

Climate of New Hampshire

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Unpublished climatological summaries have been prepared for a wide variety of users to fit specific applications.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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Topographic Features- New Hampshire occupies 9,304 square miles, nearly one-seventh of New England's total area. From south of 43° North latitude, it extends nearly 200 miles northward to beyond 45° North latitude. At its southern border, New Hampshire extends westward from the Atlantic coastline for almost 100 miles. It narrows to less than 20 miles in width at its northern tip. The eastern border lies near 71° West longitude. Its western border is the Connecticut River, except in the extreme north.

The terrain is hilly to mountainous. Elevations less than 500 feet above sea level are only found in the coastal areas of the southeast, the Merrimack River Valley and the central and southern portions of the Connecticut River valley. Elsewhere the general elevation is from 500 to 1,500 feet, except in the extreme north where elevations reach nearly 2,500 feet. Numerous mountains extend to heights of 2,000 to 4,000 feet above sea level over most of the State except in the southeast. Many White Mountain summits rise above 4,000 feet with eight peaks in the Presidential Range above 5,000 feet. Mt. Washington towers 6,288 feet above sea level. This is the highest mountain in the northeastern United States. The climate atop Mt. Washington makes this location valuable for cold weather testing and research. However, these extreme conditions are not representative of the more temperate climate of the State in general. Some flatland is found near the coast and in the river valleys, with less than 10 percent of the total State area being classified as farmland. The glacier of the great Ice Age accounts for much of the topography, including many of the numerous lakes. About 1,300 lakes and ponds add to the State's attractions. The largest is Lake Winnepesaukee, which covers the area of 71 square miles in the central part of the State. Inland waters cover about 280 square miles. The Atlantic coast is 18 miles in length and has several fine beaches.

The two principal rivers in New Hampshire are the Connecticut and the Merrimack, both flow in a southerly direction. The Connecticut, the larger of the two, rises in the extreme northern part of the State and forms the border with Vermont. Other rivers include the Androscoggin and the Saco which rise in the east slopes of the White Mountains and flow eastward into Maine.

Approximately 80 percent of New Hampshire is forested. Considerable area, especially in the north, is sparsely settled. The mountains, hills, lakes, streams and forests combine to make New Hampshire a state of scenic beauty.

Characteristics of New Hampshire climate are: changeableness in the weather, large ranges in temperature, both daily and annual, great differences between the same seasons in different years, equable distribution of precipitation and considerable diversity from place to place. The regional New England climatic influences are modified in New Hampshire by the varying distances from the relatively mild ocean waters, elevations and types of terrain. These modifying factors divide the State into two climatological divisions, Northern and Southern. A detailed discussion concerning both divisions follows.

New Hampshire lies in the “prevailing westerlies,” the belt of generally eastward air movement, which encircles the globe in the middle latitudes. Embedded in this circulation are extensive masses of air originating in higher or lower latitudes and interacting to produce frequent storm systems. Relative to most other sections of the country, a large number of such storms pass over or near to New Hampshire. The majority of air masses affecting the State belong to three types: cold, dry air pouring down from sub-arctic North America; warm, moist air streaming up on a long journey from the Gulf of Mexico, and subtropical waters (Gulf Stream) to the east; and cool, damp air moving in from the North Atlantic. Because the atmospheric flow is usually offshore, New Hampshire is influenced more by the first two types than it is by the third. In other words, the adjacent ocean constitutes an important modifying factor, especially along the immediate coastal plain, but does not dominate the State’s climate.

The procession of contrasting air masses and the relatively frequent passage of storm circulations bring about a roughly twice-weekly alternation from mainly fair to cloudy or stormy conditions. These fluctuations are often attended by abrupt changes in temperature, moisture, sunshine, wind direction and speed. There is usually no regular or persistent rhythm to this sequence, and it can be interrupted by intervals during which the weather patterns continue stable for several days or even several weeks on certain occasions. New Hampshire’s weather, however, is cited for variety rather than monotony. Changeability is one of the features on a longer time-scale. That is, the same month or season will often exhibit varying characteristics over the years, sometimes in close alternation, sometimes arranged in similar groups for successive years. A “normal” month, season, or year is the exception, rather than the rule.

The basic climate, as outlined above, obviously does not result from the predominance of any single controlling weather regime, but is rather the integrated effect of a variety of weather patterns. Hence, “weather averages” in New Hampshire usually are not sufficient for important planning purposes without further climatological analysis.

The Northern Division contains approximately one-third of the State and includes the northern and west-central areas. Its southern border is roughly parallel to the coast, except where it bends northward near the Connecticut River. This area is affected more by its higher elevation and northerly latitude than by the ocean when compared to the Southern Division. The Southern Division comprises the remaining area. Its lower elevation and latitude tend to cause higher temperatures, though this is modified seasonally by oceanic influence. A strip near the coast could be a third division, but its small size hardly merits delineation.

