



**TR 96-02, The Winter of 1995 - 1996, A Season of Extremes  
Publication**

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**Technical Report 96-02**

**The Winter of '95-'96  
A Season of Extremes**

by the  
NCDC Research Customer Service Group  
May 1996

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 **Introduction**

This report provides a review of the winter of 1995-1996--a winter of unusual extremes in parts of the country. Although December was not unusually active, January and February proved to be quite interesting. Those months included the following extreme events: The January blizzard and ensuing flooding in the Northeast, and then in February-- a severe cold wave, Pacific Northwest flooding, and unusual warmth and fires in the southern plains.

Another interesting aspect of the past winter was the 'seesaw' pattern of temperatures and precipitation over much of the nation. Extremely cold conditions (such as early February) were often followed by unusual warmth. The same applied to precipitation, with the Northwest beginning the season on the dry side, and then moving into a very wet

pattern. Therefore, as is sometimes the case in climatology, the averages of the season as a whole belie the extremes contained within.

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## December 1995

The month of December was fairly quiet compared to what was to come. In early December, record 24-hour snowfalls in Buffalo, NY of 38 inches and in Sault Ste. Marie, MI of 28 inches on December 9-10 were due to lake-effect snowstorms.

In mid-December, an unusually intense storm struck the Pacific Northwest. Heavy rains of 5-20 inches accompanied the system. However, very low pressures and high winds were its key features. Record low sea level pressure readings were recorded at Astoria, OR (28.53 inches), Seattle, WA (28.65 inches), and Medford, OR (28.93 inches). Wind gusts reached 119 mph at Sea Lion Caves, OR and 103 mph at Angel Island, CA. Six deaths and over 2 million power outages were attributed to the storm.

In the latter part of the month, Miami failed to exceed 65 F for eight consecutive days from December 21 - 28, an all-time record for the city.

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## January 1996

January proved to be quite cold over much of the nation (below normal in 37 states), with unusually heavy snowfall over most of the East. From January 6-8, much of the eastern seaboard received from 1 to 3 feet of snow during the "Blizzard of '96." A large area from the southern Appalachians to southern New Hampshire and Maine received a foot or more, with 20 inches or more very common over the major metropolitan areas of the East. However, upstate New York received very little snow as the storm featured a very pronounced western edge where snowfall ended. Storm total snowfall records set by the blizzard included:

Elkins, WV--23.4 inches (old record--20.7 on Nov 24-25, 1950)  
Charleston, WV--20.5 inches (old record--18.9 on Mar 13-14, 1993)  
Cincinnati, OH--14.4 inches (old record--11.3 on Jan 16-17, 1978)  
Newark, NJ--27.8 inches (old record--26.0 on Dec 26-27, 1947)  
Philadelphia, PA--30.7 inches (old record--21.3 on Feb 11-12, 1983)  
Scranton, PA--21.0 inches (old record--20.5 on Nov 24-25, 1971)  
New Jersey state record--White House Station, NJ--35 inches (old record--34.0 in Feb 1899)

24-hour snowfall records included:

Lynchburg, VA--20.0 inches  
Wilmington, DE--22.0 inches  
Philadelphia, PA--27.6 inches  
Roanoke, VA--22.2 inches  
Cincinnati, OH--12.8 inches

Accumulations as great as 48 inches occurred in Pocahontas County, WV at the Snowshoe ski resort. Wind gusts of over 50 mph were rather common also, and resulted in blizzard conditions for much of the area. Two lesser events then followed, resulting in additions to the snow cover, with Boston, MA and Harrisburg, PA both reporting record snow depths of 32 inches, along with Philadelphia, PA--28 inches, and Bluefield, WV--25 inches. [Table 1](#) and Figures 1-4 provide a detailed analysis of this storm. You can click on these images to see a larger versions.

