

THE EXTREME WEATHER OF FEBRUARY 1979 IN THE BALTIMORE-WASHINGTON AREA

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Abstract

February 1979 was the coldest February of this century and one of the coldest months ever recorded in the Baltimore-Washington area. Temperatures plummeted below 0°F (-18°C) on several nights at most suburban localities with record daily low minimum and low maximum temperatures being set. February 1979 was also the snowiest February this century and one of the snowiest months in the Baltimore-Washington area since official records were first taken in the early 1800s. The greatest 24-hour snowfall for any February on record also occurred in February 1979. In addition, February 1979 was the wettest February of the century in many localities in and around the Baltimore-Washington area.

INTRODUCTION

For most of this decade February has been a rather docile month. Temperatures in the 60s $^{\circ}\text{F}$ (15°C) and 70s $^{\circ}\text{F}$ (21°C) were not uncommon, and snowfall was infrequent and inconsequential. Residents of the Middle Atlantic States were lulled into believing that February was the advent of Spring rather than the dead of Winter. However, the past two years in the month of February (1978 and 1979) stunned many people into the realization that February is indeed a winter month.

During most of February 1979 a strong quasi-stationary upper trough was positioned over the northeastern United States (Figure 1).

This intense trough maintained a vigorous flow of frigid Canadian air into the Middle Atlantic area, but during the last week of the month the trough weakened somewhat which resulted in a more zonal flow and milder temperatures.

At the surface, a massive high pressure system that extended from Siberia across the North Pole into Canada and the northern U.S. dominated the weather for most of the first three weeks of the month; however, low pressure systems did affect the Middle Atlantic States on four separate occasions.

TEMPERATURES

February 1979 was the coldest February in 80 years in the Baltimore-Washington area. The average temperature at Baltimore-Washington International Airport (BWI), Dulles International Airport (IAD), and National Airport (DCA) was

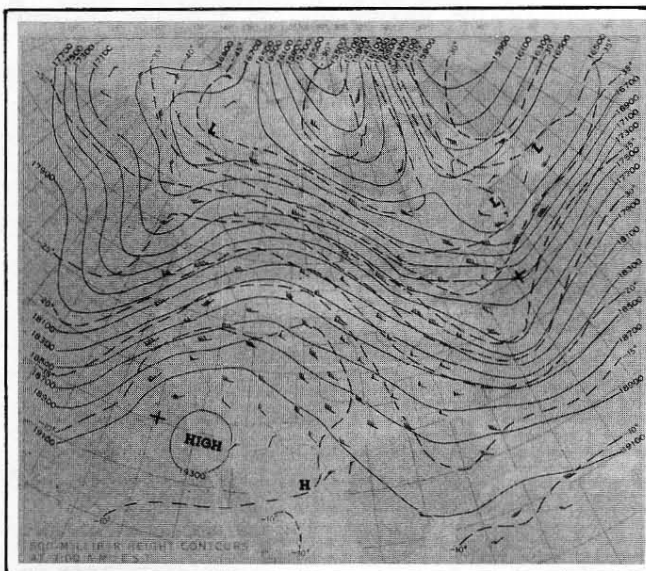


Figure 1. Mean February 1979 500-mb Height Contours.

25.6 $^{\circ}\text{F}$ (-3.5°C), 23.3 $^{\circ}\text{F}$ (-4.8°C) and 28.4 $^{\circ}\text{F}$ (-2.0°C), respectively (Figure 2). The normal February temperatures at these airports are 34.98 $^{\circ}\text{F}$ (1.5°C) at BWI, 33.8 $^{\circ}\text{F}$ (1.0°C) at IAD, and 37.3 $^{\circ}\text{F}$ (2.9°C) at DCA. BWI is generally representative of temperature conditions in suburban areas, IAD of temperature conditions in rural areas and DCA of temperature conditions in urban areas.

