved up over some rather shallow, cold air that was entrenched over portions of southern, western, and central Maine. As a result, freezing rain developed which put a coating of ice on many roads. Over 100 accidents were reported by state police throughout the day. In Oxford County in western Maine, there were 40 to 45 accidents reported. The accidents across Maine ranged from car collisions to cars sliding off the ice covered surface. Seventeen injuries occurred in a variety of accidents. However, no serious injuries were reported.</p>									
MARYLAND AND DC									
MDZ005 District of Columbia	04	1100EST- 1500EST			0	0	4	0	High Winds
<p>High winds knocked down numerous trees, some of which were easily uprooted after 3 days of heavy rain. Power lines were pulled down by falling trees. Some 50,000 customers in Washington, DC, and the Maryland suburbs were without power. In Anne Arundel County, a Pasadena home was damaged when a 60-foot oak was uprooted and fell onto the front porch. The highest wind recorded wind speed was 44 mph at Washington National Airport.</p>									
MDZ008-009	04	0300EST- 2200EST			0	0	4	0	Snow
<p>Snow squalls brought widespread slippery roads and very poor visibility, particularly in Garrett County. Many traffic accidents were caused by icy roads. Several major highways were among those closed by accidents and hazardous conditions.</p>									
MDZ003-005 > 009 District of Columbia	14	1530EST- 2000EST			0	0	5	0	High Winds
<p>High winds following a cold front caused widespread damage to trees and power lines. A barn was blown over in Carroll County where winds were measured at 62 mph. Several telephone poles were snapped in Cecil County. In Montgomery County, a Bethesda home was damaged by a 150-year-old tree falling through the roof. The tree was 40 inches across at the base. Other recorded wind speeds: 75 mph in Washington County; 56 mph at Woodlawn in Baltimore County; 62-knot gust (71 mph) at Andrews Air Force Base; and 77 mph atop a television studio in northwestern Washington, DC, along with street-level winds estimated at more than 60 mph. More than 60,000 homes and businesses in central and northeastern Maryland and the District of Columbia were left without power, some for as long as 2 days.</p>									
City of Baltimore	19	0700EST			1	0	0	0	Cold
<p>A homeless man was found dead on a street two blocks from a shelter. His death was attributed to hypothermia, but with alcohol also a factor. Overnight temperatures were as low as 23° in the city. (M530)</p>									
MDZ005-007	23	0600EST- 0830EST			0	0	4	0	Glaze
<p>Light freezing rain accumulated on trees, power lines, and some roads. The state police reported more than 70 accidents caused by the icy conditions, including a 12-vehicle pileup on the Frederick-Montgomery county line. An accident at Boonsboro in Washington County claimed the life of a 34-year-old man and hospitalized another motorist.</p>									
MDZ005-007-008	28 29	1200EST- 0400EST			0	0	3	0	Glaze
<p>Light freezing rain caused several traffic accidents and coated power lines and trees.</p>									

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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MASSACHUSETTS

MAZ004-005-006-010	03 04	0000EST- 1100EST			0 0 ?	0	Glaze
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A wintry mix of freezing rain, sleet, and a little snow fell across the central and western portions of the state. At times, the precipitation was heavy as temperatures remained slightly below freezing. Scattered brief power outages occurred due to falling tree limbs. Icy roadways caused many skidding accidents.

MAZAll	14 15	1900EST- 0400EST			0 0 4	0	High Winds
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Strong to gale force southerly winds ahead of an approaching cold front between 1900 EST and 2200 EST and almost as strong winds in the wake of the front between 0100 EST and 0400 EST brought gusts to 50 mph across most of the state. Higher terrain had gusts to 70 mph. Wind damage included isolated power outages and a number of autos damaged by falling tree limbs. In the Berkshires, Otis had a gust to 60 mph and Goshen a gust to 57 mph. In the central and eastern portions of the state, Worcester recorded a 61 mph and Blue Hill Observatory in Milton recorded a gust to 70 mph.

MICHIGAN

MZ003 > 006-013 014 > 017-039 > 068 Southwest-Central Northern Lower Michigan	02 03	1800EST- 0800EST			0 0 4	0	Heavy Snow
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Heavy snow fell across most of Lower Michigan. The heavy snow fell north of a line that extends from Grand Rapids to Oscoda. North of this line, 6 to 13 inches of snow fell. The heaviest snowfall as in Clare County. Over Southeast Lower Michigan, the precipitation was mostly freezing rain. Except for the extreme southeast, near Detroit, the precipitation began as snow, then changed to freezing rain. Snowfalls in this area was in the 2- to 4-inch range. The heaviest snowfall was between 2200 EST Tuesday, December 2 and 0600 EST Wednesday, December 3, 1991. The snow ended completely by 0800 EST Wednesday morning. The freezing rain ended as drizzle around 0300 to 0400 EST on Wednesday morning. Heavy snow fell over 39 counties of Lower Michigan. Northeast winds of 15 to 25 mph with gusts to 35 mph blew the snow into 2 foot drifts. Around half-inch of freezing rain fell over the southeast. This in combination with the strong northeasterly winds caused many trees and power lines to come down. Also, numerous traffic accidents resulted from the freezing rain downed power lines and downed trees. In all, 10,000 Consumer Power and Detroit Edison customers lost power during the storm. Most of the schools across Lower Michigan were closed Wednesday. There was 2 to 4 inches of snow over the Upper Peninsula during this storm, but this did not cause any problems. Most of the damage reported during the storm was because of freezing rain related problems. This all resulted from a storm system that moved northeast from western Tennessee Tuesday afternoon, crossing central Lake Erie around 0200 EST Wednesday morning, then continued northeast to southern Quebec by early Wednesday afternoon.

MZ001 > 004-007 > 012-022-057 > 059-063-064-069- 073-074-076 > 078 Southwestern and Northwestern Lower Portion and Western Upper Portion of Michigan	03 04	0800EST- 1300EST			0 0 0	0	Heavy Snow
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Even as the storm that caused the heavy snow over Lower Michigan was moving away, the lake effect quickly developed. The largest area of heavy snow was over Southwest Lower Michigan where 11 counties had between 8 to 14 inches of snow. Over Northwest Lower Michigan and and Western Upper Michigan, snowfalls were in the 6- to 10-inch range. The snow tapered to light snow showers or flurries by mid morning on Thursday, December 4th. There were some traffic problems, mostly minor traffic accidents associated with the snow over Southwest Lower Michigan, otherwise no significant problems resulted from this snowfall.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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MICHIGAN Cont'd

MZ004 > 006-013 > 017-031 > 034-036 > 059 Central Lower Michigan	05	0700EST- 2200EST			0	0	0	0	Heavy Snow
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An Alberta Clipper type storm raced from southern South Dakota early on the morning of Friday, December 5th, to west central Lower Michigan by early in the morning hours of Saturday, December 6th. The heavy snow was ahead of system, so by the time the storm center reached Lower Michigan, the significant snow had already ended. Snowfalls ranged from 6 to 10 inches in most areas, but parts of west central Lower Michigan between Cadillac and Traverse City had between 10 and 14 inches of snow. This is an unusually large amount of snow from this type of system, even in that area. However, no significant problems were noted from this event since the snow had a low water content causing it to be very fluffy.

Mescosta County Big Rapids

07 09	0700EST- 0700EST				0	0	4	0	Flood
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An ice jam on the Muskegon river, formed 3 miles upstream from the Rogers Hydroelectric facility. This caused a 1-mile-long ice jam that resulted in minor flooding. Nine families were evacuated from their homes and at least 38 homes had been damaged.

MZ003-004-013 050-052-058-060 069-072-075 > 078-83 Southwest-Northwest Lower Michigan and Upper Peninsula

14	0000EST- 1800EST				0	0	0	0	Heavy Snow
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This heavy snow resulted from another Alberta Clipper. Lake effect followed as the system moved east of Upper Michigan. The storm center raced from eastern North Dakota during the afternoon of Friday, December 13, 1991 to western Lake Superior by 0200 EST Saturday, December 14th. By early afternoon on Saturday, the storm center was moving east of Lake Huron. The areas of heavy snow over Southwest and Northwest Lower Michigan were a result of lake effect behind the storm. As a result, most of this snow fell from around 0700 EST on December 14th until around 1800 EST on Saturday, December 14th. Over the Upper Peninsula, the snow fell during most of this time over the western sections, but over the east, most of the snow fell after 0400 EST on the morning of December 14th. Some light snow continued to fall into the morning of Sunday December 15th, but this was mostly an inch or less. Snowfalls were 6 to 8 inches over the heavy snow areas of Southwest and Northwest Lower Michigan, to 7 to 15 inches over parts of Upper Michigan. The heaviest snow was in western Alger county where 15 inches fell near Chatham. The Keweenaw Peninsula reported 8 to 11 inches. No major problems were noted with this storm.

MZ006-014-035- 047-050 > 060-062 > 065-069 > 072-083 Northwest Lower Upper Michigan

16 18	1800EST- 1200EST				0	0	0	0	Heavy Snow
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A slow moving storm system with an associated warm front caused a prolonged period of snow over Michigan. During the two days this east-central storm affected Michigan, areas of heavy snow developed and dissipated. No one place in either Upper or Lower Michigan had heavy snow for this entire time. The eastern part of St. Clair County Michigan had its heavy snow on the 18th during the mid to late morning hours. During that time, 5 to 7 inches of snow fell, mostly near Port Huron. Snowfalls over Northwest Lower Michigan ranged from 8 to 15 inches and 8 to 9 inches fell over Eastern Upper Michigan. Over the rest of Michigan, snowfalls of 2 to 5 inches were common in most of the other counties. Only southeast Lower Michigan escaped with less than an inch of snow.

Mescosta County Big Rapids

19 21	0700EST- 0700EST				0	0	4	0	Flood
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An ice jam once again formed on the Muskegon river, 3 miles upstream from the Rogers Hydroelectric facility. Again, it caused a 1-mile-long ice jam that resulted in minor flooding. Nine families were evacuated from their homes and at the same 38 homes were damaged again.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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MINNESOTA

MNZ013-015-017-018 Southwestern Quarter	03	0600CST- 2100CST			0	0	?	0	Blizzard
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Strong northwesterly winds, behind a departing surface low, brought blizzard conditions and dangerously cold wind chill readings across the southwest section of the state. A general 1 to 3 inch snowfall occurred across the area and combined with winds gusting to 50 mph at times generated whiteout conditions from the morning into the evening. Air temperatures combined with the strong wind, wind chill values ranged from 30 to 50 below zero.

A number of schools and business were closed during the morning as the storm intensified. Several car accidents and jackknifed tractor-semitrailers littered roadways. Many roads were closed at the height of the storm. Power outages occurred over a small portion of the area due to the strong wind downing ice-covered power lines.

Rice County	03	1800CST- 04 1200CST			0	0	?	0	Flood
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An ice jam developed downstream from a small dam in the city of Northfield greatly restricting the flow of the Cannon River. The river rose slowly during the evening as the ice jam increased to 2 to 3 miles in length. Flooding occurred during the evening of the 3rd into the morning of the 4th. Several businesses in Northfield along the rivers edge were flooded. A few homes downstream were evacuated until the ice jam dissipated and the river receded.

MNZ001 > 004-006- 007-010 Northern Third	13	0400CST- 14 1100CST			0	0	?	0	Blizzard Heavy Snow
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An intense low pressure system moved into the northwest by evening on the 13th and to the western shores of Lake Superior by morning of the 14th. A band of heavy snow fell across extreme northern Minnesota while light snowfalls and strong northwesterly winds caused blizzard conditions over portions of the northwest. Winds increased during the early evening hours of the 13th and gusted to over 45 mph at times in the northwest. Visibilities were reported to be near zero at times making travel nearly impossible. A number of highways were closed during the night. Several cars and trucks were reported to have slid into the ditch along Interstate 94 from Alexandria to Moorhead.

Heavy snow in excess of 6 inches fell from near Roseau to Little Fork and along the Minnesota/Canadian border in extreme northeastern Minnesota. The greatest snowfall reported was 11 inches at Pelland.

MISSISSIPPI

MSZ004-005-007	01- 04				0	0	5	0	Flood
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Heavy rainfall which began November 30th and lasted through December 2nd caused widespread flooding over north-central and northeastern Mississippi. Nearly every river, stream, and small creek overflowed its banks. The most significant flooding occurred along the Little Tallahatchie River and along the Upper Tombigbee Basin. The crest stage of 29.29 feet at Etta on the Little Tallahatchie River was the second highest stage ever recorded. Most of the damage due to flooding was limited to roads, bridges, and culverts. Only a couple of houses were affected by high waters and they were in flood plains.

Lincoln County	02	1530CST-			0	0	0	0	Hail (0.75)
Boque Chitto	02	1530CST			0	0	0	0	Hail (0.75)
Copiah County	02	1535CST			0	0	2	0	Thunderstorm Winds

Several power lines and utility poles were blown down.

Simpson County	02	1555CST			0	0	3	0	Thunderstorm Winds
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Two trees were blown down. One of the trees fell on a mobile home and punctured the roof allowing water damage to the interior.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

MISSISSIPPI Cont'd

Lincoln County 3 NE Brookhaven	02	1555CST			0	0	2	0	Thunderstorm Winds
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Several trees were blown down.

Simpson County Mendenhall	02	1600CST			0	0	3	0	Thunderstorm Winds
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Several trees were blown down. One tree that was 2 feet in diameter on a house causing minor damage to the front porch and the roof.

Lawrence County 5 N Monticello	02	1610CST			0	0	2	0	Thunderstorm Winds
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Several utility poles were blown over along Highway 27.

Simpson County 3 S Mendenhall	02	1630CST			0	0	2	0	Thunderstorm Winds
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Several trees and power lines were blown down.

Covington County 4 E Collins	02	1645CST			0	0	2	0	Thunderstorm Winds
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Several trees and large limbs were blown down and knocked down several power lines.

Neshoba County 6 S Philadelphia	02	1715CST			0	0	2	0	Thunderstorm Winds
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Numerous trees and power lines were blown down.

Newton County Union	02	1715CST			0	0	3	0	Thunderstorm Winds
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Numerous trees were blown down; one tree fell on top of a car.

Lauderdale County 1 NE Topton 1 S Lauderdale	02	1753CST	5.0	80	0	0	3	0	Tornado (F0)
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This was a weak tornado that moved through a sparsely populated area. The main damage was to trees and limbs. The tornado was sighted by an observer at 1755 CST 5 miles south of Meridian Naval Air Station.

Adams County Natchez	13	1700CST			0	0	5	0	Flash Flood
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A bridge and a drainage culvert were washed out. Water was about 6 inches deep over some roads.

MISSOURI

None reported.

MONTANA

MTZ003	01	1000MST- 1700MST			0	0	4	0	High Winds (G78)
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Winds gusted to 90 mph at Dupuyer, 80 to 85 mph at Shelby and Cut Bank. Some signs and roof damage occurred in Cut Bank and Shelby.

MTZ007	01 02	1200MST- 0400MST			0	0	5	0	Ground Blizzard
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Strong winds gusting over 80 mph produced a ground blizzard between Livingston and Big Timber resulting in many accidents and the closing of Interstate 90 for over 12 hours.

MTZ003	11	0156MST			0	0	0	0	High Winds
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Fifty-eight-mph wind gusts were reported at Cut Bank.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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MONTANA Cont'd

MTZ004	13	0500MST- 1100MST			0	0	3	0	Heavy Snow
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Ten inches of snow fell at Helena with heavier amounts surrounding mountains.

NEBRASKA

NEZ016 Southwestern Nebraska	31 JAN01	0880CST- 0900CST			0	0	?	?	Heavy Snow
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Up to 10 inches of snow fell over the extreme southwestern corner of Nebraska.

NEVADA

None reported.

NEW HAMPSHIRE

NHZ001-002-003- 004-005-006-007	03 04	0600EST- 1300EST			0	?	?	0	Heavy Snow
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A strengthening low pressure system moved from the Ohio Valley northeast into the Gulf of Maine and dropped 4 to 6 inches of snow across all of New Hampshire. The snow later changed to freezing rain and drizzle as warmer air filtered into the state. Numerous car accidents were reported throughout the state resulting in extensive damage. Several injuries were also reported with some of the accidents although none were serious in nature.

NHZ001-002	07 08	1000EST- 1100EST			0	0	0	0	Heavy Snow
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Four to eight inches of snow fell over portions of north-central and northern New Hampshire beginning during the morning hours on the 7th and lasting until the morning hours on the 8th. A few 10-inch snowfall reports were observed over the far northern portions of the state. Two areas of low pressure, which moved east along a warm front situated over southern New Hampshire, brought the heavy snowfall to the state.

NHZ005-006-007	16	1300EST- 1900EST			0	?	?	0	Snow
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A weak area of low pressure skirted east across northern Massachusetts depositing a couple of inches of snow over the southern sections of New Hampshire. Nearly 100 accidents, all minor in nature, were reported. A few minor injuries were sustained with some of the accidents.

NHZ001-002-003- 004-006-007	17 18	2200EST- 0200EST			0	?	?	0	Heavy Snow
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The seasons first big snowstorm hit New Hampshire late in the day on the 17th and continued into the better part of the day on the 18th. Low pressure situated near Long Island, New York during the evening hours on the 17th, strengthened as it moved into the Gulf of Maine on the 18th. Four to eight inches of new snow was common throughout New Hampshire with a foot or more being reported across portions of central and northern New Hampshire. Numerous accidents were reported during the snowstorm, but no fatalities occurred.

NYZ002-003-004- 005-006	29	0900EST- 2300EST			0	?	?	0	Glaze
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Freezing rain developed over most of southern and central New Hampshire causing more than 100 accidents throughout the day. The accidents were either car collisions or vehicles skidding off the road. Several injuries were reported, but no fatalities occurred.

NEW JERSEY, Northern

NJZ00N Northern Portion	14	1826EST- 2005EST			0	2	?	0	High Winds
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High winds, in the wake of a strong cold front, downed numerous trees and power lines across northern New Jersey. Nearly 25,000 homes and businesses lost power early Saturday night as the

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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NEW JERSEY, Northern Cont'd

cold front passed through. Several cars and homes were damaged by the downed trees. Two people were injured as a result of the storm. A woman was hit by flying glass from a shattered window in Union County and a driver was hurt in Newark when the strong winds caused a brick wall to collapse on his car.

NEW JERSEY, Southern

NJZ00S Southern New Jersey	14	1800EST- 2030EST			0 0	5 0	High Winds
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High winds behind a cold front blew across southern New Jersey bringing down trees, tree limbs, utility lines, billboards and other large signs. Some windows were blown out and siding and roofing material was blown off some buildings. A large mobile crane had its boom bent over and down on top of a building in Deptford Township, Gloucester County. Over southern New Jersey wind gusts were estimated to be up to around 60 mph and gusts were over 60 mph at Ocean City around 1930 EST.

NEW MEXICO

NMZ002-004- 006-012	11	0800MST- 2300MST			0 0	0 0	Heavy Snow
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A storm moved from Baja California across New Mexico, dumping heavy snow mainly in the mountains. A foot of snow fell at Red River in Taos County and Ski Apache in Lincoln Ski Areas. Eight inches was reported at Angel Fire in Colfax County, 6 inches at Eagle Nest in Colfax County and Las Vegas in San Miguel County, with 4 to 5 inches near Grants in Cibola County.

NMZ002	18 19	1000MST- 0500MST			0 0	0 0	Heavy Snow
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Another storm moved from Baja California across New Mexico, with 6 to 7 inches reported at several locations in the Northcentral Mountains.

Grant County 40 S Silver City	18	1550MST- 1700MST			0 0	3 0	Hail (0.50)
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A thunderstorm dumped up to 6 inches of small hail on Interstate 40 between Lordsburg and Deming, forcing 5 vehicles to slide off the road.

NMZ002-004-006- 008-010-012	20	0200MST- 2130MST			0 0	0 0	Heavy Snow
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Yet another storm (the third in the past 10 days) moved across New Mexico. This one was the strongest, with heavy snow at most mountain locations. The greatest amounts were: 9 inches at Chama in Rio Arriba County and Ruidoso in Lincoln County; 7 inches at Clines Corners in Torrance County; and 6 inches at McGaffey in McKinley County.

NMZ002-004-006- 008-012	21 22	0600MST- 0600MST			0 0	4 0	Heavy Snow
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The second storm in as many days dumped heavy snow over most of New Mexico's mountains. The central mountain chain was hardest hit, with 1 to 2 feet reported at Clines Corners in Torrance County, Ruidoso in Lincoln County, and Cloudcroft in Otero County. At Cloudcroft, ground-soaking heavy rains preceeded the snowfall, allowing many become uprooted under the weight of 2 feet of heavy, wet snow. Many trees fell on power lines, leaving Cloudcroft and nearby communities without power for a couple days (some for up to seven days). An indirect fatality occurred on United States 380 just west of Carrizozo when a 50-year-old male was killed in a vehicle accident.

NEW YORK, Central

NYZ006-010-013 Susquehanna, Catskills, and Lower Hudson Valley	02 03	2300EST- 1100EST			0 0	7 ?	Ice Storm
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Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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NEW YORK, Central Cont'd

One of the worst ice storms on record hit the southern parts of the Lower Hudson Valley and Catskills, and the extreme eastern parts of the Susquehanna Region. In all, over 35,000 electric customers were left without power and numerous trees were knocked down as up to 1 inch of ice coated surfaces. Sullivan, Ulster and Orange Counties were hardest hit accounting for the bulk of the power outages as some customers were left without power for several days.

NYZ008 > 013-018 >
020

Eastern New York

02	2300EST-						
03	1100EST			0	0	5	? Winter Storm

A heavy mix of snow, sleet and freezing rain fell over much of Eastern New York prompting officials to close many schools. Several inches of snow fell before the changing over to sleet and freezing rain which made traveling difficult from northern portions of the Lower Hudson Valley and Catskills to the Canadian border. Also 5,000 customers were left without power in the Upper Mohawk Valley region as ice-caked trees and tree limbs fell on power lines.

NYZ012-018-020

Lake George-Saratoga,
Greater Capital
District and Western
Adirondacks

03	AM						? High Winds
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High winds tore trees down in the Hamilton County in the towns of Long Lake and Blue Mountain Lake with several trees about 2 feet in diameter across the road in front of the Adirondack Museum in Blue Mountain Lake. High winds also uprooted some trees and downed some limbs in outlying areas of northern Rensselaer and southern Washington Counties.

Greene County
Catskill

04	0700EST						Ice
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A small school bus overturned in Catskill due to icy roads which developed overnight when temperatures fell back below freezing.

Putnam County
Kent Cliffs

04	PM						Snow Squall
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Three construction workers were struck by a car on the Taconic State Parkway in Kent Cliffs during a blinding snow squall.

Chenango County
Sherburne

06	1300EST						Snow
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Two people were injured when the car they were riding in spun out of control and struck a tree on Furman Mills Road in Sherburne.

Areawide

07	0600EST- 1400EST						Snow Sleet Freezing Rain
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A warm front moved into Eastern New York on December 7th resulting in a mixed bag of precipitation which caused hundreds of accidents across the area as roads became icy. The most serious accident involved two cars and a tractor-semitrailer which jackknifed across Route 50 in the town of Ballston in Saratoga County where a 61-year-old man was killed. Another accident in the Utica area involved a 13- car pile-up along Route 12. (M61V)

Mohawk and Upper
Hudson Valleys

12	0600EST- 0900EST						Black Ice
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A thick fog combined with freezing temperatures resulted in black ice which formed on the roadways causing a number of accidents including an accident along Route 30 in the town of Northampton which claimed the life of a woman and injured three others. (F24V)

NYZ006 > 013-018 >
020

Areawide

14	1745EST-						
15	0345EST			0	1	6	0 High Winds

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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NEW YORK, Central Cont'd

Eastern New York	17 18	1200EST- 0900EST			4	10	5	0	Snow
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Snow totaling 2 to 4 inches fell over the remainder of Eastern New York as a low pressure system tracked east across the northern part of the state. Numerous traffic accidents were reported in the Capital District area with two fatal car accidents reported in the Western Mohawk Valley. The first fatal accident occurred along Route 8 in Clayville in Oneida County where two vehicles collided during a snow squall killing three people and injuring three others. The second fatal accident was a two-car crash along Lake Moraine Road in Madison in Madison County at 0820 EST killing one person and injuring another. (F07V) (M21V) (M21V) (F24V)

Areawide	21	AM			0	9	5	0	Snow Sleet Freezing Rain
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A cold front pushing through New York State resulted in a mixture of snow, sleet and freezing rain across eastern New York which resulted in numerous traffic accidents. The two most serious accidents occurred in Verona in Oneida County where three people were injured and in Johnstown in Fulton County where four people were injured.

Accumulations were generally on the light side with Northeastern New York picking up 1 to 3 inches of snow by the time the snow tapered off late in the morning.

Montgomery County Mindenville	22	2130EST			0	1	3	0	Black Ice
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Black ice was the cause of a one car accident along Mindenville Drive at 2130 EST in which the driver was slightly injured.

Areawide	29	0400EST- 2000EST			2	25	6	?	Freezing Rain
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A storm system moved up the Atlantic Coast on December 29th resulting in freezing rain which pushed north from the Southern Tier of New York to the Saint Lawrence Valley during the day. Hundreds of accidents were reported across Eastern New York with the most serious accident involving two vehicles which collided head-on along Route 29 in the town of Johnstown at 1330 EST killing two people and injuring two others. A 16- and 7-car pile up along Interstate 787 prompted police to close part of the highway from 0700 EST to 0945 EST. Further north Interstate 87 was closed at Exit 17 between 0830 EST and 1030 EST, and between Exits 27 and 30 for 2 hours following numerous accidents. (F70V) (M74V)

Eastern New York	30	AM- PM			0	4	4	0	Snow
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Light snow fell early on December 30th across parts of Eastern New York with accumulations of generally 1 to 2 inches. The snow combined with the freezing rain which had fallen on the 29th caused some accidents as roads were slippery and slush covered. Accidents which involved injuries were reported in Salem, Homer and the town of Minden.

Lower Hudson, Susquehanna and Catskill Regions in Eastern New York	All Month				0	0	?	0	Drought
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The New York State Department of Environmental Conservation continued the drought warning for the following nine counties in Eastern New York: Delaware, Dutchess, Greene, Orange, Otsego, Putnam, Schoharie, Sullivan and Ulster. The drought warning was continued due to the continuation of low levels within the New York City Reservoir Storage.

NEW YORK, Coastal

NYZ0SE Southeastern Portion	14	1850EST- 2030EST			0	0	?	0	High Winds
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High winds, in the wake of a strong cold front, downed several trees and power lines across sections of southeastern New York. Many homes and businesses lost power early Saturday night as the cold front passed through. The falling trees and heavy branches caused some damage, but for the most part this was minor.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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NEW YORK, Western

NYZ022	02	2200EST			0	0	4	0	Ice Storm
NYZ003	02	0100EST			0	0	4	0	Ice Storm
Steuben County									
NYZ001-002-005-021	02	0100EST			0	0	4	0	Ice Storm
NYZ004	02	0500EST			0	0	4	0	Ice Storm

Low pressure tracking northeast from Kentucky brought warm air and significant amounts of moisture to the area. Cold air over the region at the surface was overrun by the warm air spreading north and caused the precipitation to begin as freezing precipitation. From 0.50 to 1.50 inch of freezing rain and sleet fell over the area. The freezing rain downed trees and power lines. Scattered power failures were reported throughout western and central New York.

NYZ022	04	0915EST- 1020EST			0	0	4	0	Heavy Snow
Chautauqua and Cattaraugus Counties									
NYZ001	04	1020EST			0	0	4	0	Heavy Snow
Erie County									
NYZ004									
Oswego County									
NYZ002	04	2000EST			0	0	4	0	Heavy Snow
Wayne County									
NYZ005	05	0100EST			0	0	4	0	Heavy Snow
Onondaga County									
	05	0100EST			0	0	4	0	Heavy Snow

A cold west to northwest flow across the relatively warm waters of Lakes Erie and Ontario produced snow squalls downwind of the lakes. Snow fell at the rate of one inch per hour reducing visibilities to near zero in the squalls. Specific reports included: Cattaraugus County - 11 inches in Little Valley, 10 inches in Ellicottville; Chautauqua County - 8 inches in Dunkirk, 17 inches in Mayville, 12 to 18 inches in Jamestown, 20 inches in Casadaga; Erie County - 6 inches in Springville; Oswego County - 12 inches in Oswego, 15 inches in Fulton; Wayne County - 12 inches in Sodus; and Onondaga County - 14 inches in Syracuse, and 16 inches in Baldwinsville.

Tompkins County									
Ithaca	14	1520EST			0	0	4	0	Thunderstorm Winds (G50)
NYZ022	14	1700EST			0	0	5	0	Snow Winds
NYZ001-021	14	1800EST			0	0	5	0	Snow Winds
NYZ002-003-005	14	1900EST			0	0	5	0	Snow Winds
NYZ004	14	2200EST			0	0	5	0	Snow Winds

A low pressure system moved from the central plains across the Great Lakes to the Northern New England Coast. The storm brought a combination of snow and strong winds to the area. Though snowfall amounts were only a few inches, the high winds caused blowing snow and reduced visibilities to near zero at times. The winds downed trees and power lines. Numerous auto accidents were blamed on the wintery conditions. Winds frequently gusted over 50 mph with gusts of 54 mph at Buffalo, 75 mph at Dunkirk, and 63 mph at Syracuse reported.

NYZ005	16	0500EST			0	0	4	0	Heavy Snow
NYZ001-022	16	0600EST			0	0	4	0	Heavy Snow
NYZ004	16	1200EST-							
	17	1800EST			0	0	4	0	Heavy Snow
NYZ022	18	0500EST			0	0	4	0	Heavy Snow

A deep low pressure system over the Great Lakes moved rapidly northeast toward the Canadian Maritimes. In its wake, a very strong west to northwesterly flow of Arctic air overspread the region and produced localized snowsqualls to the lee of Lakes Erie and Ontario. Significant snowfall reports included: Off Lake Erie - Cherry Creek, 25 inches; Salamanca, 12 inches; Friendship, 10 inches; Village of Allegany, 8 inches; Franklinville, 8 inches; and Hamburg, 8 inches. Off Lake Ontario - Highmarket, over 3 feet; Turrin, 18 inches; Lowville, 9 inches; and Syracuse, 6 inches.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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NORTH CAROLINA

Henderson County E Flat Rock	03	0454EST			0	0	3	0	High Winds
A tree fell on a mobile home causing serious damage.									
Dare County Frisco	03	2301EST			0	0	3	0	Thunderstorm Winds
One camper trailer was destroyed and 4 others were blown off their foundations.									
Union County Monroe	23	2224EST			0	0	3	0	Thunderstorm Winds
Large tree limbs were blown down shorting an electrical transformer and causing a fire.									

NORTH DAKOTA

NDZ003-004-007- 008-011-013-014- Most of Southern North Dakota	13	1300CST- 2100CST			0	0	4	0	High Winds
A deepening low pressure system moved into south-central North Dakota the morning of the 13th, from northeastern Montana. The system then moved northeast into northwestern Minnesota by late afternoon the 13th.									
Behind this system, northwest winds 30 to 50 mph, with a few gusts over 60 mph, occurred over most of southern North Dakota the afternoon and evening of the 13th. A gust to 63 mph was reported at the Jamestown Airport, while a gust to 59 mph was reported at the Dickinson Airport.									
This low pressure system also brought blizzard conditions to north-central and northeastern North Dakota.									
NDZ009-015-016- North-Central and Northeast North Dakota	13 14	1500CST- 0300CST			1	0	3	0	Blizzard
A short-lived blizzard, 3 to 8 hours in duration, affected north-central and northeastern North Dakota late afternoon and night of the 13th, ending early morning the 14th.									
Snow and northwesterly winds to 50 mph caused zero visibilities in snow and blowing snow. In addition, wind chill factors were 30 to 40 degrees below zero.									
This combination cause one exposure death. A man left his vehicle when it went into a ditch during the blizzard, then walked 1 mile before collapsing. He was found one mile northwest of Carbury in Bottineau County. The time of death was about 2200 CST on the 13th.									
The storm also caused multi-vehicle accidents and stranded many motorists. (M770)									
NDZ012 > 018- Eastern North Dakota	27- 31				0	0	5	0	Frost
A moist stagnant airmass over the northern plains brought considerable fog, freezing drizzle, and frost to eastern North Dakota the last days of 1991. Frost and ice buildups up to 6 inches thick on trees and power lines caused widespread power outages.									

OHIO

OHZ006-008-009 Central, South- western and South- central Ohio	02 03	1300EST- 1200EST			0	0	4	0	Urban Flood Small Stream Flood
Heavy rain moved into southern Ohio during the late morning of the 2th and continued into the early morning of the 3rd. Rainfall amounts were from 3 to 5 inches which caused widespread flooding of drainage systems, small streams, underpasses, roads and basements.									
Adams County	02 03	2100EST- 0700EST			0	0	5	0	Flash Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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OHIO Cont'd

Streams washed out numerous roads and some bridges, and flooded several homes. Several cars were washed off roads along Ohio Brush Creek near West Union. Two mobile homes were moved off their foundation near West Union.

Scioto County	02	2300EST-							
	03	0800EST			0	0	5	0	Small Stream Flood

Streams washed out numerous roads and some bridges, and flooded several homes.

Monroe County Rinard Mills	03	0100EST-							
		0900EST			0	0	5	0	Flash Flood

Streams washed out numerous roads and some bridges, flooded homes and businesses along the Little Muskingum river in the southern part of the county. One mobile home was washed 500 feet downstream. The husband and wife escaped by swimming to higher ground. Four of their cars were lost in the flood.

Washington County	03	0100EST-							
		0900EST			0	0	5	0	Flash Flood

Streams washed out numerous roads and some bridges, flooded homes and businesses along the Little Muskingum and Muskingum Rivers. Two mobile homes and a few cars were washed downstream as Rainbow and Bear Creeks flooded near Lowell. Near Watertown a GTE telephone switching station was washed out which caused nearly \$100,000 in damage.

OHZ003 Northeastern Lakeshore	03	1700EST-							
	04	2200EST			0	0	3	0	Lake Effect Snow

Heavy lake effect snow moved into far northeast Ohio during the evening of the 3rd and ended by the evening of the 4th. Snowfall reached 6 inches in Madison at 0200 on the 4th, with final snow totals of up to 20 inches in Painesville.

Statewide	14	1200EST-							
	15	0700EST			0	0	5	0	High Winds

High winds developed over Ohio and Lake Erie after the passage of an arctic cold front. Winds were from 30 to 40 mph over much of the state with gusts around 50 mph common. Gusts were between 60 and 70 mph over extreme northern Ohio adjacent to Lake Erie. Trees and power lines were blown down in many areas and some minor structural damage occurred to buildings. A tug boat sank on Lake Erie, just off Cleveland, as it was moving a barge from the Cuyahoga River to the Rocky River. The tug was later recovered from the bottom of Lake Erie.

OHZ003 Northeastern Lakeshore	15	1700EST-							
	16	1300EST			0	0	3	0	Lake Effect Snow

Heavy lake effect snow moved into Ashtabula county of northeast Ohio during the evening of the 15th and ended by the afternoon of the 16th. Snowfall reached 6 inches in northern parts of Ashtabula County at 0600 EST on the 16th. Total snowfall in Ashtabula County was from 5 to 9 inches.

OHZ002-003-004 Central Lakeshore, Northeastern Lakeshore, and Northeastern Inland	17	2200EST-							
	18	2300EST			0	0	4	0	Heavy Snow

Heavy snow moved into northeast Ohio during the late evening hours of the 17th. Snow depths reached 6 inches in Burton, in Geauga County by 0800 EST on the 18th. At 1400 EST, snowfall reached 6 inches north of Akron and south of Cleveland around 1800 EST. Total snowfall over northeast Ohio was from 2 to 10 inches with Burton receiving the most snow.

OKLAHOMA

Southern, Eastern, Central Oklahoma	01	Unknown-							
OKZ010-OKZ011-OKZ012- OKZ013-OKZ014-OKZ015- OKZ019-OKZ020-OKZ026- OKZ027-OKZ028-OKZ029-	02				1	0	?	?	Ice Storm

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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OKLAHOMA Cont'd

OKZ030-OKZ031-OKZ032-OKZ033

A winter storm moved across portions of southern, eastern, and central Oklahoma. The storm moved from southwest to northeast across the state. Nearly half inch of frozen precipitation was reported in the Oklahoma City area, but some eastern counties reported as much as 4 inches. High temperatures on December 2nd did not rise above freezing, which further aggravated the problem.

An 86-year-old woman slipped on ice and froze to death at Wetumka in Hughes County on the morning of December 2nd. Across the state, the storm also was responsible for numerous traffic accidents, resulting in two fatalities. In addition to travel problems from the ice, power lines were reported down in many areas, resulting in nearly 15,000 electrical customers being without electric power. (F86O)

Okfuskee and Hughes Counties

Near Wetumka 2 SW Weleetka	12	0445CST- 0500CST			0	0	4	?	Thunderstorm Winds
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Winds from a severe thunderstorm caused major damage to three homes near Weleetka as well as uprooting large trees and damaging fences. Near Wetumka, minor damage to homes was reported as well as several barns leveled.

