Average Weather in Philadelphia Pennsylvania, United States

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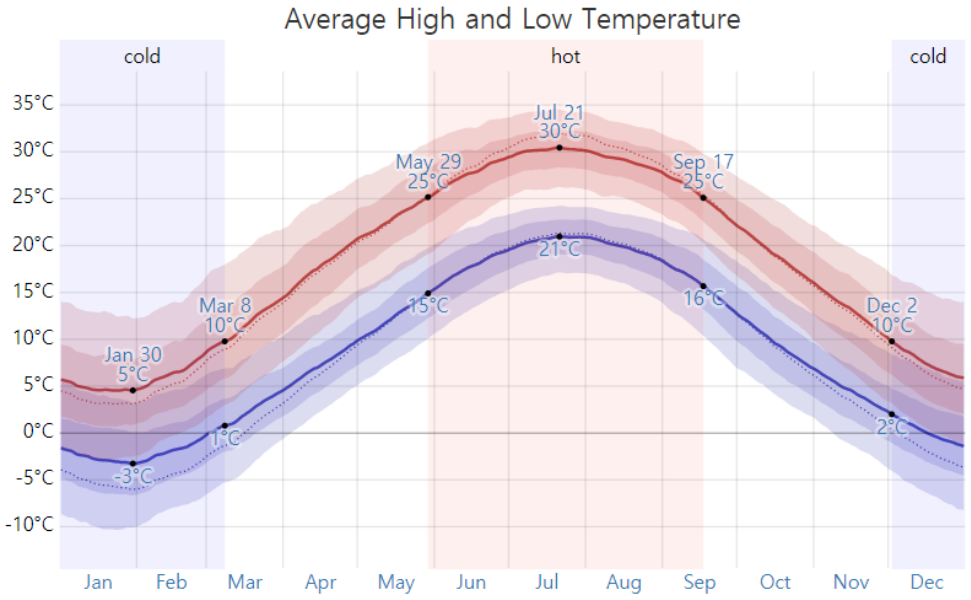
In Philadelphia, the summers are warm and humid, the winters are chilly, and it is wet and partly cloudy year round. Over the course of the year, the temperature typically varies from *-3°C* to *30°C* and is rarely below *-10°C* or above *35°C*.

The *hot season* lasts for *3.6 months*, from *May 29* to *September 17*, with an average daily high temperature above *25°C*. The hottest day of the year is *July 21*, with an average high of *30°C* and low of *21°C*.

The *cold season* lasts for *3.2 months*, from *December 2* to *March 8*, with an average daily high temperature below *10°C*. The coldest day of the year is *January 30*, with an average low of *-3°C* and high of *5°C*.



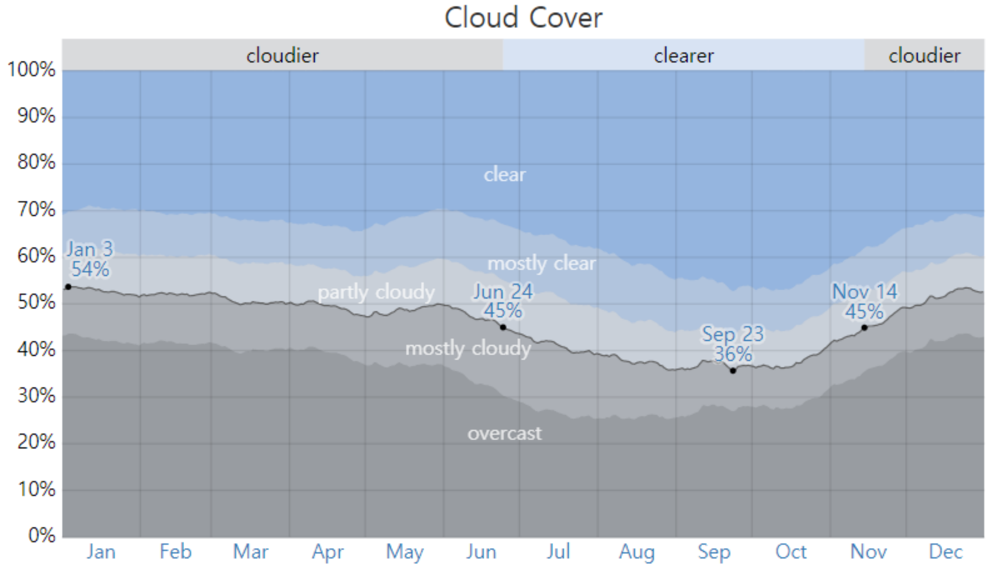
The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

Clouds

In Philadelphia, the average percentage of the sky covered by clouds experiences *mild* seasonal variation over the course of the year.

The *clearer* part of the year in Philadelphia begins around *June 24* and lasts for *4.7 months*, ending around *November 14*. On *September 23*, the *clearest day* of the year, the sky is *clear*, *mostly clear*, or *partly cloudy 64%* of the time, and *overcast* or *mostly cloudy 36%* of the time.

The *cloudier* part of the year begins around *November 14* and lasts for *7.3 months*, ending around *June 24*. On *January 3*, the *cloudiest day* of the year, the sky is *overcast* or *mostly cloudy 54%* of the time, and *clear*, *mostly clear*, or *partly cloudy 46%* of the time.