Temperature- The annual temperature averages 41 degrees Fahrenheit (° F) in the Northern Division and near 45 in the Southern. Within the Northern Division it ranges from about 37 in the extreme north to 42° F in the extreme south. Averages vary within the divisions from causes other than latitude. Elevation, slope and other environmental effects, including urbanization, each has an effect. An extreme effect of altitude is Mt. Washington, whose summit has an annual average of 27° F, compared to averages of 40 to 42 at other stations in the general area. Across the State, the highest temperatures can top 100° F while the lowest can drop lower than -45° F.

Summer temperatures are delightfully comfortable for the most part. They are reasonably uniform across New Hampshire, excepting topographical extremes. Hot days (90° F or higher) occur an average from only a few times per year in the extreme north to five to 15 per year across most of the rest of the State. The frequency varies from place to place and from year to year. They range, in frequency of occurrence, from only a few in a cool summer to as many as 30 to 40 in the Southern Division in the hottest summers. The diurnal range may reach 40 degrees or more during cool, dry weather in valleys and lowlands. Freezing temperatures may be a threat even in the warmer months in a few of the more susceptible areas.

Average temperatures vary from place to place more in the winter than in the summer. Days with subzero readings are relatively few along the immediate coast but are common inland. They range from 25 to 50 in number per year for most of the Northern Division and from 10 to 25 in the Southern Division.

The growing season for vegetation subject to injury from freezing temperatures averages from 95 to 125 days in the Northern Division. In the Southern Division the average is 120 to 140 days except up to 160 to 180 in the extreme southeast, a coastal effect. Local topography causes exceptions to these values. Swampy areas, particularly, may have a shorter season. The average date of the last freezing temperature in spring varies from late April at some of the southern stations to early June in colder locations across the north. For most of the State, the growing season begins in May and ends in the latter part of September.

Precipitation- New Hampshire is fortunate in having its precipitation rather evenly distributed throughout the year. Low pressure, or frontal, storm systems are the principal year-round moisture producers. This activity ebbs somewhat in the summer, but thunderstorms are of increased activity at this time, tending to make up the difference. Though brief and often of small extent, the thunderstorms produce the heaviest local rainfall intensities, and sometimes cause minor washouts of roads and soil erosion. Rains of one to two inches in an hour can be expected at least once in a 10-year period.

Variations in monthly precipitation totals are extreme, ranging from no measurable amount to 10 inches or more. A majority of the monthly totals falls in the range of 50 to 200 percent of normal. As prolonged droughts are fairly infrequent, irrigation water is available during the fairly common dry spells of summer. Similarly, widespread floods are infrequent. However, tropical systems and their remnants can sometimes cause significant flooding. Floods occur most often in the spring when they are caused by a combination of rain and melting snow. At other times of the year, high flows and major flooding from rainfall alone occur less frequently. The mean annual runoff in the streams ranges from 14 inches in the north-central Connecticut River Valley to 50 inches in the White Mountains area.

Total annual precipitation averages near 42 inches in the Northern Division and 44 inches in the Southern. The distribution is quite uniform across the Southern Division, ranging from 37 to 46 inches. The mountainous character of much of the northern and central New Hampshire, and the generally higher elevations there, account for variability from place to place. As an extreme example, Berlin, elevation 930 feet, has an annual average of 40 inches, about 39 percent that of

Mt. Washington (102 inches), where the gauge elevation is about 6,262 feet above sea level. These stations are only about 18 miles apart.

Considerable rain and/or wet snow falls along the coast in the winter, while farther inland snow is more generally the rule. Occasionally freezing rain occurs, coating exposed surfaces with troublesome ice. Most areas can expect at least one glaze episode annually.

Measurable precipitation falls on an average of one day in three. Frequency is higher at the higher elevations and in extreme northern New Hampshire, up to 140 to 150 days annually. At the Mt. Washington station, measurable precipitation falls on average 214 days per year. As much as six inches of rain in 24 hours is rare in the State. However, the town of Warren, located in the west central part of the State, recorded 6.31 inches in six hours. New Durham had 8.00 inches in 24 hours. The heaviest, 24 hour event in New Hampshire was Mt. Washington's 10.38 inches on February 10 – 11, 1970.

Average annual snowfall amounts in the Southern Division increase from around 50 inches near the coast to 60 to 70 inches inland. Totals vary greatly in the Northern Division. Along the Connecticut River in the southern portion, totals average near 60 inches, but increase to over 100 inches at the higher elevations of the northern and western portions. The summit of Mt. Washington receives over 300 inches. As an example of great variation over a short distance, Berlin only 18 miles to the north, receives about 80 inches annually.

The number of days with one inch or more of snowfall varies from near 20 per season over much of the Southern Division up to 30 to 40 in the Northern Division and 50 or more at the highest elevations. Most years will have several snowstorms depositing five or more inches. Storms of this magnitude disrupt transportation temporarily.