Maximum temperatures failed to reach the freezing mark on 15 occasions at BWI, 16 occasions at IAD and 11 occasions at DCA, and maximum temperatures remained below 20 $^{\circ}\text{F}$ (-7°C) on 5 different days at BWI and IAD. On February 18

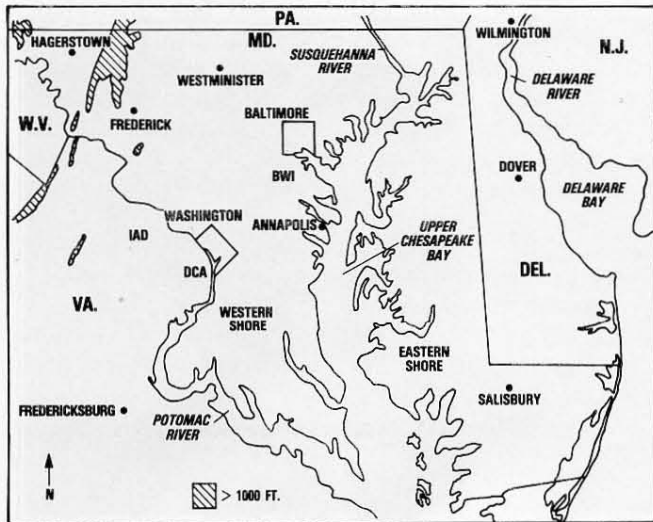


Figure 2. Location of Baltimore-Washington International Airport (BWI), Dulles International Airport (IAD), and National Airport (DCA).

the maximum temperature did not exceed 10°F (-12°C) at many localities. During the last several days of the month temperatures finally moderated as the upper trough was displaced to the east, and the flow aloft was from the southwest rather than the northwest. Maximum temperatures in most areas reached 50°F (10°C) on February 22 and again on February 28.

Minimum temperatures were below freezing 25 days at BWI, 26 days at IAD, and 22 days at DCA. Temperatures dropped to 0°F (-18°C) on three different occasions at BWI and on 7 different occasions at IAD, and in some localities temperatures of -10°F (-23°C) were recorded on 3 different occasions. On February 18 IAD reported a low of -14°F (-25°C) and a high of 8°F (-13°C) which resulted in an average daily temperature of -3°F (-19°C). For a ten-day period between February 9 and 18, the average maximum temperature at some localities in the Baltimore-Washington area was 20°F (-7°C) and the average minimum was 0°F (-18°C). This was the coldest 10-day period since February 1899 in the Baltimore-Washington area. The average temperature for this 10-day period was more than 20°F (-7°C) below normal. For the entire month the average daily temperature was below normal on 22 of the 28 days and above normal on only 4 days.

The unusually cold temperatures that prevailed during most of February were caused by: - the persistent upper trough and surface High that continuously forced frigid air into the Middle Atlantic area; (2) radiational cooling that resulted from the frequent clear nights and unusually deep snow cover. Not only does the presence of snow reflect heat away from the surface, but snow emits long wavelength radiation at a more effi-

cient rate than does grass or soil; thus, temperatures are likely to decrease more rapidly when a snowcover is present; (3) also, the snowcover produces a much smoother surface than the underlying ground, and therefore there is less turbulence at the microscale. The lack of turbulence allows the temperature to drop rapidly, soon after the sun sets; and (4) in addition, almost 2/3 of North America was snowcovered during February 1979, and so air masses moving across the cold snow did not moderate to the extent that they normally would when the ground is free of snow.

The extended period of extremely cold air produced severe ice conditions in the Chesapeake Bay and its tributaries (Figure 3). The ice was especially severe in the Chesapeake Bay north of the Potomac River. In many areas of the upper bay the ice was 6-10 in (15-25 cm) thick, and ice 18 in (45 cm) thick was not uncommon in estuaries and in sheltered areas near the shore. Only steel-hulled ships with a minimum of 1,000 horsepower were permitted in the upper bay, and Coast Guard escorts were required for ships in the Potomac River. Although the ice conditions in February 1979 were not as severe as in January and early February 1977, the ice cover was unusually extensive for so late in the winter. Ice remained on ponds and reservoirs in many places until early March.



Figure 3. Ice Pilings on the Shore of the Chesapeake Bay, February 17, 1979.