Marshall, Bryan, Atoka, and Pushmatoka Counties

20	1300CST- 2000CST			0	0	?	?	Flash Flood
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Areas of heavy rain with embedded thunderstorms moved over portions of southeastern Oklahoma, causing minor flooding of roadways.

OREGON

ORZ001	05	0400PST- 1600PST			0	0	?	0	High Winds
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Wind ahead of a Pacific front gusted along the northern coast. Wind speeds reached 62 mph at Seaside and Netarts, 52 mph at Pacific City and 51 mph at Arch Cape.

ORZ004	06	0000PST- 2200PST			0	0	4	0	Flood
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A soaking winter storm dumped 2 inches of rain in 16 hours in Gresham. This was enough for Johnson Creek to flood around 1600PST. At least six homes were surrounded by 2 to 3 feet of standing water.

ORZ008	12	0700CST- 2000PST			0	1	4	0	High Winds
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Wind gusting to 70 mph caused damage from Bend to Sunriver to LaPine. Around Sunriver, 600-800 trees were downed, some onto buildings and electrical lines. In the morning, a construction worker was hit by a falling tree or parts of a tree. He broke his shoulder and sustained other injuries. An 80-foot fir tree was snapped in two and fell onto the Osprey Inn. The Grange Hall east of Bend had its roof torn off.

ORZ010	12	0900PST- 2000PST			0	0	?	0	High Winds
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Wind gusted to 50 mph in Pendleton and 58 mph at the Umatilla Army Depot. A weather spotter near Condon had winds 65 to 88 mph.

ORZ011	12	1000PST- 2100PST			0	0	4	0	High Winds
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Wind up to 60 mph caused damage around La Grande. The wind blew the doors and a metal roof off of one storage facility while a dust storm forced people to take shelter. Doors were also blown off of a seed business. Later, a metal roof was ripped from one barn and thrown onto the neighbor's shop roof. The neighbors roof was destroyed. On the Tollgate Highway, 20 trees were toppled which forced the temporary closing of Oregon Route 204.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

OREGON Cont'd

ORZ007	18	0300PST-1200PST			0	0	0	0	Heavy Snow
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A cold winter storm brought widespread snow and rain and local freezing rain to Oregon. The special affects of the Columbia River Gorge on wind and temperature caused 12 inches of snow to fall in a narrow region centered around Cascade Locks (elevation 150 feet).

ORZ005	27	0800PST-1700PST			0	0	0	0	High Winds
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Wind gusts to 50 mph were knocking smaller trees down east and west of Ashland.

PENNSYLVANIA, Eastern

PAZ007-016 Susquehanna, Wayne, Pike and Lackawanna Counties	03	0100EST			1	0	5	0	Ice Storm
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Rainfall occurred across the region, and was heavy at times, from around 1800 EST on the 2nd through the morning of the 3rd. During most of this time temperatures were at or below freezing over the higher elevations. This resulted in considerable ice buildup on trees and utility lines. By 0100 EST on the 3rd the weight of ice was great enough to cause damage. Trees, tree limbs, utility lines and poles were down all across the higher elevations. Trees and limbs came down on houses, other buildings and vehicles. Many roads were blocked by fallen trees and utility lines and were quite hazardous due to icing. In Jefferson Township, Lackawanna County a tree fell on a house and collapsed part of a stone chimney. The chimney fell through the roof and killed a man sleeping in a bedroom inside. Over 10,000 customers lost electrical power and some sections did not have power restored until 4 days later. (M37P)

Lycoming County S Williamsport	14	1604EST			0	0	4	0	Thunderstorm Winds
Williamsport	14	1607EST			0	0	3	0	Thunderstorm Winds (G56)
Airport									
Williamsport	14	1617EST			0	0	3	0	Thunderstorm Winds
Barbours	14	1619EST			0	0	3	0	Thunderstorm Winds
Clarkstown	14	1629EST			0	0	3	0	Thunderstorm Winds
Muncy	14	1638EST			0	0	3	0	Thunderstorm Winds

Thunderstorm wind gusts downed trees and utility lines in Williamsport, Duboistown, Barbours, Hepburnville, Clarkstown, Hughesville and Muncy. Trees came down on vehicles in Williamsport and on two houses in South Williamsport. The wind gusts reached 56 knots at Williamsport-Lycoming County Airport where a roof vent was blown off and damaged an automobile.

PAZ00E Eastern Pennsylvania	14	1652EST-2115EST			1	3	5	0	High Winds
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High winds behind a cold front blew across Eastern Pennsylvania bringing down trees, tree limbs and utility lines. Trees fell on houses or vehicles in some locations and blocked roadways in others. Wind gusts were measured at 63 mph in Philadelphia, 64 mph at Williamsport and in the Wilkes-Barre Scranton area and at 66 mph in Harrisburg. In Haverford Township, Delaware County a tree fell on an automobile and injured three people. The wind gusts capsized a boat on the Susquehanna River north of Marysville, Perry County. One man was able to swim to shore, but another drowned. At least two homes had portions of their roof blown off in York County. At Eddystone, Delaware County a 900-foot tanker was ripped from its dock mooring and swept out into the Delaware River. (M??O)

PENNSYLVANIA, Western

McKean and Elk Counties	02	2201EST			0	0	0	0	Ice Storm
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Trees and power lines were downed due to ice accumulations.

McKean County Bradford	02	2355EST			0	0	0	0	Ice Storm
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Seventeen trees were downed in Bradford due to ice accumulation.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons	Estimated Damage	Character of Storm	
					Killed	Injured	Property	Crops

PENNSYLVANIA, Western Cont'd

22 SW Smethport	03	0010EST- 0800EST			0	0	0	0	Ice Storm
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Half of Kane was shut down by downed trees and powerlines. Two main highways were also closed down by 0800 EST. Ice accumulation was 0.5 inch thick on objects.

Green County Northwestern Portion	03	0025EST- 1000EST			0	0	0	0	Flood
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Road flooding and mudslides in the northwestern portion of the county resulted in some evacuations. Pursley Creek was out of its bank and onto the roadway in Oak Forest at 0735 EST. The southern fork of Ten Mile Creek was out of its bank at 0746 EST. Numerous roads were closed at 0935 EST.

Westmoreland County Greensburg 9 SW Greensburg	03	0230EST			0	0	0	0	Flood
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Small stream flooding occurred in Greensburg and poor drainage flooding occurred in Greensburg, South Huntingdon, and Derry at 0405 EST. In Sewickley Township, a bridge was submerged under water and 12 roadways were flooded throughout the county.

Washington County 12 SE Washington	03	0730EST- 1000EST			0	0	0	0	Flood
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Big and Little Ten Mile Creeks around Marianna were flooded.

PAZ001 Lakeshore PAZ002 Northwestern Portion	04	1340EST			0	0	0	0	Heavy Snow
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Erie received 11 inches of lake effect snow, 14 to 15 inches in Lawrence Park, 18 to 20 inches in Northeast, 10 to 12 inches in Corry, 6 to 7 inches in Meadville, 6 to 7 inches in Cambridge, and 6 to 8 inches in Linesville.

PAZ005 Laurel Mountains	14	1255EST- 1605EST			0	0	5	0	High Winds
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Part of an abandoned house collapsed in East Conemaugh at 1255 EST in addition to two other buildings. A building in Cresson partially collapsed and the top portion of a water tower was blown off at 1325 EST. A 60-mph wind gust was reported in Somerset at 1405 EST and Hooversville at 1605 EST; all were non convective wind.

PAZ015 Southwestern Portion	14	1330EST- 1650EST			0	0	5	0	High Winds
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In Connellsville in Fayette County, a wind gust to 64 mph was reported along with trees and power lines downed at 1330 EST. In New Stanton in Westmoreland County, large trees and power lines were downed at 1335 EST. In Brownsville in Fayette County, a 59-mph wind gust was recorded at 1340 EST. In Beaver Falls in Beaver County, a wind gust to 60 mph was reported at 1343 EST. In Sewickley in Allegheny County, a 64-mph wind gust and downed fences were reported at 1350 EST. Trees were uprooted in Ross and Swissvale. In Moon, a house under construction was blown down. At 1354 EST, part of a department store roof was blown off in Washington in Washington County. Between 1415 EST and 1430 EST, a 70-foot tower was blown off a municipal building in Mt. Lebanon in Allegheny County and a car was crushed by falling trees in the Chartiers section 3 miles west of Pittsburgh. At 1453 EST, trees and power lines were downed in Latrobe in Westmoreland county. In West Mifflin in Allegheny County, a 58-mph wind gust was reported at 1515 EST. At 1650 EST, trees and power lines were downed in Murrysville in Westmoreland County. At 1720 EST, numerous trees were downed at Washington in Washington County. In Indiana County at the Jimmy Stewart Airport, a 74-mph wind gust was reported during the afternoon; all non convective wind

PAZ014 North-Central Mountains	14	1500EST			0	0	5	0	High Winds
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A home under construction was destroyed by non convective wind in Punxsutawney. Time given is estimated.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
PENNSYLVANIA, Western Cont'd									
PAZ002 Northwestern Portion	14	1500EST			0	0	0	0	High Winds
Numerous trees and power lines were downed throughout the county. Time given is estimated.									
PAZ040 Northern Mountains	14	1615EST			0	0	0	0	High Winds
Many trees were downed in St. Marys and Ridgeway due to non convective wind.									
PAZ006 South Central Mountains	14	1640EST- 2217EST			0	0	0	0	High Winds
Altoona Flight Service Station reported gust to 58 mph. At 2030 EST in Claysburg in Blair County, gust to 60 mph were reported. In the towns of Bedford and Everett in Bedford County, numerous roofs were blown off around 2217 EST.									
PAZ003 Western Portion	14	1700EST- 1705EST			0	0	0	0	High Winds
Trees and power lines were downed across Butler and Armstrong Counties.									
PAZ002 Northwestern Portion	14	2315EST			0	0	0	0	Heavy Snow
Corry received 6 inches of lake effect snow and Waterford received 6 to 8 inches.									
PAZ002 Northwestern Portion	15	0400EST- 1025EST			0	0	0	0	Heavy Snow
Waterford received 8 to 10 inches of lake effect snow, 6 to 7 inches in Summit, and 6 inches in Edinboro. By 1025 EST, southern Erie, Warren, and Crawford Counties receive 12 inches.									
PAZ002 Northwestern Portion	18	1400EST			0	0	0	0	Heavy Snow
Edinboro received 8 to 10 inches of lake effect snow, Corry had 9 inches, and Meadville received up to 6 inches.									
RHODE ISLAND									
None reported.									
SOUTH CAROLINA									
Spartanburg County Sugartit Community	23	2105EST			0	1	4	0	Thunderstorm Winds (G55)
A weak derecho moved across the Upstate along with a number of other thunderstorms during the evening hours. The steady state storm produced wind gusts from 35 to 45 knots consistently along its path along with numerous reports of 0.25 to 0.50 inch hail. The hail covered the ground in some places. The storm also produced spectacular (although apparently not very damaging) lightning for a winter thunderstorm. The storm was moving east-northeast at 55 knots directly under a mid-level jet of 75 to 80 knots. The storm displayed a distinctive bow echo as it passed across Pickens and Greenville Counties. As the bow was weakening, the storm produced its highest wind gust about 5 miles southeast of the Greenville-Spartanburg Jetport. The location of the damage was on a broad ridge in open country. Two mobile homes were damaged and one destroyed by high winds. The home that was destroyed was not tied down; the two that sustained only damage were tied down. One man in the demolished home was slightly injured.									
SOUTH DAKOTA									
SDZ001-002-008 009-010-013 > 016-019	13	0400CST- 2200CST			0	0	0	0	High Winds
A strong low pressure system moved through the western and central parts of South Dakota causing 30 to 40 mph sustained winds and gusts to over 60 mph.									
SDZ003-004-005	20	0600CST- 1800CST			0	1	4	0	Ice Storm
Light freezing drizzle and freezing rain developed over northern South Dakota from Timber Lake									

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

SOUTH DAKOTA Cont'd

to Webster. Numerous car accidents were attributed to slippery conditions. The Aberdeen Police Department reported 24 accidents in Aberdeen, but only one resulted in an injury. Numerous businesses closed and schools were cancelled.

SDZ0SE Southeastern South Dakota	31	0000CST- 2400CST				0	1	3	0	Ice Storm
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Light freezing drizzle coupled with heavy frost downed power lines from Minnehaha to Kingsbury Counties. Power outages affected nearly 1,000 people. Slippery roads also caused two traffic accidents which resulted in one injury.

TENNESSEE

Giles County	01	1200CST			0	0	2	0	Flood
Franklin County	01	1200CST			0	0	2	0	Flood
Lawrence County	01	1200CST			0	0	2	0	Flood
Cannon County	01	1230CST			0	0	2	0	Flood
Marshall County	01	1230CST			0	0	2	0	Flood
Bedford County									
Shelbyville	01	1230CST			0	0	2	0	Flood
McMinn County	01	1230CST			0	0	0	0	Flood
Marion County									
South Pittsburg	01	1330CST			1	0	3	0	Flood
Grundy County									
Pelham	01	1300CST			0	0	2	0	Flood
Knox County									
Knoxville	01	1330CST			0	0	2	0	Flood
Sevier County	01	1400CST			0	0	2	0	Flood
Union County									
Sharps Chapel	01	1430CST			0	0	3	0	Flood
Hamilton County									
Northern Portion	01	1530CST			0	0	2	0	Flash Flood

Several roads were closed due to flood waters.

Marion County Jasper	01	1530CST			0	0	2	0	Flash Flood
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A major highway was closed due to flood waters.

Rhea County	01	1600CST			0	0	2	0	Flash Flood
Sequatchie County	01	1600CST			0	0	2	0	Flash Flood

Several roads were closed in both counties due to flood waters.

Hamilton County	01	2315CST			0	0	2	0	Flash Flood
Rhea County	01	2315CST			0	0	2	0	Flash Flood

Additional heavy rainfall closed several roads in both counties.

Blount County									
Maryville	01	2330CST			0	0	3	0	Flood
Meigs County	01	2330CST			0	0	4	0	Flood
Coffee County									
Tullahoma	01	2330CST			0	0	3	0	Flood
Perry County	02	1200CST			0	0	2	0	Flood
Marion County									
Jasper	02	1230CST			0	0	2	0	Flood
Hamilton County	02	1230CST			0	0	4	0	Flood
Hardin County	02	1230CST			0	0	2	0	Flood
Grundy County	02	1300CST			0	0	3	0	Flood
Rhea County									
Sandtown	02	1300CST			0	0	2	0	Flood
Wilson County	02	1300CST			0	0	2	0	Flood
Cumberland County									
Crossville	02	1330CST			0	0	2	0	Flood
Gibson County									
Trenton	02	1330CST			0	0	2	0	Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
TENNESSEE Cont'd									
Montgomery County	02	1330CST			0	0	2	0	Flood
Cheatham County	02	1330CST			0	0	2	0	Flood
Robertson County	02	1330CST			0	0	3	0	Flood
Claiborne County									
Lafollette	02	1330CST			1	0	2	0	Flood
White County	02	1400CST			0	0	2	0	Flood
Henry County									
Paris	02	1430CST			0	0	2	0	Flood
Crockett County	02	1500CST			0	0	2	0	Flood
Anderson County									
Clinton	02	1700CST			0	0	2	0	Flood
Oakridge									
Smith County	02	1835CST			0	0	2	0	Flood
Claiborne County	02	1930CST			0	0	2	0	Flood
Grainger County	02	1930CST			0	0	2	0	Flood
Hawkins County									
Rogersville	02	2000CST			0	0	2	0	Flood
Rutherford County	02	2100CST			0	0	2	0	Flood
Meigs County									
Athens	02	2330CST			0	0	3	0	High Winds
Maury County	02	2330CST			0	0	3	0	Flood
Wayne County									
Waynesboro	03	1300CST			0	0	2	0	Flood

Heavy rainfall from December 1st through 3rd produced widespread flooding across much of Tennessee. Over 14 inches of rain fell across a middle and eastern sections of the state during the 3-day period. Numerous roads were either covered with water or closed due to high water. A few families were briefly evacuated due to the threat of high water, but no homes were actually damaged. In addition to the flooding, high winds knocked down two greenhouses in the town of Athens in Meigs County. An 8-year-old boy was killed in South Pittsburg when he fell into a construction drainage ditch that has 8 feet of water inside. A man from Lafollette in Claiborne County was killed when he drove his truck into a flooded road. (M80V) (M6?O)

TEXAS, Northern

Entire Area 18-23

The month of December was one of the wettest in northern Texas since records began in 1898. December rainfall totals included 6.28 inches at Abilene, 6.93 inches at Wichita Falls, 8.44 inches at Waco, and 8.75 inches at the Dallas Fort Worth Airport. Both Waco and the Dallas Fort Worth Airport set new record rainfall amounts for December.

The heaviest rainfall in northern Texas initially began on the 19th and continued through the 23rd. The heaviest rainfall was generally southeast of Stephenville where rainfall was generally southeast of Stephenville where rainfall amounts in excess of 10 inches was observed in Erath, Bosque, and Hamilton Counties. The heavy rains in combination with low drying conditions allowed runoff to be excessive.

All northern Texas rivers were either out of banks or above their flood stage during the last of December. On December 20th, the following rivers set new record stages: North Bosque River at Hico, Cowhouse Creek near Pidcoke, Lampasas River near Kempner, Leon River near Hamilton, and the Nolan River near Blum. On December 21st, record stages were observed at the North Bosque River near Clifton and at Valley Mills, the Leon River at Gatesville, and the Chambers Creek near Rice. Other record stages were set at the Brazos River near Highbank on the 22nd and Lake Waco on the Bosque River on the 24th.

Substantial flood crests were observed along the Trinity River from Fort Worth, through Dallas, to Lake Livingston and along the Brazos River from Possum Kingdom Reservoirs downstream to Lake Whitney. Most of the northern Texas area Corps of Engineers reservoirs were slightly above the top of the conservation pools on the 18th and utilizing between 50 and 90 percent of their respective flood pools by the end of the month.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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TEXAS, Northern Cont'd

Erath County	20	0745CST- 2200CST			0 0	5 ?	Flash Flood
<p>Heavy rains of 3 inches in a 24-hour period and 6 to 8 inches in a 48-hour period resulted in the flash flooding of most county and secondary roadways. Farm-to-Market Road 914, Farm-to-Market 219 near Lingleville, U.S. Highway 67 between Dublin and Stephenville, and U.S. Highway 281 near Hico observed high water up to 1 foot in depth at various locations. One evacuation occurred near Hico.</p>							
Parker County Countywide	20 21	0800CST- 1200CST			0 0	5 ?	Flash Flood
<p>Heavy rains of six to eight inches in a 48-hour period resulted in the flash flooding of approximately 80 roadways and numerous bridges countywide. Over 20 residences were evacuated in Weatherford when creeks overflowed their banks.</p>							
Southern Portion	20 23	1400CST- 0000CST			0 0	6 ?	Flood
<p>In southern Parker County, the Brazos River from Possum Kingdom Reservoirs downstream to Lake Whitney experienced very large crest flows. Possum Kingdom's flood gates were initially opened at 0800 CST on the 20th with peak release of about 50,000 cfs. Along the Brazos River in southern Parker County, approximately 60 residences were flooded. In the Horseshoe Bend area, five mobile homes were destroyed while 25 residences received major damage.</p>							
Tarrant County Countywide	20 21	0830CST- 1200CST			0 0	5 ?	Flash Flood
Countywide	21 22	1200CST- 0000CST			0 0	5 ?	Flood
<p>Heavy rains of 4.22 inches in a 24-hour period and 6.17 inches in a 48-hour period were measured at the Dallas Fort Worth Airport. Flash flooding at low-water crossings was observed over 50 roadways in Fort Worth, Haltom City, Mansfield, and Arlington. In Haltom City, several roadways were barricaded along the Fossil Creek while one mobile home park was evacuated. In Arlington, flash flooding was observed at 2300 CST on the 20th along Johnson Creek.</p> <p>On the 21st, the West Fork of the Trinity River at Fort Worth was almost 0.5 foot over its flood stage. Six homes were flooded along the shores of Lake Worth when water releases reached 3.6 feet above the spillway. At Lake Arlington, a yacht club marina and a park were flooded at the Hill Creek subdivision when a creek overflowed its banks. At Eagle Mountain Lake, several boat docks and outbuildings were destroyed when water releases reached 2.4 feet over the spillway.</p>							
Hood County	20 21	0830CST- 0600CST			0 0	5 ?	Flash Flood
<p>Heavy rains, measured at 4.50 inches in a 24-hour period, resulted in the flash flooding of most low-water crossings. High water was observed up to 2 feet in depth along portions of Farm-to-Market Roads 51 and 211, Farm-to-Market Road 1109 and 4 near Lipan, Farm-to-Market Road 2870 just west of Paluxy, and U.S. Highway 377 near Whiskey Flats.</p>							
Johnson County	20 21	0830CST- 0600CST			0 0	6 ?	Flash Flood
<p>Heavy rains up to 7.25 inches were measured in a 48-hour period and resulted in the flash flooding of most low water crossings. High water was observed up to 4 feet in depth in Cleburne where over 100 residences and businesses were flooded. Two automobiles were submerged at the intersection of Buffalo Creek and U.S. Highway 67 between Cleburne and Keene. In addition, Farm-to-Market Road 2280 in Keene and State Highway 174 near Rio Vista were closed due to high water.</p>							
Somervell County Countywide	20 21	0900CST- 0600CST			0 0	5 ?	Flash Flood
Glen Rose	20 21	1500CST- 0600CST			0 0	5 ?	Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

TEXAS, Northern Cont'd

Heavy rains estimated between 8 and 10 inches in a 48-hour period produced flash flooding of most secondary roadways including State Highway 67 between Glen Rose and Cleburne where high water up to 2 feet in depth was observed.

Numerous homes in Glen Rose were flooded when the Paluxy River overflowed its banks.

Hamilton County Countywide

20	0900CST-								
21	1200CST				0	0	5	?	Flash Flood
Countywide									
20	1200CST-								
21	1200CST				0	0	5	?	Flood

Heavy rains of 8 inches in a 10-hour period were measured in Evant. Several streams and creeks overflowed their banks and produced flash flooding of low-water crossings. High water up to 1 foot in depth was observed along portions of U.S. Highway 281. High water was also observed at Farm-to-Market Road 1602 from Fairy to State Highway 22 and Farm-to-Market Road 2005 at the Lampasas River.

On the 20th, the North Bosque River at Hico set a new record flood state of 23.30 feet while the Leon River at Hamilton set a new gauge height of 35.04 feet. Several homes were flooded along the Leon River between Farm-to-Market Road 2905 and State Highway 22.

Bosque County Countywide

20	1000CST-								
21	0700CST				0	0	5	?	Flash Flood
Countywide									
20	1500CST-								
21	2400CST				2	0	6	?	Flood

Heavy rains of 6.50 inches, measured in a 10-hour period at Meridian, resulted in flash flooding at the intersection of low-water crossings and State Highway 22 between Meridian and Cranfills Gap, State Highway 6 south of Clifton at Neils Creek, Farm-to-Market Road 219 east of Clifton, Farm-to-Market Road 1991 near Clifton, Farm-to-Market Road 927 from Walnut Springs to Lakeside Village, and Farm-to-Market Road 216 north of Iredell.

Two fatalities occurred between midnight and 0600 CST on the 21st when an automobile drove around a barricade on State Highway 6 and was swept into a ravine at the Meridian Creek Bridge. The North Bosque River was between 4 and 8 feet above its flood stage at Hico, Clifton, and Valley Mills. Approximately 40 residences, a veterans hall, a bridge at the intersection of State Highway 6 at Meridian Creek, and 0.5 mile of a railroad track were destroyed in Clifton where damage estimates were in excess of \$1 million. In Meridian, a sheriff's office was flooded, a bridge was washed out at State Highway 22 and the Bosque River. Meanwhile, State Highway 6 and 22 were closed between Meridian and Waco. In Valley Mills, high water was up to 2 feet in depth in several homes while numerous vehicles were submerged (F40V) (F06V)

Coryell County Countywide

20	1000CST-								
21	0700CST				0	0	5	?	Flash Flood
Countywide									
20	1500CST-								
21	2400CST				0	0	6	?	Flood

Heavy rains of 3.88 inches measured in a 24-hour period at Killeen resulted in the flash flooding of U.S. Highway 84 at Purmela, Farm-to-Market Road 920 and 2412 at Levita, Farm-to-Market Road 183 at Pearl, Farm-to-Market Road 1783 at Cowhouse Creek, Farm-to-Market Road 932 at Ireland, Farm-to-Market Road 185 east of Gatesville at Osage, and State Highway 236 at Mother Neff Park.

Record stages were set at both the Leon River at Gatesville and the Cowhouse Creek at Pidcoke. Along the Leon River near Levita, one car was swept away. Two mobile homes were destroyed and two bridges were damaged at the Mocassin Bend of the Cowhouse Creek.

Damage to bridges, roadways, and other structures from both flash flooding and flooding was estimated at \$3.5 million.

Hill County Countywide

20	1030CST-								
21	0600CST				0	0	5	?	Flash Flood
Countywide									
20	1500CST-								

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
TEXAS, Northern Cont'd									
	21	2400CST			0	0	5	?	Flood
	Flash flooding was observed at the intersection of low-water crossings and Farm-to-Market Road 933 between State Highway 174 and Whitney, Farm-to-Market Road 309 northwest of Hillsboro at Cottonwood and Aquilla Creek, and Farm-to-Market Road 934 west of Osceola at Aquilla Creek.								
McCulloch County	20	1115CST-2200CST			0	0	5	?	Flash Flood
	Flash flooding was observed at the intersection of low-water crossings and County Road 123 at Brady Creek, Farm-to-Market Road 311 at Calf Creek, and numerous secondary roadways.								
Brown County	20	1200CST-1600CST			0	0	5	?	Flash Flood
Countywide	21	0300CST-23			0	0	6	?	Flood
	Approximately three inches of rain in a 24-hour period resulted in flash flooding at the intersection of low-water crossings and Farm-to-Market Roads 105 and 590. Several residences and vehicles were damaged along U.S. Highway 377.								
	Several city and lake area homes and businesses were flooded up to 5 feet in depth in Brownwood when Lake Brownwood reached 3.5 feet over its spillway. Damage was estimated at \$100,000 to 10 homes and \$580,000 to 40 businesses.								
Dallas County	20	1200CST-							
Countywide	21	1200CST-			0	0	5	?	Flash Flood
Countywide	21	0430CST-							
	31	2400CST			0	0	7	?	Flood
	Heavy rains of 4.22 inches in a 24-hour period and 6.17 inches in a 48-hour period was measured at the Dallas Fort Worth Airport. In Grand Prairie, flash flooding was observed at low-water crossings along Johnson Creek, Cottonwood Creek, and Bear Creek. Several streets were closed along Duck Creek in Garland and Near White Rock Creek in Dallas.								
	Substantial flooding occurred along the Trinity River from Grand Prairie through Dallas. In Grand Prairie, 11 homes, a concrete manufacturing plant and over 100 rental cars at a parking lot were flooded by high water up to 5 inches in depth. In Dallas, approximately 180 homes and 15 businesses received up to \$4.5 million in damage from flooding. Around 130 homes were flooded up to several feet in depth at Rochester Park while three homes were flooded in Cadillac Heights. Forty persons were evacuated from a mobile home park in Hutchins.								
Collin County	20	1230CST-							
	21	0600CST			0	0	5	?	Flash Flood
	Heavy rains resulted in the flash flooding of both the Wilson Creek near McKinney and the Los Rios Creek in Plano. Several automobiles were submerged by high water while numerous secondary roadways were closed at low-water crossings including U.S. Highway 75 near McKinney and Farm-to-Market Road 544 in Plano.								
Denton County	20	1300CST-							
	21	0600CST			0	0	5	?	Flash Flood
	Heavy rainfall of 4.30 inches in a 24-hour period resulted in the widespread flash flooding of secondary roadways. Over 35 city and county roads at low-water crossings were closed including U.S. Highway 380 and Farm-to-Market Roads 1173, 407, 428, 455, 2449, and 1385.								
Wise County	20	1330CST-							
Countywide		2100CST			0	0	5	?	Flash Flood
Countywide	20	1800CST-							
	31	2400CST			0	0	5	?	Flood
	Flash flooding was observed at the intersection of low-water crossings and Farm-to-Market Road 730 from Boyd to East Mountain, Farm-to-Market Road 1655 south of Alvord, and Farm-to-Market Road 3259 between Paradise and U.S. Highway 59 south. The western fork of the Trinity River								

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
TEXAS, Northern Cont'd									
									remained over 3 feet above bankfull stage and produced extensive low-land flooding. At Lake Bridgeport, several boat docks and outbuildings were destroyed when water releases reached 3 feet above the spillway.
Fannin County	20 21	1400CST- 0600CST			0	0	4	?	Flash Flood
									Several secondary roadways including Farm-to-Market Road 271 at Bois D Arc Creek were closed due to high water.
Grayson County Eastern Portion	20	1400CST- 1700CST			0	0	4	?	Flash Flood
									Several secondary roadways in eastern Grayson County were closed at low-water crossings.
Cooke County	20 21	1700CST- 2400CST			0	0	3	?	Flood
									The Elm Fork of the Trinity River overflowed its banks and flooded Farm-to-Market Road 2071 south of Gainesville, Interstate 35 in southern Cooke County, and Farm-to-Market Road 902 at the Timber Creek railroad in Collinville.
Bell County Countywide	20 21	1700CST- 0300CST			0	0	5	?	Flash Flood
Countywide	21 22	0500CST- 2400CST			0	1	6	?	Flood
									Heavy rains of 3.50 inches in a 34-hour period resulted in the flash flooding of low-water crossings. Flash flooding was observed at Farm-to-Market Road 438 between Oenaville and Belfalls, Farm-to-Market Road 1123 at Sommers Mil, Farm-to-Market Road 2484 at Youngsport, Farm-to-Market Road 437 at Little Elm, Farm-to-Market Roads 2086 and 940 at Big Elm, Farm-to-Market Road 2670 from State Highway 195 to Maxdale, Interstate 35 at Salado, State Highway 36 at Rogers, and U.S. Highway 190 at Nolanville. In Temple, numerous city roadways were closed and one automobile was submerged when the depth of the water reached 5 feet.
									Approximately 30 residences in Youngsport, 20 residences in Maydale, and 18 parks were flooded when creeks flowing from Lake Belton and Stillhouse Hollow Lake overflowed their banks. Damage was estimated at \$1 million.
McLennan County Countywide	20 21	1800CST- 0600CST			0	0	5	?	Flash Flood
Countywide	21 24	1200CST- 2400CST			0	0	5	?	Flood
									Heavy rains of 3.70 inches in a 24-hour period resulted in the flash flooding of Loop 304 in Waco, Farm-to-Market Road 3400, Farm-to-Market Road 1637 at the Bosque County line, State Highway 6 frontage road at Twin Bridges, and the U.S. Highway frontage road on the west side of the Bosque River in Woodway.
									Flooding occurred along the shores of Lake Waco which set a new record elevation. Mobile homes and recreational vehicles at both Riverview and Speegleville Park were flooded by high water up to 3 feet in depth.
Ellis County	20 21	1900CST- 0800CST			0	0	5	?	Flash Flood
									Heavy rains of 4.54 inches in a 24-hour period resulted in several creeks overflowing their banks and producing flash flooding of low-water crossings. Several roadways were closed due to high water including Farm-to-Market Road 667 between Italy and Frost, Farm-to-Market Road 813 in Rockett, Farm-to-Market Road 984 between Bardwell and Rankin, Farm-to-Market Road 66 at Chambers Creek, and the Interstate 45 service road between Trumbull and Palmer at the Red Oak Creek.
Lampasas County	20 21	2000CST- 2400CST			0	0	6	?	Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons	Estimated Damage	Character of Storm	
					Killed	Injured	Property	Crops

TEXAS, Northern Cont'd

The Lampasas River overflowed its banks and washed out a bridge on U.S. Highway 190 located west of Kemper. A mobile home was destroyed at the intersection of Farm-to-Market Roads 580 and 2313 while two automobiles were submerged on County Road 2 near Lucy Creek Ranch by Adamsville.

Coleman County	20	2000CST-						
	24	2400CST			0	0	6	?
								Flood

Flooding occurred along Lake Coleman where water reached 7.60 feet above the spillway. Approximately 40 homes and several marinas were flooded with water up to 5 feet in depth.

Rockwall County	20	2000CST-						
	21	0600CST			0	0	4	?
								Flash Flood

High water was observed across most county roadways at low-water crossings.

Freestone County	20	2130CST-						
	21	1400CST			0	0	4	?
								Flash Flood

Flash flooding was observed along U.S. Highway 84 between Teague and Mexia, U.S. Highway 287 between Corsican and Palestine, Farm-to-Market Road 80 near Streetman and Donie, and Farm-to-Market Road 246 between Streetman and Wortham.

Navarro County	20	2300CST-						
	21	1400CST			0	0	5	?
								Flash Flood

Heavy rains of 4.00 inches in a 24-hour period resulted in the flash flooding of numerous roadways including Interstate 45, State Highway 75, State Highway 51, Farm-to-Market Roads, 3194, 3041, and 55. High water up to 5 feet in depth was observed crossing State Highway 287 at the Chambers Creek bridge in Corsicana where several vehicles were submerged and one residence was evacuated.

Smith County	21	0000CST-						
		1400CST			0	0	4	?
								Flash Flood

Flash flooding was observed at the intersection of low-water crossings and County Road 2133, Farm-to-Market Road 2868 between Fling and Gresham, and Farm-to-Market Road 2133 at Farm-to-Market Road 346 near Tyler.

Cherokee County	21	0030CST-						
		0700CST			0	0	3	?
								Flash Flood

Flash flooding was observed along Farm-to-Market Road 855 located north of U.S. Highway 175.

Henderson County	21	0030CST-						
		1400CST			0	0	4	?
								Flash Flood Flood

Heavy rains of 5.08 inches in a 24-hour period resulted in the flooding of the Trinity River across State Highway 287 near Chambers Creek. High water was observed across State Highway 287 at Cayuga, the Cedar Creek bridge between Malaoff and Trinidad, and the Trinity River bridge on Farm-to-Market Road 85 located just west of Seven Points. Flash flooding was also observed at the intersection of low-water crossings and State Highways 198 and 274.

Wood County	21	0030CST-						
		0700CST			0	0	3	?
								Flash Flood

Flash flooding was observed at the intersection of low-water crossings and Farm-to-Market Road 1804 located southeast of Mineola.

Anderson County	21	0500CST-						
		1400CST			0	0	5	?
								Flash Flood

Flash flooding was observed at the intersection of low-water crossings and Farm-to-Market Roads 1231, 1232, 355, 309, 320, 399, 2213, and 2212. One bridge was washed out on County Road 483 while portions of State Highway 287 were closed.

Rains County	21	0500CST-						
		0800CST			0	0	3	?
								Flash Flood

Flash flooding was observed at low-water crossings and several Farm-to-Market Roads including

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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TEXAS, Northern Cont'd

State Highway 287 north of Emory.

**Nacogdoches County
Northern Portion**

22.	0000CST-1200CST				0	0	4	?	Flood
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Several creeks between Linn Flats and Union Springs overflowed their banks and flooded wooden bridges and vehicles on County Roads 918, 919, and 839.

TEXAS, Southern

**South-central
and Southeastern
Texas**

19 31	0125CST-				11	?	8	7	Flash Flood Flood
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Widespread heavy rains fell over central and northern Texas December 18th through the 22nd. This heavy rain produced significant flash flooding and river flooding. The river flooding persisted into January 1992. On December 18th, a cold surface ridge had settled over Texas. A deep upper-level trough was moving eastward into California. Warm, moist, unstable air began to spread northward from the Gulf of Mexico, and up over the cold surface air. As the overrunning increased late on the 18th, embedded thunderstorms began producing heavy rains over south-central Texas.

The general overrunning pattern persisted through the 21st of the month. The deep, cold upper-level trough over the southwestern United States and northern Mexico continued to tap tropical moisture from the low latitudes across Mexico, and into central and northern Texas. Short-wave troughs would rotate around the long-wave trough, across Texas, and intensify the rains for a short period. The level-moisture flow from the Gulf of Mexico would also continue, at times increasing to over 70 mph. The three phenomena (upper trough to the west, cold surface high pressure, and moist, low-level jet) combined to produce rainfall from the hill country into north-central Texas, totaling an average of 12 to 16 inches over the 4-day period of December 18th through the 21st, and making it the wettest December on record in several areas as well as one of the wettest months ever.

