

Historical Climatology: Columbus, Ohio



Overview and Geography

Columbus is the 15th largest city in the United States with an estimated 2013 population of over 822,000. The Greater Columbus Area is home to nearly 2 million residents.

The Scioto and Olentangy rivers meet just northwest of downtown Columbus while many tributaries run through the metro area. The topography around Columbus is generally flat with some locations that vary notably in elevation. Nearby ravines expose the bedrock, which varies from limestone to shale.

Relative to the rest of the Great Lakes region, Columbus typically experiences hot and humid summers and generally mild winters with regular cold snaps. Lake effects are limited to occasional increased cloudiness during the winter. Its position near the center of the continent makes it subject to both hot and cold extremes along with a wide range of severe weather.

Summary of Observed Changes

Rising average temperatures: Annual average temperatures warmed by 2.3°F from 1951-2012, faster than national and global rates. Average low temperatures have warmed much faster than high temperatures.

Longer freeze-free season: The length of the freeze-free season (growing season), increased 25.5 days from 1951-2012.

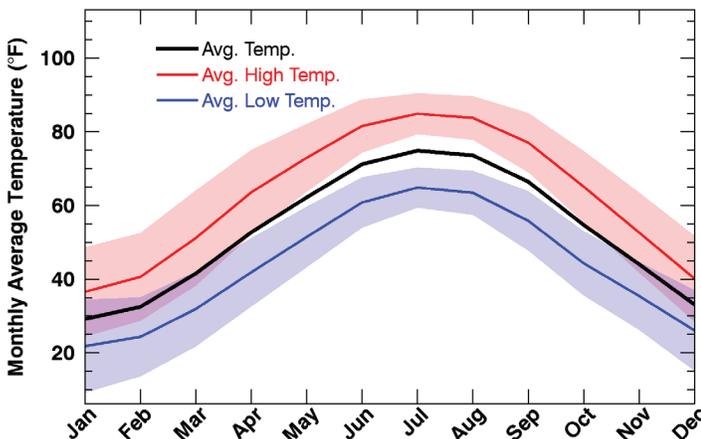
More precipitation: Total precipitation increased 19.8%, from 1951 through 2012. Fall precipitation increased dramatically, by 43.5% (3.2 inches).

More heavy precipitation: From the 1951-1980 period to the 1981-2010 period, the amount of precipitation falling during the heaviest 1% of precipitation events increased by 36.2%.

Recent Climate Summary: 1981-2010 Temperature and Precipitation

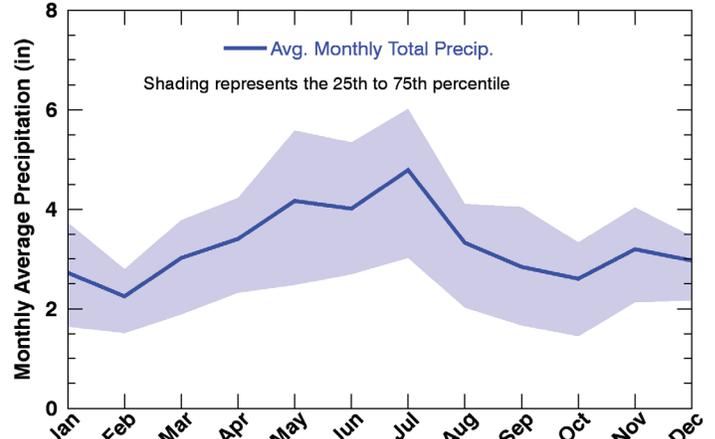
Average Temperature	53.1°F
Average Low Temperature	43.6°F
Average High Temperature	62.6°F
Days/Year that exceed 90°F	13.6
Days/Year that fall below 32°F	99.6
Lowest Average Temperature	50.8°F
Highest Average Temperature	56.4°F
Average Precipitation Total (in)	39.3 in
Lowest Annual Precipitation Total (in)	26.8 in
Highest Annual Precipitation Total (in)	53.2 in
Days/Year that exceed 1.25" of Precipitation	5.0