SNOWFALL

February 1979 was the snowiest month this century and one of the snowiest months ever in the Baltimore-Washington area. The average snowfall for February is about 6 in (15 cm) at BWI, 7 in (18 cm) at IAD, and 5 in (13 cm) at DCA. But in February of 1979 more than 30 in (75 cm) of snow was reported at nearly every location in the Baltimore-Washington area. BWI recorded 33.1 in (84 cm), IAD 27.6 in (70 cm) and DCA 30.6 in (78 cm). There were 10 days when measurable amounts of snow fell during the month. This was also one of the wettest months of February on

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record. More than 7 in (178 mm) of precipitation was measured at BWI. Most of this precipitation occurred during two separate storms; the snow storm of February 18-19, and the rain storm of February 24-25.

There were three heavy snow storms in the Baltimore-Washington area during February 1979, each of which deposited at least 4 in (10 cm) of snow. The storm of February 7 was caused by a low-pressure system that developed in the Gulf of Mexico. The low moved to the northeast through Georgia and South Carolina and then proceeded up the Atlantic coast. Approximately 4-8 in (10-20 cm) of snow fell from this system. The western suburbs of Baltimore and Washington, since they are as much as 500 ft (150 m) higher than the eastern suburbs, received somewhat more snow. The snow storm of February 12 resulted from a low-pressure system that formed to the lee of the Rocky Mountains and then moved to the east, passing just to the south of Washington. About 6 in (15 cm) of snow was measured throughout the area.

The record snow storm of February 18-19 deposited between 15-25 in (38-64 cm) of snow. BWI, IAD, and DCA recorded 20 in (51 cm), 16 in (41 cm) and 19 in (48 cm) respectively; but most suburbs reported higher amounts. This storm was the result of two low pressure systems that merged off the North Carolina coast (Figure 4). One low located over Kentucky on the morning of the 18th moved to the east, and the other low off the east coast of Florida moved to the north. Early on the morning of the 19th these two lows merged off the North Carolina coast and moved slowly to the northeast. Snow began to fall late in the afternoon of the 18th, but by midnight only about 4 in (10 cm) of new snow had accumulated. From approximately 3:00 AM - 9:00 AM on the 19th, the rate of snowfall was extremely intense. During this 6-hour period the rate of snowfall averaged about 2 in (5 cm) per hours; however some localities received as much as 5 in (13 cm) per hour between 7:00 AM - 8:00 AM. Visibility dropped to about 1/16 mi (0.1 km) during these intense snow bursts. The snow ended in most areas by 10:00 AM, so the duration of the storm was approximately 18 hours. This was the greatest amount of snow ever recorded in a 24-hour period in the Baltimore-Washington area during the month of February.

Owing to the low temperatures at which the snow fell, the snow was quite dry, with 10 in (25 cm) of snow having a water equivalent of about 0.9 in (2.3 cm). Wind gusts during the storm reached about 20-25 mph (9-12 ms) and the light dry snow was easily blown into 4-6 ft (1.2-1.8 m) drifts (Figures 5 and 6). But this storm did not qualify as a true blizzard. In a true blizzard, wind velocities of 35 mph (15 ms) or more must be

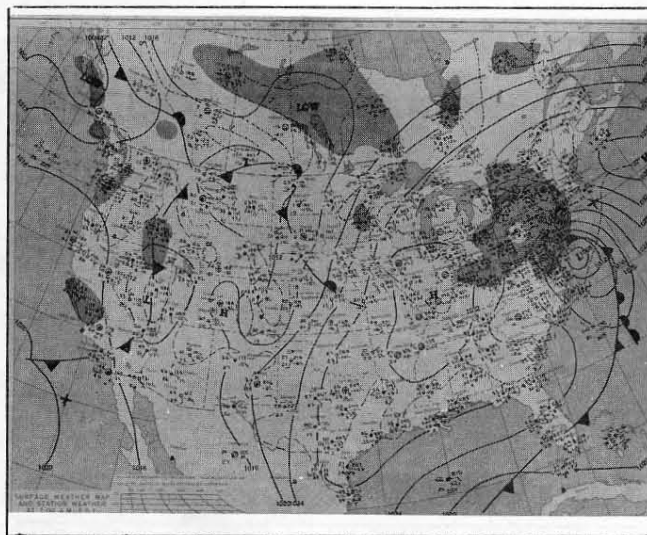


Figure 4. Surface Weather Map at 7:00 AM EST, February 19, 1979.