Flash flooding and rapid rise on the headwaters of the river and streams across the hill country into north-central Texas were the main problems during the first day or two. Several people lost their lives in the rapidly rising headwaters. During the last couple of days rising waters along the mainstreams of the rivers and anticipated rises downstream to the Gulf of Mexico were the main areas of concern. The following is a summary of damage and fatalities by county. Several counties in the lower reaches of the river system in southern Texas were still in the flood as of early February. Damage assessments of some of these counties still have not been made due to the continuing flooding.

Atascosa Several roads and highways were closed on Saturday the 21st due to flooding. The Co-op on Highway 281 in Pleasanton was flooded, damage was estimated to be near \$10,000.

Austin Over \$150,000 in agricultural losses were reported in the county, most of this was hay that was washed down the river. Approximately 3 miles of fence was lost along with a few head of cattle.

Bandera Several schools in the county were closed due to flooding on roadways Friday morning and several recreational vehicles had to be moved to avoid flooding in the Jellystone Recreational Vehicle Park in Bandera. A bridge over the Medina was washed out during the flooding and Texas Highway 16 was closed until the 24th. Around \$50,000 damage was estimated to the county roads and bridges. The flooding subsided by the 22nd.

Bastrop Over 100 homes were flooded along the Colorado River in the county. Estimated cost of repairs was near \$2 million dollars, agricultural losses in the county were over \$3.5 million dollars. The estimated cost of repairs to streets bridges and waste-water facilities was \$500,000. The county was declared a Federal Disaster Area.

Bexar Two youths were walking along the banks of Leon Creek in west San Antonio around 1130 CST Saturday the 21st, the bank collapsed under them and they fell into the water. One youth was able to pull himself out, the other was washed down stream. His body was found the next day tangled in brush in the creek a 0.25 mile from where he fell in. All low-water crossings in the county were closed by the 22nd. Several people had to be rescued after they tried to cross the low-water crossing and were washed off. Approximately 10 cars were lost in this way. U.S. Highway 90 and Interstate 35 south of downtown San Antonio were closed on the 20th due to flooding, all traffic

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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TEXAS, Southern Cont'd

							had to be diverted. Estimated damage to the roads and bridges in the county was near \$100,000. (M140)
Blanco							Several low-water crossings were flooded on the 20th in the county. Estimated damage in the county to the roads and bridges was only \$2,500.
Brazos							Around \$800,000 in damage was done to the roadway system in the county and around \$100,000 in agricultural damage was reported.
Brazoria							Total damage to property in the county area was estimated at over \$4 million. This includes 500 buildings that were flooded, the town of Holiday Lake was complete flooded from water of Oyster Creek. Damage estimates for the roads and bridges will go higher as most of the roads that were damaged were still under water. Agricultural damage in the county was estimated at an additional \$4 million. The county was not declared a disaster area due to the inaccurate damage estimates.
Burleson							Estimates of around \$2 million in damage were reported by county officials. Over half of this estimate was damage to agriculture, several thousand acres of wheat and oats along with approximately \$250,000 in hay were washed down the Brazos River. Over 50 miles of barbed wire fences and around 50 head of livestock were also lost during the flooding. Damage to roads and bridges account for the remainder of the estimate. Many roads were still under water as of this writing and an accurate estimate was not available.
Burnet							Several homes along the Colorado River were damaged, 16 were destroyed and an additional 92 were severely damaged. Damage estimates were just over \$1 million for private property throughout the county. county roads and bridges only sustained around \$75,000 in damage. Agricultural losses were estimated to be near \$100,000 mainly in fences and hay bales that were washed away. Burnet County was declared a Federal Disaster Area.
Caldwell							The county only that sustained minor damage to roadways. Estimates for repairs were near \$80,000.
Calhoun							Estimates of damage to private property were around \$750,000 and included 11 homes that were flooded along with 26 mobile homes that sustained flood damage. Estimates for damage to county roads were made at \$500,000. This estimate will go higher, due to several roadways still under water.
Colorado							Around \$150,000 in flood damage was reported to private property in the county. Only \$2,500 in damage to roadways and bridges in the county was reported. The Lower Colorado River Authority reported around \$300,000 in damage to a hydroelectric plant on the Colorado River. Estimates of agricultural damage were only \$50,000 and were mainly in hay and feed.
Dewitt							U.S. Highway 183 near Hochheim was closed for several days due to a 0.25-mile section of the roadway was under water. Thirteen mobile homes along the Guadalupe River were damaged and one was destroyed by flood waters. Estimated cost of damage was around \$100,000. Permanent structures along the river received an estimated damage of around \$500,000 this includes a hydroelectric plant that was flooded.
Edwards							A car with five passengers was swept off a low-water crossing on the Little Hackberry Creek near the Town of Barksdale, early on Friday the 20th. Two of the occupants made it to safety, the others were washed down stream and drowned. The body of the 2-year-old boy and the 31-year-old female were recovered a few days later. The county only sustained minor damage to roadways; estimated at only \$5,000. (F01O) (M02O) (F31O)
Fayette							Several homes located between the "Frisch Auf!" Golf Course and the Colorado River near La Grange were flooded over the weekend of December 21st. One low-water-crossing bridge was washed out. Damage estimates were near \$750,000 for public and private property; and near \$100,000 for agriculture. Fayette County was declared a Federal Disaster Area.
Fort Bend							Total damages estimated for the county were \$5 million, including approximately 200 homes that sustained flood damage. Around \$500,000 in damages were sustained to the Thompson Oil Field, mainly from pumps being flooded. Roadways through out the county sustained major damage, several culverts were washed out. Local officials feel that the damage estimates were low because several roadways were still under water when it was made.
Gillespie							Estimates for damage in the county were near \$500,000; over \$100,000 for the repair of a water main that ran under the Pedernales River. The main was washed out and sheered off during the flood. Major damage also occurred to the low-water bridge over Baron Creek on South Creek

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
TEXAS Southern Cont'd							
							Street. Preliminary figures for repairing the bridge were around \$50,000. A number of automobiles were washed off low-water crossing when people try to cross. One family had to be evacuated from a mobile home that flooded. All schools in the county were closed Friday the 20th due to flooded roads.
Goliad							The sheriff's office reported that several roads were closed due to flooding in the county. Flooding began around 1600 CST on the 21st.
Gonzales							Major damage was done to the roadways in the county. Estimates of \$1 million in damage were made. Around 100 head of cattle were lost in the county and estimates of \$10,000 for fencing that was washed down the river.
Grimes							Major damage was done to roadway surface and bridges in the county. Estimates to repair one of three bridges damaged were around \$40,000. County Road 101 near Iola has been closed indefinitely due to damage from flooding. Agricultural losses in the county were near \$100,000 and includes over \$5,000 in cattle lost as well as several miles of fence.
Hays							Two women in a car were swept off a low-water crossing on Farm-to-Market Road 1826 near Dripping Springs about 1800 CST on Friday the 20th. The passenger in the car was able to stay in a tree until rescued, the driver was washed down stream. Her body was found on Monday the 23rd. Officials in the county estimate damage to be near \$1 million for roadways and bridges, no estimates were available for agricultural damage. (F170)
Harris							The Houston Police Department reported a man missing around 1800 CST on the Saturday the 21st. Eye witnesses reported that the man slipped and fell into White Oak Bayou while getting out of his car. His body was not recovered. (M50?)
Kendall							Several schools in the county were closed on the 20th due to flooding on roadways. Damage estimates for county roads were around \$15,000, and around \$2,000 for agriculture. Flood waters subsided by the 22nd.
Lampasas							An estimated cost of \$2 million in damage was done to roadways and bridges in the county. Agricultural damage was estimated at over \$500,000. Most of the agricultural damage was due to lost fences. The county was declared a Federal Disaster Area.
Lavaca							The sheriff's office reported that several roads throughout the county were closed due to flooding around 1000 CST on the 21st.
Liberty							The county was one of the hardest hit areas in the state. Over 500 homes sustained flood damage, at least 5 single family homes and 23 mobile homes were totally distorted. Estimated costs to repair or replace all of these homes were made at \$4.5 million. Roadways and bridges in the county sustained an additional \$1 million in damage. At least one bridge was washed out completely. Damage estimates will go higher as several roads and bridges are still under water.
Llano							Estimates of \$4 million were made by county officials for damage to public property. Most of the damage was done to roadways and bridges. In addition, several vehicles were washed off of low-water crossing when motorist tried to cross. Flood waters damaged 30 single-family homes, 35 mobile homes and 25 businesses. Flood waters began to subside by the 22nd. The county was declared a Federal Disaster Area.
Madison							Over \$300,000 in damages were done to the roadway system in the county due to flooding. Over 60 homes in the county received flood damage, this includes 3 mobile homes that were totally distorted. Cost of repair and replacement was near \$250,000. Agricultural losses were estimated at \$100,000.
Milam							Around 1100 CST on Friday the 20th, a man in a Chevrolet Blazer tried to cross a flooded low-water crossing on Alligator Creek, his body was found Monday about 0.50 mile from where his truck was washed off the road. Three men in pickup tried to cross a flooded low-water crossing on Farm-to-Market Road 2027, 10 miles northwest of Culvert around 1400 CST Saturday the 21st. Two of the men were swept downstream, their bodies were found the next day. The third man was able to hold on to the truck until he was rescued. Damage estimates of around \$1.25 million were reported by county officials; this includes \$765,000 in agriculture alone. Approximately 500 head of livestock are missing or dead. Most of the other damage was done to roadways and bridges throughout the county. (M54O) (M52O) (M42O)
Mills							Around \$150,000 in damage was done to county roads and bridges due to flooding. An estimated \$100,000 in damage was done to agricultural interest in the county. Most of the agricultural

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed Injured	Estimated Damage Property Crops	Character of Storm
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TEXAS, Southern Cont'd

damage was the result of fences being washed out.

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|-------------|---|--|--|--|--|--|--|
| Montgomery | The county only sustained roadway and bridge damage due to flooding. The damage was in the form of washouts of roads and some minor damage was reported to a few low-water-crossing bridges. Estimated cost of repair was around \$100,000. | | | | | | |
| Polk | Around 36 homes sustained flood damage around Lake Livingston; estimated damages were \$200,000. Damage to roadways and bridges in the county were estimated at \$750,000; this includes a parking lot near the dam at Lake Livingston that was completely washed away. A section of the road near Holiday Lake was also washed out. The county was declared a Federal Disaster Area. | | | | | | |
| San Jacinto | Over 200 homes were damaged by flood waters in the county, estimates of cost to repair or replace was over \$2 million. County roads and bridges sustained \$75,000 in damage. Agricultural losses in the county were low, approximately 400 round bails of hay were washed down the Trinity River along with several miles of fence. Major damage was done to the earthen dam on Lake Livingston, estimates from Federal Emergency Management Agency of damage were over \$2 million. San Jacinto County was declared a Federal Disaster Area. | | | | | | |
| San Saba | Several mobile homes and camp grounds were flooded along the Colorado River. Estimated damage to the areas was \$200,000, an additional \$20,000 in damage was done to the roadways and bridges. | | | | | | |
| Travis | A middle aged man drowned late Thursday night the 19th after he fell asleep along the banks of Waller Creek in downtown Austin. The rain swollen creek rose up and swept the man away. Another man's body was found near Farm-to-Market Road 973 and Sandeen Road where his car was washed off a low-water crossing, the man died from exposure. An estimated 50 homes were completely flooded around Lake Travis and a total of 265 single family homes sustained flood damage throughout the county. Roadways throughout the county sustained major damage. An Austin music store sustained around \$500,000 in damage when the store's front window gave way and more than 4 feet of water poured through. Estimates of damage to the county totaled around \$5 million. Travis County was declared a Federal Disaster Area. (M520) (M590) | | | | | | |
| Trinity | Damage to private property was estimated at \$300,000; this includes 12 homes that were damaged along with 4 other out-buildings. Roadway and bridges in the county sustained around \$150,000 in damage. Agricultural damage was minimal; estimated under \$10,000. | | | | | | |
| Victoria | Approximately 300 people were evacuated from along the Guadalupe River in the county on Monday the 23rd. Only minor damage was reported; around \$52,000 in damage was done to roadways and bridges in the county and no figures were available for private property. | | | | | | |
| Walker | Over 150 homes sustained flood damage in the county, mainly in the Deep River Plantation subdivision and the Thomas Lake area, most of the homes were flooded to the roofs. Damage was estimated at over \$3 million. In addition, over \$100,000 in damage was done to roads and bridges throughout the county. Agricultural losses were estimated at \$150,000. | | | | | | |
| Waller | The county sustained only minor damage to the roadway system. Agricultural losses were substantial. Over 750 tons of hay were washed down the river along with approximately 20 miles of barbed-wire fence. Thirty head of cattle died as a result of the flooding. Between 5,000 and 10,000 acres of pasture have been covered with 2 to 12 inches of sand and silt from the flood waters. Total damage to the areas was estimated at \$500,000; this does not include recovery of the lost pasture land. | | | | | | |
| Washington | Minor damage was reported to the road system in the county. Agricultural losses in the county were estimated at around \$150,000; mainly in the form of hay feed. | | | | | | |
| Wharton | Total damage in the county was estimated at \$4 million. Several homes sustained minor damage from flooding and 14 received major damage. Two mobile homes were completely destroyed. Estimated cost of damage to the homes was around \$400,000. One business received minor damage, and a school had several out buildings washed away. Estimates to the county roads and bridges were around \$600,000 although several roads were still under water in the county. Wharton County was declared a Federal Disaster Area. | | | | | | |
| Williamson | Only minor damage was reported in the county to agricultural interest. Roadways and bridges sustained around \$250,000 in damage. | | | | | | |

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
TEXAS, Western									
Runnels County									
Ballinger	20	1100CST- 1300CST			0	0	2	1	Flash Flood
									Heavy rains over Runnels County produced flash flooding in Ballinger. The city manager reported minor flooding near Elm Creek and the city park. No significant damage resulted.
Ballinger	20	1720CST- 1900CST			0	0	1	1	Flash Flood
									Continued heavy rains resulted in additional flash flooding in Ballinger. The Ballinger Police Department reported flooding along Valley Creek. No significant damage resulted.
TXZ007-010	25	1600CST- 2200CST			0	0	1	1	Heavy Snow
Western South Plains									A vigorous upper level disturbance tracked across the western South Plains on the evening of the 25th. A swath of heavy snow fell across the area. The heaviest snow fell at Morton, where 5 inches were reported. The snow caused no significant damage.
UTAH									
UTZ001-002-003	04	0000MST- 0400MST			0	0	3	0	Ice Storm
UTZ001-003	02	0100MST- 2200MST			0	21	4	0	Heavy Snow
									A cold front that moved into northwestern Utah late on the 1st, and early on the 2nd produced widespread snow and some freezing drizzle over the area. The freezing drizzle began in the Cache Valley around 0000 MST, and then moved into the Wasatch Front from 0100 MST to 0200 MST. The heavy snow began first in the Cache Valley and the northwestern mountains then along the Wasatch Front from 0330 MST to 0430 MST. The heavy snow in the northern mountains zone was confined to the northwestern mountains. The heavy snowfall ended in the valley locations at 1500 MST and in the northwestern mountains around 2200 MST. Snowfall amounts in the valley locations ranged from 4 to 7 inches. The northwestern mountains received 11 to 21 inches with locally higher amounts in the Wasatch Mountains of 27 to 32 inches.
									The combination of the freezing drizzle and the snow caused roadways throughout the area to be very slick. Numerous accidents were reported during the morning hours. The number of injuries due to the accidents, and the damage done to vehicles will be reported in the heavy snow portion. Four of the accidents accounted for all of the injuries. The majority of these injuries occurred when a road sander went out of control, and struck a school bus carrying 75 students (15 passengers were injured). This accident occurred in Orem. Of the 15 injuries, the most serious was a broken collarbone. Damage to the bus was estimated at \$20,000, and \$5,000 was done to the sander. This accounts for most of the damage totals for the heavy snow portion.
									The freezing precipitation caused power lines to break, and some power outages. This is the only damage included in the estimate for this event.
UTZ004-005-008-011-012	18 19	1600MST- 0700MST			0	0	0	0	Heavy Snow
									A moist southerly flow caused heavy snow in this area. The snow began in the southern portion of this area at 1600 MST, in the east central portion by 2000 MST, and in the northeast by early morning of the 19th. Valley locations received 4 to 6 inches while the mountainous and high plateau areas received 7 to 8 inches.
UTZ001	18	2330MST- 2115MST			0	0	0	0	Ice Storm
UTZ001-002-003	18 19	2330MST- 0800MST			0	0	0	0	Heavy Snow
									With an inversion still in place over the area, the precipitation that fell ahead of an approaching storm system caused freezing rain. There was some accumulation of ice, but no damage was reported.
									The above mentioned storm system moved into extreme northwest Utah late on the 18th, and moved

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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UTAH Cont'd

over the remainder of the area by 0200 MST. Snowfall amounts were 4 to 5 inches. No significant damage was reported.

UTZ006-013	28	1800MST-			0	0	0	0	Heavy Snow
	29	0000MST			0	0	0	0	
UTZ006	29	0700MST-			0	0	4	0	Dense Fog
		0900MST							

Another storm system brought snow to most of the of the state. The heaviest valley snowfall occurred in the south-central portion of the state. Most of this area received 4 inches of snow.

The combination of slick roads and dense fog caused several accidents and the closure of a portion of Interstate 15 in Millard County. The worst accident was when a tractor-semitrailer crashed into an unoccupied Utah highway patrol car. The car was completely destroyed.

UTZ013	30	0300MST-			0	0	0	0	Heavy Snow
		1200MST							

Another storm system moved into southern Utah early on the 30th. The area received 4 to 7 inches of snow.

UTZ010	31	0500MST-			0	0	0	0	Heavy Snow
		1400MST							

A small storm moved in from the northwest, and caused heavy snow in the northwestern mountains. Snowfall amounts were in the 8- to 9-inch range.

VERMONT

VTZ001 > 005 Statewide	02	2300EST-			0	0	4	0	Winter Storm
	03	1100EST							

A storm system moved from the Eastern Great Lakes up the Saint Lawrence Valley on the morning of December 3rd resulting in a heavy mix of snow, sleet and freezing rain. A few minor traffic accidents were reported throughout the state with no injuries or fatalities. Two to four inches of snow fell across the state before a changeover to sleet and freezing rain.

VTZ001-002-004 Western and Central Vermont	03	AM			0	0	5	?	High Winds
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High winds blew ice and snow laden trees onto power lines leaving a total of 11,500 Central Vermont Gas and Electric customers without power. In the Rutland area alone, 6,000 customers were without power where a wind gust to 62 mph was recorded between 0800 EST and 0900 EST. Winds gusted to 80 mph along the western slopes of the Green Mountains in Underhill.

Franklin County	07	AM- PM			0	2	4	0	Snow Blowing Snow
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Strong winds along with snow and blowing snow made traveling difficult across Franklin County on December 7th. Up to 6 inches of snow was reported in the Enosburg Falls area with white-out conditions. A two-vehicle accident in Swanton injured two people, one critically. The Saint Albans weather station recorded wind gusts to over 50 mph.

VTZ003 Northeastern Vermont	07	0600EST-			0	0	4	0	Heavy Snow
		1200EST							

A trough of low pressure over northern Vermont on the morning of December 7th was responsible for dumping 2 to 8 inches of snow across Northeast Vermont.

VTZ001 > 005 Statewide	14	2030EST-			0	0	5	?	High Winds
	15	0345EST							

A strong pressure gradient associated with a low pressure center which moved from northern Lake Ontario to northern New Hampshire during the afternoon of December 14th resulted in damaging winds across Vermont. The high winds downed trees and power lines throughout the state, blew a tree into a house in Putney, and blew down a 75-foot tower in Arlington. The highest recorded wind gust of 90 mph occurred on top of Mt. Mansfield at 2300 EST.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
VERMONT Cont'd									
Southern Vermont	15	1800EST- 2400EST			3	22	6	0	Snow Ice
									<p>Snow turned to ice after it became packed down across the roadways of southern Vermont. Black ice forced the closure of a 16-mile-stretch of Interstate 91 between the Rockingham and Ascutney Exits from 1900 EST until 2400 EST after 50 vehicles were involved in accidents along a 5-mile-stretch of the highway in Springfield. Around 1900 EST, a 2 vehicle accident along Route 7 near Emerald Lake resulted in 3 fatalities and 8 others injured. (F19V) (M25V) (F29V)</p>
Caledonia County Hardwick	16	0816EST			0	2	4	0	Ice
									<p>Ice was responsible for a two vehicle accident along Route 15 in Hardwick which left two people injured.</p>
VTZ003-005 Eastern Vermont	17 18	1300EST- 0800EST			1	0	4	0	Heavy Snow
									<p>A storm system moved from the upper Great Lakes on the morning of December 17th to the Gulf of Maine on the morning of December 18th dumping 6 to 8 inches of snow across eastern Vermont. Ludlow, Townsend, East Haven and West Dover all picked up 8 inches of snow. The snow resulted in mainly minor accidents around the state; however, a Massachusetts man was killed when his car skidded off the road along Interstate 89 in Randolph. (M64V)</p>
Statewide	29	0700EST- 1600EST			0	15	6	?	Freezing Rain
									<p>A storm system moved up the Atlantic Coast on December 29th resulting in freezing rain across Vermont. Numerous traffic accidents, some of which even involved state highway trucks, were reported across the state as the freezing rain turned roadways into skating rinks. In addition 2,800 Central Vermont Gas and Electric customers were left without power as trees and branches gave way under the weight of the ice falling on power lines. The freezing rain also forced the closure of Interstate 91 from Springfield south to the state line.</p>
VIRGINIA									
Wise, Scott, Buchanan, Lee, and Dickenson Counties	01 03	0000EST- 2400EST			0	0	4	0	Flood
									<p>County officials reported numerous state highways under water following 3 days of heavy rain. In Wise County, high water in the Inman area forced several families out of their homes. There were several mud and rock slides that temporarily blocked some roads. A mud slide at Grundy in Buchanan County on the 3rd caused damage to an apartment building and buried a 500-gallon propane tank, which sprung a leak and forced evacuation of the area for several hours.</p>
Henrico and Hanover Counties Highland Springs	03	1330EST- 1400EST			0	0	4	0	High Winds
									<p>A line of showers produced strong winds over eastern and central Henrico County and in southern Hanover County. Most damage occurred in the Highland Springs area of Henrico County. A microburst caused damage in a path 1 mile long and 200 to 300 yards wide. Numerous trees were uprooted or lost large limbs. Several sheds were destroyed. A large tree was uprooted and fell onto a house, damaging the roof and front entrance. A 7,500-pound camper was tilted onto a garage. Based on the damage at Highland Springs, the National Weather Service estimated the winds there at 60 to 70 mph. Thunder was not observed with the line of showers.</p>
VAZ005	14	1700EST- 2000EST			0	0	4	0	High Winds
									<p>Strong winds following a cold front caused numerous power outages across northern Virginia as reported by power company officials.</p>

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

VIRGINIA Cont'd

VAZ005-011-012	23	0600EST- 0830EST			0	0	4	0	Glaze
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Light freezing rain caused numerous traffic accidents and accreted on trees and power lines in northern and northwestern Virginia including the northern Shenandoah Valley. Accidents claimed the lives of a 29-year-old man near Leesburg in Loudoun County and a couple in the city of Manassas.

VAZ005-009-011 > 016	28	0500EST- 2000EST			0	0	4	0	Glaze
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Freezing rain coated trees and power lines especially over higher elevations. Many roads were iced up in those higher elevations. Shenandoah National Park was closed due to very icy roads. The freezing rain changed to rain over south-western Virginia in the morning, but persisted into the evening elsewhere.

WASHINGTON

WAZ004-005 Coastal Washington	05	0500PST- 1500PST			0	0	4	0	High Winds
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Winds in the 30- to 40-mph range were common along the coast during the morning and afternoon of the 5th. Peak winds along the coast were reported at Cape Disappointment with gusts of 59 mph.

WAZ008 Eastern Slopes Cascades	11	1200PST- 1500PST			0	0	0	0	High Winds
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Gusty westerly winds developed behind a cold front during the early afternoon hours of the 11th. Yakima reported a peak wind of 60 mph at 1400 PST. There were no reports of damage.

WAZ001-002-003 Western Washington	12	0100PST- 0800PST			0	0	5	?	High Winds
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The second strong cold front in as many days moved into western Washington on the morning of the 12th. Winds gusting to 45 mph were recorded at Sea-Tac Airport with gusts of 50 to 55 mph reported around the rest of the area. The storm left 12,000 homes without power east of Kent and Renton. Numerous trees were downed by the winds in Marysville. In Sedro-Woolley a car was crushed by a tree falling on it while in Bellevue a roof on one house was destroyed falling tree. No injuries were reported in either incident.

WAZ010-013 Central Basin Southern Washington	12	1000PST- 1300PST			0	0	0	?	High Winds
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Winds picked up over the central basin and southeastern Washington later in the morning as the front moved into the area. Peak winds of 52 mph at 1045 PST were recorded at Walla Walla with a peak wind of 55 mph at Hanford.

WAZ008 Cascades Eastern Slopes	21	0700PST- 1300PST			0	?	4	?	Freezing Rain
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Intermittent freezing rain fell along the eastern slopes of the Cascades causing numerous traffic accidents. A total of 50 accidents were reported along Interstate 82 between Yakima and Toppenish.

WEST VIRGINIA

Wyoming County	02	1725EST- 1830EST			0	0	5	0	Small Stream Flood
Mingo County	02	1730EST- 1930EST			0	0	3	0	Small Stream Flood
Logan County	02	1730EST- 2200EST			0	0	4	0	Small Stream Flood
Raleigh County	02	1730EST- 2200EST			0	0	4	0	Small Stream Flood
Lincoln County	02	1730EST-			0	0	4	0	Small Stream Flood

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
WEST VIRGINIA Cont'd									
Boone County	02	1930EST			0	0	4	0	Small Stream Flood
		1730EST- 2000EST			0	0	6	0	Small Stream Flood
Kanawha County	02	1740EST- 2000EST			0	0	6	0	Small Stream Flood
		1745EST- 2200EST			0	0	4	0	Small Stream Flood
Clay County	02	1800EST- 2000EST			0	0	5	0	Small Stream Flood
		1800EST- 2000EST			0	0	5	0	Small Stream Flood
Webster County	02	1810EST- 2330EST			1	0	5	0	Small Stream Flood
		1810EST- 2330EST			0	0	5	0	Small Stream Flood
Randolph County	02	1826EST- 2130EST			0	0	4	0	Small Stream Flood
		1826EST- 2130EST			0	0	4	0	Small Stream Flood
Pocahontas County	02	1826EST- 2130EST			0	0	4	0	Small Stream Flood
		1826EST- 2130EST			0	0	4	0	Small Stream Flood
Upshur County	02	1826EST- 2130EST			0	0	4	0	Small Stream Flood
		1826EST- 2130EST			0	0	4	0	Small Stream Flood

After a daylong steady rain, heavy rain fell between 1600 EST and 1900 EST along the western slopes and into the mountains. Within a 3-hour period, 1.00 to 1.50 inches of rain fell over saturated ground. Streams, already swollen, overflowed their banks during the evening. The headwaters of the Elk, Gauley, and Coal Rivers were also affected. Water surrounded homes, flooded basements and vehicles, blocked and undermined roads, destroyed several small private bridges, damaged culverts, and caused mud/rock slides. Urban flooding also occurred.

A 36-year-old man drove his pickup truck through flood waters from Williams River near Dyer of Webster County between 2000 EST and 2100 EST. His vehicle was quickly swept away; his body was found 1 mile downstream.

Areas affected the most by the small stream and headwater flooding included Kelly Creek near Cedar Grove of Kanawha County, headwaters of the Big Coal River from Whitesville to Seth in Boone County, the Summersville to Birch River region of Nicholas County, and along Syramore and Buffalo Creeks in Clay County.

The headwaters of the Elk River crested at 10.5 feet at Bergoo in Webster County between 2100 EST and 2200 EST. Evacuations were required for a short time along several of these streams.

State officials reported a total of five mobile homes and two single family dwellings destroyed. Thirty-five other houses or mobile homes had major damage. Many schools were closed on the 3rd. Damage is estimated at \$4,000,000. (M36V)

Marshall County	02	2330EST-							
		03	1400EST		1	0	4	0	Small Stream Flood

Flooding occurred along Big Grove Creek, Middle Grave Creek, and Wolf Run east of Moundsville. A miner, leaving work at 2345 EST, drove his car through a flooded road and was washed into Big Grave Creek. The water was 1 to 2 feet deep on the road. The empty car was found about 3 miles downstream around dawn. His body was not recovered until about 4 weeks later, 100 feet from where he entered the creek. At 0350 EST flooding occurred on Big Grave Creek south of Moundsville. At 0945 EST Wheeling Creek flooded three parks in the northern part of the county. (M48V)

Wood County	03	0100EST- 0400EST			0	0	3	0	Small Stream Flood
Mason County	03	0200EST- 0330EST			0	0	3	0	Small Stream Flood
		0300EST- 0530EST			0	0	4	0	Small Stream Flood

Roads were flooded by overflowing streams as the last area of heavy rain fell over extreme western

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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WEST VIRGINIA Cont'd

counties. Parkersburg city police reported stream flooding within the city limits. Route 152 in Wayne County was blocked near Dunlow.

Ohio County 2 S Wheeling	03	0445EST- 1440EST			0	0	0	0	Small Stream Flood
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Flooding occurred on Wheeling Creek. The crest at Elm Grove was at the 7-foot flood stage around 1000 EST.

WV004-005-006- 009-012	02 03	2200EST- 2000EST			0	0	5	0	Minor River Flood
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Minor river flooding occurred when the upper Gauley, Elk, Tygart Valley, and Coal Rivers reached 1 to 3 feet above flood stage. Three days of 3- to 6-inch rains caused the flooding.

The most unusual rise was on the lower Elk River, downstream of the Sutton Dam. This was the first time the lower Elk River had reached flood stage since December, 1978, and it was the highest crest since March, 1967.

Low lying roads adjacent to these rivers were blocked by the high water. Outbuildings along the Elk River were flooded. No major evacuations took place. A few specific crests included 18.1 Ft. at Philippi on the Tygart Valley River; 20.9 Ft. at Clay, and 21.2 Ft. at Queen Shoals on the Elk River; and 26.3 Ft. at Tornado along the Coal River. Damage, including to roads, estimated at \$250,000.

Ohio County Wheeling	14	1707EST			0	0	0	0	High Winds
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Power lines and trees were blown down by non-convective wind gusts.

WV010-011 Eastern Panhandle	28 29	1200EST- 0500EST			0	0	4	0	Glaze
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Freezing rain accumulated on power lines, trees, and roads; several accidents were reported.

WISCONSIN

WIZ013-016-017- 019-020 East-central and Southeastern Wisconsin	02 03	Late Afternoon- Early Morning			0	0	?	0	Heavy Snow
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A snowstorm dumped between 6 and 10 inches of snow over portions of east central and southeast Wisconsin. Dozens of schools were closed and many accidents occurred. Snowfall amounts included 10.5 inches at Mukwonago in Waukesha County, 10 inches at Burlington and Caledonia in Racine County and 9 inches at Manitowoc in Manitowoc County, and Brookfield in Waukesha.

WYOMING

WYZ067-071	01 02	2300MST- 0400MST			0	0	0	0	High Winds
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Strong winds with gusts to 63 mph were noted on the summit between Cheyenne and Laramie early morning of the 2nd.

WYZ065-067-071	03	0500MST- 0800MST			0	0	0	0	High Winds
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Strong winds occurred over and near the mountains in southeastern Wyoming. Wind gusts to 62 mph were reported on the summit between Cheyenne and Laramie shortly after 0700 MST. Wind gusts to 57 mph noted near Elk Mountain between 0600 MST and 0700 MST.

WYZ022-059-067 069-071	06	0200MST- 1630MST			0	0	0	0	High Winds
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Strong winds buffeted southeastern Wyoming during the early morning hours and throughout the day. Wind gusts of 60 to 65 mph were reported in the city of Casper between 0400 MST and 0500 MST. An 80-mph wind gust was recorded 12 miles southeast of Wheatland after 0800 MST. Winds gusting to 60 mph were common to the summit west of Cheyenne during the day. A wind gust to 100 mph was reported 12 miles southeast of Wheatland near 1545 MST.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	
WYOMING Cont'd									
WYZ004	11	0900MST- 1500MST			0	0	0	0	High Winds
									Winds of 30 to 40 mph with gusts to 61 mph and only minor damage buffeted the Cody area.
WYZ022-059-067- 069-071	12 13	1200MST- 0300MST			0	0	0	0	High Winds
									Winds of 30 to 40 mph occurred over southeast Wyoming during the afternoon and evening of the 12th. Wind gusts to 79 mph were reported 12 miles southeast of Wheatland near 1400 MST. Winds gusting to 68 mph reported in parts of the city of Casper between 1600 MST and 2200 MST. A wind gust of 75 mph noted 12 miles southeast of Wheatland before midnight.
ALASKA, Northern									
AKZ006 Eastern Norton Sound	02- 03				0	0	?	0	High Winds
									Two days of strong easterly winds hit the eastern portion of Norton Sound; Unalakleet had sustained winds of 40 knots and peak gusts to 50 knots.
AKZ024 Saint Lawrence Island and Bering Strait Coast	13- 14				0	0	?	0	Blizzard
									A blizzard starting on the morning of the 13th and ending on the evening of the 14th, hit Saint Lawrence Island and Bering Strait. Sustained winds were near 40 knots and peak gusts to 53 knots at Gambell, on Saint Lawrence Island.
AKZ007 Tanana Valley	26- 27				0	0	?	0	High Winds
									A brief period of unusually strong southeasterly winds hit the Tanana Valley, mostly near the Alaska Range. At the Texas Range station on Fort Greely, peak gusts were 55 to 60 knots; Healy had peak gusts to 55 knots, and Big Delta had gusts to 50 knots. The strong winds started around 2100 on the 26th and ended by 0300 on the 27th.
AKZ007 Tanana Valley	28				0	0	?	0	Heavy Snow
									A small area of heavy snow appeared in the Tanana Valley early on the 28th; the heavy snow was all west of Fairbanks. At Healy, 6 inches of snow fell and 3 to 4 inches were reported at Livengood, northwest of Fairbanks. Fairbanks and Nenana received about 2 inches of snow.
ALASKA, Southern									
Valdez	01	0845AST			?	?	?	?	Record High Temperature
									Easterly winds behind a low pressure system allowed for warm downslope conditions that caused the temperature to rise to a daily record high of 44 degrees. The old record of 37 degrees was set in 1983.
Cold Bay	02	1500AST			?	?	?	?	Record High Temperature
									A new daily high temperature of 45 degrees was set. The old record of 42 degrees was set in 1989.
Kodiak Island	03	0900AST			?	?	?	?	Record Rainfall
									At Kodiak State Airport, a new all time record rainfall amount of 91.23 inches for a calendar year. The old record of 91.09 inches was set in 1943.
South-central Alaska Anchorage	06- 07				0	?	?	0	Heavy Snowfall
									A persistent low pressure system south of Prince William Sound pushed warm moist air up across cold air in the Cook Inlet region producing moderate to heavy snow over the Kenai Peninsula and Cook Inlet. Anchorage International Airport had a storm total of 10.8 inches with some areas receiving 20 or more inches during the 36-hour period.
Aleutians Alaska Peninsula	12- 13				0	?	?	0	High Winds

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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ALASKA, Southern Cont'd

Bristol Bay

Strong low pressure that brought 70 to 90 mph winds to the western and central Aleutians on the 12th brought 50 to 70 mph winds to the Alaska Peninsula and Bristol Bay on the 13th.

South-central Alaska	16				0	?	?	0	High Winds Heavy Snow
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An intense low curved northward into the Gulf of Alaska on the afternoon of the 15th. This low then moved to western Prince William Sound early Monday and into the Copper River Basin by late morning. Very strong winds, gusting between 50 and 85 mph preceded the storm along much of the eastern gulf coast and into Prince William Sound. Heavy snow fell along much of the Seward Highway, portions of the Sterling Highway, and along the Glenn Highway south of the Knik River Bridge. Snowfall amounts in Anchorage ranged from 4 inches at the Airport to 12 inches on the eastern side of town. Higher amounts were reported along the hillside. Southwest winds gusting to 30 mph caused blowing snow, rarely seen in the city. Moose Pass became closed after receiving over 30 inches of new snow and at least one avalanche blocked motorists travel to Seward. Wind gusts close to 40 mph hammered portions of Kachemak Bay Andhomer, however, snowfall in that area was much lighter.

Pribilofs Alaska Peninsula Yukon Kuskokwim Delta	21- 23				?	?	?	?	High Winds Blizzard Cold Wind Chills
--	-----------	--	--	--	---	---	---	---	--

A 950 mb low moving along the Aleutians to the Alaska Peninsula brought blizzard conditions to the Pribilofs with sustained winds of 40 to 45 mph with gusts to 60 and 65 mph. Snow and blowing snow reduced visibilities to 0.25 mile at times. Winds gusting over 40 mph combined with temperatures 10 to 20 degrees below zero produced wind chills as low as 80 degrees below zero at Bethel. Visibilities less than 0.25 mile in blowing snow were also reported.