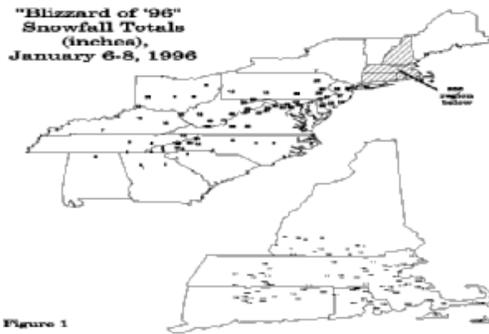


Figure 1

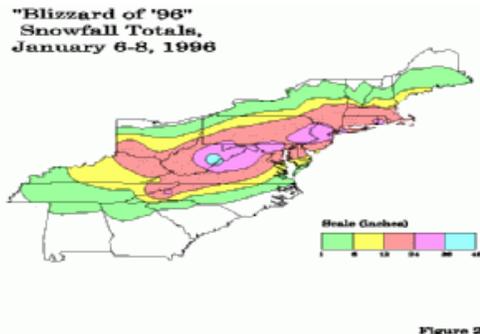
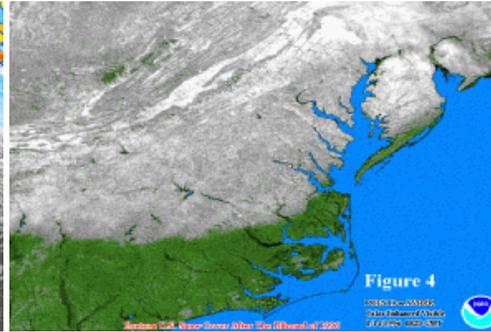
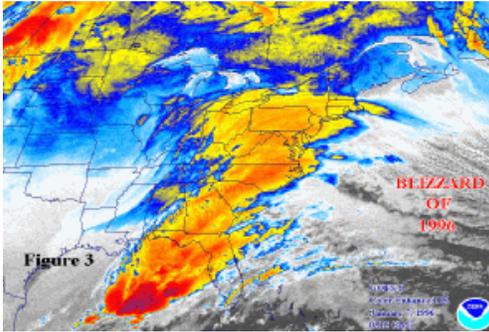


Figure 2



Following are some state by state impacts of the January 6-8 snowstorm. Death tolls include direct and indirect causes, and some states, such as Pennsylvania, keep very detailed records of these statistics.

- Alabama--2 deaths, some roads closed by ice.
- Arkansas--4 deaths.
- Connecticut--4 deaths, 27 inches at Darien.
- Delaware--4 deaths, 22 inches at New Castle, a record for January.
- District of Columbia--Federal and local governments closed.
- Georgia--1 death, up to 12 inches in mountains of northeastern Georgia.
- Indiana--3 deaths, up to 9 inches in southern portion of state.
- Kentucky--6 deaths, 28 inches at Pine Mountain.
- Maine--no deaths reported, up to 12 inches of snow along coast.
- Maryland--6 deaths, 33 inches at Frostburg.
- Massachusetts--no deaths reported, 18 inches in Boston.
- New Hampshire--no deaths reported, up to 17 inches in southwest portion of state.
- New Jersey--4 deaths, 27.8 inches at Newark Airport.
- New York--7 deaths, 27.5 inches in New York City on Staten Island, 20.2 inches in Central Park.
- North Carolina--5 deaths, up to 30 inches in northern mountains.
- Ohio--3 deaths, up to 18 inches in southeastern counties, 14.4 inches at Cincinnati.
- Pennsylvania--80 deaths, 30.7 inches in Philadelphia.
- Rhode Island--no deaths reported, 24 inches at Warwick.
- South Carolina--2 deaths, 10 inches in mountains of Pickens County.
- Tennessee--4 deaths, up to 30 inches in higher mountains.
- Virginia--13 deaths, 47 inches in Shenandoah National Park.
- West Virginia-- 6 deaths, 48 inches at Snowshoe--highest total for the storm.
- Overall snowstorm death toll--154.

The sudden warm-up that followed proved to be almost as deadly and damaging as the blizzard itself. Burlington, VT recorded 65 F on January 19. Moderate to heavy rains (3.03 inches in 24 hours at Williamsport, PA) and rapid snowmelt triggered serious flooding along the Delaware, Susquehanna, upper Ohio, Potomac and James River basins, with crests as much as 20 feet above flood stage. The flooding killed 33 people, forced over 200,000 from their homes, and destroyed or damaged hundreds of roads and bridges. In Harpers Ferry, WV, where the Shenandoah and Potomac rivers meet, the water crested at 31 feet--13 feet above flood stage. USGS scientists estimated that the Potomac River crested at a flow of 312,000 cubic feet per second (cfs) at Point of Rocks, MD, nearing the level of 347,000 cfs reached in June of 1972 after rains from Hurricane Agnes. The Susquehanna River

at Harrisburg, PA crested at 570,000 cfs, well below the flow of 1 million cfs reached in June 1972 from Hurricane Agnes.