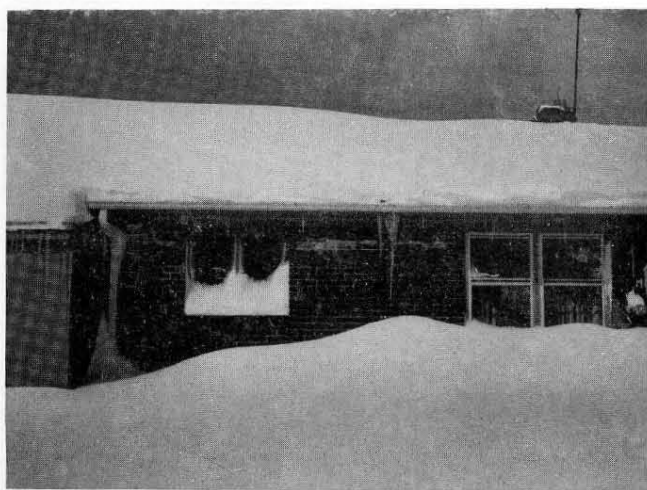


Figure 5. Aftermath of February 18-19 Snow Storm Which Deposited 15-25 in of Snow in the Baltimore-Washington Area.



Figure 6. Snow Drifts Completely Covering Cars. Antennae Can Be Seen Protruding Through The Snow.

sustained, and the visibility must be reduced to .25 mi (.4 km) or less. This storm easily met the latter criteria but not the former. On Maryland's Eastern Shore, however, which was much closer to the storm center, blizzard conditions were met as wind gusts of 60 mph (26 ms) were measured and the visibility was less than .25 mi (.4 km).

Although this was an intense storm, the Baltimore-Washington area was far enough from the center of the storm so that the barometer did not fall below 30.00 in (1016 mb) during the entire storm. The barometer on the afternoon of the 18th was at about 30.80 in (1043 mb) and dropped to about 30.20 in (1022 mb) during the peak of the storm on the morning of the 19th.

There have been four other noteworthy snow storms in the Baltimore-Washington area in the last 100 years. In February 1899 the "Blizzard of 1899" produced up to 35 in (89 cm) of snow in a storm that lasted about 54 hours. The "Knickerbocker Storm" of January 1922 covered the ground with about 25 in (64 cm) of snow, and following the "Palm Sunday" storm of March 1942, 20-25 in (51-64 cm) of snow blanketed the ground. More recently, the "Blizzard of 1966" produced more than 15 in (38 cm) of snow in January of that year.

There was 5-9 in (13-23 cm) of snow on the ground prior to the February 18-19 storm of 1979 (Figure 7). After the storm had passed, the snow depth increased to about 20-30 in (51-76 cm) in open areas and as much as 25-30 in (64-76 cm) in wooded areas (Figure 8). This was the greatest depth of snow on the ground that was observed since 1922 in the Baltimore-Washington area.

The cost of the February 18-19 storm was estimated to be close to \$200 million. This included revenues lost by businesses, the cost of cleaning area streets, train tracks and runways, money spent in salaries for employees who were not able to go to work, and repair costs for damaged homes and automobiles. Since the storm occurred on a holiday (George Washington's birthday) the impact of the storm on retailers was especially severe, because this is one of the biggest shopping days of the year. Although Tropical Storm "Agnes" in June 1972 was perhaps the most expensive storm in the Baltimore-Washington area, it did not have such devastating consequences on retail businesses and travel.

Amazingly enough, almost all of the snow which had accumulated during the February 18-19 storm had disappeared by February 25 (Figure 9). The first few days following the storm the temperatures moderated gradually. However, on the 22nd, the temperature exceeded 50°F (10°C) for the first time in a month, and under sunny skies the snow rapidly melted. In addition, several inches of snow were lost from the snowpack as

the snow settled. By the morning of the 23rd only about 8-12 in (20-30 cm) of snow remained. The snowpack had become isothermal and melting was prevalent throughout the pack. Under such condi-