Pribilofs	25- 27				?	?	?	?	Blizzard
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A deep low moving along the Aleutian chain moved into the Bering Sea. The center of this low passed directly over the Pribilofs with winds gusting over 50 mph. As the low moved off to the east-northeast, strong northwesterly winds gusting over 60 mph were recorded at St. Paul Island. Snow and blowing snow create white out conditions as visibilities dropped to zero for several hours.

Anchorage Upper Hillside	26				0	?	?	?	High Winds
-----------------------------	----	--	--	--	---	---	---	---	------------

While much of the Anchorage bowl area experienced wind gusts between 30 and 45 mph during the evening. Winds literally roared above Hillside Drive. Speeds gusted to at least 107 mph at Glenn Alps Blowing debris dangerously around. A 98-mph gust was recorded at the Rabbit Creek Station. In Bear Valley and the southern end of the Old Seward Highway, near Potter Marsh, 100-mph winds were recorded. Wind gusts of 70 mph were reported on Kasilof Drive just above Prospect Drive. Wind gusts of 51 mph also buffeted the observing site at Fort Richardson. Anchorage International Airport had a peak gust of 32 mph.

Prince William Sound Palmer Anchorage Matanuska Valley	25- 27				0	?	?	0	Heavy Snow
---	-----------	--	--	--	---	---	---	---	------------

A strong storm centered near Bethel with a front from Kenai Peninsula along the northern gulf coast dumped 21.1 inches of snow in less than 24 hours at the observing site in Valdez. The worst snow storm in years ripped through Cordova on the 26th. On the 27th, at the height of the storm, 27 inches of snow fell at Cordovas Mudhole Smith Airport. The heaviest 24-hour amount in years. On the heels of a major wind storm on the 26th, heavy snows blanketed the upper hillside and much of the Matanuska Valley on the 27th with 8 to 12 inches of snow. Only 1.1 inches of snow was reported at Anchorage International Airport.

AKZ012 Lynn Canal Glacier Bay	03 07	Morning- Morning			0	0	0	0	Heavy Snow
AKZ013 Central South- eastern Alaska	03 05	Early Morning- Late Morning			0	0	4	0	Heavy Snow

A 980 mb low moved north into the Gulf of Alaska on the 3rd and slowly dissipated on the 4th.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons Killed	Injured	Estimated Damage Property	Crops	Character of Storm
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ALASKA, Southern Cont'd

By late in the evening of the 4th, a second low reached the central gulf at 963 mb. This low remained nearly stationary and gradually weakened through the 7th. Both lows forced warm moist air over an Arctic airmass entrenched in the northern half of the panhandle, producing snow which was heavy at times. Late in the evening of the 5th, the Arctic air began to erode from the southwest. By early on the 7th, the cold continental air lingered only in the extreme northern end of Lynn Canal.

Snow totals ranged from 14 inches at Hoonah to nearly 23 inches at the Juneau Airport, to around 32 inches at Haines, to 37 inches just north of Juneau. Numerous trees and power lines were downed in the Juneau area. Some homes were without power for almost 2 days. Slick roads also caused several traffic accidents with no serious injuries reported.

AKZ013 Central South- eastern Alaska	09	Early Morning			0	0	0	0	High Winds
AKZ014 Southeastern Alaska	08 09	Evening- Early Morning			0	0	0	0	High Winds
AKZ015 Coastal South- eastern Alaska	08 09	Afternoon- Early Morning			0	0	0	0	High Winds

A strong north Pacific low deepened as it moved northeast into the Gulf of Alaska. The low reached the outer coast of the panhandle early in the evening of the 8th at approximately 958 mb. Sustained winds at Port Alexander were as high as 40 mph with gusts reaching 58 mph. Winds from the roof of the Ketchikan Airport terminal building were measured at 69 mph.

AKZ012 Lynn Canal Glacier Bay	14	Morning- Afternoon			0	0	0	0	Heavy Snow
-------------------------------------	----	-----------------------	--	--	---	---	---	---	------------

A front moved east across the Gulf of Alaska and forced moist air over cold air in the northern panhandle of Alaska. The produced snow over the northern half of the panhandle with the heaviest snowfalls in Lynn Canal. About 1 foot of snow fell in Haines according to the police station there.

AKZ014 Southern South- eastern Alaska	20	Morning			0	0	0	0	High Winds
AKZ015 Coastal South- eastern Alaska	20 21	Late Evening- Early Morning			0	0	0	0	High Winds

A strong north Pacific low moved to the northeastern Gulf of Alaska and deepened to 960 mb. As the associated front approached the panhandle, strong southeasterly winds developed over southern southeastern Alaska. The peak gust from the roof of the Ketchikan Airport terminal building was 92 mph. After the front passed, strong westerly winds hit the outer coast of the panhandle. Sustained winds at Cape Decision reached 50 mph while the highest gust at Cape Spencer was 64 mph.

AKZ013-015 Central and Coastal Southeastern Alaska	22	Morning- Early Afternoon			0	0	0	0	High Winds
---	----	-----------------------------	--	--	---	---	---	---	------------

A deep low over the eastern Aleutians sent a strong front across the Gulf of Alaska. As the front neared the eastern gulf coast, a wave traveling along the front deepened into a 976 mb low near Yakutat. This produced a very strong pressure gradient, especially over the northern half of the panhandle. The highest sustained wind at Cape Spencer was 51 mph. The highest gust recorded at Port Alexander was 75 mph. The peak gust recorded from the top of the Federal Building in downtown Juneau was 68 mph.

HAWAII

Kauai	14	0400LST			4	0	6	0	Flash Flood
-------	----	---------	--	--	---	---	---	---	-------------

Heavy rains, as much as 20 inches between midnight and noon, drenched a watershed above Anahola and caused extensive flooding which destroyed several homes in the flood plain. Three persons drowned in the flood waters which a fourth died from complications several days later. Damage to public and private property about \$5 million mainly to roads and bridges.

Storm Data and Unusual Weather Phenomena

December 1991

Location	Date	Time Local/ Standard	Path Length (Miles)	Path Width (Yards)	Number of Persons		Estimated Damage		Character of Storm
					Killed	Injured	Property	Crops	

PACIFIC

American Samoa	07-10				4	200	8	7	Hurricane Val
----------------	-------	--	--	--	---	-----	---	---	---------------

Hurricane Val developed northwest of Samoa within the Tuvalu Group as the month began. On the 5th it moved out heading southeastward toward Samoa. On the 7th it crossed the western most island of Savaii in Western Samoa. Val then remained nearly stationary south of Savaii on the 8th while battering that island with heavy rain, wind, and surf. On the 9th Val moved east along the southern shores of Upolu and Tutuila with the eye passing very close to the coast and over Pago Pago, or at least the northern edge of the eye did. Early on the 10th Val passed eastward south of the Manua Group and away from Samoa.

Val was a hurricane of moderate strength with sustained winds estimated at 120 mph. Terrain effects caused somewhat higher winds locally. Damage was generally more severe than what occurred with Ofa in early February 1990. Crops, such as banana and breadfruit, had just recovered sufficiently to promise a good crop when it was flattened again by wind and rain. Early warnings help keep the death toll low. One life was lost in American Samoa and as many as a dozen died in Western Samoa. Injuries were mostly minor and estimated at 200. The American sailing vessel Flying Cloud with a crew of three, was reported overdue in Pago Pago from Tonga and thus was considered lost in the storm. Property damage was estimated at \$100 million with 4,000 homeless. Damage to roads and bridges was very substantial.

PUERTO RICO

Aguadilla	05	1135AST	?	?	0	0	0	0	Waterspout
-----------	----	---------	---	---	---	---	---	---	------------

A pilot reported a waterspout 5 miles west of Aguadilla.

001-002-005	20	1430AST			0	1	?	0	Thunderstorm Winds
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A cold front moved across Puerto Rico and generated thunderstorms mainly over the eastern half of the island. Damages were to utility lines and trees due to thunderstorm winds. A 14-year-old boy in Hatillo received severe burns from downed electrical power lines.

VIRGIN ISLANDS

None reported.

CORRECTIONS

SEPTEMBER 1991 - page 27

MASSACHUSETTS

Charleston should read Charlestown

OCTOBER 1991 - page 73

STORM SUMMARY - RHODE ISLAND

Entry under THUNDERSTORM WINDS should be under HIGH WINDS

STORM DAMAGE CATAGORIES

REFERENCE NOTES

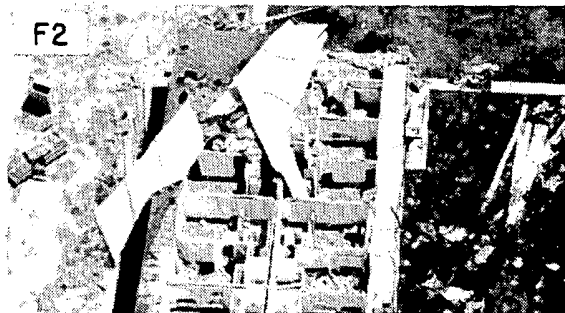
- 1 Less than \$50
- 2 \$50 to \$500
- 3 \$500 to \$5,000
- 4 \$5,000 to \$50,000
- 5 \$50,000 to \$500,000
- 6 \$500,000 to \$5 Million
- 7 \$5 Million to \$50 Million
- 8 \$50 Million to \$500 Million
- 9 \$500 Million to \$5 Billion

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

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

Definition of Fujita Tornado Scale (F scale)

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



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



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

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



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

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



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

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

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

STORM SUMMARY

December 1991

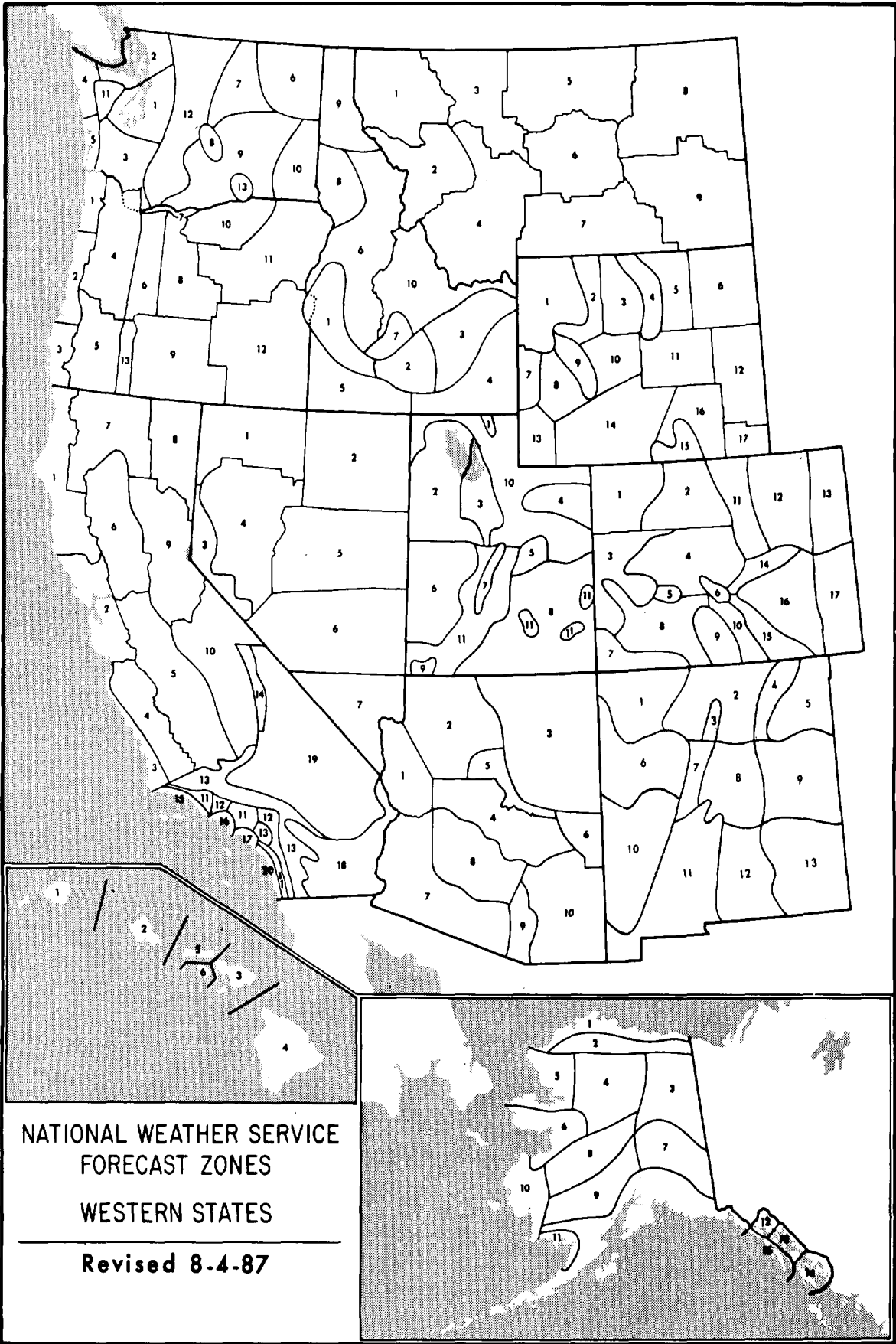
TYPE	ALABAMA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND & DC	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE
TORNADOES			0		0																		0			0	
Number				1							1											1					
Days				1							1											1					
Deaths				0							0											0					
Injuries				0							0											0					
Property Damage				0							0											0					
Crop Damage				0							0											0					
HAIL																											
Deaths		0									0																
Injuries		0									0																
Property Damage		0									0																
Crop Damage		0									0																
THUNDERSTORM WINDS																											
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Injuries											0											0					
Property Damage											0											0					
Crop Damage											0											0					
HIGH WINDS																											
Deaths							0	0										0	0					0			
Injuries							0	0										0	0					0			
Property Damage							0	0										0	0					0			
Crop Damage							0	0										0	0					0			
LIGHTNING																											
Deaths																											
Injuries																											
Property Damage																											
Crop Damage																											
FLASH FLOODS																											
Deaths	0	0													2	0						0					
Injuries	0	0													4	0						0					
Property Damage	0	0													0	0						0					
Crop Damage	0	0													0	0						0					
FLOODS																											
Deaths	1															1						0					
Injuries	0															0						0					
Property Damage	0															0						0					
Crop Damage	0															0						0					
HEAVY SNOWSTORMS AND BLIZZARDS @																											
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Injuries																											
Property Damage																											
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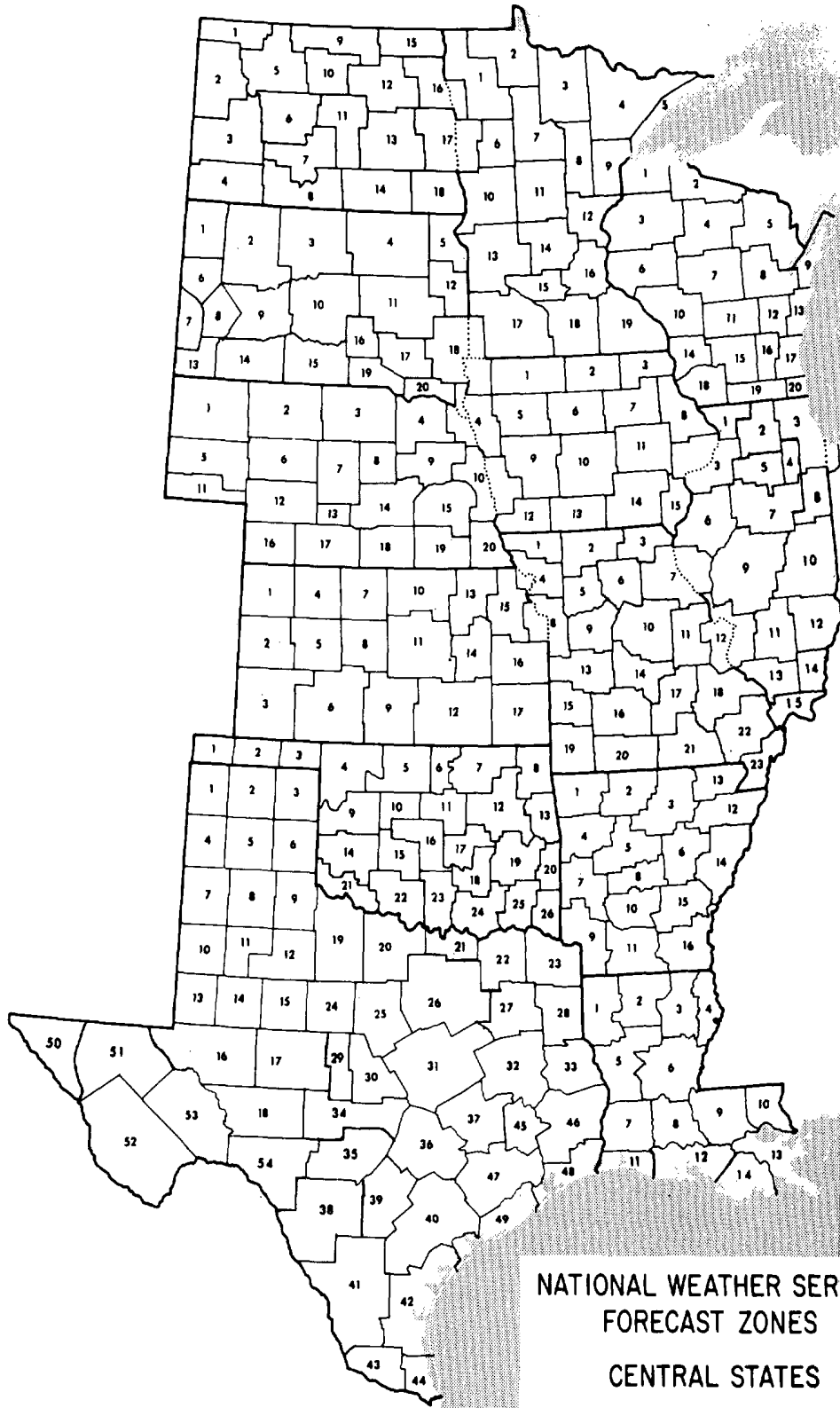
STORM SUMMARY

December 1991

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 DEATHS	& INJURY TOTALS
TORNADOES											0															0		
Number																												2
Days																												
Deaths																												
Injuries																												
Property Damage																												
Crop Damage																												
HAIL																												
Deaths		0																										
Injuries		3																										
Property Damage		0																										
Crop Damage		0																										
THUNDERSTORM WINDS																												
Deaths																												
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Property Damage																												
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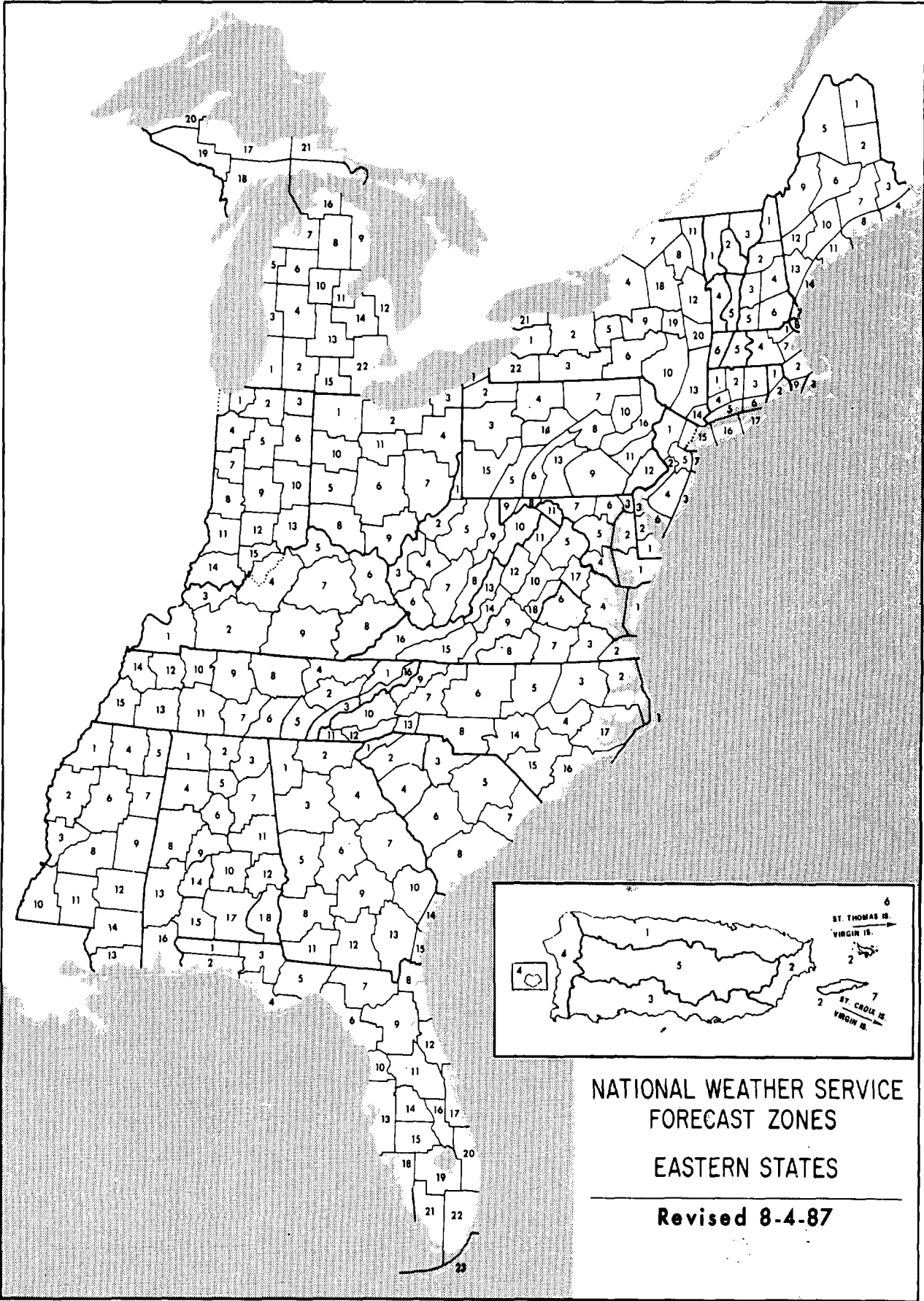
SEE REFERENCE NOTES FOR STORM DAMAGE CATEGORIES





NATIONAL WEATHER SERVICE
FORECAST ZONES
CENTRAL STATES

Revised 8-4-87



NATIONAL WEATHER SERVICE
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STORM DATA

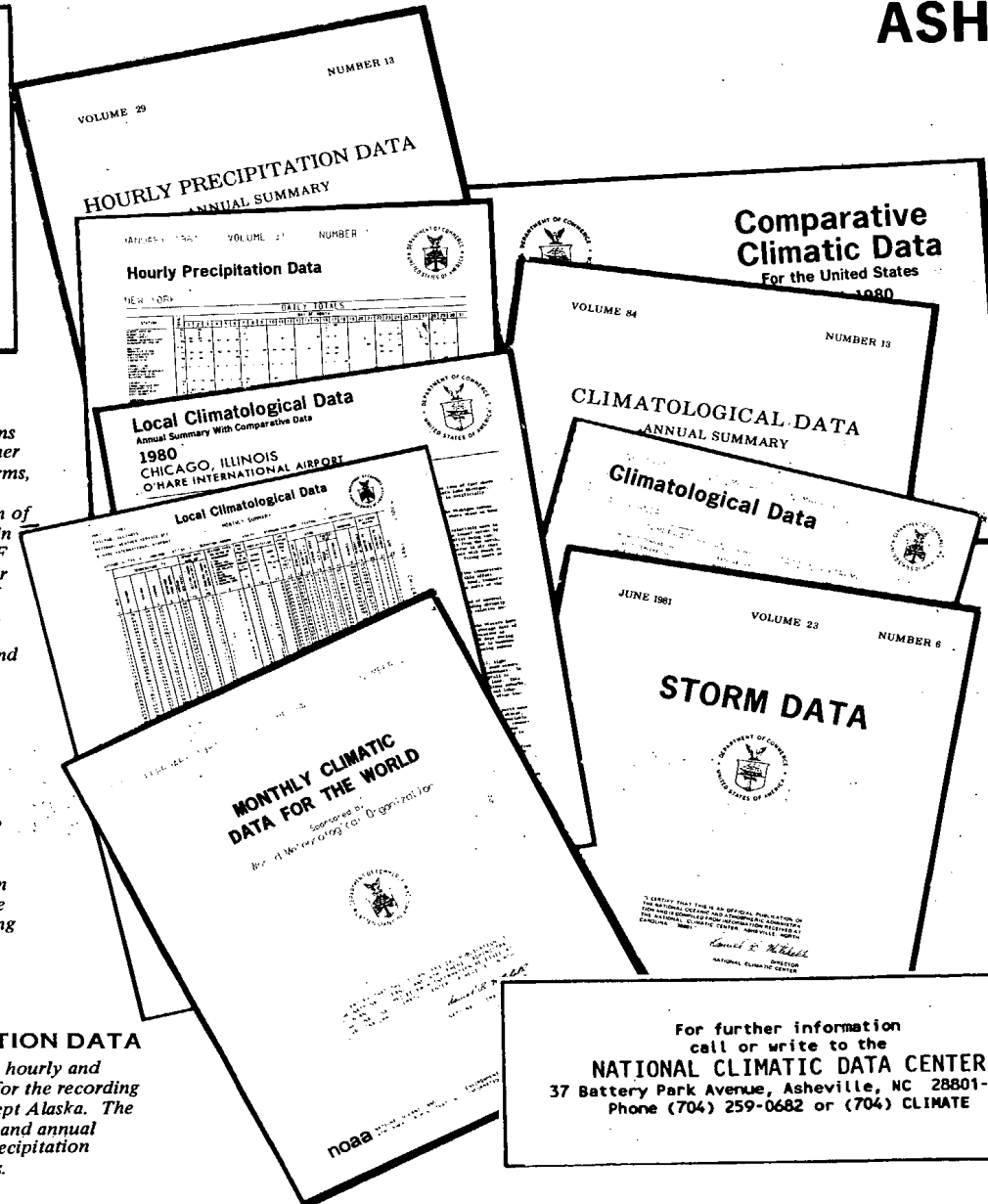
Monthly issue presents a chronological listing, by states, of occurrences of storms and unusual weather phenomena, together with data on the paths of individual storms, deaths, injuries, and estimated property damage, and a brief narrative description of each event. A new section in the bulletin entitled "OUTSTANDING STORMS OF THE MONTH" highlights severe weather and includes descriptive photographs of storms, their tracks, and analyzed maps. The December issue includes annual summaries of tornadoes and lightning and North Atlantic tropical cyclones.

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NATIONAL SUMMARY OF TORNADOES, 1991

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

The 1991 tornado season began on January 14th at 5:50 p.m. near Rosansky, Texas. It lasted for only a short time and caused minor damage. There were 1,132 tornadoes in 179 days, which killed 39 people and injured 864. Tornadoes destroyed or damaged more than 750 mobile homes, which resulted in 23 deaths and more than 65 injuries. There was no tornado activity reported in Alaska, Connecticut, Hawaii, Rhode Island, and Vermont. Location of killer tornadoes, new monthly records since 1953 by state, and state-to-state border crossings are shown in the following three tables:

TABLE I. LOCATION OF KILLER TORNADOES

<u>DATE</u>	<u>STATE</u>	<u>COUNTY</u>	<u>TOTAL DEATHS</u>
January 14	Texas	Colorado	1
March 22	Kentucky	Logan	1
March 22	Tennessee	McNairy	4
March 22	Tennessee	Lewis	1
March 27	Indiana	Steuben	1
March 27	Wisconsin	Dane	1
March 29	Alabama	Talladega	5
April 26	Kansas	Butler	13
April 26	Kansas	Cowley	1
April 26	Kansas	Elk	1
April 26	Kansas	Sedgewick	4
April 26	Oklahoma	Pawnee	1
April 26	Oklahoma	Washington	1
June 12	New York	Westchester	1
July 5	Minnesota	Cass	1
November 29	Missouri	Greene	<u>2</u>
			39

TABLE II. NEW MONTHLY RECORDS (SINCE 1953)

<u>MONTH</u>	<u>STATE</u>	<u>RECORD</u>	<u>PREVIOUS RECORD (YEAR)</u>
January	Texas	20	14 (1973)
March	California	12	9 (1978)
March	Montana	1	0
March	North Carolina	13	8 (1975)
March	Oklahoma	17	16 (1959)
March	South Carolina	7	4 (1974)
April	Idaho	2	1 (1990)
April	New York	4	1 (1990)
April	Pennsylvania	11	5 (1954)
May	Colorado	38	16 (1976)
May	Idaho	3	1 (1989)
May	Illinois	13	12 (1983)
May	Kansas	54	47 (1959)
May	Montana	7	4 (1980)
May	Texas	72	70 (1989)

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

<u>MONTH</u>	<u>STATE</u>	<u>RECORD</u>	<u>PREVIOUS RECORD (YEAR)</u>
June	Montana	15	9 (1975)
June	New Mexico	21	9 (1965)
July	Utah	3	1 (1990)
August	North Carolina	10	4 (1964)
September	Utah	2	1 (1989)
November	Oregon	3	1 (1989)

TABLE III. STATE-TO-STATE BORDER CROSSING

<u>DATE</u>	<u>STATE</u>		<u>STATE</u>
March 26	Oklahoma	into	Kansas
March 27	Indiana	into	Ohio
April 2	Oklahoma	into	Kansas
April 26	Kansas	into	Nebraska
July 23	Ohio	into	Pennsylvania
October 28	Oklahoma	into	Arkansas

The first tornado of 1991 occurred on January 14th at 5:50 p.m. near Rosansky, Texas. It lasted a short period of time and caused minor damage.

A tornado touched down on January 14th at 6:18 p.m. in Columbus, Texas. The tornado first struck a trailer park, destroying four mobile homes. It injured several residents of the mobile home park, one died of injuries 13 days later. This was the first fatality in 1991. The tornado struck a convenience store, then lifted briefly over a residential area and touched down again. People were trapped for a short time in the convenience store. Six homes were lost to the tornado with damages estimated at \$35,000 per home. The tornado also destroyed the historic William Harbert plantation, which was over 150 years old.

A tornado (F3) touched down on February 19th at 2:45 a.m. near Denning, Texas, and destroyed two chicken houses valued at \$180,000. The tornado moved northeastward and damaged one airplane hangar and destroyed four airplanes at the San Augustine Airport. Damage was estimated at \$400,000.

A massive tornado (F3) plowed through sections of western Tennessee on the 22nd of March. It first touched down at 4:35 p.m. near Big Hill Pond State Park east of Pocahtontas and then traveled northeastward 22 miles across the county. Hardest hit was Selmer with a population of about 4,000 people, where 65 homes and 28 mobile homes were destroyed. The tornado was over 300 yards wide at Selmer, where it demolished most of the high school and heavily damaged over 20 downtown business structures. Three deaths occurred in Selmer. The tornado continued along Highway 64 on its way to

Adamsville. The tornado struck the Lawton community, causing the fourth fatality, wrecking the fire station, a community center, and another school. Property damage was estimated at over \$15 million.

A tornado occurred in Lewis County, Tennessee, at 6:05 p.m. on March 22nd. Three homes, eight mobile homes, and six businesses were destroyed when the same storm that produced the Selmer tornado slammed into Howenwald. Several trees were downed along the path of the storm. Moderate damage occurred to several homes. A 4-month-old baby girl was killed when pulled from her father's arms in an apartment in Howenwald, Tennessee.

There were 15 tornadoes reported in Michigan on March 27th. Fortunately, there were no deaths, but there were 18 injuries reported in Calhoun County.

A tornado occurred on March 29th at 5:30 a.m. in Talladega County, Alabama. The tornado (F1) moved northeast over a 1-mile-long and 75-yard-wide path through Munford. Four family members were killed when the tornado destroyed their mobile home. A woman in another mobile home died from injuries a few days later. There were five deaths and thirteen reported injuries from this storm.

A tornado (F3) touched down on April 11th at 7:12 p.m. 6 miles west of Stockton, Kansas. The tornado destroyed three farm homes in Rooks County. One woman was injured when the tornado blew her home off its foundation and then tossed a pickup truck into the basement. Another vehicle was found 75 yards away from its original position. The damage in Rooks County was estimated at \$1.5 million.

A tornado (F4) touched down 6 miles west of Arkansas City, Kansas, on April 26th at 5:30 p.m. Several homes were destroyed south of Hackney. Near Tisdale, a woman was killed in her mobile home. Damage from this storm exceeded \$5.5 million.

A violent tornado (F5) moved out of Sedgwick County and slammed into the southern part of Andover, Kansas, at 5:40 p.m. on the 26th, destroying or severely damaging 84 frame houses and 14 businesses. A 241-unit mobile home park was hit the hardest when 223 mobile homes were destroyed and 13 deaths occurred in the mobile home park. There were 150 injuries from this storm.

Severe thunderstorms developed in northeastern Oklahoma during the afternoon hours of April 26th and moved into north-central and northeastern Oklahoma in the late afternoon and evening hours. A total of nine tornadoes developed, four from a severe thunderstorm complex that moved over Garfield, Noble, Osage, and Washington Counties. Four more formed from a thunderstorm complex that moved along a path south of the other complex through Payne, Pawnee, southern Osage, Tulsa, and Rogers Counties. A third thunderstorm produced one additional tornado.

The third tornado of the nine touched down 2.5 miles east of Garber, Oklahoma, about 5:30 p.m. and moved northeast. The tornado increased to F3 intensity as it passed 4.5 miles south of Billings. Oil tanks were destroyed, well pumps toppled, and power poles snapped. The path width at this point was estimated at 0.5 mile. The tornado grew to 0.75-mile wide and destroyed a home 5 miles southeast of Billings. The tornado strengthened to F4 intensity as it neared Interstate 35, debarking many trees and destroying a home. The tornado lifted at 6:55 p.m. 9 miles west-northwest of Pawhuska, with a total path length of 66 miles. Damage was estimated at \$500,000. Six injuries occurred because of this tornado, but none were serious.

The seventh tornado on the evening of the 26th was the most damaging. It touched down 1 mile west of Oologah in Rogers County, Oklahoma, at 8:45 p.m. and moved toward the northeast along a short but devastating 4-mile path. In the Oologah area, 60 homes and 16 mobile homes, 16 apartments, and 30 barns were destroyed. There were 22 injuries in the Oologah area, one was serious. Major tornado damage occurred at the Oologah School Complex where all buildings had significant structural damage. The F4 tornado had a path width of 0.75 mile. The tornado lifted at 8:55 p.m. west of Oologah Lake. Damage was estimated near \$15 million, with \$12 million to the Oologah School Complex.

Spotters reported a tornado (F3) southwest of Grant, Nebraska, on May 2nd from 6:00 p.m. to 6:30 p.m. Damage started at a farmhouse 2 miles southwest of Grant and continued as the tornado hit the western and northeastern sections of Grant. A deputy sheriff's car was blown into a ditch, 2 mobile homes

were destroyed, 15 cars were damaged, and several large high-voltage power lines were blown down. Extensive damage occurred to at least 30 homes, the hospital roof, and football field. There were over 25 center-pivot irrigation systems destroyed or damaged.

A large, multiple vortex tornado (F3) damaged two farms in Hodgeman County, Kansas, on May 16th at 1:45 p.m. Two people received minor injuries. Witnesses reported that the large-scale rotation of the tornado was weak but the small suction vortices were the primary damage producers. A garage, barn, shed, two abandoned farmhouses, and two granaries were destroyed. Forty acres of wheat were destroyed by hail and the tornado.

A tornado touched down north of Oakland, Nebraska, on May 27th at 11:45 p.m. The tornado (F3) destroyed a mobile home and injured its two occupants. One of the occupant's back was broken and he is paralyzed from the waist down. Nine houses, sixteen farms, and four center-pivot irrigation systems were damaged at a cost of \$900,000.

A tornado (F2) touched down 3 miles southeast of Carlsbad, New Mexico, Airport on May 31st at 7:42 p.m. traveling 1 mile on the ground toward the northeast. The width of the tornado track was 285 yards. The tornado destroyed 14 mobile homes and damaged 37 additional buildings. Many cars, trucks, campers, and boats were damaged or destroyed. Twenty-one people were injured and two were hospitalized. The tornado occurred when most people were still outside and were fortunate they were not in their homes or sleeping. One family reported their couch missing was found over a mile away. Another family observed the tornado lifting an automobile off the ground.

A tornado (F3) touched down west of Minatare, Nebraska, on June 9th at 4:20 p.m. As it moved through the town, it destroyed 20 houses and damaged 30 others extensively. Damage was estimated at \$3 million.