Monthly Average Temperature, 1981-2010



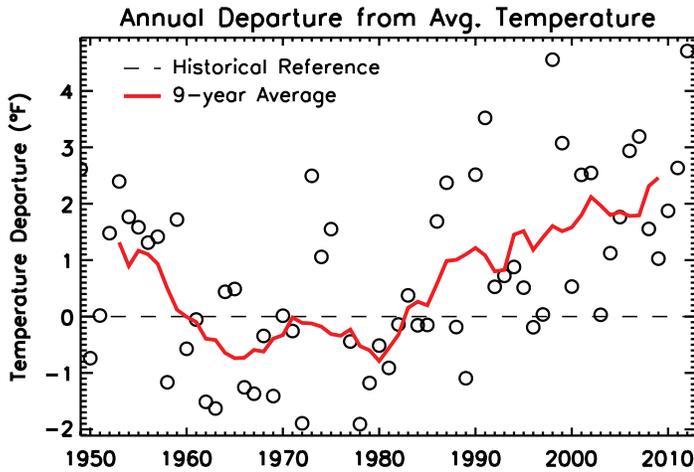
Average monthly temperatures during the 1981-2010 period. Shaded bands represent the standard deviation in the 30-year monthly average.

Monthly Average Precipitation, 1981-2010

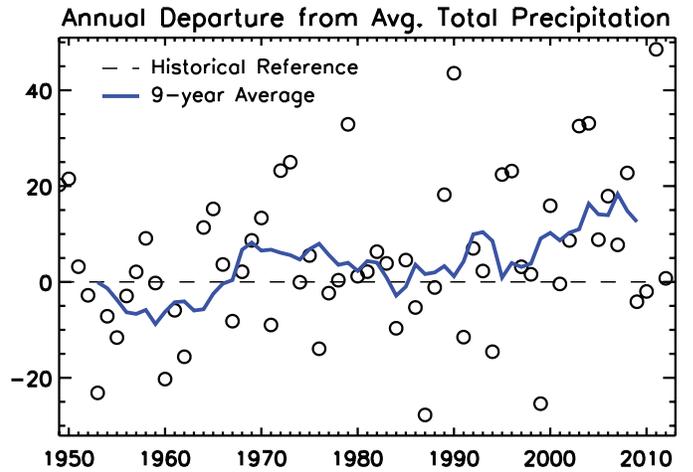


Average monthly total precipitation for the 1981-2010 period. The shaded band represents the 25th to 75th percentile.

Changes in Average Temperature and Precipitation



Annual departures from the 1951-1980 average annual temperature. The solid red line is the 9-year moving average. Open circles represent the departure from the 1951-1980 historical reference for a single year.

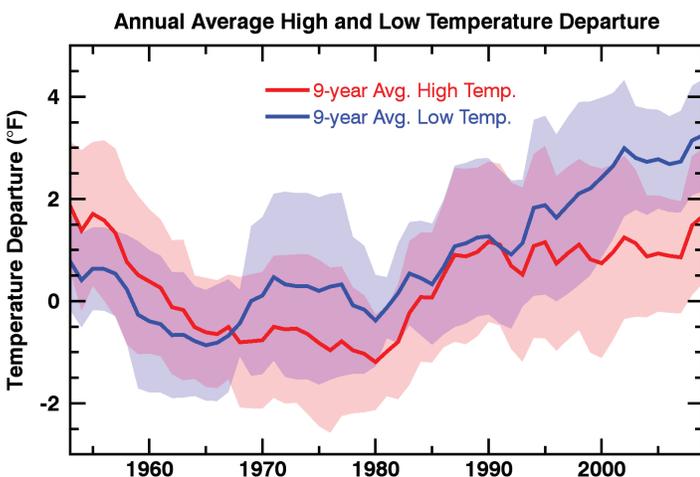


Annual departures from the 1951-1980 average of total annual precipitation. The solid blue line is the 9-year moving average. Open circles are departures from the 1951-1980 average for single years.