State officials reported flood fatalities as follows:

Pennsylvania--19  
 New York--10  
 West Virginia--2  
 Vermont--2

No flood-related deaths have been reported from Maryland, Virginia, Ohio, or New Jersey. Presidential disaster declarations included the states of Virginia, Ohio, Pennsylvania, Maryland, West Virginia and New York. Pennsylvania was especially hard hit by the blizzard and flooding as the following statistics show:

- Estimated \$1 billion in total damages and costs from the combined blizzard and flooding.
- Some areas experienced the worst flooding since Hurricane Agnes in 1972, which killed 48 people and left 220,000 homeless.
- 99 deaths (80 blizzard-related, 19 flood-related).
- Over 52,000 homes affected (over 11,000 destroyed or with major damage).
- 57 of the state's 67 counties received some flooding.
- More than 200,000 Pennsylvanians evacuated during the flooding.
- Approximately 2000 businesses damaged or destroyed.
- Over 1500 roads and bridges damaged.
- 78 parks damaged or destroyed.
- Damage to state and local highways and bridges estimated to be over \$500 million.

Various statistics from other states:

West Virginia: Over 8000 homes affected and over \$24 million in damages to public facilities and infrastructure. Maryland: Over 700 homes and businesses damaged or destroyed. Ohio: Over 2000 homes and businesses damaged, with approximately \$500,000 in uninsured damages, and public facility and infrastructure losses estimated at approximately \$11 million.

Overall, the blizzard and ensuing flooding killed an estimated 187 people and caused approximately \$3 billion in total damages and costs (including snow removal).

## February 1996

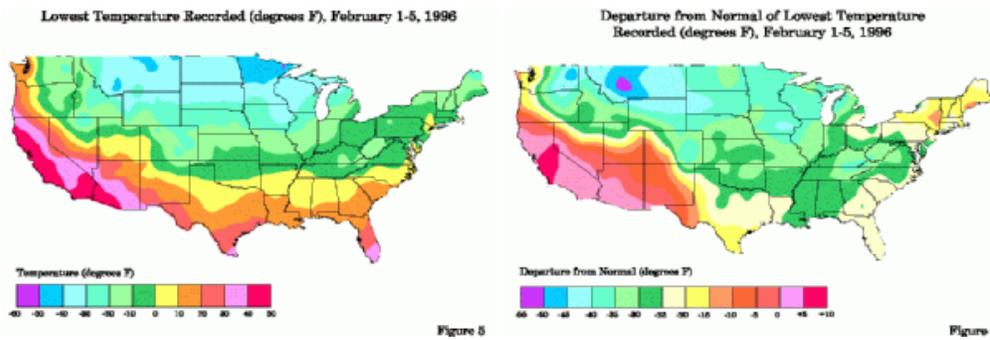
February was just as eventful as January with one severe cold episode affecting the eastern two-thirds of the nation, and one severe flooding event affecting the Pacific Northwest. Also, the southern plains experienced record warmth and extensive prairie fires due to an extended drought.

The arctic outbreak actually began in late January in the northern plains and northern Rockies. Glasgow, MT had 21 successive subzero minimum temperatures from January through early February. Then, the air mass began to move slowly south and east. Minneapolis-St. Paul recorded six consecutive minimums below -20 F, breaking a record set during the arctic outbreak of 1899. Wind chills of between -50 F and -100 F were rather common throughout the northern plains area. Overall, this outbreak set nearly 400 record daily minimums, at least 15 all-time low readings, and over 50 new records for the month of February. Waterloo, IA reported a record number of successive hours below zero (139 hours), as did Des Moines, IA (132 hours). Immokalee, FL reached 27 F, and preliminary damage estimates for Florida's vegetable crop stand at \$50-60 million. The citrus industry escaped without significant damage. Nationwide, over 100 deaths were attributed to the cold wave and its associated weather.

New state record low temperatures were tied or set at the following locations:

Minnesota--Tower (-60 F) on Feb 2, old record -59 F at Leech Lake Dam, Feb 8, 1899  
 Iowa--Elkader (-47 F) on Feb 3, tied record set at Washta, Jan 12, 1912  
 Illinois--Elizabeth (-35 F) on Feb 3, tied record set at Mt. Carroll, Jan 22, 1930  
 Rhode Island--Greene (-25 F) on Feb 5, old record -23 F at Kingston, Jan 11, 1942

[Table 2](#) and Figures 5-6 provide more detailed statistics for this event. You can click on these images to see larger versions.