A tornado (F1) touched down June 14th at 4:55 p.m. in Jackson County, Michigan. The tornado touched down just north of Losey Road, then traveled north-northeast across Cooper Road, lifting just before Territorial Road. The tornado was on the ground for 2 minutes but during that time lifted the roof off a barn and toppled two huge trees onto a farmer's two-story frame home. A mobile home was tipped over, many trees were twisted out of the ground, several of which blocked Cooper Road. A 19-year-old bulldozer operator saw the tornado coming and jumped in his truck. He was lifted by the tornado and spun in the air for about 20 feet. The tornado left him and his truck in the mud. The driver was fortunate. He had only minor scratches and the truck had broken glass and dents and scrapes.

A tornado (F1) touched down in Cartersville, Kentucky, on July 8th at 6:38 p.m. leaving a path of destruction. Barns and block buildings were

destroyed and several houses were damaged. Several large trees were uprooted.

A tornado (F1) occurred July 13th at 4:42 a.m. in Port Manatee, Florida. It ripped off part of three roofs, flipped a construction trailer and carried it 100 yards before dumping it on its side, then flipped a flatbed truck. A 23-foot barge was flung into the air over several cars and then deposited onto a truck, which bounced into several other trucks. It ripped metal doors off the maintenance warehouse before lifting back into the parent cloud.

Thunderstorms produced three small tornadoes (F0s and F1) over Onslow County, North Carolina, on August 2nd. The most serious damage occurred in the Haws Run area, 10 miles west-southwest of Jacksonville, where nine homes and a mobile home were destroyed. One woman was injured when trapped in a collapsed mobile home.

A tornado (F2) occurred on August 8th at 4:43 p.m. in Benton County, Indiana. Windows were blown out of a farmhouse and siding was ripped from portions of the house. The roof of a corn crib was blown off, and one of its walls blown down. A 200-gallon gas tank was blown from its base and deposited 300 yards to the east-southeast.

The tornado moved in an east-southeast direction, crossed 700 South, and hit another farm on the southern side of 700 South. The entire eastern roof was removed from a large barn at this location, and the building was twisted. Doors and portions of the roof and a wall were ripped from a tool shed. The southern windows of a workshop were blown in, and the building was twisted. Tree limbs were downed, and a 3-foot-diameter tree was broken. The tornado also damaged the corn crop at this location.

The tornado continued moving east-southeast, and at 800 South and 200 East, still in Benton County, it damaged a corn crop, leaving a 50-foot-wide path through a field. The tornado lifted at this location, but touched down again 1 mile north of Pine Village in Warren County. At this location, a 48- by 80-foot pole barn was blown off its foundation. The tornado moved east-southeast, and 2.5 miles east of Pine Village another farm was hit. Here, the tornado destroyed a 24- by 30-foot outbuilding, and a 24- by 60-foot corn crib. Two 1,000-bushel grain bins were blown off their foundations. Corn was also damaged at this location. The tornado lifted 3 miles east of Pine Village. The estimated damage from this tornado was \$120,000 to \$140,000.

A tornado (F1) occurred on September 7th at 6:30 p.m. in Fort Meyers, Florida. The tornado touched down several times along a 2-mile path between the Caloosahatchee River south near U.S. Highway 41 to Page Field. Flying glass caused minor injuries to seven people at two shopping malls. Fourteen homes were damaged, two were destroyed and three others suffered major damage. A total of 34 commercial/industrial buildings were damaged with 1

destroyed and 19 had major damage. Total damage was estimated at \$350,000.

A tornado (F2) occurred on September 18th at 4:10 p.m. near McAlevys Fort, Huntington County, Pennsylvania, touching down several times. On the first touchdown, the roofs of a house and a barn were seriously damaged. About 0.75 mile northeast of that point, a mobile home with tie downs, sitting on a hill, was overturned and torn apart. One occupant saw the tornado just moments before it struck. The three occupants received minor injuries. Over the next 3 miles it touched down briefly at least four more times snapping off and uprooting many large trees. Minor roof damage to another home also occurred.

A severe thunderstorm in the evening of October 22nd in Baton Rouge, Louisiana, snapped many pine and oak trees in half, produced golf ball-size hail, at least two tornadoes, and 7.50 to 8.00 inches of rain 1.5 miles on either side of an axis that extended from Interstate Highways 10 and 12 split east-northeast to the East Baton Rouge, Livingston Parish border. Most of the damage was from falling trees and wind blown debris. The East Baton Rouge Office of Emergency Management found that one single-family home was crushed by a large falling tree. In addition, 50 single-family homes and 56 apartments suffered major damage while 191 homes and 37 apartments received minor damage. A damage survey conducted by the National Weather Service showed that a small tornado struck the area surrounding the Interstate 12 and Millerville Road exit. More extensive damage resulted by another tornado in the Broadmoor section. The Broadmoor Elementary School had its roof torn off, one of its walls collapsed, and most of its windows damaged by a tornado. This allowed the interior to be flooded by torrential rains. Damage to the school is estimated to be between \$500,000 and \$750,000. Golf ball-size hail caused major damage to the new car inventories of two automobile dealerships and minor damage to another car dealership in the Interstate Highway 12, Airline Highway area. Some \$7.1 million damage insurance claims were filed. Electrical power remained out in some areas for up to 3 days. City and parish cleanup costs to remove tons of fallen debris were estimated to be around \$200,000. There were no injuries or fatalities.

A tornado (F3) struck Marion, Illinois, November 19th at 4:55 p.m. causing \$30 million damage. It destroyed 45 homes, another 23 had major damage, 250 had minor damage, 22 cars were destroyed, and an additional 90 were damaged. Some of the homes sustained F3 damage. The hardest hit area was Midway Court on the southwestern side of town. Part of the high school gym roof was peeled off and glass doors were shattered. In the business district, signs were damaged, windows were broken, a lumber store sustained major damage and a warehouse roof was torn off.

A tornado (F4) touched down on November 29th at 6:05 p.m. in a subdivision 3 miles north of downtown

Nixa, Missouri. Although minor wind damage was reported west and northwest of Nixa before touchdown, the tornado reached F3 intensity quickly. The tornado then continued northeast for about 10 miles, lifting over southeastern Springfield, just before reaching Sunshine Street. Light wind damage continued to be produced by the storm to about 0.5 mile northeast of Sunshine Street in eastern Springfield. Minor damage occurred to three homes along the southern part of Springfield Lake, along with trees topped off and uprooted. Tornado damage intensity increased again in a cemetery on a hill north of Springfield Lake, becoming F2-F3 intensity and destroying a house just west of U.S. Highway 65. The tornado picked up a truck from highway 65 and flipped it onto a frontage road, killing one passenger. Many injuries occurred from a traffic pile-up on Highway 65 because of a truck that flipped over. The storm continued northeast producing F3 to F4 intensity damage for about 1.5 miles in the subdivisions of Woodbridge and Natural Bridge Estates before lifting. The other fatality occurred to a man in his house in southeastern Springfield. Damage was estimated at over \$15 million and includes extensive damage to utility and telephone poles.

The final reported tornado of 1991 occurred on December 29th at 10:00 a.m. when a waterspout moved onshore at Gaviota State Park, California. Windows were broken in a parked motor home and two people were injured from broken glass.

More detailed information about tornado activity can be obtained from the monthly *Storm Data* publications. The National Severe Storms Forecast Center has generated a magnetic tape that contains tornado statistics for the period 1950-1991. A copy of that tape can be obtained by contacting the National Climatic Data Center, Federal Building, 37 Battery Park Avenue, Asheville, North Carolina 28801-2733 (telephone: (704) 259-0682).

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 auto 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-size missiles fly through the air in excess of 100 mph; 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

TORNADO SUMMARY BY STATE AND NATION, 1991

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA													
NUMBER	0	0	5	5	0	0	0	0	0	0	0	0	10
DAYS	0	0	2	3	0	0	0	0	0	0	0	0	5
DEATHS	0	0	5	0	0	0	0	0	0	0	0	0	5
INJURIES	0	0	29	4	0	0	0	0	0	0	0	0	33
ARIZONA													
NUMBER	0	0	0	0	0	0	0	1	1	0	0	0	2
DAYS	0	0	0	0	0	0	0	1	1	0	0	0	2
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	2	0	0	0	0	2
ARKANSAS													
NUMBER	0	0	7	3	0	1	1	0	0	1	1	0	14
DAYS	0	0	2	2	0	1	1	0	0	1	1	0	8
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	14	0	0	0	0	0	0	0	0	0	14
CALIFORNIA													
NUMBER	0	2	12	0	0	0	0	0	0	1	0	1	16
DAYS	0	1	6	0	0	0	0	0	0	1	0	1	9
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	1	0	0	0	0	0	0	0	0	0	2	3
COLORADO													
NUMBER	0	0	0	0	38	31	5	2	0	0	0	0	76
DAYS	0	0	0	0	12	11	1	2	0	0	0	0	26
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
DELAWARE													
NUMBER	0	0	0	0	0	0	1	0	0	0	0	0	1
DAYS	0	0	0	0	0	0	1	0	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
FLORIDA													
NUMBER	7	0	11	9	9	6	7	3	4	0	0	0	56
DAYS	3	0	3	3	7	6	6	3	4	0	0	0	35
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	5	0	2	0	0	0	0	0	7	0	0	0	14
GEORGIA													
NUMBER	1	1	8	3	1	1	1	0	1	0	0	0	17
DAYS	1	1	3	2	1	1	1	0	1	0	0	0	11
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	51	8	0	0	0	0	0	0	0	0	59
IDAHO													
NUMBER	0	0	1	2	3	3	0	1	1	0	0	0	11
DAYS	0	0	1	2	2	3	0	1	1	0	0	0	10
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
ILLINOIS													
NUMBER	0	0	6	8	13	0	0	1	0	2	1	1	32
DAYS	0	0	2	2	10	0	0	1	0	1	1	1	18
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	7	0	0	0	0	0	0	0	16	0	23
INDIANA													
NUMBER	0	0	4	0	4	2	0	4	0	0	0	0	14
DAYS	0	0	1	0	3	1	0	3	0	0	0	0	8
DEATHS	0	0	1	0	0	0	0	0	0	0	0	0	1
INJURIES	0	0	6	0	0	0	0	0	0	0	0	0	6
IOWA													
NUMBER	0	0	13	14	10	6	1	3	5	0	1	0	53
DAYS	0	0	2	4	4	4	1	1	1	0	1	0	18
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	2	2	0	0	0	0	0	0	0	0	4
KANSAS													
NUMBER	0	0	17	39	54	5	0	1	0	0	0	0	116
DAYS	0	0	3	6	6	4	0	1	0	0	0	0	20
DEATHS	0	0	0	19	0	0	0	0	0	0	0	0	19
INJURIES	0	0	13	244	2	0	0	0	0	0	0	0	259
KENTUCKY													
NUMBER	0	0	1	5	0	0	1	1	0	0	0	0	8
DAYS	0	0	1	1	0	0	1	1	0	0	0	0	4
DEATHS	0	0	1	0	0	0	0	0	0	0	0	0	1
INJURIES	0	0	12	3	0	0	0	0	0	0	0	0	15

TORNADO SUMMARY BY STATE AND NATION, 1991

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
LOUISIANA													
NUMBER	1	1	4	7	9	4	2	0	0	2	6	0	36
DAYS	1	1	1	5	5	4	2	0	0	1	2	0	22
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	5	0	1	0	0	0	0	0	9	0	15
MAINE													
NUMBER	0	0	0	0	0	1	0	0	0	0	0	0	1
DAYS	0	0	0	0	0	1	0	0	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
MARYLAND													
NUMBER	0	0	0	0	0	0	0	1	0	0	0	0	1
DAYS	0	0	0	0	0	0	0	1	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
MASSACHUSETTS													
NUMBER	0	0	0	0	0	0	0	1	0	0	0	0	1
DAYS	0	0	0	0	0	0	0	1	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN													
NUMBER	0	0	15	1	5	1	4	3	0	0	0	0	29
DAYS	0	0	1	1	2	1	1	1	0	0	0	0	7
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	18	0	0	1	0	0	0	0	0	0	19
MINNESOTA													
NUMBER	0	0	1	5	9	11	11	0	0	0	0	0	37
DAYS	0	0	1	2	2	5	3	0	0	0	0	0	13
DEATHS	0	0	0	0	0	0	1	0	0	0	0	0	1
INJURIES	0	0	0	9	0	0	3	0	0	0	0	0	12
MISSISSIPPI													
NUMBER	0	0	2	5	2	1	0	0	0	0	1	1	12
DAYS	0	0	2	2	1	1	0	0	0	0	1	1	8
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	3	0	0	0	0	0	0	0	15	0	18
MISSOURI													
NUMBER	0	1	3	5	2	3	0	0	1	0	2	0	17
DAYS	0	1	2	2	2	2	0	0	1	0	2	0	11
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	2
INJURIES	0	0	0	0	0	0	0	0	0	0	6	4	6
MONTANA													
NUMBER	0	0	1	0	7	15	6	1	0	0	0	0	30
DAYS	0	0	1	0	5	7	4	1	0	0	0	0	18
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
NEBRASKA													
NUMBER	0	0	0	9	29	25	1	0	1	0	0	0	65
DAYS	0	0	0	4	6	8	1	0	1	0	0	0	20
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	2	4	0	0	0	0	0	0	0	6
NEVADA													
NUMBER	0	0	0	0	0	0	1	1	0	0	0	0	2
DAYS	0	0	0	0	0	0	1	1	0	0	0	0	2
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW HAMPSHIRE													
NUMBER	0	0	0	0	1	0	0	0	0	0	0	0	1
DAYS	0	0	0	0	1	0	0	0	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW JERSEY													
NUMBER	0	0	0	0	0	0	0	1	0	0	0	0	1
DAYS	0	0	0	0	0	0	0	1	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW MEXICO													
NUMBER	0	0	0	1	6	21	2	1	0	0	0	0	31
DAYS	0	0	0	1	4	4	2	1	0	0	0	0	12
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	21	5	0	0	0	0	0	0	26

TORNADO SUMMARY BY STATE AND NATION, 1991

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
NEW YORK													
NUMBER	0	0	0	4	3	1	0	2	0	0	0	0	10
DAYS	0	0	0	2	1	1	0	1	0	0	0	0	5
DEATHS	0	0	0	0	0	1	0	0	0	0	0	0	1
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
NORTH CAROLINA													
NUMBER	0	0	13	1	0	1	1	10	0	1	0	0	27
DAYS	0	0	3	1	0	1	1	3	0	1	0	0	10
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	40	0	0	0	0	1	0	0	0	0	41
NORTH DAKOTA													
NUMBER	0	0	0	0	3	10	3	0	1	0	0	0	17
DAYS	0	0	0	0	2	4	1	0	1	0	0	0	8
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OHIO													
NUMBER	0	0	1	0	1	2	2	2	0	0	0	0	8
DAYS	0	0	1	0	1	2	1	2	0	0	0	0	7
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	18	0	0	0	0	0	0	0	0	0	18
OKLAHOMA													
NUMBER	0	0	17	24	20	4	1	0	0	7	0	0	73
DAYS	0	0	2	3	7	2	1	0	0	2	0	0	17
DEATHS	0	0	0	2	0	0	0	0	0	0	0	0	2
INJURIES	0	0	9	65	6	0	0	0	0	0	0	0	80
OREGON													
NUMBER	0	0	0	1	1	0	0	0	0	0	3	0	5
DAYS	0	0	0	1	1	0	0	0	0	0	1	0	3
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA													
NUMBER	0	0	0	11	3	0	3	1	2	0	0	0	20
DAYS	0	0	0	1	2	0	1	1	1	0	0	0	6
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	7	3	0	0	0	3	0	0	0	13
SOUTH CAROLINA													
NUMBER	0	1	7	1	1	0	0	0	0	0	0	0	10
DAYS	0	1	3	1	1	0	0	0	0	0	0	0	6
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	6	0	0	0	0	0	0	0	0	0	6
SOUTH DAKOTA													
NUMBER	0	0	0	0	18	9	5	1	1	0	0	0	34
DAYS	0	0	0	0	5	6	3	1	1	0	0	0	16
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	25	0	0	0	0	0	0	0	25
TENNESSEE													
NUMBER	0	0	6	1	0	1	0	0	0	0	1	0	9
DAYS	0	0	2	1	0	1	0	0	0	0	1	0	5
DEATHS	0	0	5	0	0	0	0	0	0	0	0	0	5
INJURIES	0	0	59	0	0	0	0	0	0	0	0	0	59
TEXAS													
NUMBER	20	5	2	39	72	36	1	2	3	8	4	0	192
DAYS	2	2	2	10	14	11	1	2	3	3	1	0	51
DEATHS	1	0	0	0	0	0	0	0	0	0	0	0	1
INJURIES	15	0	0	3	4	2	0	0	0	0	0	0	24
UTAH													
NUMBER	0	0	0	0	0	0	3	0	2	0	0	0	5
DAYS	0	0	0	0	0	0	2	0	2	0	0	0	4
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA													
NUMBER	0	0	1	0	0	0	0	1	0	0	0	0	2
DAYS	0	0	1	0	0	0	0	1	0	0	0	0	2
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON													
NUMBER	0	0	0	1	0	1	0	0	0	0	0	0	2
DAYS	0	0	0	1	0	1	0	0	0	0	0	0	2
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0

TORNADO SUMMARY BY STATE AND NATION, 1991

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
WEST VIRGINIA													
NUMBER	0	0	0	1	0	0	0	0	0	0	0	0	1
DAYS	0	0	0	1	0	0	0	0	0	0	0	0	1
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
WISCONSIN													
NUMBER	0	0	1	1	3	2	2	0	1	0	0	0	10
DAYS	0	0	1	1	2	2	2	0	1	0	0	0	9
DEATHS	0	0	1	0	0	0	0	0	0	0	0	0	1
INJURIES	0	0	5	0	0	0	1	0	0	0	0	0	6
WYOMING													
NUMBER	0	0	0	0	8	12	0	1	2	0	0	0	23
DAYS	0	0	0	0	5	9	0	1	1	0	0	0	16
DEATHS	0	0	0	0	0	0	0	0	0	0	0	0	0
INJURIES	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES													
NUMBER	29	11	159*	206*	335	216	65*	46	26	22*	20	3	1132*
DAYS &	6	5	16	20	30	30	22	17	16	9	5	3	179
DEATHS	1	0	13	21	0	1	1	0	0	0	2	0	39
INJURIES	20	1	299	347	66	8	4	3	10	0	104	2	864

* CORRECTED FOR BOUNDARY-CROSSING TORNADOES.
& TORNADO DAYS FOR COUNTRY AS A WHOLE.

TORNADOES, TORNADO DAYS, AND DEATHS BY STATE AND NATION, 1953-91

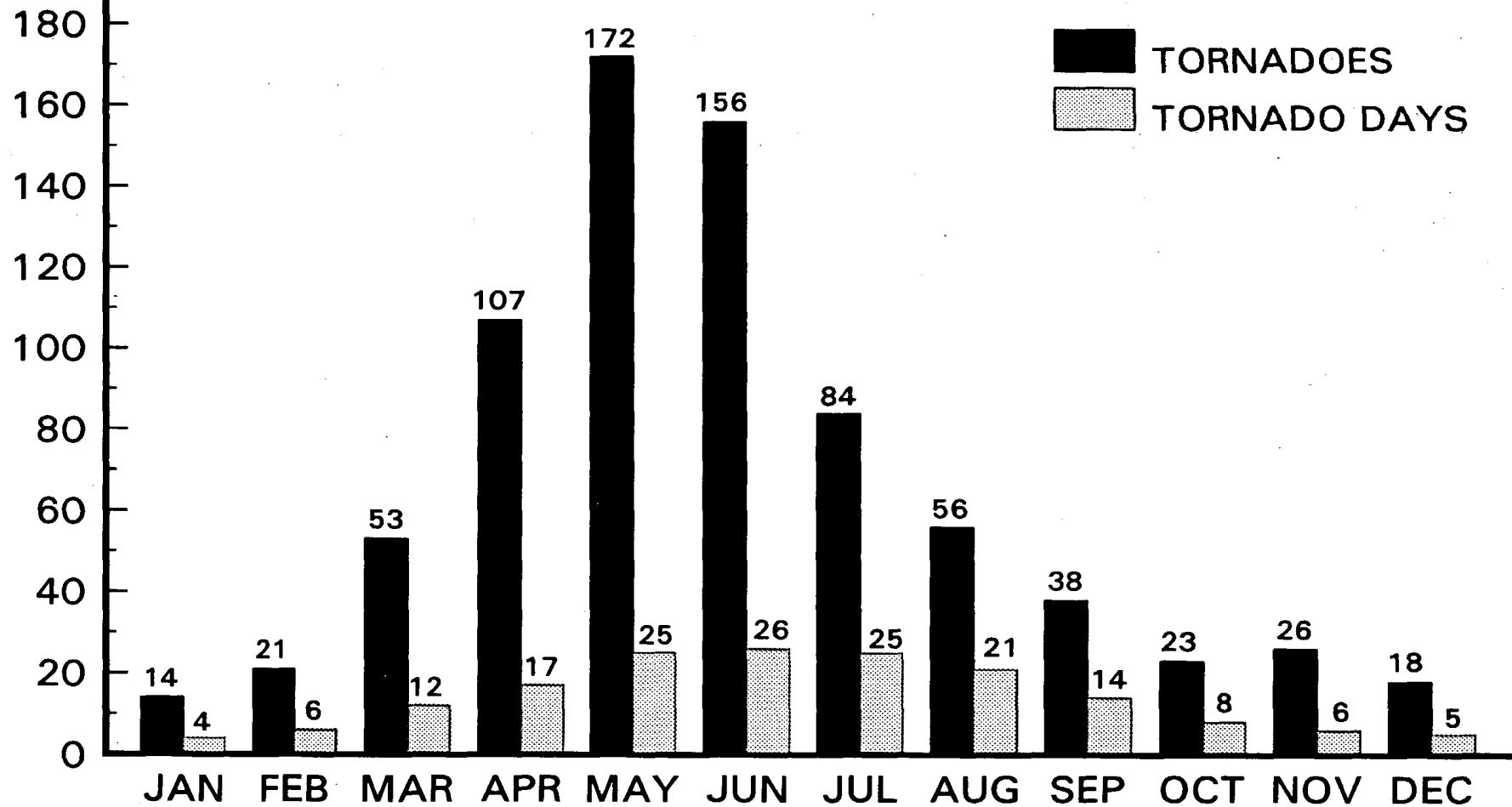
STATE	TORNADOES							DAYS		DEATHS		
	TOTAL	AVERAGE	GREATEST	YEAR	LEAST	YEAR	PER # 10,000 SQ. MI.	TOTAL	AVERAGE	TOTAL	AVERAGE	PER # 10,000 SQ. MI.
ALABAMA	817	20	45	1983+	5	1956	3.88	430	11	242	6	47
ALASKA	1	0	1	1959	0	1989+	.00	1	0	0	0	0
ARIZONA	128	3	17	1972	0	1965	.27	104	2	3	0	0
ARKANSAS	777	19	78	1982	2	1987+	3.58	357	9	165	4	31
CALIFORNIA	169	4	16	1991	0	1968+	.25	124	3	0	0	0
COLORADO	902	23	76	1991	1	1959	2.21	506	12	2	0	0
CONNECTICUT	50	1	8	1973	0	1988+	2.00	44	1	4	0	8
DELAWARE	37	0	5	1975	0	1987+	.00	34	0	2	0	10
DISTRICT OF COLUMBIA	0	0	0	0+	0	0+	.00	0	0	0	0	0
FLORIDA	1762	45	97	1975	10	1956	7.68	1125	28	70	1	12
GEORGIA	778	19	46	1974+	2	1987	3.23	428	10	76	1	13
HAWAII	27	0	4	1971	0	1987+	.00	23	0	0	0	0
IDAHO	97	2	11	1991	0	1977+	.24	80	2	0	0	0
ILLINOIS	1042	26	107	1974	4	1953	4.61	482	12	177	4	31
INDIANA	807	20	49	1990	4	1984	5.51	377	9	215	5	59
IOWA	1229	31	71	1990	7	1956	5.51	531	13	60	1	11
KANSAS	1736	44	116	1991	14	1976	5.35	759	19	189	4	23
KENTUCKY	331	8	34	1974	0	1953	1.98	190	4	103	2	25
LOUISIANA	949	24	72	1990	3	1955	4.95	542	13	96	2	20
MAINE	77	1	11	1971	0	1987+	.30	68	1	1	0	0
MARYLAND	100	2	10	1975+	0	1988+	1.89	75	1	2	0	2
MASSACHUSETTS	128	3	12	1958	0	1988+	3.63	90	2	99	2	120
MICHIGAN	661	16	39	1974	2	1959	2.75	370	9	236	6	41
MINNESOTA	701	17	37	1991	5	1988+	2.02	392	10	78	2	9
MISSISSIPPI	905	23	62	1988	1	1979	4.82	449	11	346	8	73
MISSOURI	1044	26	79	1973	6	1987+	3.73	461	11	135	3	19
MONTANA	198	5	30	1991	0	1974+	.34	136	3	1	0	0
NEBRASKA	1449	37	88	1990	10	1966	4.79	671	17	51	1	7
NEVADA	41	1	8	1987	0	1985+	.09	37	0	0	0	0
NEW HAMPSHIRE	69	1	9	1963	0	1987+	1.07	60	1	0	0	0
NEW JERSEY	92	2	17	1989	0	1984+	2.55	65	1	0	0	0
NEW MEXICO	346	8	31	1991	0	1953	.66	253	6	3	0	0
NEW YORK	189	4	16	1990	0	1953	.81	137	3	19	0	4
NORTH CAROLINA	505	12	38	1973	2	1970	2.28	304	7	79	2	15
NORTH DAKOTA	711	18	52	1976	2	1961	2.55	382	9	21	0	3
OHIO	546	14	43	1973	0	1988	3.40	287	7	171	4	41
OKLAHOMA	2042	52	107	1957	17	1988	7.44	827	21	203	5	29
OREGON	38	0	5	1991	0	1988+	.00	32	0	0	0	0
PENNSYLVANIA	364	9	33	1985+	0	1959	1.99	227	5	73	1	16
PUERTO RICO	9	0	2	1979	0	1989+	.00	8	0	0	0	0
RHODE ISLAND	7	0	3	1986	0	1988+	.00	6	0	0	0	0
SOUTH CAROLINA	357	9	23	1973	1	1986+	2.90	234	6	43	1	14
SOUTH DAKOTA	970	24	64	1965	1	1958	3.11	460	11	8	0	1
TENNESSEE	429	11	44	1974	1	1987+	2.60	234	6	87	2	21
TEXAS	4949	126	232	1967	32	1953	4.71	1856	47	449	11	17
UTAH	65	1	6	1984	0	1989+	.12	55	1	0	0	0
VERMONT	31	0	5	1962	0	1985+	.00	28	0	0	0	0
VIRGINIA	230	5	22	1975	1	1982+	1.23	155	3	19	0	5
VIRGIN ISLANDS	2	0	1	1979+	0	1989+	.00	2	0	0	0	0
WASHINGTON	52	1	4	1989+	0	1988+	.15	45	1	6	0	1
WEST VIRGINIA	77	1	6	1980+	0	1988+	.41	60	1	2	0	1
WISCONSIN	733	18	43	1980	3	1953	3.26	383	9	76	1	14
WYOMING	401	10	42	1977	0	1970	1.02	261	6	2	0	0
PACIFIC ISLANDS	2	0	1	1981+	0	1989+	.00	2	0	0	0	0
TOTAL: UNITED STATES	29953*	768	1133	1990	421	1953	2.13	6619&	169	3614	92	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 29,952 TORNADOES THAT OCCURRED FROM 1953-1991)



NATION SUMMARY OF TORNADOES, TORNADO DAYS, AND DEATHS BY MONTH AND ANNUAL, 1953- 91

YEAR	JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			ANNUAL		
	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS	NUMBER	DAYS	DEATHS			
1953	14	6	0	16	3	3	40	10	24	47	16	34	94	21	161	111	24	244	31	19	0	24	15	0	5	4	0	6	4	0	12	6	0	21	8	49	421	136	515
1954	2	1	0	17	9	2	63	13	10	112	22	33	101	22	9	107	26	5	45	23	0	49	21	1	21	10	3	14	8	0	2	2	0	17	3	1	550	160	36
1955	3	2	0	4	4	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	0	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	7	41	19	1	200	22	3	171	29	0	78	26	0	51	21	6	24	11	0	11	10	0	5	4	1	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	0	68	15	2	145	25	4	137	28	7	99	27	0	69	21	19	20	11	0	26	10	0	5	3	0	23	7	1	608	155	66
1970	9	5	0	16	3	0	25	12	2	117	16	29	88	19	26	134	24	6	81	26	3	55	21	0	54	20	0	50	13	6	10	4	0	14	8	0	653	171	72
1971	18	7	1	83	12	131	40	13	2	75	14	11	166	24	7	199	28	1	100	30	1	50	21	0	47	15	0	38	12	0	16	7	0	56	9	2	888	192	156
1972	33	10	5	7	4	0	69	17	0	96	20	16	140	27	0	114	25	2	115	29	0	59	23	2	49	19	0	34	10	0	17	4	2	8	6	0	741	194	27
1973	33	7	1	10	4	0	80	16	17	150	22	10	250	26	35	224	26	2	80	26	0	51	23	4	69	22	3	25	11	0	81	11	12	49	12	3	1102	206	87
1974	24	8	2	23	9	0	36	12	1	269	22	313	144	28	10	194	26	31	59	19	0	107	26	0	25	11	0	45	10	4	13	8	0	8	5	0	947	184	361
1975	52	7	12	45	12	7	84	16	12	108	20	13	188	30	5	196	28	6	79	26	2	60	25	2	34	17	0	12	7	0	40	8	0	22	8	1	920	204	60
1976	12	5	0	37	6	5	180	18	21	113	23	1	155	24	8	169	26	3	84	28	2	38	18	1	35	15	3	11	5	0	0	0	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	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	10	0	31	12	0	30	7	4	58	10	31	3	1	0	856	160	50
1990	11	7	0	57	10	1	88	8	3	108	17	0	243	27	5	335	28	11	106	26	0	60	22	29	45	15	0	35	9	2	18	5	0	35	7	2	1133	181	53
1991	29	6	1	11	5	0	159	16	13	206	20	21	335	30	0	216	30	1	65	22	1	46	17	0	26	16	0	22	9	0	20	5	2	3	3	0	1132	179	39
POR	531	173	99	802	218	204	2066	470	308	4166	682	1181	6709	974	818	6102	1028	496	3275	975	47	2194	810	97	1489	549	64	912	303	72	1011	247	111	717	190	117	29953	6619	3614
MEAN	14	4	3	21	6	5	53	12	8	107	17	30	172	25	21	156	26	13	84	25	1	56	21	2	38	14	2	23	8	2	26	6	3	18	5	3	768	170	93

NATIONAL TORNAOES, TORNADO DAYS, DEATHS AND RESULTING LOSSES BY YEARS, 1916-91

YEAR	NUMBER TORNAOES	TORNAO DAYS	TOTAL DEATHS	MOST DEATHS IN SINGLE TORNAO	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	63	45	136	36	7	20	5	0
1919	64	35	206	59	7	10	0	0
1920	87	50	499	87	7	14	0	0
1921	105	55	202	61	7	22	0	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	1	1
1925	119	65	794	689	7	34	2	1
1926	111	57	144	23	6	28	0	0
1927	163	62	540	92	7	42	0	0
1928	203	79	955	14	7	40	4	0
1929	97	74	274	14	7	48	4	0
1930	92	72	179	41	7	38	6	0
1931	94	57	36	6	6	14	1	0
1932	151	67	394	37	7	23	1	0
1933	258	96	362	34	7	46	9	0
1934	147	77	47	6	6	10	0	0
1935	180	77	71	11	6	29	0	0
1936	151	71	552	216	7	17	5	1
1937	147	75	299	5	6	24	0	0
1938	213	76	183	32	7	29	0	0
1939	152	75	91	27	7	21	0	0
1940	124	62	65	18	7	13	0	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	0
1952	240	98	229	57	7	53	19	0
1953	421	136	515	116	8	63	18	7
1954	530	160	36	6	7	63	8	1
1955	533	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	664	166	19	19	7	70	8	1
1959	604	196	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	158	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	2
1975	920	204	60	9	9	189	31	5
1976	835	169	44	5	8	145	41	5
1977	852	189	43	2	8	173	40	6
1978	788	173	53	16	9	153	53	6
1979	852	186	84	4	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	22	1	9	193	90	3
1985	684	168	94	18	9	114	55	14
1986	764	168	15	3	9	157	66	9
1987	656	151	30	3	9	112	32	6
1988	702	156	32	5	9	148	48	7
1989	856	160	30	2	9	133	60	18
1990	1133	181	33	2	8	215	91	10
1991	1132	179	39	13	8	194	49	15
MEAN	768	170	93	-	-	129	39	8

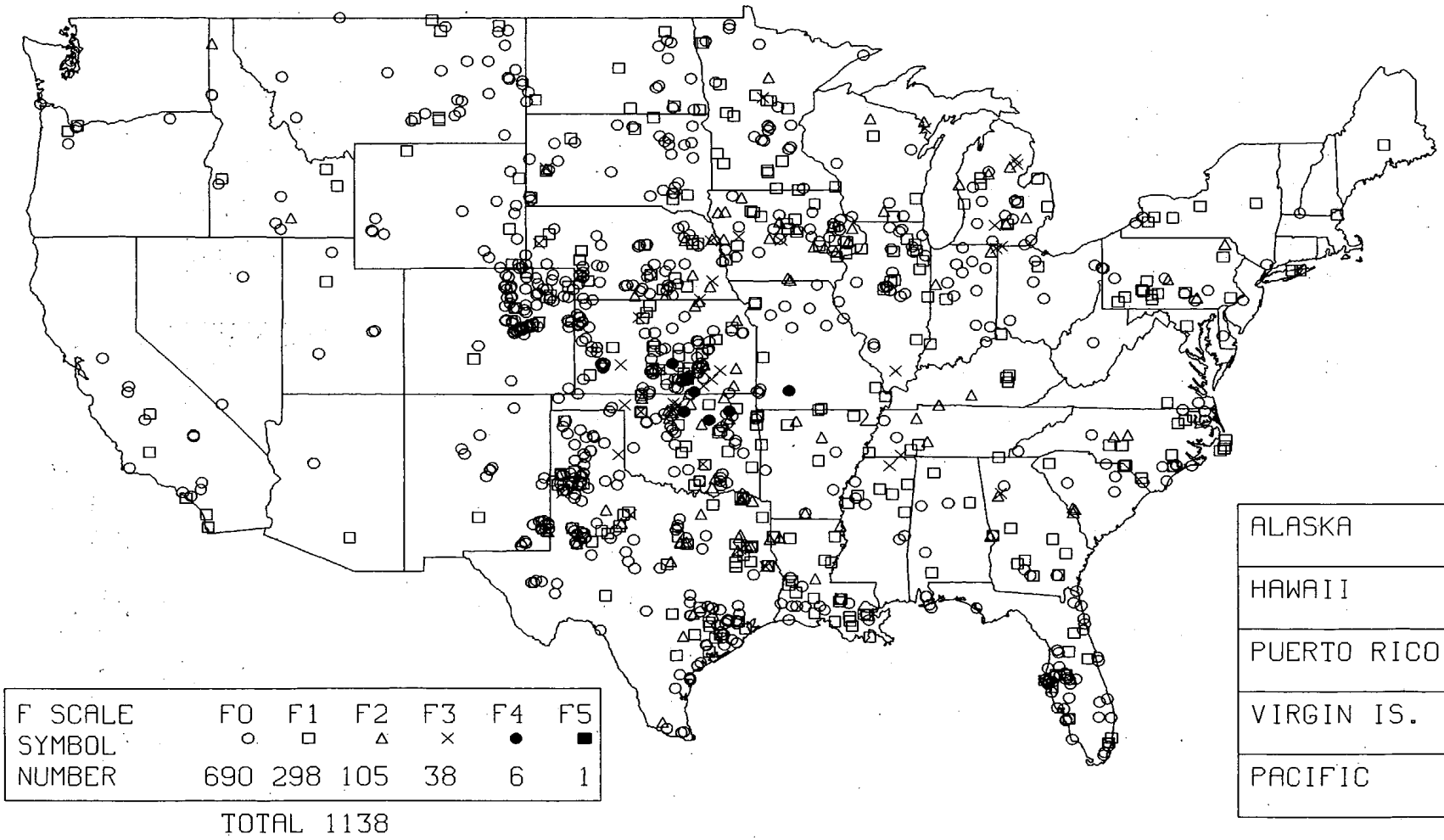
NOTE: - THE ABOVE ESTIMATED LOSSES ARE BASED ON VALUES AT TIME OF OCCURRENCE.
MEAN WAS DERIVED FROM DATA FOR PERIOD 1953-1991

\$ 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.

