# Climate of Delaware

## Introduction

This publication consists of a narrative that describes some of the principal climatic features and a number of climatological summaries for stations in various geographic regions of the State. The detailed information presented should be sufficient for general use; however, some users may require additional information.

The National Climatic Data Center (NCDC) located in Asheville, North Carolina is authorized to perform special services for other government agencies and for private clients at the expense of the requester. The amount charged in all cases is intended to solely defray the expenses incurred by the government in satisfying such specific requests to the best of its ability. It is essential that requesters furnish the NCDC with a precise statement describing the problem so that a mutual understanding of the specifications is reached.

Unpublished climatological summaries have been prepared for a wide variety of users to fit specific applications. These include wind and temperature studies at airports, heating and cooling degree day information for energy studies, and many others. Tabulations produced as by-products of major products often contain information useful for unrelated special problems.

The Means and Extremes of meteorological variables in the Climatography of the U.S. No.20 series are recorded by observers in the cooperative network. The Normals, Means and Extremes in the Local Climatological Data, annuals are computed from observations taken primarily at airports.

The editor of this publication expresses his thanks to those State Climatologists, who, over the years, have made significant and lasting contributions toward the development of this very useful series.

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## Climate of Delaware

Topographic features- The State of Delaware is located on the east coast of the United States midway between the North and the South. It is bounded on the east by the Atlantic Ocean and by the Delaware Bay and Delaware River, which separate it from New Jersey for a distance of about 85 miles. The northern arc-shaped portion of the State is bounded by Pennsylvania for a distance of 25 miles. On the west and south, Delaware is bounded by Maryland.

Delaware lies in a north-south position, spanning a distance of 96 miles. The width increases from nine miles in the northern portion to 35 miles in the extreme southern portion. The State occupies the northeastern potion of the Delmarva Peninsula which is bounded by the Chesapeake Bay on the west and Delaware Bay and the Atlantic Ocean on the east.

The total area of Delaware is 2,057 square miles. By size, it is the second smallest state, exceeding only Rhode Island.

Although Delaware ranks as the 49$^{th}$ largest state and does not encompass a wide range of physiographic features, its north-south orientation with highest elevations in the extreme northern portion most distant from bays and the ocean contribute to climatic differences between northern and southern portions of the State. Delaware has two rather well-defined physiographic belts which parallel the Atlantic Coast—the Coastal Plain and the Piedmont Province.

The Appalachian Mountains extend along a northeast-southwest axis about 150 miles to the northwest of Delaware. These mountains range in height from 2,000 feet to 3,000 feet and contribute to some slight tempering of the cold air masses which move rapidly out of the interior of the continent over the Delaware region in the winter.

Over 95 percent of the land area of the State is more or less flat and without significant topographic features: however, the extreme northern portion, about 120 square miles, which lies in the Piedmont, is undulating and hilly with elevations rising to 438 feet. This increase in elevation contributes to a slight decrease in local temperatures under certain circumstances.

The land rises more or less gradually from the Atlantic Ocean across the Coastal Plain. Elevations in the southernmost county, Sussex, are generally below 50 feet above sea level, but rise to 70 feet at a point near the midpoint of the southern boundary. Large portions of the State along the Atlantic Coast, Delaware Bay and Delaware River are low and marshy. Small streams and tidal estuaries comprise the drainage of the State. In the southwestern portion the flow is southwestward into Chesapeake Bay, while in the northern and eastern portions it is eastward into Delaware Bay and the Atlantic Ocean.

The Piedmont Province includes approximately five percent of the land area of the State. It is characterized by undulating, hilly terrain. From its southern boundary, which is known as the Fall Line, low undulation hills gradually increase in elevation toward the Pennsylvanian border.