As the cold air moved south and east, much warmer air surged into the plains states with temperatures reaching 70 F as far north as southeastern Montana, a rise of 100 F from the prior week. This typified the winter's 'seesaw' pattern as mentioned earlier. Tulsa, OK set new February records for minimum temperature (-11 F) and maximum temperature (90 F) only 18 days apart. Warm air returned to the south and east with 100 F temperatures in southern Texas (including San Antonio) on Feb 21-22. This warm air then spread eastward with several locations in the Ohio Valley approaching 80 F on the 23rd. In Texas and Oklahoma, extensive prairie fires resulted from a combination of an unusually dry winter (less than 50% of normal precipitation), very low humidities, and high winds. Over 180,000 acres burned in the 2 states.

Another key event of the month was the severe flooding in the Pacific Northwest. On February 6th, a very strong subtropical jet stream reached Oregon. Moisture feeds of this kind are sometimes referred to as the Pineapple Express due to their origin in the vicinity of Hawaii. Although such subtropical flows of moisture are not rare, it is unusual for them to persist with such intensity for such a long period of time (3-5 days).

The early February rains were quite heavy in both Washington and Oregon. In Oregon, the heaviest rains occurred in the northwest corner, while in Washington, the heaviest rains occurred on the windward sides of the Cascades. In these two areas amounts of 12 to 20 inches were reported, and up to 30-inch totals were estimated in some higher elevation locations.

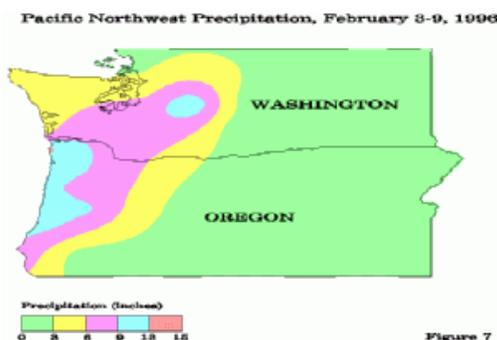
Some of the notable precipitation amounts included:

- Laurel Mountain, OR--8.20 inches in 24 hours, over 23 inches in 3 days.
- Corvallis, OR--3.26 inches in 24 hours (new record for any day in February).
- Eugene, OR--5.17 inches in 24 hours.
- Newport, OR--7.71 inches in 3 days.
- Government Camp, OR--11.30 inches in 4 days.
- Blazed Alder, OR--18.30 inches in 5 days.
- Little Meadows, OR--17.60 inches in 5 days.
- Saddle Mountain, OR--20.40 inches in 5 days.
- Portland (10.03 inches), Salem (13.01), and Eugene, OR (16.89 inches)--wettest February on record.
- Astoria, OR-- 2nd wettest February with 14.53 inches.

Prior to this event, October through January seasonal precipitation had also been above normal:

	Oct 95-Jan 96	Normal
Laurel Mountain, OR	108.66	59.10
Portland, OR	27.46	19.50
Eugene, OR	41.55	28.13

See [Table 3](#) and Figure 7 for additional preliminary data. Note that Figure 7 does not reflect the locally heavier amounts which fell in higher mountain locations. For October 1 through February 11, precipitation amounts exceeded 130% of normal for Washington state from the Puget Sound to the Cascades, over northern and western Oregon, western Montana, and northern Idaho. Some locations exceeded 200% of normal. You can click on this image to see a larger version.



In addition to the wet conditions, temperatures were unusually warm. In the Willamette Valley, daily minimum temperatures were often higher than normal maximum values for early February. Early morning minimums in the 50's were quite common. As a result, the freezing level quickly moved upward to 7000 - 8000 feet. Rain fell at mountain pass levels, which induced heavy snowmelt. At Government Camp in Oregon, snow depths dropped from 88 inches on February 5th to just 30 inches on February 9th. Therefore, melting snow became just as severe a problem as the heavy rains. The combination was devastating.

At Portland, the Willamette River crested just 5 inches from the top of the sea wall, saving the downtown areas from widespread flooding. The Columbia River crested between 7 and 14 feet above flood stage at various stations. The flooding was considered to be the worst since 1964 in many areas. Several smaller rivers reached record levels at one or more measuring sites, including the Sandy, Tualatin, Pudding, S. Yamhill, and Nehalem Rivers. Over 30,000 residents were forced from their homes; numerous bridges and roads were washed out (including parts of I-90 and I-5); and 60 counties in Oregon, Washington, Idaho, and Montana were declared federal disaster areas because of the flooding.