Changes in Average Temperature 1951-2012

	°F	°C
Annual	2.3	1.3
Winter, December-February	2.3	1.3
Spring, March-May	3.1	1.7
Summer, June-August	2.1	1.1
Fall, September-November	1.8	1.0

Typical for the Midwestern United States, temperatures in Columbus fell from warm periods during the Dust Bowl of the 1930s before rising steadily since the 1950s. Annual average temperatures warmed by 2.3°F from 1951-2012, faster than national and global rates. All seasons have warmed and spring has warmed the fastest. Winter temperatures have been highly variable, rising from the 1960s through the 1990s before declining sharply over the last decade.



Changes in Total Precipitation 1951-2012

	inches	%
Annual	7.3	19.8
Winter, December-February	0.9	11.8
Spring, March-May	0.8	7.8
Summer, June-August	2.1	18.2
Fall, September-November	3.2	43.5

Annual precipitation totals rose 19.8% from 1951-2012, similar to other locations in Ohio. All seasons have seen an increase in precipitation, with Fall seeing the greatest change both in actual volume and percentage change compared to the 1951-1980 average.

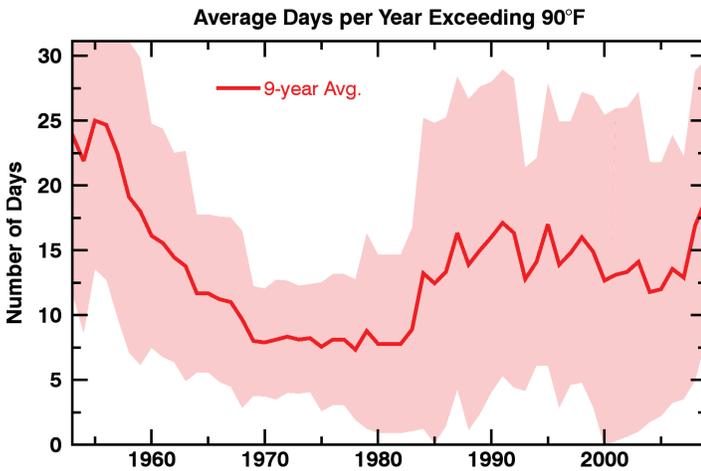
Changes in Average High and Low Temperatures from 1951 through 2012

	°F	°C
Highs	+0.9	0.5
Lows	+3.6	2.0

Overnight low temperatures warmed four times as fast as mid-day high temperatures from 1951 through 2012. This may mean that temperatures have been cooling less overnight than they have warmed during mid-day.

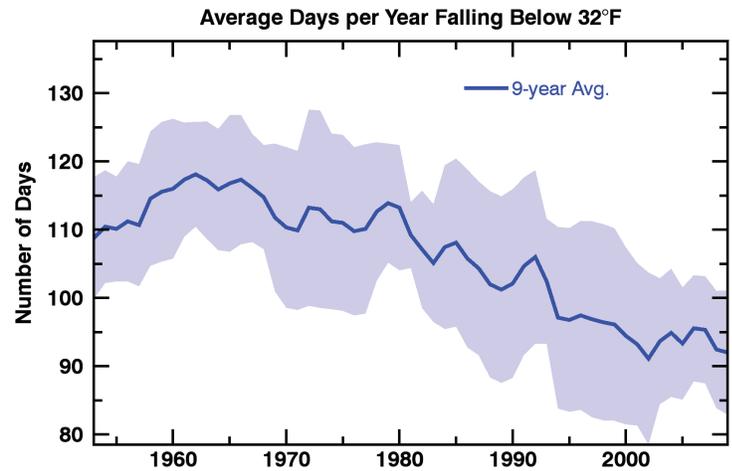
Left: Departures from the 1951-1980 average high and low temperatures. The red and blue lines are the 9-year moving averages. The shaded bands represent the standard deviations.

Changes in Hot and Cold Days



The red line represents the 9-year moving average of the number of days per year exceed 90°F. The shaded band represents the standard deviation.