Since the flow of the atmosphere in temperate latitudes is from west to east, the distribution of land and water masses gives the Delaware area a continental climate. This type of climate in middle latitudes is marked by well-defined seasons. Winter is the dormant season for plant growth and is one of low temperature rather than drought. In spring and fall, the changeableness of the weather is a striking characteristic. It is caused by a rapid succession of warm and cold periods associated with storms, which generally move from a westerly direction over the eastern portion of the United States. Summers are warm to hot. The higher atmospheric humidity along the coast causes the summer heat to be more oppressive or sultry and the winter cold more raw and penetrating than in drier climates interior.

A semi-permanent high pressure area (clockwise circulation in the northern Hemisphere) virtually overspreads the entire Atlantic Ocean at middle latitudes and exerts a pronounced effect on the weather regimes of the East Coast as well as contiguous regions. During the winter season, the Atlantic High maintains an average position between latitudes 32 and 35° North and longitudes 40 and 45° West. In the summer location the Atlantic High dominates the flow of air over the eastern United States. Weather in this type of air mass consists of scattered thunderstorms, considerable daytime cloudiness, and hot, sultry conditions. In this position the high exerts blocking action on Lows, which are then forced to travel across more northerly latitudes. Persistence of this high over the eastern United States frequently results in drought conditions.

Temperature- The difference in latitude of northern Delaware and southern Delaware contributes in some part to the difference in mean temperature between these two regions of the State. The mean temperature difference of three to four degrees Fahrenheit (° F) between northern and southern portions in winter and one to two degrees in summer is largely, but not entirely, due to the variation in solar radiational heating. The greater yearly range in mean temperature in northern Delaware, 42° F as compared to 40 in southern Delaware is due, in part, to the increase in the yearly variation of solar radiation at higher latitudes.

In the extreme northern portion where elevations range from 300 to 400 feet, altitude plays a small role in temperature, and reduces temperatures by approximately one degree on average compared to the nearby lower terrain.

In order for ocean currents to act as a direct temperature control, the winds must be prevailing onshore. The relatively frequent occurrence of easterly winds associated with cyclonic storms to the southeast brings about advection of air off the mild waters and consequently tend to raise the normal winter temperatures and lower the summer temperatures. Therefore, mean winter temperatures of Delaware are roughly five degrees higher than for regions of the continental interior at the same latitudes.

The effect of the Gulf Stream and the Atlantic Ocean is to lower mean temperatures along the Atlantic coastal area by about one to two degrees in summer as compared to mean temperatures

at the same latitude along the western boundary of the State. To the north, as the width of the State diminishes and distance from the Atlantic Ocean increases, this summer depression of the mean temperature along the coast virtually vanishes. The greater maximum temperature depression in southern coastal areas arises largely from a greater amount of insolation and a more pronounced sea breeze. On some hot summer days the maximum temperatures on the coast may be as much as 10 to 15° F lower than at points inland, it is this climatic condition that makes the Delaware coast a popular resort and vacation area in summer.

In winter there is virtually no difference between mean temperatures at coastal and inland points at the same latitude. However, the extreme low temperatures generally occur at inland stations. Extreme high temperatures for the winter months occur more or less at equal frequencies between coastal and inland points.

The climate of Delaware is "humid temperate" with hot summers and mild winters. The mean annual temperature ranges from 55 in New Castle County to 56° F over Kent and Sussex counties.

The winter climate is intermediate between the cold of the Northeast and the mild weather of the South. Extremely cold air masses from the interior of the continent are moderated somewhat by passage over the Appalachian Mountains. The average frost penetration ranges from about five inches in southern Delaware to about 10 inches in northern Delaware. Summer weather is characterized by considerable warm weather, including at least several hot, humid periods. However, nights are usually quite comfortable. The average length of the growing season based on minimum temperatures higher than 32° F, ranges from about 175 to 195 days.

The lowest temperature of record for Delaware is -17° F, at Millsboro on January 17, 1893, came in a month which is quite likely the coldest ever known in Delaware and surrounding areas. Noteworthy is the fact that Millsboro also has the distinction of having the highest temperature, 110° F, which occurred on July 21, 1930. An extended heat wave during the period July 18-31, 1930, brought maximum temperatures of 100° F, or higher, on three to four consecutive days at many places.