Interstate 5 was blocked by a mudslide near Centralia, and was also closed at Chehalis because of water over the road, severing western Washington's major north-south route. Sections of Interstate 82 were closed because of flooding along the Yakima River. The White Pass highway (U.S. 12), the last link between eastern and western Washington, was closed near Randle because of water over the road. Interstate 90 and U.S. 2, the major east-west routes across the Cascades, were closed by mudslides.

Of the nine people who died, six victims were in Oregon, two in Montana, and one in Washington. Oregon officials estimated at least \$400 million in uninsured property damage alone, as only about 20 percent of the homes and businesses destroyed or damaged there are covered by insurance. Oregon also reported \$166 million in highway damage and \$165 million in waterway infrastructure damage. States of emergency were declared in 19 of Washington's 39 counties. Officials there estimated flood damage at \$120 million. In Idaho, flood damage is estimated to be well over \$100 million. Overall damage estimates for the Pacific Northwest are not yet complete, but are well over \$600 million and climbing. Over 1000 homes in the region were either severely damaged or destroyed.

During the third week of February the tropical feed shifted south, moving the heaviest precipitation into California. Mt. Wilson reported over 19 inches for the month. The heavy precipitation generally did not reach the Rockies. In fact, winter precipitation along the continental divide was below normal, with extremely dry conditions found east of the mountains in the central and southern plains. Several samples of February's precipitation in these areas:

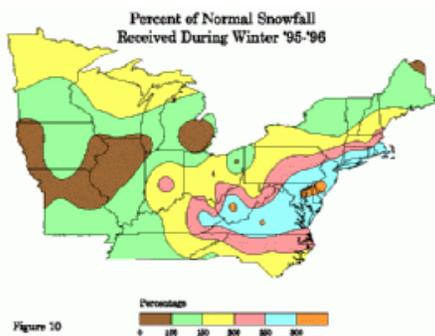
In Colorado: Denver--.38 inches, Colorado Springs--.18 inches. In New Mexico: Hobbs--.08 inches, Roswell--.23 inches. In Texas: San Angelo--.49 inches, Corpus Christi--.42 inches, San Antonio and Del Rio--no measurable precipitation for the month. In Arizona: Yuma and Tucson--no measurable precipitation for the month.

## Summary and Conclusions

Figures 8-9 provide a state by state and national perspective on the winter (December through February) conditions taken as a whole. Compared to normal, the Southeast was the coldest region, and the Southwest was the warmest. The upper Midwest and Northeast regions were also colder than normal, although periods of warmth 'masked' the periods of extreme cold. You can click on this image to see a larger version.



Much of the nation received near to below normal precipitation, with portions of the far west, north-central, and New England being wetter than normal. The northern plains, Great Lakes, mid-Atlantic, and Northeast generally received 200-350% of normal seasonal snowfalls. [Table 4](#) shows seasonal snowfall amounts (as of April 30), including 24 locations which set new seasonal records. Figure 10 shows the percent of normal for the season over the mid-Atlantic and Northeast regions. You can click on this image to see a larger version.



Over 300 deaths can be attributed in some way to the Winter of '95-'96. Also, \$3-4 billion in total damages and costs were inflicted by the combination of very heavy snowfall and severe flooding. For further information and data, please contact the National Climatic Data Center -- email: [orders@ncdc.noaa.gov](mailto:orders@ncdc.noaa.gov), phone 704-271-4800, WWW homepage <http://www.ncdc.noaa.gov>. This report is also on line via NCDC's homepage.

## References

NCDC obtained the information from this report from numerous sources including:

- The National Weather Service
- The Midwestern Climate Center
- The Oregon State Climatologist
- The Pennsylvania State Climatologist
- The Climate Prediction Center
- The U.S. Geological Survey
- Individual state emergency management offices

All figures for damages and fatalities are based on individual state reports from their emergency management offices. The Climate Prediction Center has an excellent report available on line with additional information concerning the Winter of 1995-1996--internet address is <http://nic.fb4.noaa.gov/products/>.

[Table 1 - Blizzard of '96 Snowfall Totals \(inches\)](#)

(Most data obtained from NWS bulletins via internet)

[Table 2 - Lowest Temperature \(degrees F\) , February 1-5, 1996](#)

(Based on NWS bulletins obtained via internet)

[Table 3 - Pacific Northwest Precipitation \(in inches\), February 3-9, 1996](#)

Preliminary report based on NWS bulletins obtained via internet

[Table 4 - Table of 1995-96 seasonal snowfall totals \(in inches\), along with seasonal normals and percent of normal.](#)

\* indicates new seasonal record. Values are as of April 30, 1996.

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<http://nndc.noaa.gov/onlinestore.html>

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