1991 CONFIRMED TORNAOES



NATIONAL SUMMARY OF LIGHTNING, 1991

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

Seventy-two people were killed in the United States during 1991, which was 23 percent below the national average of 94 deaths. There were 431 injuries which was 67 percent above the national average of 258. Locations and percentage frequency of lightning deaths are depicted in the following two figures for 1991, and the period 1959-1991:

FIGURE 1A - LIGHTNING DEATHS

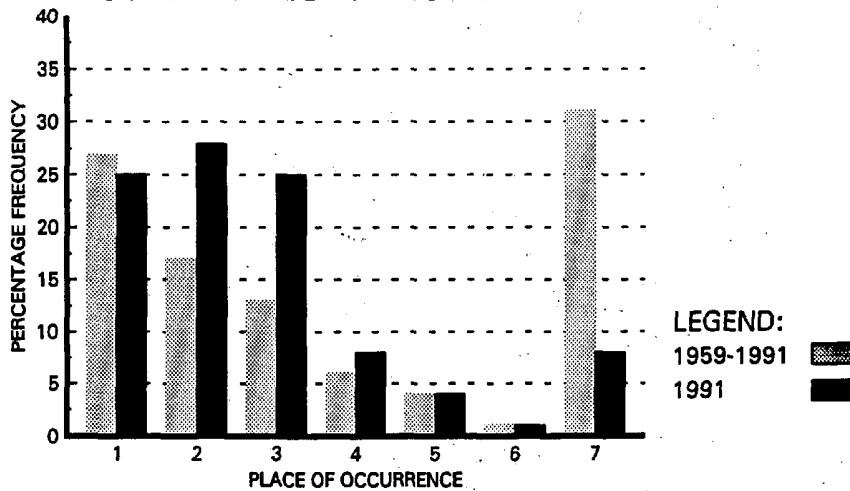
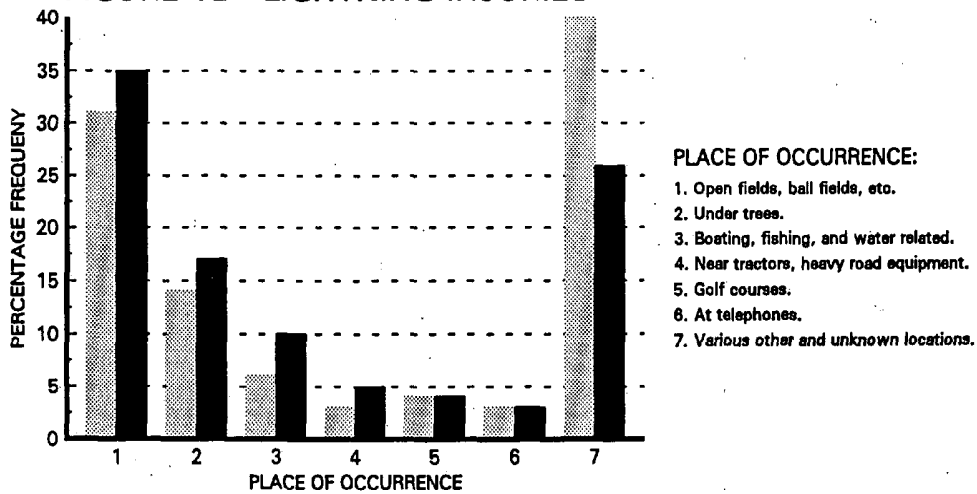


FIGURE 1B - LIGHTNING INJURIES



Some lightning incidents are described in the following monthly summaries:

JANUARY

A bolt of lightning struck a house in Wilton, Connecticut, that blew four holes in the roof. No fire resulted but there was damage to the interior of the house.

FEBRUARY

Lightning struck the gondola line and the Bucksaw lift at Sugarloaf USA in Franklin County, Maine, closing the gondola and knocking out telephone service for awhile.

MARCH

Two men were struck by lightning while standing by a hangar at O'Hare Airport, Chicago, Illinois, both were taken to the hospital in critical condition. Lightning struck a barn near Geneva, Iowa. The barn burned to the ground and killed several hogs and chickens.

APRIL

Lightning struck 12 soldiers participating in training exercises at Ft. Chaffee, Arkansas. Six were taken to the hospital and two were admitted because of more serious injuries. The soldiers were in a tent when the lightning struck. Two golfers received minor burns from a lightning strike in Cherry Hills, Colorado. A Savannah, Georgia, police department dispatcher was injured when lightning entered the radio system and shocked him through his headset. Lightning struck a home in Weleetka, Oklahoma, that started a fire that killed a 78-year-old man and his 78-year-old wife.

MAY

Two teenage boys were injured by lightning in Morgan County, Alabama, while playing basketball. The bolt struck a tree and traveled down an attached clothesline before hitting the boys. Three teenagers were struck by lightning during a soccer game at the Air Force Academy, Colorado Springs, Colorado. A 16-year-old was in critical condition from the strike. Lightning struck two men as they walked on New Smyrna Beach, Florida, killing one and sending the other to the hospital with serious injuries. Three men sought shelter under a tree in Berrydale, Florida, and were struck by lightning. All three were critically injured and placed on life support. One man died on May 28th, and another (his son) died on June 11th. A 5-year-old boy was struck and killed by lightning in Shired Island, Florida, as he played outside at a county park. A 41-year-old construction worker was

killed by lightning, and two others were thrown to the ground but not seriously injured in Gurnee, Illinois. A 7-year-old boy was killed by lightning while riding a bike in his driveway in Yorktown, Indiana. A 37-year-old man was killed by lightning while playing golf in Jefferson County, Kentucky. Two other men were knocked to the ground. All three were standing under a tree holding umbrellas. Strong thunderstorms interrupted a lacrosse game between city prep schools in the District of Columbia. Many people took shelter from the storm under large trees. Eleven people were injured when lightning struck a tree; one of them, a 15-year-old boy, died the next day. Four of the eleven received serious injuries. Lightning struck a 13-year-old girl or the dog she was walking in North Smithfield, Rhode Island. The dog was killed instantly, but the girl suffered burns to her arms when the current traveled through the metal leash. She was treated and released from a local hospital.

JUNE

An Arkansas National Guardsman was killed and two others injured when lightning struck the tent they were sleeping in. The incident occurred in North Little Rock, Arkansas. Lightning struck a tree in Denver, Colorado, where five men and two women were picnicking. One man was critically injured; the others received minor injuries. Lightning struck a wedding rehearsal party in Pueblo, Colorado, one woman was killed and three other persons were injured. Three people fishing in the St. Johns River 10 miles northeast of Palatka, Florida, pulled into a dock when a thunderstorm developed. They were standing under a canopy when lightning struck. One man was killed and the other two were injured. A man was killed by lightning in Tampa, Florida. He was driving a boat pulling two boys on inner tubes when lightning struck the boat. The two boys were not injured. Lightning struck near three men on a golf course, in Orlando, Florida. One man was killed and two were injured. Eight people in Harvard, Illinois, were injured when lightning struck the entertainment tent at the fairgrounds during "Harvard Milk Days." All were taken to a hospital, where they were treated and released. Two men were injured when lightning struck a pontoon boat on Harrington Lake, Mercer County, Kentucky. Both men were knocked unconscious and received burns. Lightning struck power lines leading to a residence in Baltimore, Maryland, causing a power surge that exploded a television and set the house afire. The residence was destroyed and two people were injured when they jumped from a second-floor window to escape the fire. Six spectators at the 1991 U.S. Open

Golf Tournament in Chaska, Minnesota, sought shelter from a midday thunderstorm under a tree at the Hazeltine Golf Course. Lightning struck the tree and spread to the spectators. Four people received minor burns and two suffered cardiac arrest. One man died and the other recovered. A man was killed in Tishomingo County, Mississippi, when lightning struck a tree he was standing near. A 13-year-old girl was killed and two people were injured in Waveland, Mississippi, when lightning struck a beach. A 21-year-old man in Cleveland, Tennessee, was killed by lightning while under his mobile home. Lightning struck a small aluminum boat on Lake Gaston near Gasburg, Virginia, in which two youths were sitting. One of them was hit by the lightning and died about 7 hours later. The lightning melted a 2-inch hole in the boat seat where the youth had been sitting. A 55-year-old man was struck and killed by lightning in an open field in Orfordville, Wisconsin.

JULY

One soldier was killed and 17 others were injured when lightning struck a tree near their tent in Russell County, Alabama. A 64-year-old man was struck and killed in Elmore County, Alabama. The lightning struck a tree, left the tree 25 feet above the ground, then struck the victim. A 27-year-old woman was carrying her 1-year-old daughter at the Sabino Canyon Visitors Center, Arizona, when lightning struck and killed them. Lightning struck and killed a 29-year-old man in Fort Lauderdale, Florida, who sought shelter under a tree. Lightning struck a 35-year-old Dade City, Florida, man in his head and exited his foot. Paramedics arrived within a few minutes and restarted his heart. Lightning struck a small boat in St. Joe Bay, Florida, that killed a 67-year-old man and injured his wife. A 17-year-old baseball player was struck and killed by lightning in Winnetka, Illinois. He was playing second base when lightning struck. Witnesses said it was not raining at the time and the sky was blue. According to radar data, a severe thunderstorm was about 5 miles south. Another 17-year-old was injured. A 14-year-old boy was killed and his 14-year-old friend was hospitalized with injuries after lightning struck their fishing boat in Grand Lake, Louisiana. Two boaters were killed by lightning as they took shelter in a cove near Carroll Island, Maryland. A 19-year-old man was struck and killed by lightning while playing golf on Ocean Isle Beach, North Carolina. A 16-year-old girl was struck and killed by lightning while working in her yard at Dudley, North Carolina. A 32-year-old woman was struck and killed while walking in an open parking lot in Chattanooga, Tennessee. Lightning struck and killed a 49-year-old man in a Fort Worth, Texas, cemetery while he was

visiting his mother's grave. A man was hospitalized in critical condition in Springfield, Virginia, after being struck by lightning. He was found in a parking lot with his clothing smoldering. Two farm workers were struck and killed by lightning in Clayton, West Virginia, while sitting under a tree. Two other workers were injured and three dogs and a cat were killed. Lightning killed a 60-year-old man who was in a metal shed on the parking lot of Rios Funeral Home in San Sebastian, Puerto Rico.

AUGUST

Lightning killed one man and injured two others as they were cutting down a tall pine tree in Montgomery, Alabama. Lightning struck the pavement near a metal van in Fort Huachuca, Arizona, where 12 soldiers were unloading equipment. All 12 were taken to the hospital, 9 were treated and released, 3 were hospitalized in stable condition. Four children in Valdosta, Georgia, were struck by lightning while playing outside. One boy died about 35 minutes later. A 39-year-old man was struck and killed by lightning in a parking area at the Crooked Stick Golf Course near Carmel, Indiana. He was carrying an umbrella. Lightning struck and killed a 16-year-old boy and injured another while they were in a boat on Lake Umbagog near Upton, Maine. A man was struck by lightning and badly burned while hunting near the crest of Diamond Mountain 10 miles northeast of Eureka, Nevada. Lightning strikes injured seven people, including four emergency rescue people in Gaston County, North Carolina. The lightning caused structural damage to buildings and started 30 separate fires in homes and businesses in Catawba County. In Samson County, four horses were killed by a lightning strike. Twelve dairy cattle were killed by lightning in Union County, North Carolina. A 33-year-old man was struck in the head and killed by lightning while riding a tractor near Denmark, South Carolina. The bolt threw the tractor into a nearby ditch. A 42-year-old man was killed by lightning near Fountain Inn, South Carolina, when he stopped his truck along Interstate Highway 385 to help at a traffic accident. A 23-year-old man was struck and killed by lightning while getting out of a boat at Lake Douglas, Tennessee. Another Tennessee man was killed when lightning struck a nearby tree in Chattanooga. A 27-year-old man swimming off the Bayland Park Beach, Baytown, Texas, was struck and killed by lightning. Two boys, ages 14 and 16, were killed by lightning while camping with a Boy Scout troop at Islands Lake, Utah. Two other boys were injured. Lightning struck and killed a 33-year-old sheep herder northwest of Tabiona, Utah. The lightning also killed the horse he was riding.

SEPTEMBER

Lightning took the lives of two children and injured three others in Little Rock, Arkansas. The children had gathered under a tree and were preparing to go inside when lightning struck the tree. Two farm workers, one in Salinas and one in Soledad, California, were struck and killed by lightning. Both men were in their 20s. Two workers at San Jose Airport, California, were injured when lightning struck near the aircraft they were refueling. A 25-year-old man was struck and injured by lightning as he was inserting a key in a car at a dealership parking lot in Barrington, Illinois. An isolated, solitary bolt of lightning struck a football practice field in Silver Spring, Maryland. A 15-year-old boy was critically injured when he took a direct hit on the head. His helmet was shattered, his hair, shoulder pads, and the grass surrounding him were singed. Another 15-year-old boy about 25 feet away suffered electrical shock that caused temporary numbness to his right side. A man near White Haven, Pennsylvania, was killed when lightning struck while he was talking on the telephone.

OCTOBER

Lightning struck a tree in Lonoke County, Arkansas, killing 11 cows of which 7 were pregnant. Lightning caused a fire which destroyed the 100-year-old Camp Creek Presbyterian Church in Industry, Illinois. A boy was injured when he was struck by lightning after touching a metal gate in Lawrenceburg, Tennessee. Lightning struck a house, destroying the chimney and shocking two youths in Victoria, Texas. One youth was using the telephone and the other was near the television.

NOVEMBER

Lightning struck a house in Davenport, Iowa, resulting in minor damage. This was the only reported incident in *Storm Data*.

DECEMBER

Lightning struck and destroyed a water pump in front of the Onteora High School in Boiceville, New York. It was the fourth time in the last 3 years that lightning had struck pumps at the same location. This was the only incident reported in *Storm Data*.

Additional information is presented in the following tables.

More detailed information about lightning data can be obtained in the monthly *Storm Data* publication. The National Climatic Data Center has lightning data available on magnetic tape for the period 1959-1991. 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, 37 Battery Park Avenue, Asheville, North Carolina 28801-2733 (telephone: (704) 259-0682.

TOTAL DEATHS BY STATE AND NATION FOR YEAR 1991

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	0	0	0	2	1	0	0	0	0	3
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	0	0	4	0	0	0	0	0	4
ARKANSAS	0	0	0	0	0	1	0	0	2	0	0	0	3
CALIFORNIA	0	0	0	0	0	0	0	0	2	0	0	0	2
COLORADO	0	0	0	0	0	1	1	0	0	0	0	0	2
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	1	0	0	0	0	0	0	0	1
FLORIDA	0	0	0	0	4	3	3	5	0	0	0	0	15
GEORGIA	0	0	0	1	0	0	0	2	0	0	0	0	3
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	1	0	1	0	0	0	0	0	2
INDIANA	0	0	0	0	1	0	0	1	0	0	0	0	2
IOWA	0	0	0	0	0	1	0	0	0	0	0	0	1
KANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0
KENTUCKY	0	0	0	0	1	0	0	0	0	0	0	0	1
LOUISIANA	0	0	0	0	0	0	1	0	0	0	0	0	1
MAINE	0	0	0	0	0	0	0	1	0	0	0	0	1
MARYLAND	0	0	0	0	0	0	2	0	0	0	0	0	2
MASSACHUSETTS	0	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN	0	0	0	0	0	0	0	0	0	0	0	0	0
MINNESOTA	0	0	0	0	0	1	0	0	0	0	0	0	1
MISSISSIPPI	0	0	0	0	0	2	0	0	0	0	0	0	2
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	0	0	0	0	0	0	0
NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW YORK	0	0	0	0	0	0	0	0	0	0	0	0	0
NORTH CAROLINA	0	0	0	0	0	1	3	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	0	0	0	0	0	0	0	0	0
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	1	0	0	0	1
PUERTO RICO	0	0	0	0	0	0	1	0	0	0	0	0	1
RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	0	0	0	0	0	0	0	3	0	0	0	0	3
SOUTH DAKOTA	0	0	0	0	0	1	0	0	0	0	0	0	1
TENNESSEE	0	0	0	0	0	1	1	2	0	0	0	0	4
TEXAS	0	0	0	1	0	1	2	1	0	0	0	0	5
UTAH	0	0	0	0	0	0	0	3	0	0	0	0	3
VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	0	0	0	0	0	1	0	0	0	0	0	0	1
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0	2	0	0	0	0	0	2
WISCONSIN	0	0	0	0	0	1	0	0	0	0	0	0	1
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	0	0	0	2	8	15	23	19	5	0	0	0	72

TOTAL INJURIES BY STATE AND NATION FOR YEAR 1991

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	0	0	3	0	17	4	0	0	0	0	24
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	0	0	1	12	0	0	0	0	13
ARKANSAS	0	0	0	14	0	4	1	1	3	0	0	0	23
CALIFORNIA	0	0	0	0	0	0	0	0	3	0	0	0	3
COLORADO	0	0	0	2	5	14	0	2	1	0	0	0	24
CONNECTICUT	0	0	0	0	0	0	0	0	0	0	0	0	0
DELAWARE	0	0	0	0	0	0	1	0	0	0	0	0	1
DISTRICT OF COLUMBIA	0	0	0	0	10	0	0	0	0	0	0	0	10
FLORIDA	0	0	0	3	15	21	21	31	2	0	0	0	93
GEORGIA	0	0	0	2	0	11	1	4	1	0	0	0	19
HAWAII	0	0	0	0	0	0	0	2	0	0	0	0	2
IDAHO	0	0	0	0	0	0	0	2	0	0	0	0	2
ILLINOIS	0	0	2	0	4	10	6	0	6	0	0	0	28
INDIANA	0	0	0	0	0	0	4	9	4	0	0	0	17
IOWA	0	0	0	0	0	0	0	1	0	0	0	0	1
KANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0
KENTUCKY	0	0	0	0	2	2	2	0	0	0	0	0	6
LOUISIANA	0	0	0	1	1	1	2	3	1	0	0	0	9
MAINE	0	0	0	0	0	7	0	1	0	0	0	0	8
MARYLAND	0	0	0	0	0	0	1	1	2	0	0	0	4
MASSACHUSETTS	0	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN	0	0	0	0	2	0	2	4	0	0	0	0	8
MINNESOTA	0	0	0	0	0	11	4	0	0	0	0	0	15
MISSISSIPPI	0	0	0	0	0	2	2	0	0	0	0	0	4
MISSOURI	0	0	0	0	0	0	0	0	6	0	0	0	6
MONTANA	0	0	0	0	0	5	0	0	0	0	0	0	5
NEBRASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
NEVADA	0	0	0	0	0	0	0	1	0	0	0	0	1
NEW HAMPSHIRE	0	0	0	0	0	1	1	0	0	0	0	0	2
NEW JERSEY	0	0	0	0	0	0	1	2	0	0	0	0	3
NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW YORK	0	0	0	0	1	10	1	6	0	0	0	0	18
NORTH CAROLINA	0	0	0	0	0	1	3	7	1	0	0	0	12
NORTH DAKOTA	0	0	0	0	0	0	2	1	0	0	0	0	3
OHIO	0	0	0	0	0	3	1	1	3	0	0	0	8
OKLAHOMA	0	0	0	1	0	0	0	0	0	0	0	0	1
OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	0	0	0	0	0	0	3	0	2	0	0	0	5
PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0
RHODE ISLAND	0	0	0	0	1	0	0	0	0	0	0	0	1
SOUTH CAROLINA	0	0	0	3	0	2	1	2	0	0	0	0	8
SOUTH DAKOTA	0	0	0	0	0	1	3	1	0	0	0	0	5
TENNESSEE	0	0	0	2	0	0	3	2	1	1	0	0	9
TEXAS	0	0	0	0	0	0	0	3	0	2	0	0	5
UTAH	0	0	0	0	1	0	0	3	0	0	0	0	4
VERMONT	0	0	0	0	0	0	0	1	0	0	0	0	1
VIRGINIA	0	0	0	2	1	4	2	0	0	0	0	0	9
WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	0	0	0	0	0	0	2	0	0	0	0	0	2
WISCONSIN	0	0	0	0	2	1	6	0	0	0	0	0	9
WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: UNITED STATES	0	0	2	30	48	111	94	107	36	3	0	0	431

TOTAL DEATHS BY STATE AND NATION FOR PERIOD 1959-91

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	0	0	2	2	5	23	28	20	1	1	0	0	82
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	0	0	0	0	2	1	23	15	12	1	0	0	54
ARKANSAS	0	0	8	0	13	32	28	20	6	0	0	1	108
CALIFORNIA	0	0	0	0	0	2	8	5	5	0	0	0	20
COLORADO	0	0	0	2	10	20	38	16	1	1	0	0	88
CONNECTICUT	0	0	0	0	0	4	5	3	1	0	0	0	13
DELAWARE	0	0	0	0	2	2	7	3	0	0	0	0	14
DISTRICT OF COLUMBIA	0	0	0	0	1	2	1	1	0	0	0	0	5
FLORIDA	0	0	5	4	28	79	85	83	38	4	1	1	328
GEORGIA	0	0	2	5	6	18	32	12	2	1	0	0	78
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	10	23	13	14	11	2	0	0	77
INDIANA	0	0	1	2	8	21	17	13	5	2	0	0	69
IOWA	0	0	1	3	11	20	6	13	4	4	0	0	62
KANSAS	0	0	0	4	10	7	14	12	4	2	2	0	55
KENTUCKY	1	0	0	3	10	21	17	14	10	0	0	0	76
LOUISIANA	1	0	1	5	10	21	42	16	11	0	4	1	112
MAINE	0	0	0	0	0	3	6	9	0	3	0	0	21
MARYLAND	0	0	0	0	4	5	10	11	1	1	0	81*	113
MASSACHUSETTS	0	0	0	1	3	4	6	9	7	0	0	0	24
MICHIGAN	0	0	0	1	7	22	28	23	7	0	0	0	88
MINNESOTA	0	0	0	3	3	11	11	13	10	1	0	0	52
MISSISSIPPI	1	0	4	2	12	14	27	21	6	0	0	0	87
MISSOURI	0	0	5	4	20	19	14	8	3	1	0	0	74
MONTANA	0	0	0	0	2	8	6	2	1	0	0	0	19
NEBRASKA	0	0	0	1	3	15	8	6	4	0	0	0	37
NEVADA	0	0	0	0	0	2	0	2	1	0	0	0	5
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	20	61	26	6	2	0	0	124
NORTH CAROLINA	0	1	5	3	23	37	54	35	5	0	0	0	163
NORTH DAKOTA	0	0	0	0	0	4	4	3	0	0	0	0	11
OHIO	0	0	0	3	10	22	43	17	10	2	2	0	109
OKLAHOMA	1	1	1	10	14	13	7	20	13	3	2	0	85
OREGON	0	0	0	0	2	0	0	1	2	1	0	0	6
PENNSYLVANIA	0	1	0	1	8	26	29	25	9	1	0	0	100
PUERTO RICO	0	0	0	0	0	3	9	9	5	3	0	0	29
RHODE ISLAND	0	0	0	0	0	1	1	0	2	0	0	0	4
SOUTH CAROLINA	0	0	1	0	6	11	31	16	7	0	0	0	72
SOUTH DAKOTA	0	0	0	0	4	2	6	1	3	3	0	0	19
TENNESSEE	0	1	1	7	15	32	25	21	14	2	3	0	121
TEXAS	0	0	1	15	29	19	41	24	16	7	1	0	153
UTAH	0	0	0	3	1	5	8	9	2	1	0	0	29
VERMONT	0	0	0	0	0	4	5	4	0	1	0	0	13
VIRGINIA	0	0	0	0	10	10	11	10	3	0	0	0	44
WASHINGTON	0	0	0	0	0	1	0	0	0	0	0	0	1
WEST VIRGINIA	0	0	0	0	4	2	10	3	1	0	0	0	20
WISCONSIN	0	0	1	1	2	9	12	15	2	1	1	1	45
WYOMING	0	0	0	0	2	4	7	6	2	0	0	0	21
TOTAL: UNITED STATES	4	4	39	92	328	652	897	657	259	50	16	85	3083

* 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 1959-91

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ALABAMA	6	1	10	3	11	24	76	52	2	4	0	0	189
ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	2	0	0	0	6	1	30	36	18	3	0	0	96
ARKANSAS	1	2	2	27	31	41	38	61	13	1	0	2	219
CALIFORNIA	1	0	0	13	0	2	15	7	13	1	1	1	54
COLORADO	0	0	0	0	33	79	75	55	11	0	0	0	256
CONNECTICUT	0	0	2	3	7	20	17	11	6	3	0	0	66
DELAWARE	0	0	0	0	8	12	4	1	0	0	0	0	27
DISTRICT OF COLUMBIA	0	0	0	0	10	4	1	1	0	0	1	0	17
FLORIDA	0	2	17	19	45	211	242	221	149	28	0	1	935
GEORGIA	0	0	5	9	22	76	125	39	4	5	0	0	285
HAWAII	0	0	0	0	0	0	0	3	0	0	0	0	3
IDAHO	0	0	0	1	6	17	15	21	4	1	0	0	65
ILLINOIS	12	0	2	2	21	53	69	48	34	2	0	0	243
INDIANA	0	0	2	4	21	32	39	34	5	0	0	0	137
IOWA	0	0	2	9	22	45	40	19	16	3	1	0	157
KANSAS	0	0	5	11	18	26	45	31	29	5	1	0	171
KENTUCKY	0	0	0	2	22	62	61	36	10	1	0	0	194
LOUISIANA	1	0	6	3	15	18	101	42	15	2	2	1	206
MAINE	0	0	0	0	4	12	28	54	0	0	1	0	99
MARYLAND	0	0	0	0	36	20	36	21	8	2	0	0	123
MASSACHUSETTS	0	0	1	11	21	44	108	75	26	4	2	1	293
MICHIGAN	0	0	2	9	41	141	129	209	47	6	0	0	584
MINNESOTA	0	0	0	0	15	29	28	20	9	4	0	0	105
MISSISSIPPI	1	2	8	3	13	15	109	40	10	2	3	1	207
MISSOURI	0	1	3	8	20	16	4	15	9	2	4	0	82
MONTANA	0	0	0	0	5	14	10	11	2	0	0	0	42
NEBRASKA	0	0	0	4	14	8	13	16	6	0	0	0	61
NEVADA	0	0	0	0	0	2	1	4	1	0	0	0	8
NEW HAMPSHIRE	0	0	0	0	2	21	32	5	2	0	0	0	62
NEW JERSEY	0	0	0	0	5	11	54	21	16	0	0	0	107
NEW MEXICO	0	0	0	1	19	15	57	51	6	0	0	0	149
NEW YORK	0	0	0	1	18	77	147	136	25	4	1	0	409
NORTH CAROLINA	0	2	29	15	42	75	119	123	30	2	1	0	438
NORTH DAKOTA	0	0	0	0	2	3	4	6	4	0	0	0	19
OHIO	0	0	32	3	56	57	63	107	53	4	12	0	387
OKLAHOMA	1	1	3	17	32	38	33	39	23	19	5	2	213
OREGON	0	0	0	1	2	2	0	9	5	0	0	0	19
PENNSYLVANIA	0	6	0	0	22	113	123	136	47	2	0	0	449
PUERTO RICO	0	0	0	0	0	0	3	0	2	1	0	0	6
RHODE ISLAND	0	2	0	0	2	13	12	12	3	0	1	0	45
SOUTH CAROLINA	0	0	0	6	21	24	101	37	22	1	1	0	213
SOUTH DAKOTA	0	0	0	1	4	19	18	10	1	2	0	0	55
TENNESSEE	0	1	4	8	31	60	112	54	21	5	0	0	296
TEXAS	1	2	7	39	45	48	37	49	30	12	2	0	272
UTAH	0	0	0	1	5	19	17	17	4	2	0	0	65
VERMONT	0	0	0	0	0	3	11	3	0	0	0	0	17
VIRGINIA	0	0	1	4	9	21	92	33	7	0	0	0	167
WASHINGTON	0	0	0	0	5	1	7	8	0	1	0	1	23
WEST VIRGINIA	0	0	0	1	0	4	9	26	1	1	0	0	82
WISCONSIN	0	1	2	4	20	27	65	43	7	2	2	0	173
WYOMING	0	0	0	0	4	32	18	21	6	0	0	0	81
TOTAL: UNITED STATES	26	23	145	243	813	1707	2633	2129	764	137	41	10	8671

NATIONAL TOTAL DEATHS BY YEAR FOR PERIOD 1959-91

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	2	0	69
1989	0	0	1	1	9	14	19	18	4	1	0	0	67
1990	1	0	3	1	3	18	22	15	10	0	0	1	74
1991	0	0	0	2	8	15	23	19	5	0	0	0	72
TOTAL	4	4	39	92	328	652	897	657	259	50	16	85	3083
MEAN	0	0	1	3	10	20	27	20	8	2	0	3	93

* 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 1959-91

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	1	1	0	259
1971	0	1	0	1	24	71	79	54	22	1	0	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
1990	12	0	4	6	10	43	88	62	25	1	0	1	252
1991	0	0	2	30	48	111	94	107	36	3	0	0	431
TOTAL	26	23	145	243	813	1707	2633	2129	764	137	41	10	8671
MEAN	1	1	4	7	25	52	80	65	23	4	1	0	263

LIGHTNING DEATHS BY STATE, RANK, AND LOCATION OF OCCURRENCE

1959-1991

1991

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	15	19	23	21	26	8	10	4	5	1	1	2	2	27	33	0	0	3	100	0	0	0	0	0	0	0	0	0		
ALASKA	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
ARIZONA	26	25	46	6	11	5	9	0	0	4	7	3	6	11	20	4	100	0	0	0	0	0	0	0	0	0	0	0		
ARKANSAS	9	35	32	21	19	11	10	8	7	3	3	0	0	30	28	1	33	2	67	0	0	0	0	0	0	0	0	0		
CALIFORNIA	37	5	25	3	15	2	10	3	15	0	0	0	0	7	35	0	0	0	0	0	0	2	100	0	0	0	0			
COLORADO	12	43	49	18	20	4	5	3	3	5	6	0	0	15	17	1	50	0	0	0	0	0	0	0	0	0	1	50		
CONNECTICUT	42	3	23	2	15	0	0	0	0	3	23	0	0	5	38	0	0	0	0	0	0	0	0	0	0	0	0	0		
DELAWARE	41	4	29	0	0	4	29	1	7	0	0	0	0	5	36	0	0	0	0	0	0	0	0	0	0	0	0	0		
DISTRICT OF COLUMBIA	48	2	40	2	40	0	0	0	0	1	20	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0		
FLORIDA	1	87	27	44	13	83	25	21	6	10	3	0	0	83	25	2	13	3	20	8	53	0	0	1	7	0	0	1	7	
GEORGIA	16	22	28	20	26	11	14	1	1	5	6	2	3	17	22	2	67	1	33	0	0	0	0	0	0	0	0	0		
HAWAII	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
IDAHO	38	11	58	3	16	2	11	2	11	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
ILLINOIS	17	17	22	12	16	3	4	8	10	7	9	1	1	29	38	1	50	0	0	0	0	1	50	0	0	0	0	0		
INDIANA	22	11	16	20	29	6	9	6	9	1	1	2	3	23	33	2	100	0	0	0	0	0	0	0	0	0	0	0		
IOWA	23	8	13	8	13	1	2	6	10	2	3	0	0	37	60	0	0	0	0	0	0	1	100	0	0	0	0	0		
KANSAS	24	15	27	1	2	4	7	10	18	2	4	0	0	23	42	0	0	0	0	0	0	0	0	0	0	0	0	0		
KENTUCKY	18	21	28	10	13	4	5	3	4	2	3	1	1	35	46	0	0	0	0	0	0	0	0	1	100	0	0	0	0	
LOUISIANA	7	15	13	31	28	36	32	8	7	0	0	0	0	22	20	0	0	0	0	1	100	0	0	0	0	0	0	0		
MAINE	34	0	0	3	14	7	33	0	0	0	0	0	0	11	52	0	0	0	0	1	100	0	0	0	0	0	0	0		
MARYLAND *	6	9	8	5	4	15	13	0	0	0	0	0	0	84	74	0	0	0	0	2	100	0	0	0	0	0	0	0	0	
MASSACHUSETTS	33	4	17	3	13	1	4	0	0	1	4	1	4	14	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MICHIGAN	11	24	27	23	26	10	11	2	2	10	11	2	2	17	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MINNESOTA	27	16	31	13	25	5	10	6	12	1	2	2	4	9	17	0	0	1	100	0	0	0	0	0	0	0	0	0	0	
MISSISSIPPI	13	29	33	21	24	10	11	5	6	0	0	0	0	22	25	0	0	1	50	1	50	0	0	0	0	0	0	0	0	
MISSOURI	19	16	22	17	23	10	14	5	7	3	4	2	3	21	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
MONTANA	39	7	37	2	11	2	11	4	21	0	0	0	0	4	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEBRASKA	30	16	43	2	5	3	8	10	27	0	0	0	0	6	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEVADA	47	0	0	0	0	1	20	0	0	0	0	0	0	4	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEW HAMPSHIRE	45	2	33	0	0	1	17	0	0	1	17	0	0	2	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEW JERSEY	25	18	33	5	9	13	24	2	4	4	7	2	4	10	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEW MEXICO	20	35	47	13	18	6	8	0	0	1	1	0	0	19	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NEW YORK	4	20	16	31	25	17	14	4	3	5	4	1	1	46	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
NORTH CAROLINA	2	34	21	24	15	22	13	6	4	7	4	1	1	69	42	0	0	2	50	1	25	0	0	1	25	0	0	0	0	
NORTH DAKOTA	44	2	18	0	0	0	0	3	27	0	0	0	0	6	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OHIO	8	33	30	20	18	15	14	6	6	7	6	1	1	27	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OKLAHOMA	14	30	35	11	13	15	18	6	7	1	1	2	2	20	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OREGON	46	3	50	0	0	0	0	0	0	0	0	0	0	3	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	10	30	30	13	13	3	3	3	3	11	11	2	2	38	38	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0
PUERTO RICO	32	11	36	8	28	1	3	0	0	0	0	0	0	9	31	0	0	0	0	0	0	0	0	0	0	0	0	1	100	
RHODE ISLAND	49	0	0	0	0	1	25	0	0	0	0	0	0	3	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	21	16	22	15	21	6	8	8	11	1	1	3	4	23	32	1	33	1	33	0	0	1	33	0	0	0	0	0	0	0
SOUTH DAKOTA	40	5	26	1	5	2	11	8	42	1	5	0	0	2	11	0	0	0	0	0	0	0	0	0	0	0	0	1	100	
TENNESSEE	5	33	27	32	26	9	7	9	7	7	6	2	2	29	24	1	25	1	25	0	0	0	0	0	0	0	0	1	25	
TEXAS	3	64	42	24	16	22	14	9	6	4	3	0	0	30	20	1	20	0	0	2	40	1	20	0	0	0	0	1	20	
UTAH	31	11	38	9	31	2	7	0	0	1	3	1	3	5	17	0	0	3	100	0	0	0	0	0	0	0	0	0	0	0
VERMONT	43	1	8	1	8	4	31	0	0	0	0	0	0	7	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	29	8	18	9	20	6	14	3	7	2	5	0	0	16	36	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0
WASHINGTON	50	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	36	6	30	4	20	2	10	0	0	1	5	0	0	7	35	0	0	2	100	0	0	0	0	0	0	0	0	0	0	0
WISCONSIN	28	8	18	3	7	9	20	4	9	6	13	0	0	15	33	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0
WYOMING	35	11	52	2	10	3	14	1	5	0	0	0	0	4	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	0	846	27	536	17	407	13	188	6	122	4	33	1	951	31	18	25	20	28	18	25	6	8	3	4	1	1	6	8	