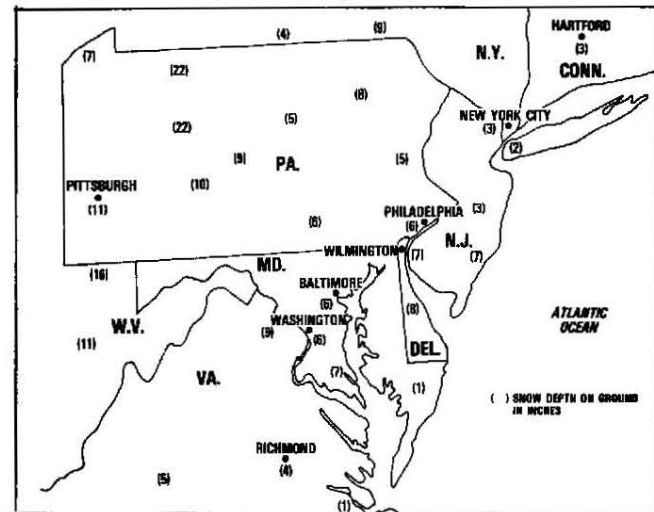


Figure 7. Observed Snowcover 7:00 AM EST, February 13, 1979.

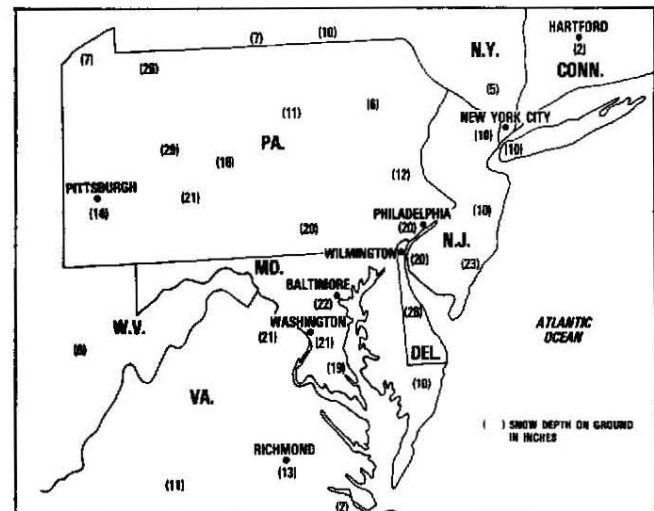


Figure 8. Observed Snowcover 7:00 AM EST, February 20, 1979.

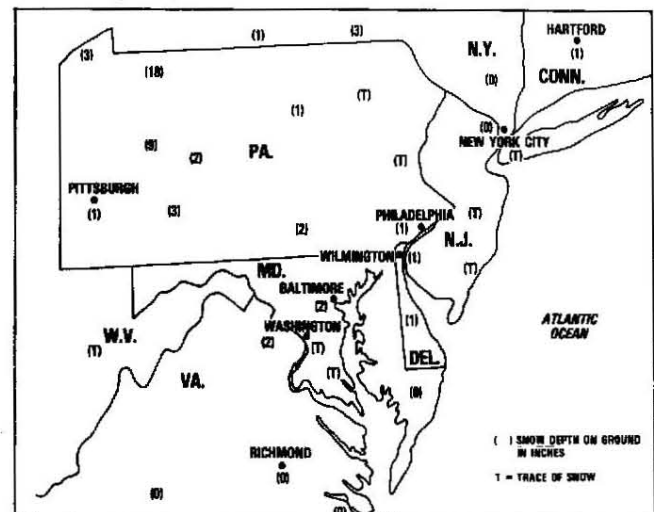


Figure 9. Observed Snowcover 7:00 AM EST, February 27, 1979.

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tions the snowpack lost its structure and collapsed. From February 13-26, the maximum temperatures hovered around 40°F (4°C) and most of the remaining snow was eventually washed away by heavy rains. Since the soil was saturated with water from above normal precipitation in December and January, and because the ground was frozen solid as a result of the record cold temperatures, the combination of 2 ft (.6 m) of melting snow and several inches of rain produced flooding in many areas from February 24-27.