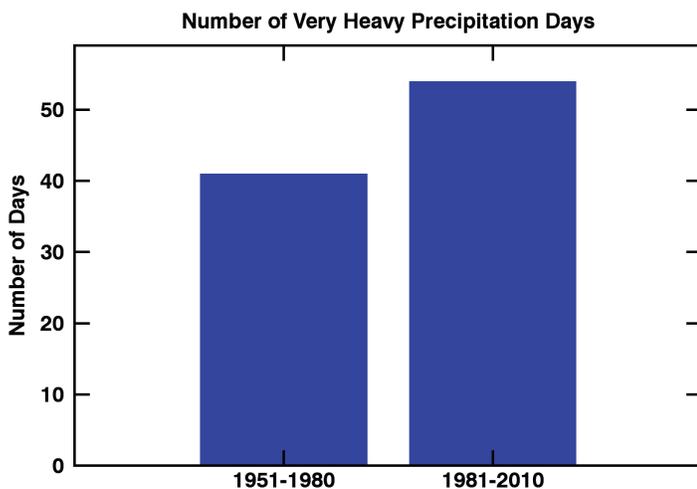
Despite rising average temperatures, the number of days per year that exceed 90°F has declined slightly even as average temperatures have warmed, a trend not uncommon in the region. The reasons for the decline are unclear, but other local factors and large-scale changes in land-use near the observing site can play a role.



The blue line represents the 9-year moving average of the number of days per year falling below 32°F. The shaded band is the standard deviation.

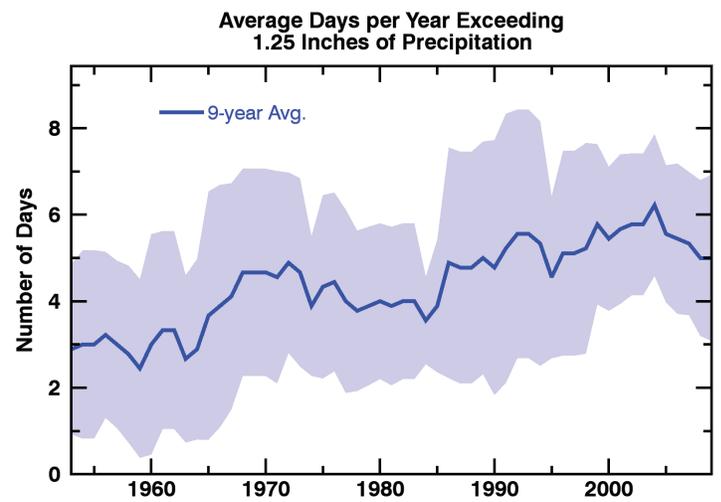
The number of days falling below 32°F per year dropped by 25.9 between the 1951-1980 and 1981-2010 periods, consistent with the increase in growing season and shorter winters.

Changes in Heavy Precipitation



The number of daily precipitation totals for the 1951-1980 and 1981-2010 periods that exceeded the size of the heaviest 1% of storms as defined by the 1951-1980 period.

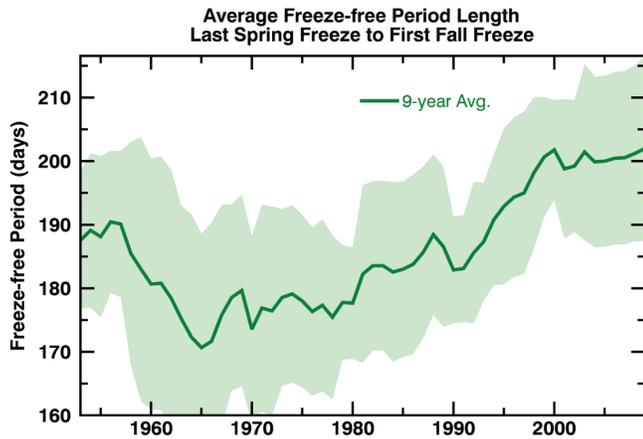
A “Very Heavy” Precipitation Day, as defined by the National Climate Assessment, is in the top 1% of daily precipitation totals. These precipitation events are typically disruptive and can cause infrastructure damage. Columbus has seen a 31.7% increase in the number of these precipitation events (41 storms from 1951-1980 to 54 storms from 1981-2010).