* 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

1959-1991

1991

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	19	57	30	42	22	3	2	1	1	1	1	10	5	75	40	4	17	19	79	0	0	0	0	0	0	0	0	1	4
ALASKA	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARIZONA	30	62	65	6	6	2	2	5	5	1	1	0	0	20	21	13	100	0	0	0	0	0	0	0	0	0	0	0	0
ARKANSAS	13	48	22	28	13	12	5	7	3	4	2	11	5	109	50	6	26	3	13	0	0	0	0	0	0	0	14	61	
CALIFORNIA	40	11	20	10	19	5	9	2	4	0	0	0	0	26	48	1	33	0	0	0	0	2	67	0	0	0	0	0	
COLORADO	11	103	40	25	10	17	7	7	3	16	6	3	1	85	33	11	46	7	29	2	8	1	4	0	0	0	0	3	13
CONNECTICUT	34	6	9	22	33	4	6	0	0	3	5	3	5	28	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELAWARE	43	9	33	10	37	0	0	0	0	0	0	2	7	6	22	1	100	0	0	0	0	0	0	0	0	0	0	0	0
DISTRICT OF COLUMBIA	47	11	65	3	18	0	0	1	6	1	6	0	0	1	6	10	100	0	0	0	0	0	0	0	0	0	0	0	0
FLORIDA	1	304	33	85	9	142	15	25	3	39	4	23	2	317	34	28	30	2	2	25	27	2	2	9	10	2	2	25	27
GEORGIA	9	107	38	35	12	20	7	3	1	21	7	4	1	95	33	12	63	2	11	0	0	0	0	0	0	0	5	26	
HAWAII	51	2	67	0	0	0	0	0	0	0	0	1	33	0	0	1	50	0	0	0	0	0	0	0	0	1	50	0	0
IDAHO	35	11	17	7	11	2	3	2	3	2	3	4	6	37	57	2	100	0	0	0	0	0	0	0	0	0	0	0	0
ILLINOIS	12	90	37	60	25	1	0	9	4	16	7	9	4	58	24	18	64	5	18	0	0	4	14	0	0	1	4	0	0
INDIANA	25	21	15	30	22	12	9	7	5	8	6	3	2	56	41	5	29	0	0	0	0	4	24	0	0	0	0	8	47
IOWA	23	28	18	20	13	1	1	1	1	2	1	2	1	103	66	1	100	0	0	0	0	0	0	0	0	0	0	0	0
KANSAS	21	26	15	14	8	2	1	7	4	10	6	7	4	105	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENTUCKY	18	55	28	23	12	9	5	4	2	13	7	7	4	83	43	0	0	0	0	2	33	1	17	2	33	0	0	1	17
LOUISIANA	17	95	46	32	16	19	9	4	2	0	0	2	1	54	26	2	22	1	11	1	11	0	0	0	0	0	5	56	
MAINE	29	4	4	39	39	4	4	0	0	1	1	2	2	49	49	1	13	6	75	1	13	0	0	0	0	0	0	0	0
MARYLAND *	26	48	39	16	13	16	13	4	3	3	2	1	1	35	28	3	75	0	0	1	25	0	0	0	0	0	0	0	0
MASSACHUSETTS	8	58	20	12	4	9	3	5	2	2	1	5	2	202	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MICHIGAN	2	220	38	103	18	26	4	15	3	31	5	17	3	172	29	1	13	4	50	0	0	2	25	1	13	0	0	0	0
MINNESOTA	28	14	13	19	18	6	6	5	5	12	11	11	10	38	36	0	0	5	33	0	0	4	27	4	27	0	0	2	13
MISSISSIPPI	16	71	34	38	18	29	14	2	1	4	2	15	7	48	23	0	0	0	0	2	50	0	0	0	0	2	50	0	0
MISSOURI	31	27	33	16	20	1	1	1	1	3	4	3	4	31	38	4	67	0	0	0	0	0	0	2	33	0	0	0	0
MONTANA	42	14	33	5	12	8	19	1	2	3	7	0	0	11	26	0	0	0	0	5	100	0	0	0	0	0	0	0	0
NEBRASKA	38	21	34	1	2	0	0	5	8	5	8	5	8	24	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEVADA	49	3	38	1	13	0	0	0	0	0	0	0	0	4	50	1	100	0	0	0	0	0	0	0	0	0	0	0	0
NEW HAMPSHIRE	37	11	18	1	2	0	0	1	2	4	6	1	2	44	71	0	0	0	0	0	0	1	50	0	0	1	50	0	0
NEW JERSEY	27	51	48	0	0	8	7	1	1	5	5	2	2	40	37	2	67	0	0	0	0	0	0	0	0	0	1	33	
NEW MEXICO	24	93	62	21	14	2	1	3	2	3	2	1	1	26	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEW YORK	5	44	11	96	23	24	6	22	5	6	1	9	2	208	51	0	0	15	83	0	0	0	0	0	0	0	3	17	
NORTH CAROLINA	4	137	31	34	8	28	6	9	2	22	5	8	2	200	46	0	0	0	0	1	8	0	0	1	8	0	0	10	83
NORTH DAKOTA	46	6	32	1	5	1	5	2	11	0	0	1	5	8	42	1	33	0	0	0	0	0	0	0	0	0	2	67	
OHIO	6	91	24	80	21	10	3	4	1	32	8	11	3	159	41	1	13	0	0	0	0	0	0	0	0	0	7	88	
OKLAHOMA	15	78	37	12	6	9	4	10	5	2	2	16	8	83	39	0	0	0	0	0	0	0	0	0	0	0	0	1	100
OREGON	45	6	32	0	0	0	0	1	5	0	0	1	5	11	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENNSYLVANIA	3	156	35	19	4	5	1	2	0	9	2	5	1	253	56	3	60	0	0	0	0	0	0	0	0	1	20	1	20
PUERTO RICO	50	1	17	1	17	0	0	0	0	0	0	0	0	4	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RHODE ISLAND	41	10	22	15	33	0	0	0	0	2	4	0	0	18	40	1	100	0	0	0	0	0	0	0	0	0	0	0	0
SOUTH CAROLINA	14	56	26	13	6	10	5	7	3	2	1	5	2	120	56	0	0	1	13	0	0	0	0	0	0	0	7	88	
SOUTH DAKOTA	39	10	18	5	9	2	4	9	16	0	0	2	4	27	49	0	0	0	0	0	0	0	0	0	0	1	20	4	80
TENNESSEE	7	91	31	80	27	4	1	7	2	8	3	11	4	95	32	3	33	0	0	0	0	0	0	0	0	0	6	67	
TEXAS	10	110	40	36	13	32	12	5	2	4	1	6	2	79	29	1	20	0	0	0	0	0	0	0	0	2	40	2	40
UTAH	36	26	40	14	22	3	5	1	2	4	6	3	5	14	22	2	50	2	50	0	0	0	0	0	0	0	0	0	0
VERMONT	48	5	29	1	6	0	0	0	0	0	0	0	0	11	65	1	100	0	0	0	0	0	0	0	0	0	0	0	0
VIRGINIA	22	16	10	35	21	8	5	2	1	7	4	3	2	96	57	2	22	0	0	1	11	1	11	0	0	0	5	56	
WASHINGTON	44	3	13	4	17	0	0	0	0	0	0	2	9	14	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST VIRGINIA	32	15	18	11	13	3	4	1	1	2	2	1	1	49	60	0	0	2	100	0	0	0	0	0	0	0	0	0	0
WISCONSIN	20	65	38	8	5	4	2	3	2	6	3	6	3	81	47	8	89	0	0	0	0	0	0	0	0	1	11	0	0
WYOMING	33	39	48	3	4	13	16	8	10	4	5	0	0	14	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	0	2646	31	1192	14	516	6	221	3	326	4	244	3	3526	41	150	35	74	17	41	10	22	5	19	4	12	3	113	26



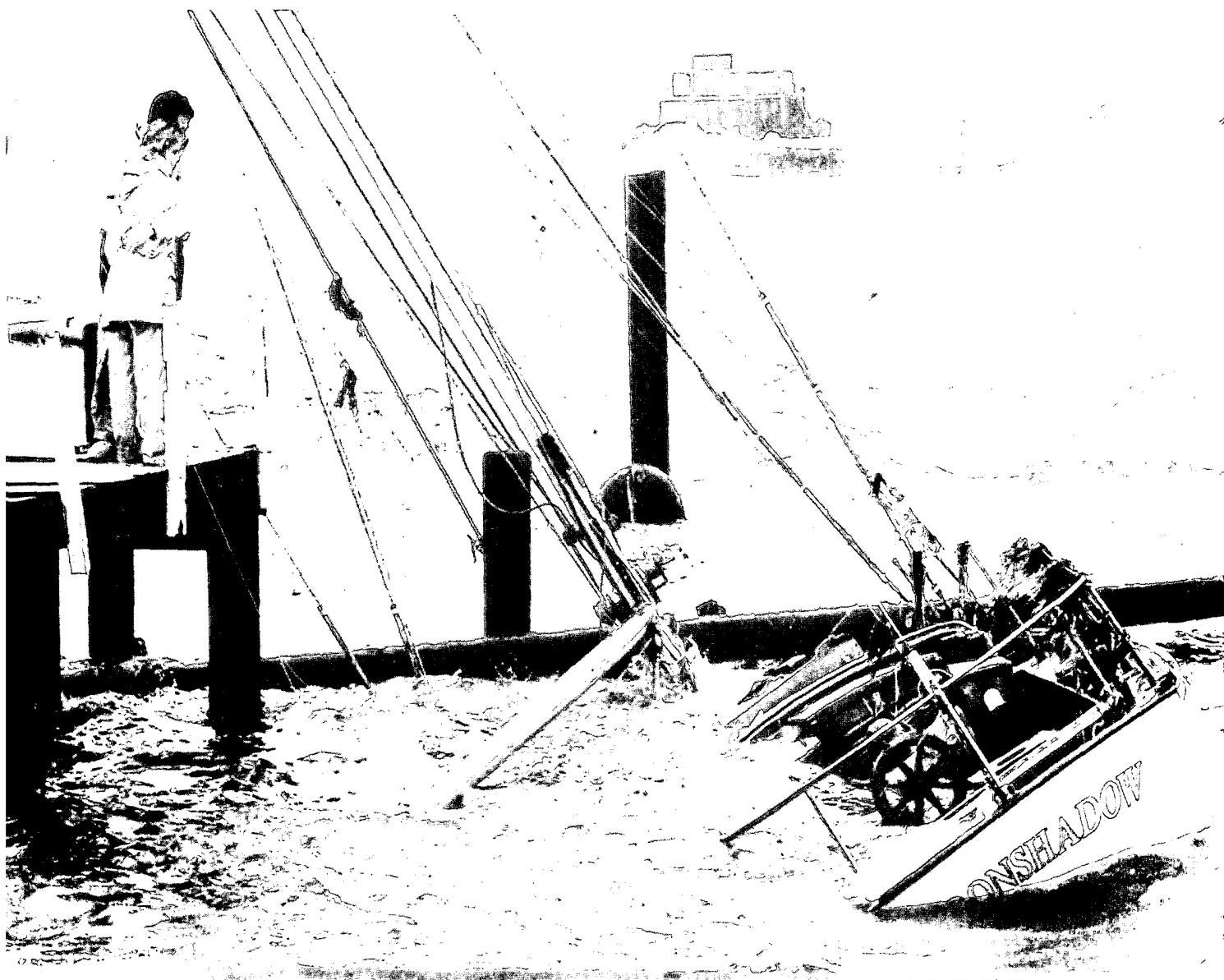
North Atlantic Hurricanes— 1991

Lixion A. Avila and Richard J. Pasch

The 1991 hurricane season was characterized by high-latitude tropical cyclone origins and tracks, only one U.S. landfall and no tropical storms or hurricanes in the Gulf of Mexico. This lack of Gulf of Mexico

tropical storms and hurricanes is a rare event that has occurred only two other times this century (1927 and 1962).

There were eight tropical storms, four of which became hurricanes. The long-term average is ten and six respectively. Additional-



The Boston Globe/ Bill Greene

Hurricane Bob created some problems and heartbreak in Woods Hole, MA and other areas along the New England coast. A couple find comfort in each others' arms after finding their sailboat swamped at its mooring (page 14), while an unidentified woman struggles against the wind and rain (right).



The Boston Globe/ Bill Greene

ly, there were four tropical depressions which did not become named storms. The 1991 tropical cyclone activity was markedly decreased from the 1990 season's total of 14 tropical storms of which eight became hurricanes. The subtropical North Atlantic region, within several hundred nautical miles southwest through southeast of Bermuda, was a *hot spot* for development this year.

Since the majority of the tracks were over open waters, ship observations along with satellite coverage continued to be of vital

Lixion Avila and Richard Pasch are Hurricane Specialists at NOAA's National Hurricane Center (NHC) in Miami, FL. Hal Gerrish, Miles Lawrence, Max Mayfield and Ed Rappaport from NHC also contributed to this report.

importance in monitoring tropical systems. The strongest winds associated with a tropical system came from an unidentified ship during Hurricane Bob on August 19 at 1200 UTC. It is interesting to note that the most significant observations of winds and seas during the 1991 season came from vessels which encountered a late season, non-tropical storm, which ultimately evolved into an unnamed hurricane.

Note that tropical cyclone positions given in this report refer to the location of the center. Tropical cyclones generally cover thousands of square miles and affect areas far from the center.

Tropical Storm Ana

Ana, the first tropical storm of the season, developed about 85 nautical miles south of Charleston, South Carolina, accelerated north-eastward and became extratropical over open waters. The strongest

ship-reported winds associated with Ana were 45 knots from a vessel about 20 nautical miles south of the center on the 4th of July. On the 5th, another vessel, the *Loyalty*, encountered the storm and observed 35-knot winds.

Hurricane Bob

Bob was the only hurricane to make landfall in the United States this season, causing the deaths of 18 people and damage estimated at \$1.5 billion. This makes Bob the most recent in a series of hurricanes that have caused damage exceeding \$1 billion in the eastern United States.

Bob originated from a large area of disturbed weather associated with the remnants of a frontal trough near Bermuda. It became a tropical depression on the 16th of August, when centered 175 nautical miles east of Nassau in the Bahamas, and was upgraded to a tropical storm on that same day.

1991 North Atlantic Hurricanes and Tropical Storms

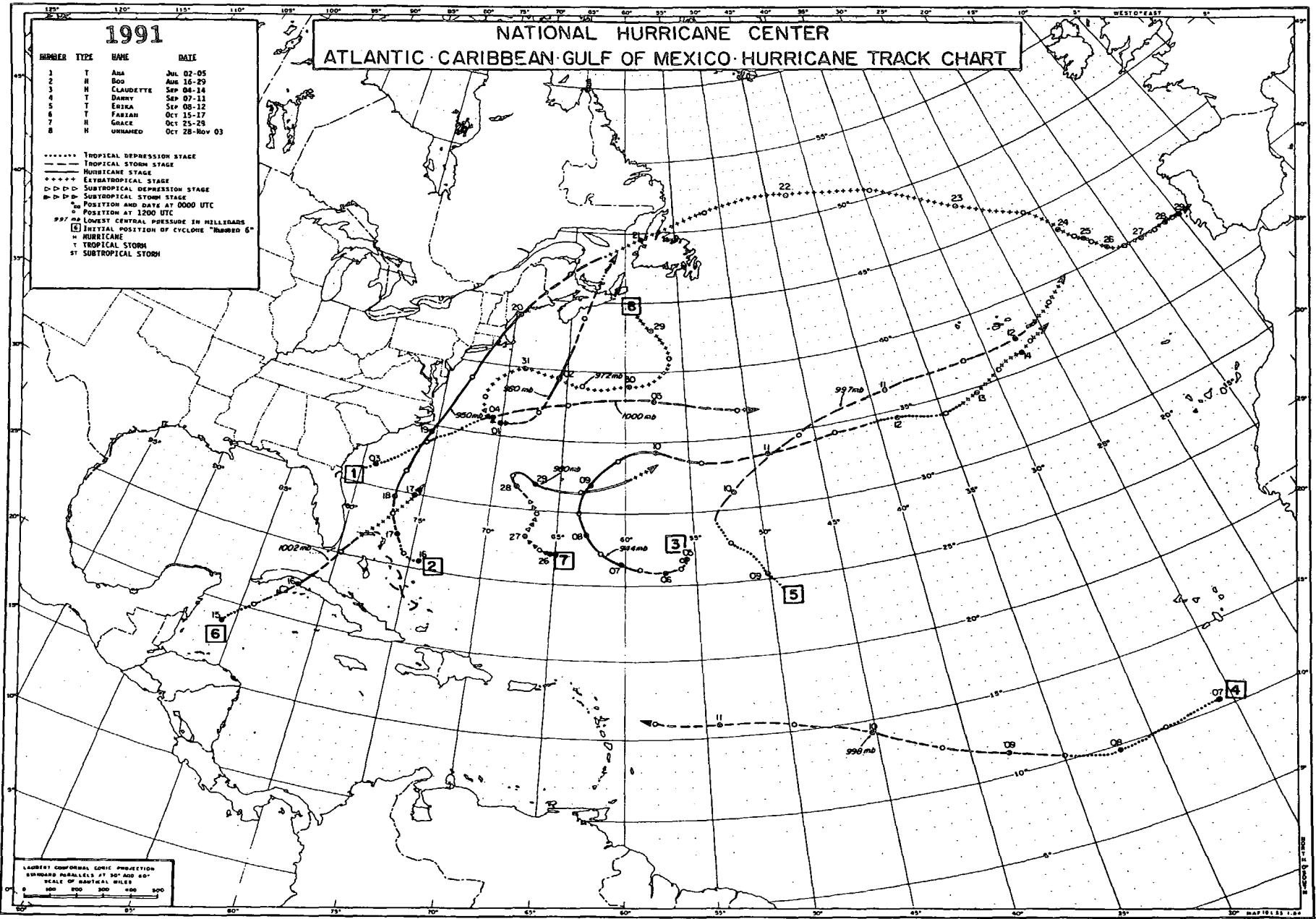
Name	Class ^a	Dates ^b	Maximum sustained wind (knots) ^c	Lowest pressure (mb)	U.S. damage (\$billions)	Deaths ^d
Ana	T	7/02-7/05	45	1000	—	—
Bob	H	8/16-8/29	100	950	1.5	18
Claudette	H	9/04-9/14	115	944	—	—
Danny	T	9/07-9/11	45	998	—	—
Erika	T	9/08-9/12	50	997	—	—
Fabian	T	10/15-10/17	40	1002	—	—
Grace	H	10/25-10/29	90	980	—	—
Unnamed	H	10/28-11/02	65	980	—	—

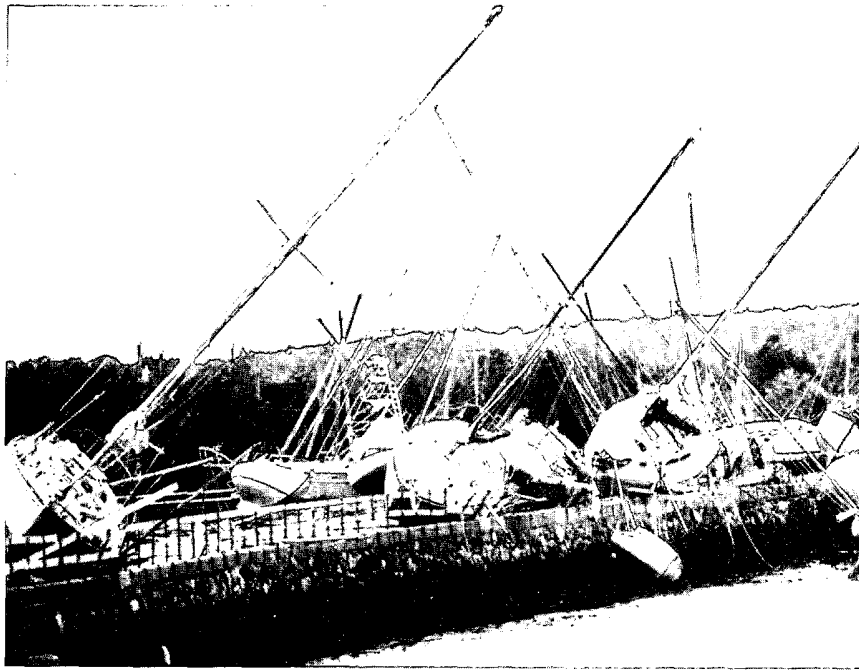
^aTropical storm, wind speed 34-63 knots. H-hurricane, wind speed 64 knots or higher.
^bDates begin at 0000 Universal Time and include tropical depression stage.
^cWind speed over a one-minute span.
^dIncludes deaths outside the United States.

Tropical Cyclone Winds (Ship encounters of 34 Knots or higher)

Tropical Cyclone	Ship Name	Date Mo/Da	Time UTC	Position LatN LonW	Wind(kn) Dir/Speed	Pressure (mb)
Ana	unknown	7/4	0900	37.0 66.5	240/45	1003.0
	Loyalty	7/5	0000	37.0 57.4	220/35	1003.1
Bob	Banko Pioneer	8/16	1800	26.0 72.9	170/44	1016.0
	Mangal Desai	8/18	1800	30.1 77.8	260/35	1011.5
	Chablis	8/18	1800	32.1 78.9	330/35	1008.1
	unknown	8/18	1800	33.0 74.4	190/44	1008.0
	unknown	8/19	1200	38.0 74.5	330/60	1002.2
Claudette	Mar Transporter II	9/9	1800	32.5 58.0	240/34	1014.0
	Beursgracht	9/10	0900	32.2 56.6	290/40	1014.8
	unknown	9/10	0900	33.4 55.1	260/45	1002.0
	Allegro	9/11	1200	34.9 44.6	360/37	1013.2
Grace	Holstencarrier	9/26	1800	29.4 67.5	020/40	1003.5
	Walter Jacob *	9/27	0300	27.7 68.2	290/35	1000.0
	Dekabrist	9/27	0600	30.3 68.2	060/43	1000.5
	Walter Jacob *	9/27	0900	27.4 69.8	330/35	1003.0
	Pato Bolo	9/27	1000	29.4 71.8	060/45	—
	Holstencarrier	9/27	1200	31.9 70.8	020/40	1010.0
	Oleander	9/27	1800	33.7 65.9	090/35	1007.0
	Golden Endeavour	9/27	1800	28.0 58.5	130/35	1014.7
	Cape Hudson	9/27	2100	29.3 64.5	170/40	1003.5
	Cape Hudson	9/28	0000	29.1 65.2	190/40	1004.0
	Cape Hudson	9/28	0300	29.1 66.4	220/45	1003.5
	Oleander	9/28	0600	32.1 64.7	080/48	1003.5
	Durian Queen	9/28	0900	36.2 72.9	360/35	1008.5
	X7	9/28	1200	31.2 70.9	310/35	1002.5
	Durian Queen	9/28	1800	29.3 71.6	320/35	1006.5
	XC67	9/28	1800	32.7 71.3	340/40	1004.5
	9110	9/28	1800	33.3 73.1	350/35	—
	Overseas Valdez	9/28	2100	30.7 72.9	310/40	—
	Humbergricht	9/29	1200	31.5 57.5	190/45	1004.7
Unnamed	YFA7	10/31	1200	38.5 72.3	010/41	1000.5
	Sea Commerce	11/1	0000	33.9 70.1	270/40	1004.5
	CFL Atlas	11/2	0600	40.9 66.7	020/45	1006.5

* tentative identification





The Boston Globe/ David L. Ryan

a 38-foot sailboat were trapped in Bob's circulation off Cape Hatteras and managed to survive after struggling for 10 days on a life raft. They were finally rescued by the Coast Guard and Navy off the New Jersey coast.

Hurricane Claudette

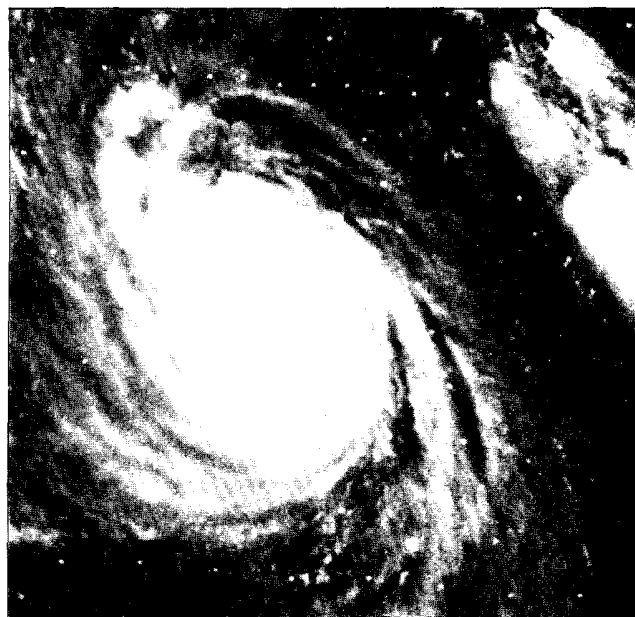
Claudette spent its life over open water and had the distinction of being the strongest hurricane of the season. It was spawned from a disturbance of non-tropical origin in the area southeast of Bermuda. After the system became a tropical depression on the 4th of September, it rapidly reached hurricane strength. Claudette further intensified to estimated maximum winds and minimum pressure of 115 knots and 944 millibars, respectively, on September 7. Claudette threatened Bermuda for awhile but it turned eastward away from the island. No ship had the misfortune to encounter the eye of this small but violent hurricane. Later, on the 9th, a ship passed south and very close to the system reporting westerly winds of 45 knots and a minimum pressure of 1002 millibars. Claudette was by then in its weakening stage. The system eventually dissipated in the vicinity

The storm reached hurricane status on the 17th about 200 nautical miles east of Daytona Beach, Florida, while heading toward the north. It then veered north-northeastward at an increasing forward speed. The hurricane reached its maximum intensity of 100 knots, with a minimum central pressure of 950 millibars, on the 19th, when it was located about 90 nautical miles east-southeast of Norfolk, Virginia. Bob was a Category 3 hurricane on the Saffir/Simpson Hurricane Scale at that time, but it weakened while accelerating toward the north-northeast over cooler waters off the mid-Atlantic coast. It made landfall as a category 2 hurricane near Newport, Rhode Island on that day.

Bob then moved over Massachusetts Bay, continued to weaken and began losing tropical characteristics as it passed just off the southern coast of Maine. It made final landfall as a tropical storm near Rockland, Maine by 0130 UTC August 20th, and turned northeastward crossing Maine and New Brunswick. Bob became extratropical over the Gulf of St. Lawrence later on the 20th. Finally, it crossed northern Newfound-

land, and the central North Atlantic along 50° to 55°N, before moving southeastward and dissipating near the coast of Portugal on August 29.

Ships near the Atlantic seaboard did not escape from Bob's fury. The strongest reported winds were 60 knots from the northwest by a vessel located in the vicinity of 38.0°N 74.5°W on the 19th. When Bob was in its developing phase, the *Sanko Pioneer*, located near the Bahamas, reported 44-knot winds. Three people in



Winds from Hurricane Bob carried sailboats from their moorings onto Bridge St. in Dartmouth (above). Dartmouth is in southeastern Massachusetts, about 6 miles southwest of New Bedford. It was formerly a shipbuilding and fishing center. Claudette (left) is located by satellite at about 1800 UTC on the 7th, near peak intensity.

NOAA/NHC

of the Azores on September 14th.

Tropical Storms Danny, Erika and Fabian

Tropical Storms Danny and Erika developed from tropical waves in the eastern and central Atlantic, respectively, during the peak of the season in September. Environmental conditions were quite hostile for development in the tropics and both systems failed to become hurricanes. Danny dissipated before it reached the Lesser Antilles and Erika turned toward the north and northeast over the Azores, where it became extratropical. Fabian developed in the western Caribbean in mid-October and rapidly moved northeastward over Cuba and the Straits of Florida. It became extratropical in the western Bahamas. Fabian produced abundant rains over central Cuba. There were no ship reports of tropical storm force winds associated with those storms.

Hurricane Grace

Since Hurricane Grace was initially subtropical in character, with its circulation encompassing a large area, numerous ships encoun-

tered it. These ship reports were vital in assessing the initial development and structure of Grace, and greatly assisted the forecast procedure. A series of observations from a ship tentatively identified as the *Walter Jacob* proved to be particularly useful in describing the early stage of Grace as a subtropical cyclone. The subtropical depression originated from an upper level disturbance located between Bermuda and the Bahamas. The system evolved into Tropical Storm Grace on the 27th of September, as convection and strong winds became concentrated near the center of circulation. Hurricane status was reached on the following day. Shortly after acquiring its peak intensity, 90-knot maximum winds and 982-millibar minimum pressure, Grace's circulation was abruptly destroyed by a cold front. Due to its large circulation, Grace generated large swells, of about 15 feet from off North Carolina, to about 10 feet near the Florida coast. Later, a large extratropical cyclone which developed off the coast of Nova Scotia, rather than Grace, caused treacherous seas over a

large portion of the northwestern Atlantic shoreline. The strongest sustained wind reported by a ship was from the east at 48 knots, observed by the *Oleander* on the 28th. However, the *Pato Bolo* recorded the highest wind gust, 67 knots on the 27th.

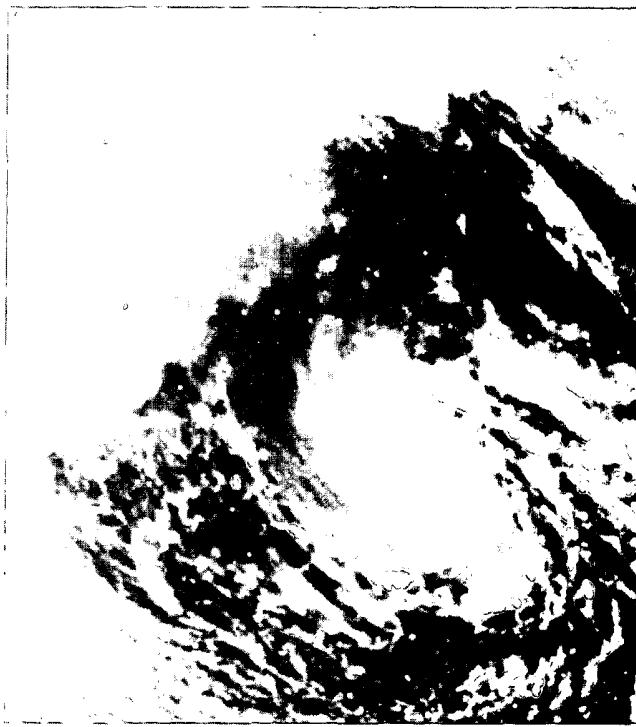
Unnamed Hurricane

The last system of the season was a rather unusual but not unprecedented event, which consisted of the formation of a tropical cyclone of hurricane strength within the aforementioned extratropical cyclone. After reaching its peak intensity as a damaging storm, the weakened extratropical low moved over a portion of the Gulf Stream south of New England. With the low moving over warm waters, convection increased near the circulation center to a point where a tropical cyclone could be identified within the central area of the low. On the 1st of November, satellite images showed an eye forming, indicating that the inner system was near hurricane strength. Indeed, an Air Force Reserve Unit aircraft confirmed that the system was already of hurricane intensity



NOAA/NHC

Amazing Grace (left), at about 1900 on the 28th, and the unnamed hurricane (right) were participants in the story of the Halloween Storm, which wreaked havoc along the U.S. East coast during the last part of October. Notice the telltale eye in the unnamed hurricane in this shot that was made at about 1700 UTC on the 1st of November.



NOAA/NHC

when the plane encountered flight level winds of 86 knots and a 981-millibar minimum pressure near 0000 UTC on November 2nd. The tropical cyclone made landfall near Halifax, Nova Scotia at 1400 UTC November 2d as a weakening tropical storm.

Several vessels passed close to the extratropical storm center on October 30 and reported winds of 50 to 60 knots. A buoy measured a peak wave height of 101 feet and a ship reported 80-foot seas and 80-knot winds on October 30, while several hundred miles northwest of the storm center. It is important to note that these strong wind speeds and high wave heights were associated with the extratropical stage of

the system, and not with the hurricane, which formed later. The table includes only the observations taken during the system's tropical and subtropical stages.

On the 2d of November, a Bahamian ship, the *CFL Atlas*, located about 110 miles southwest of the center of the tropical system, reported winds from 020° at 45 knots and pressure of 1006.5 millibars. The minimum pressure observed by a ship came from the YFA7 which reported 1000.5 millibars.

This hurricane was largely a separate phenomenon from the strong extratropical storm, which caused major coastal damage along the east coast from Florida through

Canada, and even over portions of Atlantic shorelines of the Greater Antilles. The extratropical system was on the wane, with conditions improving on the coasts, when the tropical cyclone formed. It was believed that naming the system (which met all of the meteorological criteria to be designated as a hurricane) at that time would cause confusion among the media and the public. Since the hurricane was expected to be short-lived and primarily a problem to marine interests, it was decided to handle all associated warnings in enhanced High Seas and Offshore and Coastal Waters Forecasts. Based upon reports to date, this process provided all necessary warnings.

Tropical Cyclone Names for the Northern Hemisphere—1992 Season

North Atlantic	Eastern N. Pacific	Western N. Pacific	Central N. Pacific
Andrew	Agatha	Axel	Alika
Bonnie	Blas	Bobbie	Ele
Charley	Celia	Chuck	Huko
Danielle	Darby	Deanna	Ioke
Earl	Estelle	Eli	Kika
Frances	Frank	Faye	Lana
Georges	Georgette	Gary	Maka
Hermine	Howard	Helen	Neki
Ivan	Isis	Irving	Oleka
Jeanne	Javier	Janis	Peni
Karl	Kay	Kent	Ulia
Lisa	Lester	Lois	Walaka
Mitch	Madeline	Mark	
Nicole	Newton	Nina	
Otto	Orlene	Omar	
Paula	Paine	Polly	
Richard	Roslyn	Ryan	
Shary	Seymour	Sibyl	
Tomas	Tina	Ted	
Virginie	Virgil	Val	
Walter	Winifred	Ward	
		Yvette	
		Zack	
		Angela	
		Brian	
		Colleen	
		Dan	



Eastern North Pacific Hurricane Season—1991

Edward N. Rappaport and Max Mayfield

The year 1991 marked just the third time in the last 35 years that an eastern Pacific tropical storm or hurricane did not make landfall (the other years were 1980 and 1988).

However, a tropical depression (5E) did come ashore near Salina Cruz, Mexico early on the 30th of June. It resulted in the year's lone fatality, as well as 500 injuries and significant damage to 118 homes. In addition, two people were reported missing. There were 40 people reported injured with the

passage of Tropical Storm Ignacio just offshore of Lazaro Cardenas, Mexico during mid September.

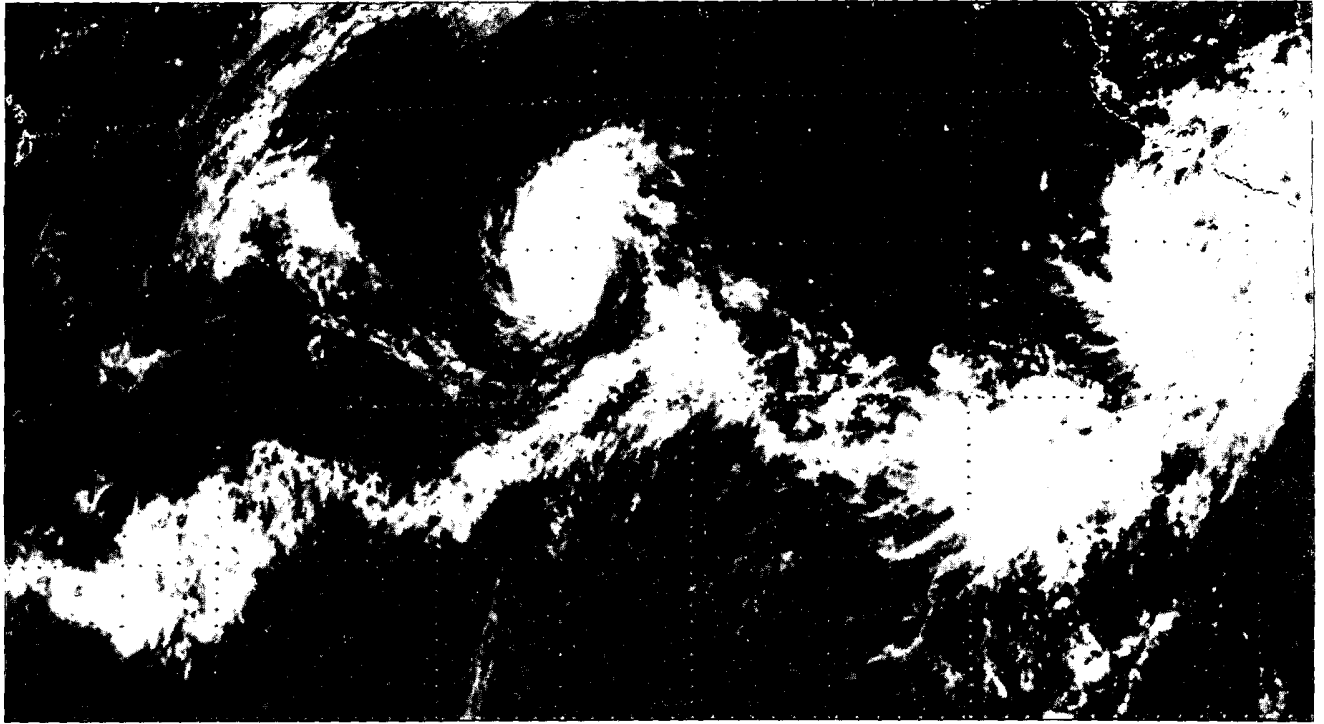
Without land to impede strengthening, some long-lasting intense hurricanes developed offshore. Several of them posed challenges for mariners. In fact, ships encountered 34 knot or higher wind speeds in five of this year's sixteen tropical cyclones.

Of the 16 tropical cyclones, 14 became tropical storms and 10 of those reached hurricane intensity. These numbers are fairly close to the long-term averages.

In addition to the ship reports, surface and upper-air sounding data from land sites, and observations from weather satellites were used in operational analyses and forecasts prepared by the National Hurricane Center (NHC). Also, for the first time in 5 years, data from instrumented aircraft in the eastern Pacific were available to the NHC. The aircraft, from NOAA and the National Center for Atmospheric Research, were participating in the Tropical Experiment in Mexico (TEXMEX), a research program on tropical cyclone formation. Data from these sources indicated that tropical waves contributed to the formation of most, if not all, of the tropical cyclones this year.