The final storm of February 1979 was also the wettest. Unlike the three previous storms, the precipitation from this storm was entirely rain. Nearly 3 in (76 mm) fell from the night of February 24 through the morning of February 27. This storm was a result of a low-pressure trough that became cut off over the southeastern United States (Figure 10). With the cut-off Low in this location vast amounts of moisture were drawn out of the Gulf of Mexico and into the Middle Atlantic States. This action produced prodigious tropical-like rains in the Baltimore-Washington area. The Potomac River at most gauging stations reached its highest February level ever as a result of the heavy snow storm and heavy rain

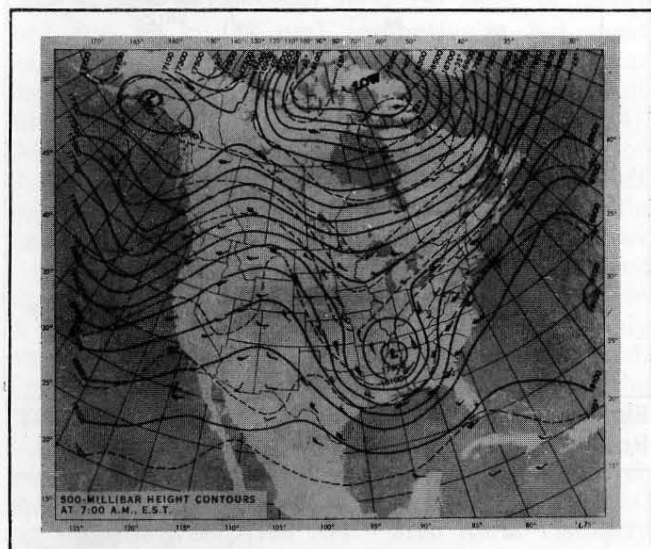


Figure 10. 500-mb Map at 7:00 AM EST, February 25, 1979 Showing Location of Cut-Off Low.

storm occurring within one week of each other. The monthly precipitation was 7.6 in (182 mm) at BWI, 5.75 in (146 mm) at IAD, and 6.31 in (160 mm) at DCA. The normal precipitation at BWI, IAD, and DCA is 2.81 in (71 mm), 2.61 in (66 mm), and 2.45 in (62 mm), respectively. It was the wettest February recorded in the Baltimore-Washington area since 1884.

COMPARISON BETWEEN FEBRUARY 1979 AND FEBRUARY 1899

In many ways, February 1979 was remarkably similar to February 1899 which was perhaps the most severe February during the 19th Century. In February 1899 the average maximum temperature at Baltimore was 34.9°F (1.6°C) and the average minimum temperature was 21.8°F (-5.6°C). In February 1979 the average maximum was 33.3°F ((.7°C), and the average minimum was 17.8°F (-7.8°C) (Table 1). It should be noted that in 1899 the weather records were taken in the city of Baltimore, but since 1951 data has been taken at the airport several miles south of the city limits.

It is interesting how the temperature regime of February 1979 closely approximates that of February 1899 (Figure 11). As in February 1979, temperatures were extremely cold during the middle of the month in February 1899. At Balti-

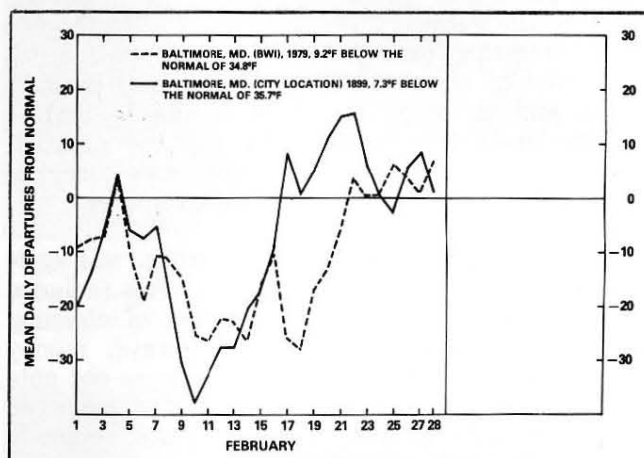


Figure 11. Mean Daily Departures From Normal for February 1979 and February 1899.