On November 22 – 23, 1943, a single storm dropped 56 inches of snow at Randolph and over 50 inches at other nearby stations. However, snowstorms of as much as 20 inches or more are unusual in any part of the State. Heaviest 24-hour falls of records at some stations do not exceed 20 inches.

Snowfall is highly variable from year to year or for the same month in different years, as well as from place to place. Totals for the least snowy seasons range from one-fourth to one-half that of the greatest seasonal amounts. At Mt. Washington, for example, seasonal snowfall range from a minimum of 135 inches to a maximum of 394 inches. At Concord, totals ranged from 29 to 103 inches. Month to month variations are much greater. A few Februarys have had less than one inch of snowfall at Concord while the maximum monthly February total is 49.8 inches.

Snow cover is continuous through the whole winter season as a rule. Most frequent exceptions are found along the immediate coast and sometimes in southern portions of the State. Snow cover reaches its maximum depth, on average, during the latter half of February in the Southern Division. In the Northern Division, the greatest depth comes in early March, excepting the higher elevations where the date is deferred to the middle of March. Some stations have a tendency for a secondary maximum in December or January. Water stored in the snow makes an important contribution to a continuous water supply. The spring melting is usually too gradual to produce serious flooding.

Sunshine averages over 50 percent of the possible amount in the Southern Division. The percentage is near 50 in the lower elevations of the northern Division. Higher elevations and the peaks are cloudier, especially in winter, reducing the percentage to less than 50, generally. Mt. Washington reports an average just over 30 percent.

Heavy fog occurrence varies widely with location and topography. Persistent fogs are sometimes experienced along the coast and on the higher elevations inland. Duration of fogs diminishes inland over flat and valley locations, however, the shorter duration heavy ground fogs of early morning frequently occur at susceptible places in these areas. The number of fog days varies from a low of 20 to well over 100 for the highest peaks.

The prevailing wind, based on a yearly average, comes from a westerly direction. It is predominantly from the northwest in winter and from the southwest in summer. Topography has a strong influence on prevailing direction. Points in major river valleys, for example, may have prevailing directions paralleling the valley. Along the coast in the spring and summer, the sea breeze is important. These onshore winds, from the cool ocean, may come inland for 10 miles or so; infrequently, they may reach as far inland as 30 miles into the interior. They tend to retard spring growth, but are refreshingly cool in the summer.

The State averages two tornadoes per year. Perhaps the worst tornado experienced in New England was the 1821 Sunapee tornado. Fortunately, most tornadoes are very small, affect a localized area. Tornadoes can occur in the northern portion of the State as well. One such occurrence was at Berlin in 1929. About 80 percent of the State's tornadoes occur between May 15 and September 15. Three-quarters strike between 2:00 p.m. and 7:00 p.m. The peak months are June and July and the peak hour of occurrence 4:00 p.m. to 5:00 p.m. The chance of a tornado striking any given spot is extremely small.

Thunder and hailstorms have a similar frequency maximum from mid-spring to early fall. Thunderstorms occur on 15 to 30 days a year. The most severe are attended by hail. Hailstorms can severely damage or even ruin field crops, break glass, dent vehicles and damage other vulnerable, exposed objects. However, this danger is minimized because of the size of the area struck is usually small.

Ice storms can produce perilous travel. A few widespread and prolonged ice storms have occurred. Besides affecting travel and transport, the weight of the ice breaks limbs and trees, utility lines and poles. In designing structures such as steel towers, potential ice load should be considered. The ice load also magnifies the wind stress by increasing the area exposed to the wind.

Climate and the Economy- Activities in New Hampshire are profoundly influenced by the climate. Tree growth is especially favored. Covering approximately four-fifths of the area, forests constitute a major scenic attraction. The spectacular coloration of foliage in the autumn is of special interest, drawing numerous visitors. Forests also provide material for forest product industries. These include lumbering, paper-making, wood products manufacturing, and related industries. The ample supply of rainfall provides not only for the growth of trees but also the

huge amounts of water required in the making of paper and paper products. Electricity is generated from hydroelectric sources.

Climate is a significant factor in the State's agriculture. It favors the production of high-value, specialized crops. New Hampshire, therefore, ranks well in the Nation in cash receipts per acre from farm marketing. Poultry raising, apples production, truck farming and dairying are all important to the State's economy. Top quality maple syrup is produced in commercial quantity. Considerable acreage is devoted to pasture, hay, oats, and in the southern portion, corn. Potatoes are also grown. The most fertile soils are found in the river valleys, such as those of the Connecticut and Merrimack rivers.

To the tourism and vacation trade, New Hampshire's climate is very important. In the summer and fall, pleasant temperatures prevail at coastal and lake resorts. Skiing and related winter sports are made possible by the abundant snowfall. For hunters and anglers, the State's abundant resources provide an opportunity to try their luck and skill.

In summary, the climate of New Hampshire contributes greatly to its industrial, agricultural and vacation activities. The climate is a rich, natural asset and is favorable to further economic development.