Temperatures of 90° F or higher occur on 15 to 20 days per year on the average in coastal areas and on 25 to 30 days at inland points. The fist day with a 90 or higher temperature occurs in May or early June. An average of one day with a maximum temperature of 90 or higher occurs in May. The last day with a maximum temperature of 90 or higher usually occurs in September or infrequently in early October. September has an average of one to two days per year with a maximum temperature of 90° F or higher. The average number of days per year with a minimum temperature of 32° F or lower varies from 90 to 100 days for coastal locations to 100 to 110 days at inland points. Temperatures of 0° F or lower occur in the winter months.

Precipitation- The average annual precipitation ranges from 44 inches in northern Delaware to 47 inches in southern Delaware. The monthly distribution is fairly uniform throughout the year, with July and August having the greatest amounts. The greater precipitation in July and August is attributed to the heavy intensities or larger quantities of precipitation associated with the infrequent to rare tropical systems or their remnants.

Precipitation in the summer season is less dependable and more variable than in winter. Although rainfall amounts are general sufficient to grow good crops, the unequal distribution of summer showers and occasional dry periods at critical stages of crop development make irrigation necessary for maximum crop yields.
The greatest daily precipitation of record for Delaware is 8.50 inches at Dover on July 13, 1975.

Flooding occurs infrequently, usually causing only minor damage, and results largely from tides pushed by strong easterly winds. The passage of tropical systems is usually in August or September. These storms pose a great threat of flooding.

The mean snowfall is 18 inches in northern Delaware and 14 inches in southern Delaware. The snow season runs from December through March, with a few light flurries in some years as early as November or late October and as late as early April. Heaviest snowfalls in Delaware generally occur in February and March. Among the outstanding snowstorms is the occurrence of February 14, 1899, when 30 to 36 inches of snow fell on Delaware. The blizzards of 1996 and 1993 also produced significant snowfall amounts.

Delaware is in the mean zone of the "westerlies" in the winter, and slightly south of the tracks followed by most of the migrating cyclones in their movement from some point in the United States to the region of semi-permanent low pressure in the Iceland or North Atlantic area. Cyclones which cross the northwestern United States, develop north of Colorado or in the central United States tend to follow paths to the north of Delaware in their easterly migration: however, cyclones which have their origin in Texas, or the Gulf of Mexico, often bring the heaviest widespread rains to the Delaware area, aside from tropical cyclones or extremely local severe thunderstorms.

There is no record of a hurricane entering the State from the Atlantic coast, but a few have crossed over the State from the south or southwest. Some hurricanes have passed northward a short distance off the Delaware coast.

Thunderstorms occur at a given station on the average of 30 to 33 days per year. The Atlantic coastal region has fewer thunderstorms than interior portions, on the average. They have been observed in every month of the year, however. Occurrences from November through February are extremely rare. One to two thunderstorm days are noted each year at a given station on the average in March and also in October. The four month period, May through August, makes up the thunderstorm season with an average of about six thunderstorm days in each month at a given station. As many as 15 days per month with thunderstorms at a given station have occurred. In extreme years, thunderstorms have occurred on 50 or more days at a given station. As few as 20 thunderstorm days per year have been recorded. July is the month with the greatest frequency of thunderstorms on the average: however, there is a pronounced variability in the number of thunderstorms in July from year to year.

Climate and the Economy- Both the weather climate and business climate are favorable for economic development in the State. Several major companies have their headquarters in Delaware. The coast's cooler daytime temperatures make it an enjoyable place to visit during

the warmer half of the year. Resorts areas such as Rehoboth Beach are very popular. Crops include some truck farming, which finds ready markets in the large cities nearby, and corn. Poultry production is also an important venture.