TABLE 1
FEBRUARY

Year	Avg. Max Temp	Avg. Min Temp	High Max Temp	Low Min Temp	High Pressure	Low Pressure	Total Precip.	Total Snow	Max. 24-Hr. Precip
1899	34.9°F	21.8°F	60°F	-7°F	30.71 in	29.53 in	5.47 in	41 in	1.10 in
1979	33.3°F	17.8°F	52°F	-3°F	30.89 in	29.58 in	7.16 in	33 in	1.90 in

more, maximum temperatures remained below 10°F (-12°C) on the 9th and 10th, and at several localities in the Baltimore-Washington area the maximum temperature failed to reach 0°F (-18°C). Minimum temperatures were below 0°F (-18°C) on two occasions at Baltimore and three occasions at Washington and on as many as seven occasions in some suburban areas. The temperature dropped to -7°F (-21°C) at Baltimore on the 10th and -15°F (-26°C) at Washington on the 11th. This is the lowest temperature ever recorded in Washington. The sudden and extreme cold weather produced severe icing in the Chesapeake Bay and halted shipping traffic for a week. After the 18th, temperatures moderated considerably and the maximum temperature exceeded 50°F (10°C) on six different occasions during the next eleven days. The highest temperatures of the month were recorded on the 22nd as temperatures climbed into the low 60s (15°C).

In February 1899 as in February 1979, there were three snow storms each of which deposited at least 4 in (10 cm) of snow. In 1899, 6 in (15 cm) of snow fell at Baltimore on the 4th of February and an additional 5 in (13 cm) accumulated from the 6th through the 8th. The greatest snow fall of the 19th century occurred during a 54-hour period in February 1899.

From late in the evening on the 11th until early in the morning on the 14th, 24-36 in (61-91 cm) of snow accumulated during what has become known as "The Blizzard of 1899". This storm was produced by a Low pressure system which formed over northern Florida on the 11th. The Low intensified as it moved to the north and was located just off the Virginia coast on the 13th (Figure 12). Sustained winds of over 35 mph (15 ms) and gusts of over 50 mph (22 ms) blew the powder-like snow into drifts as high as 20 ft (6 m). The entire Baltimore-Washington area was completely snowbound until the 15th. Following the blizzard, in many places the total depth of snow on the ground was nearly 40 in (102 cm), as the snow from the two previous storms did not melt appreciably due to the continuing cold weather. February 1899 was the snowiest February ever in the Baltimore-Washington area. As was the case in 1979, the unprecedented snow storm of February 1899 was the climax or turning point of the winter weather. For the remainder of February the temperatures averaged above normal and no snow was reported, but heavy rains occurred from the 16th through the 18th and again on the 26th and 27th. The total precipitation for February 1899 at both Baltimore and Washington was 5.47 in (139 mm), and there were 17 days when measurable precipitation occurred. Precipitation was in the form of snow on 11 of the 17 days. In February 1979 the total precipitation at Baltimore was 7.16 in (182 mm) and there were 14 days when precipitation was measured. Snow was reported on 10 of the 14 days.

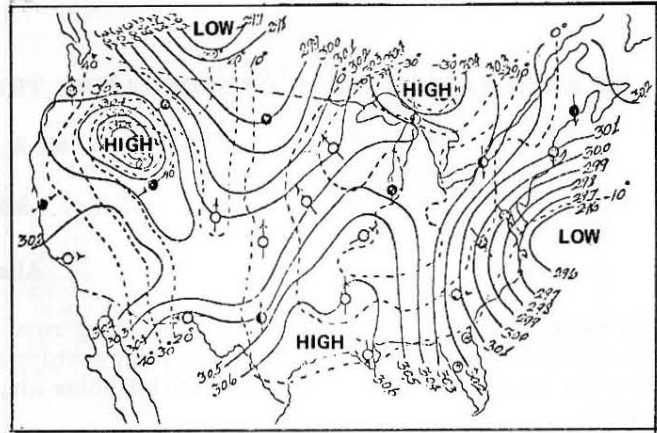


Figure 12. Surface Weather Map at 8:00 AM on February 13, 1899.

CONCLUSIONS

February 1979 was the coldest, snowiest, and wettest February this century in the Baltimore-Washington area. The most noteworthy events of the month were: (1) the extremely cold period from the 9-18th when the temperatures averaged more than 20°F (7°C) and below normal; (2) the snow storm of February 18 and 19 which deposited 15-25 in (38-64 cm) of snow in an 18-hour period; 12 in (30 cm) of which occurred in a six-hour period; and (3) the rain storm from 24-27 February which produced almost 3 in (76 cm) of rain and together with the melting snow was responsible for widespread flooding of low-lying areas. February 1979 will be remembered for a long time; it was, indeed, quite a month.

ACKNOWLEDGEMENTS

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