The blue line represents the 9-year moving average of the number of days per exceeding a daily total of 1.25 inches of precipitation. The shaded band represents the standard deviation.

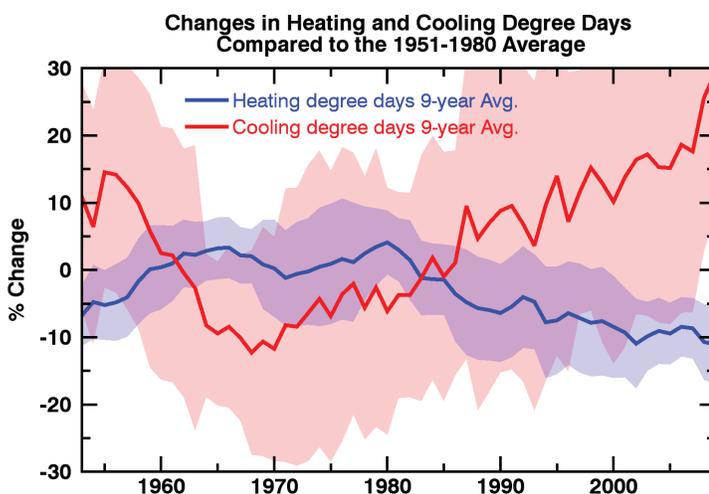
Daily precipitation totals that exceed 1.25” may lead to nuisance flooding and minor infrastructure impacts in some areas. Columbus now sees approximately 5 such days per year, 2.8 more per year (increase of 78%), on average, than in the past.

Changes in Seasonality



The freeze-free season (growing season), lengthened by 25.5 days from 1951-2012. Both the average date of first freeze in the fall and last freeze in the winter changed by more than 10 days.

Left: The green line represents the 9-year moving average of length of the time between the last freeze of spring and the first freeze of fall, the freeze-free period. The shaded band represents the standard deviation.



The percent change in heating and cooling degree day units from the 1951-1980 average. The red and blue solid lines represent the 9-year moving average. The shaded bands show the standard deviation.

Heating and cooling degree days are indexed units, not actual days, that roughly describe the demand to heat or cool a building. Cooling degree days accumulate on days warmer than 65°F when cooling is required. Heating degree days accumulate on days colder than 65°F when heating is required. Extremely hot days accumulate heating degree day units faster than a mildly warm day, and similarly, bitterly cold days accumulate cooling degree day units much faster than a mildly chilly day. Columbus sees far more days that require heating than it does days that require cooling, and so it accumulates far more heating degree days than cooling degree days in a given year.

From 1951 through 2012, total annual cooling degree days have increased by 22% while heating degree days have fallen by 11%, consistent with warming temperatures. Due to its relatively cool, Midwestern climate, however, the actual decline of 628 heating degree day units has outpaced the increase of 204 cooling degree day units.

Future Climate of Columbus

Many of the observed trends in temperature and precipitation are expected to continue or accelerate in the future.

- **Average Temperature:** Models project average temperatures will continue to rise by 3-5°F in the region through mid-century.
- **More high temperature days:** Despite little observed change in the number of days with high temperatures above 90°F, the number of hot days is expected to increase with rising average temperatures.
- **Freeze-free season:** The freeze-free period is projected to continue to lengthen by an additional 1-2 months under high emissions scenarios.
- **Total Precipitation:** Most models project precipitation will increase overall, though the magnitude of projections vary widely. Many models project that summer precipitation will remain stable or decline.
- **More Heavy Precipitation:** Heavy precipitation events will likely continue to become more intense and more frequent as they have in the recent past.
- **Changing winter precipitation:** With warmer temperatures, rain may fall in place of snow, and mixed winter precipitation events, like freezing rain, may become more likely in some areas.