The 1991 season had one of the earliest starts on record, beginning on the 16th of May with the formation of Tropical Storm Andres. The season also ended rather late, with Nora becoming the first eastern Pacific hurricane

Edward N. Rappaport and Max Mayfield are Hurricane Specialists at NOAA's National Hurricane Center. Also contributing to this report were Lixion Avila, Hal Gerrish, Miles Lawrence and Richard Pasch, who are also Hurricane Specialists at NHC.



NOAA/NHC

A faint eye is seen in Hurricane Carlos in the satellite photograph (above) taken at about 2200 UTC on the 23d of June, when the hurricane, generating 100-knot winds, was centered about 1000 nautical miles southwest of the southern tip of Baja California.

The remnants of Tropical Storm Blanca can be seen about 900 nautical miles to the west of Carlos, while the tropical depression visible near the coast of Mexico is the system that developed into Hurricane Delores.

during the last quarter century to form in November. Between Andres and Nora, the eastern Pacific had several periods with multiple tropical cyclones. Conversely, the month of July was unusually quiet. Only two systems formed all month—the fewest for a July since before 1973. Normally six tropical cyclones form during that month.

All of this year's ship reports of tropical storm conditions came from vessels located just off the southwest coast of Mexico, generally between Manzanillo and Acapulco (east of 106°W and between 13° and 21°N). The first of these encounters came late on the 24th of June during (then Tropical Storm) Delores, when a 35-knot wind was observed aboard the *Ficus* and the ship with call sign 8EG7 reported 39 knots. The *Sidney Express* also observed 35 knots in Delores about 24 hours later, by which time the system had become a hurricane.

The *Toluca* passed close to Tropical Depression Five-E. The ship reported 1004.0 mb and 38-knot winds, but was situated in an area where topographic effects may have locally amplified the wind speeds. Nevertheless, these ship data suggest that the depression was on the verge of becoming a tropical storm when the system moved inland.

The next ship report of tropical-storm force winds came during mid September when Tropical Storm Ignacio made a clockwise loop just offshore. The *OMI Willamette* and the *Texaco Georgia* reported 40 and 34 knot winds, respectively.

The *Texaco Georgia* is also recognized for making the highest wind observation that the NHC received from a ship in the eastern Pacific during 1991. On the evening of the 9th of October, just south of the center of Hurricane Marty (then a tropical storm), the *Texaco Georgia* observed a west-southwest wind of 50 knots. Sever-

al other ships near Marty reported winds of at least 34 knots.

In addition to these systems, the eastern Pacific also produced five major hurricanes (wind speeds > 95 knots). One of them, Hurricane Kevin, was the remaining tropical cyclone that ships reportedly encountered this year.

Major Hurricanes

Hurricane Carlos

Carlos formed from a tropical wave, which crossed Central America to the eastern Pacific on the 14th of June. The wave and its shower activity soon became better organized, and by the 16th of June had developed into a tropical depression. Rather rapid intensification followed, and in less than 48 hours the depression strengthened to become Hurricane Carlos.

After weakening briefly, Carlos' strengthening resumed and the hurricane reached its peak intensity of 105 knots on the 24th. During this period, a strong high devel-

oped to the north of Carlos and the steering flow around the high temporarily forced the tropical cyclone to the west-southwest.

After the 24th, Carlos experienced strong upper-level shear and moved over cooler waters. These conditions led to its dissipation by late on the 27th.

Hurricane Fefa

Fefa formed from a tropical wave that entered the eastern Pacific hurricane basin on the 25th of July. Cloudiness near the wave became better organized by the 28th. Data from a TEXMEX aircraft indicated that a 700-millibar cyclonic circulation center had formed within the wave by early the next day, but evidence of a low-level center was lacking at that time. Nevertheless, the system became a tropical depression late on the 29th. It probably formed in association with the 700 millibar center previously identified.

The depression intensified quickly to become Tropical Storm Fefa. Flight-level data on the 29th and 30th of July showed a broad area of 35 to 50 knot winds at low

levels. Interestingly, the 950-millibar center was displaced about 30 nautical miles to the northwest of the center of a 700-millibar vortex detected at about the same time.

Fefa reached hurricane strength on the 31st of July. Satellite imagery showed strong upper-level outflow and an eye on the 1st of August. The hurricane reached its maximum intensity of 105 knots early on the 2d of August.

Throughout its lifetime Fefa moved toward the west or west-northwest. When the hurricane crossed 140°W on the 5th of August, operational responsibility for the system was passed to the Central Pacific Hurricane Center (CPHC) in Hawaii. Their analyses indicated that Fefa produced local squalls and high surf on the island of Hawaii. Fefa weakened and then dissipated on the 8th of August, in a strongly sheared environment near the Hawaiian Islands.

Hurricane Jimena

The tropical wave from which Jimena likely originated left the coast of Africa on the 5th of

September. While over the eastern Atlantic, the wave formed Tropical Storm Danny.

The southern part of the wave continued westward and crossed Central America on the 14th and 15th of the month. The system developed into a tropical depression on the 20th and then into tropical storm Jimena a day later. Jimena moved toward the northwest, then the west and strengthened rapidly. It became a hurricane on the 22d. Upper-level outflow became distinct and a banding-type eye developed.

Satellite and aircraft data suggest that Jimena reached, and then generally maintained, its maximum intensity of 115 knots and minimum pressure of 945 millibars during the 23d and 24th. This made Jimena the first of two Saffir-Simpson Category 4 hurricanes in the eastern Pacific this year. Only slow weakening followed. Jimena still had a well-defined eye and winds of about 90 knots on the 28th.

It turned toward the northwest on the 29th, and that motion brought the hurricane into an area of lower sea-surface temperatures and relatively strong southwesterly



NOAA/NHC

Taken near 2100 UTC on the 30th of September, this satellite shot shows Tropical Storm Jimena centered midway between the Hawaiian Islands and Mexico, while Hurricane Kevin is near maximum

intensity a few hundred nautical miles south of the Baja. On the right edge of the picture is a tropical disturbance south of Mexico, which developed into Hurricane Linda.

1991 Eastern North Pacific Hurricanes and Tropical Storms

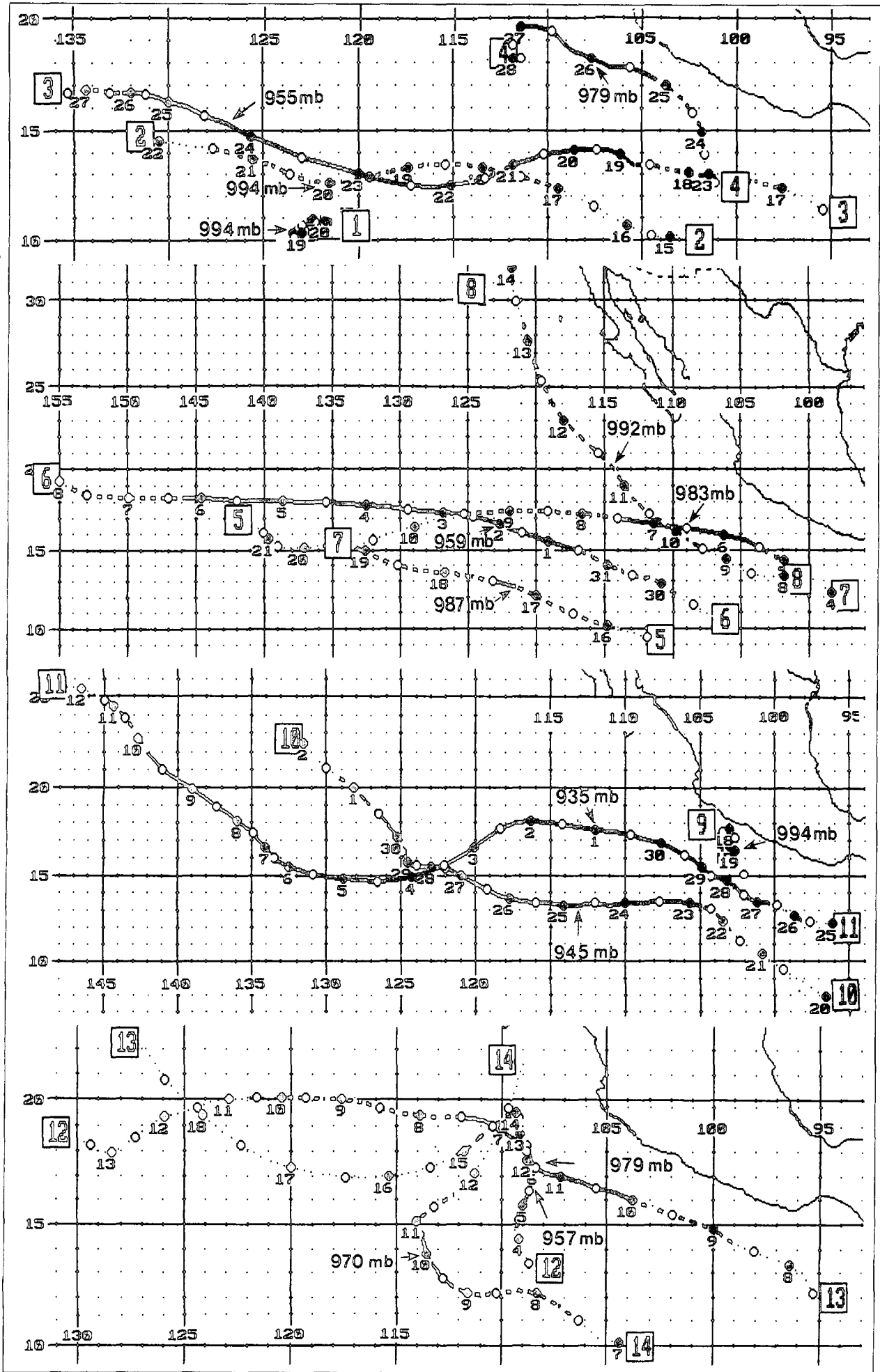
No.	Name	Class ^a	Dates ^b	Max. Lowest		No.	Name	Class ^a	Dates ^b	Max. Lowest	
				sustained wind (kn) ^c	pressure (mb)					sustained wind (kn) ^c	pressure (mb)
1.	Andres	T	5/16-5/20	55	994	8.	Hilda	T	8/8-8/14	55	992
2.	Blanca	T	6/14-6/22	55	994	9.	Ignacio	T	9/16-9/19	55	994
3.	Carlos	H	6/16-6/27	105	955	10.	Jimena	H	9/20-10/2	115	945
4.	Delores	H	6/22-6/28	75	979	11.	Kevin	H	9/25-10/12	125	935
5.	Enrique	H	7/15-7/21	65	987	12.	Linda	H	10/3-10/13	105	957
6.	Fefa	H	7/29-8/8	105	959	13.	Marty	H	10/7-10/18	70	979
7.	Guillermo	H	8/4-8/10	70	983	14.	Nora	H	11/7-11/12	90	970

Table and Track Chart Legend

- T:tropical storm, wind speed 34-63 knots.
- H:hurricane, wind speed 64 knots or higher.
- ^aDates begin at 0000 UTC (includes tropical depression stage).
- ^cWind speed over a 1-minute span.
- Tropical depression stage
- Tropical storm stage
- Hurricane stage
- ++++ Extratropical stage
- |> |> |> Subtropical storm stage
- ▶▶▶ Subtropical storm stage
- ₀₇ Position and date at 0000UTC
- Position at 1200 UTC
- ⑥ Cyclone Number 6
- H Hurricane
- T Tropical storm
- ST Subtropical storm

Tropical Cyclone Winds
(ship encounters of 34 knots or higher)

Tropical Cyclone	Ship Name	Date Mo/Da	Time UTC	Position		Wind (kn) Dir/Speed	Pressure (mb)
				LatN	LonW		
Delores	SEG7	6/24	1800	17.7	102.3	080/39	1005.0
	Ficus	6/24	1800	15.5	103.7	240/35	1008.5
	Sidney Express	6/26	0000	20.4	106.7	140/35	1006.3
Five-E	Toluca	6/29	1800	16.1	95.2	340/38	1004.0
Ignacio	Texaco Georgia	9/16	1800	16.9	103.5	100/35	—
	OMI Willamette	9/17	0100	17.4	102.4	060/40	1005.0
Kevin	Sedco-BP471	9/26	0900	14.1	100.1	040/35	1003.9
	Sedco-BP471	9/26	1200	13.9	100.6	010/36	1003.0
	Marienvoy	9/26	1500	14.5	99.5	120/34	1009.0
	Sedco-BP471	9/26	1500	13.6	101.2	020/38	1002.9
	Marienvoy	9/26	1800	15.0	100.0	110/34	1009.6
	Sedco-BP471	9/26	1800	13.1	101.3	300/35	1001.9
	Marienvoy	9/27	0000	15.3	101.2	110/34	1007.0
	Brooks Range	9/27	1800	17.1	102.6	070/45	1010.0
Star Livorno	9/30	0000	18.7	104.3	140/37	1009.5	
Marty	Sisala	10/9	0000	16.4	99.6	090/40	1008.5
	Chesapeake Bay	10/9	0300	16.8	101.0	100/35	1008.5
	Chesapeake Bay	10/9	0600	16.6	100.5	080/40	1008.1
	Start Honkonk	10/9	0600	16.4	101.3	080/35	1007.5
	Chesapeake Bay	10/9	0900	16.5	100.3	090/40	1008.7
	Star Hong Kong	10/9	0900	16.3	101.0	080/36	1004.9
	Chesapeake Bay	10/9	1200	16.4	99.9	110/37	1010.0
	Star Hong Kong	10/9	1500	15.9	100.4	130/36	1011.8
	Texaco Georgia	10/10	0300	15.8	104.5	250/50	1005.0
	Nedlloyd Barcelona	10/11	0000	19.5	105.5	140/42	1008.8
GYYP	10/13	0600	19.0	104.9	150/47	1013.0	



winds aloft. Jimena weakened quickly in that environment and by late on the 30th the circulation center was devoid of deep convection. This left a low-level cloud swirl which gradually spun down. By the 2d of October the system had dissipated.

Hurricane Kevin

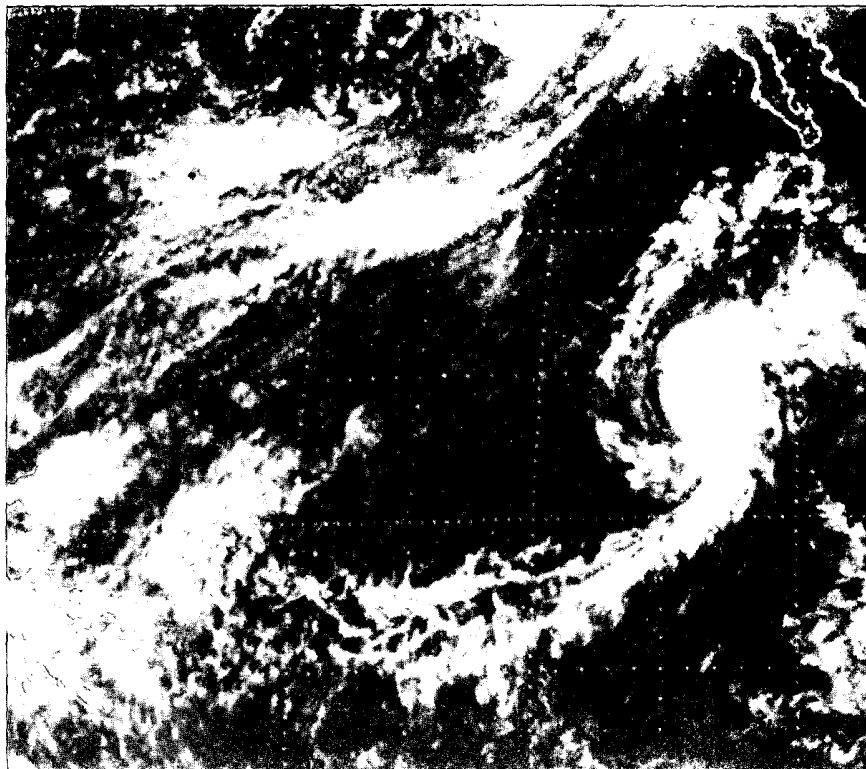
Kevin provided two highlights. Not only was it the season's strongest hurricane with Category 4 winds estimated at 125 knots, but by remaining a hurricane for 12 days to the east of 140°W, it also became the most enduring eastern Pacific hurricane on record.

Kevin formed from a tropical wave that moved into the eastern Pacific hurricane basin on the 21st of September. The convection became better organized on the 23d and 24th and the system progressed rapidly through the tropical depression stage to become Tropical Storm Kevin on the 25th. Convective banding and upper-level outflow grew more distinct on the 26th and Kevin became a hurricane that day.

Several ships reported tropical-storm force winds on the 26th and 27th. The *Brooks Range* had the highest surface wind reported for Kevin, 45 knots. Late on the 26th, the *Sedco-BP471* measured a pressure of 1001.9 millibars. This was the season's lowest pressure reported from a ship.

Between the 27th and 29th, Kevin strengthened. Satellite imagery showed the formation of a well-defined eye, which persisted for several days. Kevin reached its peak intensity on the 1st of October.

It began moving toward the west-southwest and this course was maintained for several days. During this period, Kevin's winds decreased to 75 knots. A more northerly track resumed by the 6th of October. The hurricane then



NOAA/NHC

This high resolution GOES image (page 21) was taken while Hurricane Kevin was centered about 300 nautical miles south southwest of the southern tip of Baja California near 2300 UTC on the 30th of September. Above, a GOES visible image taken on the 9th of November at about 2200 UTC, indicates a well-defined eye in Hurricane Nora. The hurricane was centered about 600 nautical miles south southwest of the southern tip of Baja California and was near its peak intensity of 90 knots.

reintensified, and by the 8th, Kevin had regained 100 knot winds.

The hurricane crossed 140°W on the 9th of October, into the CPHC area of responsibility. During the next few days, Kevin weakened and then lost its tropical characteristics over the cool waters that lie well to the northeast of Hawaii.

Hurricane Linda

Linda developed from a tropical wave that crossed Central America to the eastern Pacific on the 25th of September. Although convection flared up on the 30th, the system did not develop into a tropical depression until the 3d of October.

It initially moved toward the northwest until steering currents weakened. Linda then drifted, first toward the north, then the north northeast from the 3d through the 5th. Linda's intensification over this period was rapid. It reached

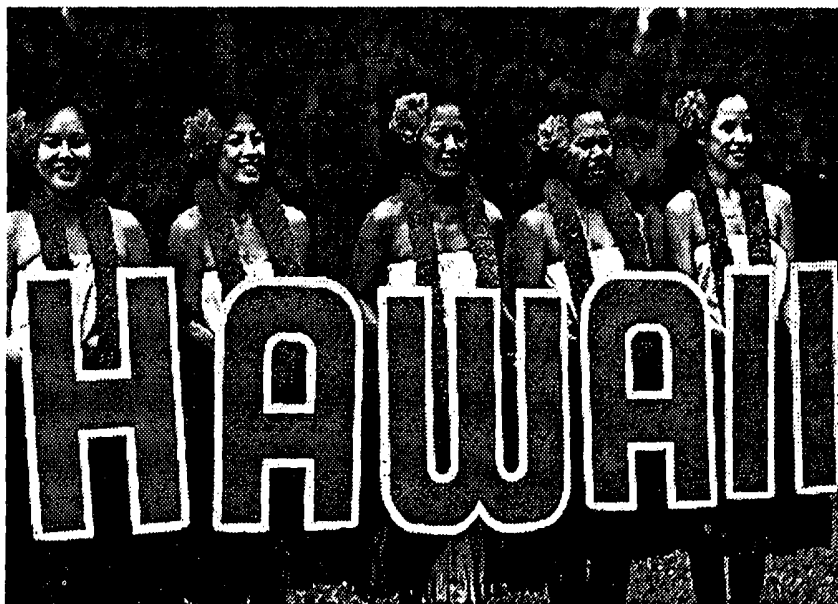
hurricane strength early on the 5th and attained its estimated maximum winds of 105 knots late that day.

Linda turned west-northwestward by the 7th of October. The system weakened when it moved over a patch of water that had been cooled by upwelling associated with Hurricane Kevin's passage a few days earlier. Even so, the hurricane caused 70-knot sustained winds at Socorro Island. This was the strongest wind from a surface site in 1991.

Strong upper-level winds sheared the deep convection near Linda's center by late on the 9th. Only low clouds remained and Linda weakened to a depression a day later. Although deep convection periodically appeared over the next few days, the system dissipated on the 14th.

The Central North Pacific hurricane season ended with just three tropical cyclones in the area. All three systems had been hurricanes in the eastern North Pacific, with Enrique weakening to a tropical depression before entering the area.

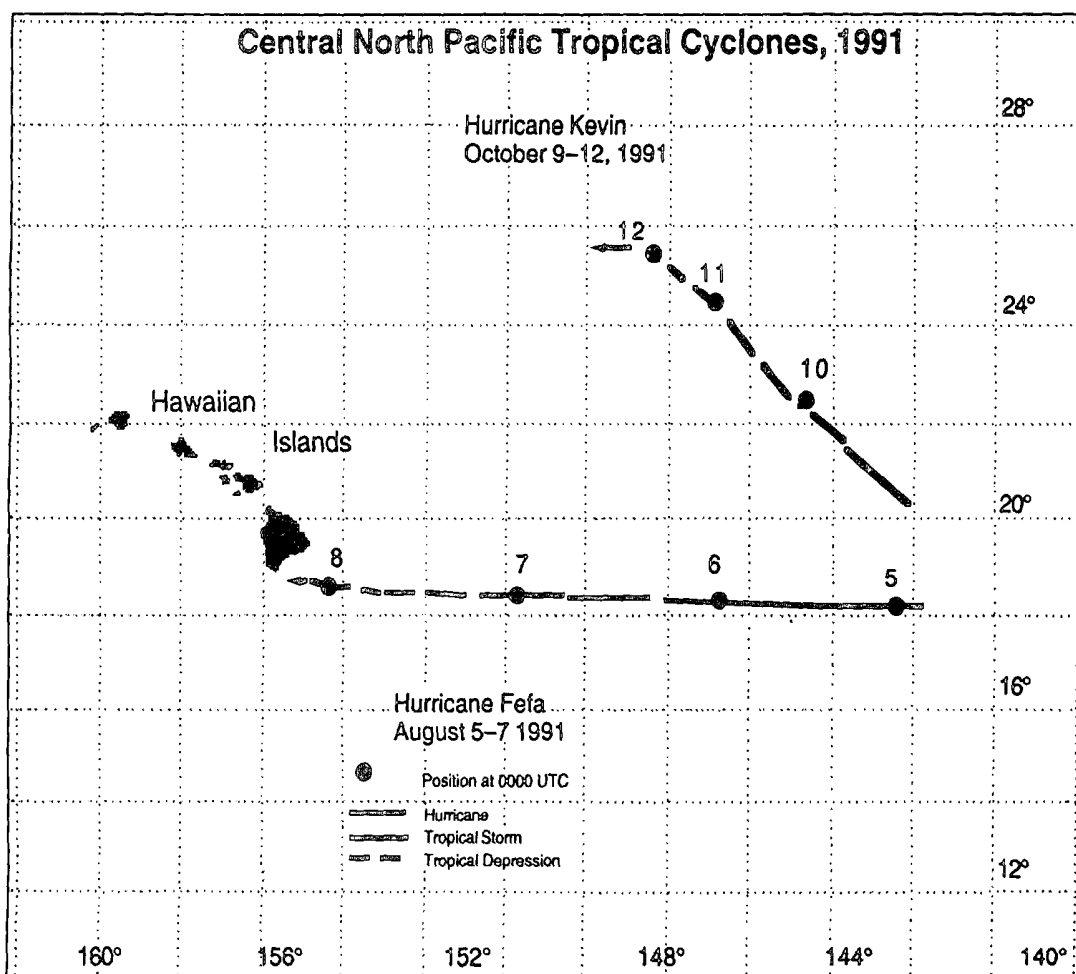
Enrique entered the Central Pacific Hurricanes Center's (CPHC) forecast area as a weakening tropical depression at about 0000 UTC on the 21st of July with sustained winds estimated at 25 knots. The remnant circulation passed 140°W and moved north-westward, remaining well east and north of the Hawaiian Islands. On the 24th, the remains of the depression reached 24°N, 150°W, and by the 26th it was observed by polar orbiting satellites as a small but well-organized circulation near 32°N, 160°W. The Joint Typhoon Warning Center subsequently issued advisories on the cyclone



Central North Pacific Hurricanes—1991

Andrew K. T. Chun

Also contributing to this article which is an excerpt from NOAA Technical Memorandum NWSTM PR-37, was Raymond T. Martin, Hans Rosendal and Glenn H. Trapp, all from the Central Pacific Hurricane Center.



Fefa's approach resulted in rough surf and gusty winds over the counties of Hawaii and Maui. Some very heavy downpours occurred, particularly on the Big Island of Hawaii, as thunderstorms developed in the northeast quadrant of the circulation. The thunderstorms formed offshore to the northeast of the Big Island and built rapidly southwestward over the slopes over Mauna Kea and the Kohala Mountains. Localized flash flooding was reported in the Kohala and Hamakua districts on the 7th.



Uniphoto

when it reintensified into a minimal tropical storm west of the International Dateline.

Hurricane Fefa was still an intense hurricane with winds estimated at 90 knots when it crossed 140°W into the CPHC's area of responsibility at 0600 UTC on the 5th of August. Fefa moved westward at 15 knots toward the Hawaiian Islands. The center of Fefa passed close to or over the Big Island at 0000 UTC on the 8th as the sea level pressure at Hilo dropped to 1005 mb, but it was only a tropical depression at that

time. Fefa's remnants interacted with the island's terrain and a cold core upper trough, which had been present near the islands for several days. This trough was largely responsible for the quick demise of Fefa due to strong vertical wind shear over the area, with strong easterly winds near the surface and westerly winds aloft. Nevertheless, locally strong winds did occur on the north side of the remnant circulation. Wind gusts ranged between 40 and 50 knots at some localities, mainly over the counties of Hawaii and Maui. Some very

heavy downpours occurred, particularly on the Big Island of Hawaii, as thunderstorms developed on the northeast quadrant of the circulation. Lightning was responsible for two injuries on the Big Island.

Kevin had been a moderately strong hurricane for well over a week, while moving slowly but steadily in a northwesterly direction toward the central Pacific. It was far north of Hawaii when crossing the 140th meridian and barely at hurricane strength. As is the case with most storms that are well offshore and parallel the islands, Kevin interrupted the trades, which resulted in sunny and fair weather over the Hawaiian Islands. Kevin was barely at hurricane intensity when it entered the central Pacific and was downgraded to a tropical storm on the 9th. By the 11th, it was a depression.

Central North Pacific Tropical Cyclone Summary, 1991

Name	Dates	Classification in CPHC area	Max Winds (kn)
Enrique	Jul. 20-21	Trop. dep.	25
Fefa	Aug. 5-8	Hurricane	90
Kevin	Oct. 9-12	Hurricane	65

STORM DATA

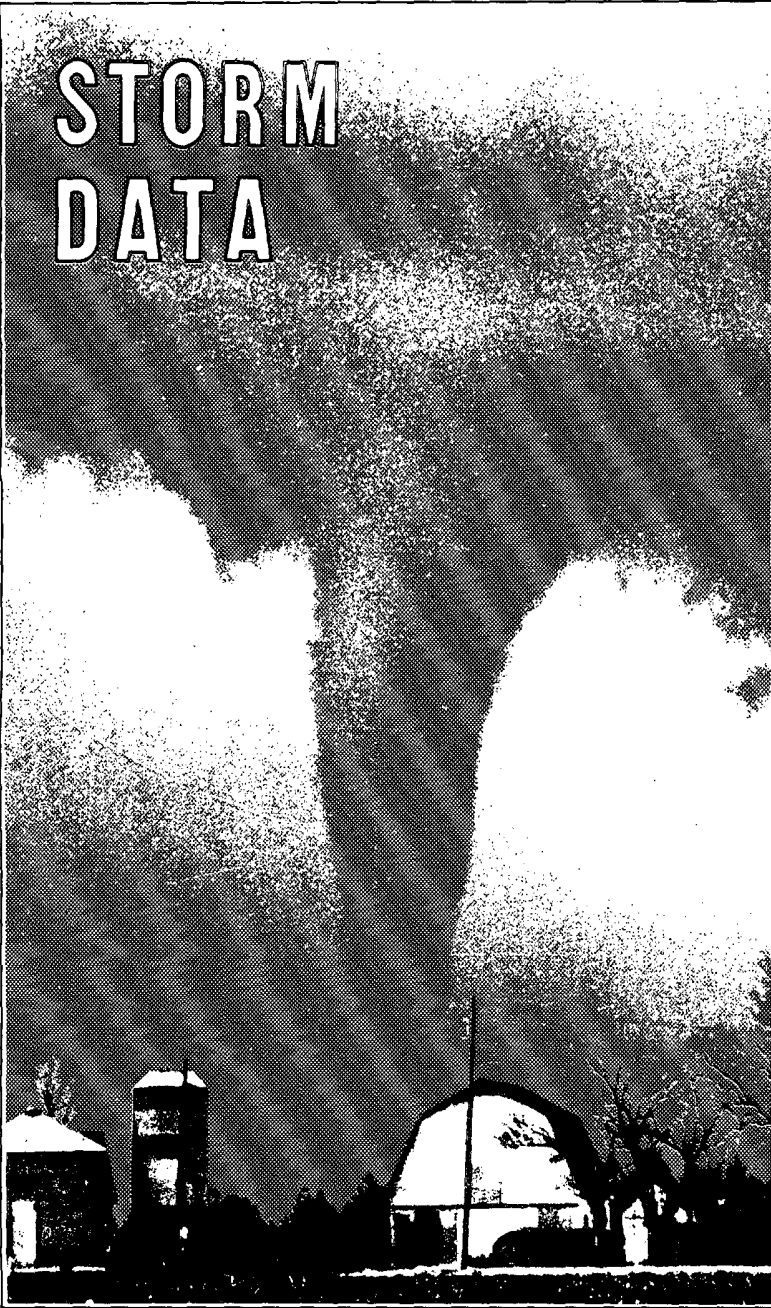


Photo courtesy: Larry Miller, Kansas Heritage Photography

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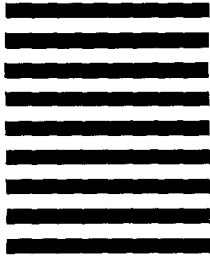


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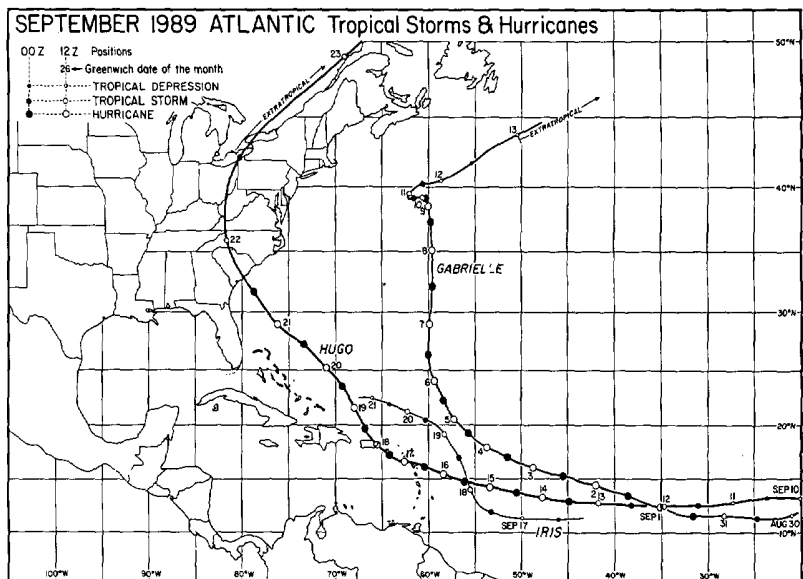
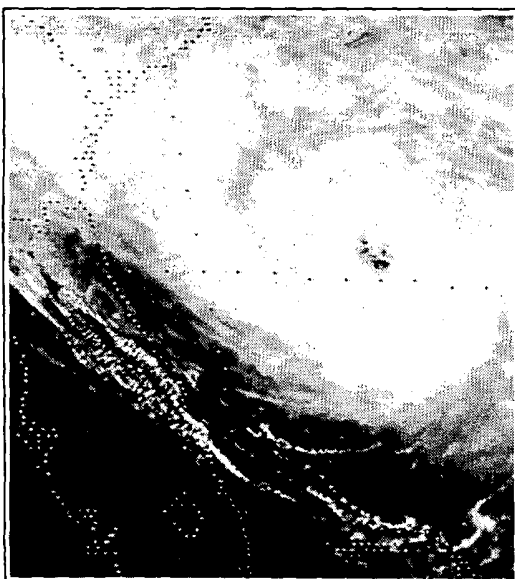
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HURRICANE HUGO, SEPTEMBER 10-22, 1989

Despite excellent warning lead times and excellent government and public response to the warnings, the fury of Hurricane Hugo took many by surprise and will undoubtedly haunt the memory of many Americans for years to come. Along with numerous deaths and injuries, HUGO brought large-scale devastation to much of the Carolinas, Puerto Rico, the Virgin Islands and other islands of the Caribbean, making it the costliest hurricane in U.S. history.

Over the course of slightly less than two weeks, HUGO followed a trajectory that was typical for an Atlantic Basin tropical system: originating near Africa in the vicinity of the Cape Verde Islands, traveling west across the tropical Atlantic to the Leeward Islands, turning northwest toward the U.S. coast until making landfall in the Carolinas, and once inland, turning northeast under the influence of the Westerlies and becoming extratropical while skirting the eastern U.S.-Canada border (see map below). The system originated from a cluster of thunderstorms that moved off the African coast on September 9th and organized into a tropical depression on the 10th just southeast of the Cape Verde Islands. The system moved west at 18 knots, attaining storm status on the 11th, and hurricane status on the 13th while located about 1100 nautical miles east of the Leeward Islands. HUGO gradually turned west-northwest and slowed in its translation as it headed for the Islands. While still several hundred miles east of the Islands on the 15th, the first reconnaissance aircraft reported HUGO as having a minimum central pressure of 918 mb and an estimated maximum surface wind of 140 knots. This turned out to be HUGO's maximum intensity.



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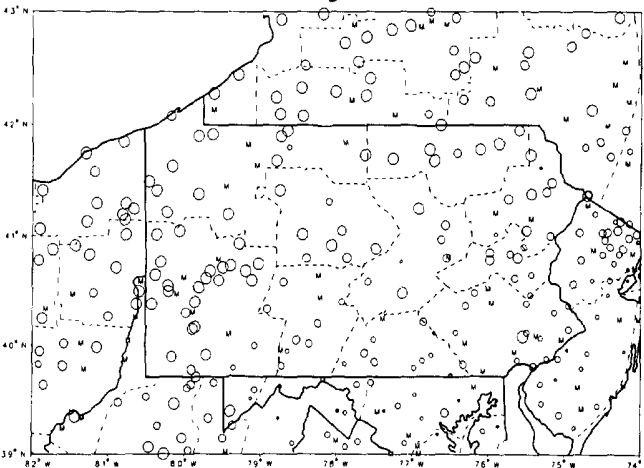


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MONTHLY PRECIPITATION DEPARTURE FROM INDIVIDUAL STATION NORMALS (1951-1980)

○ INCOMPLETE DATA FOR THE MONTH
● EXACTLY NORMAL
○○○ 5, 10, 20, ... 50% OR MORE BELOW NORMAL
●●● 10, 20, 40, ... 100% OR MORE ABOVE NORMAL



CIRCLE DIAMETER IS PROPORTIONAL TO DEPARTURE ON A CONTINUOUS SCALE

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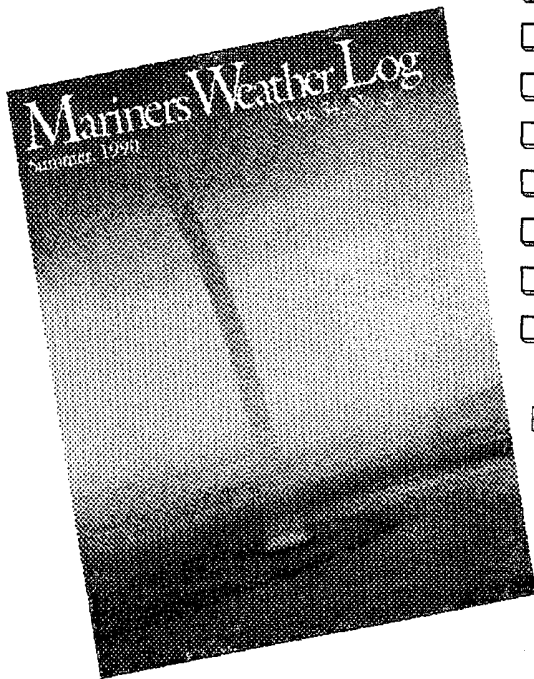
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