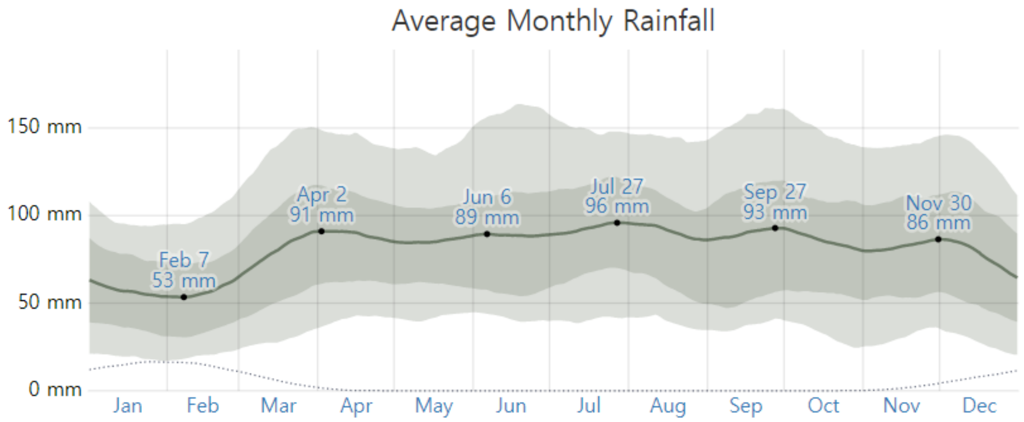
The percentage of time spent in each cloud cover band, categorized by the percentage of the sky covered by clouds: clear < 20% < mostly clear < 40% < partly cloudy < 60% < mostly cloudy < 80% < overcast.

Rainfall

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Philadelphia experiences *some* seasonal variation in monthly rainfall.

Rain falls throughout the year in Philadelphia. The *most rain* falls during the 31 days centered around *July 27*, with an average total accumulation of *96 millimeters*.

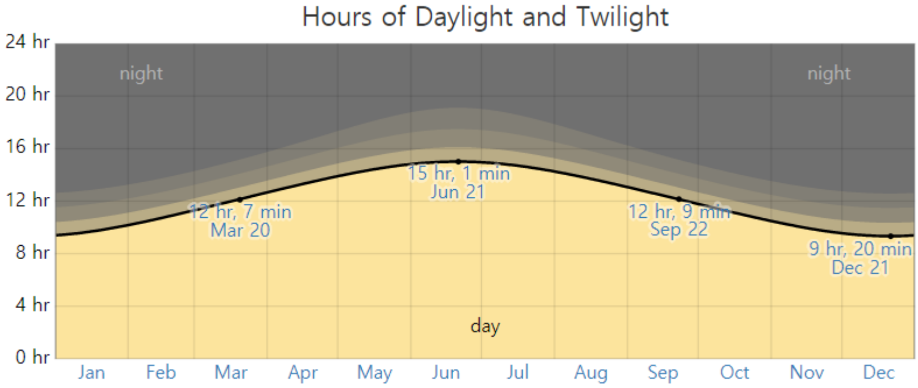
The *least rain* falls around *February 7*, with an average total accumulation of *53 millimeters*.



The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall.

Sun

The length of the day in Philadelphia varies significantly over the course of the year. In 2017, the shortest day is *December 21*, with *9 hours, 20 minutes* of daylight; the longest day is *June 21*, with *15 hours, 1 minute* of daylight.



The number of hours during which the Sun is visible (black line). From bottom (most yellow) to top (most gray), the color bands indicate: full daylight, twilight (civil, nautical, and astronomical), and full night.

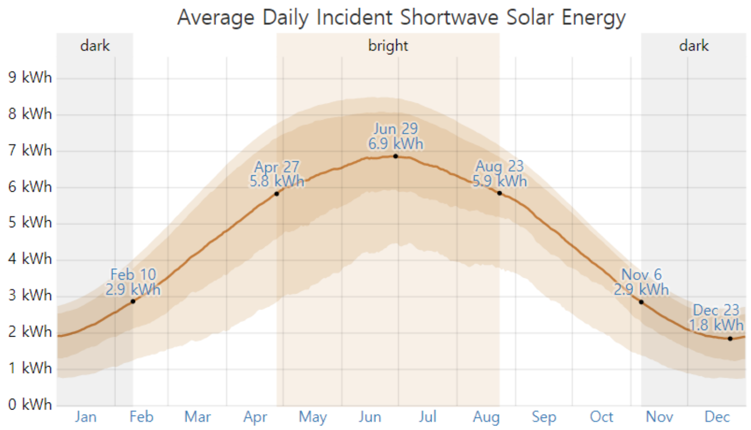
Solar Energy

This section discusses the total daily incident shortwave solar energy reaching the surface of the ground over a wide area, taking full account of seasonal variations in the length of the day, the elevation of the Sun above the horizon, and absorption by clouds and other atmospheric constituents. Shortwave radiation includes visible light and ultraviolet radiation.

The average daily incident shortwave solar energy experiences *extreme* seasonal variation over the course of the year.

The *brighter* period of the year lasts for *3.9 months*, from *April 27* to *August 23*, with an average daily incident shortwave energy per square meter above *5.8 kWh*. The *brightest* day of the year is *June 29*, with an average of *6.9 kWh*.

The *darker* period of the year lasts for *3.1 months*, from *November 6* to *February 10*, with an average daily incident shortwave energy per square meter below *2.9 kWh*. The *darkest* day of the year is *December 23*, with an average of *1.8 kWh*.



The average daily shortwave solar energy reaching the ground per square meter (orange line), with 25th to 75th and 10th to 90th percentile bands.

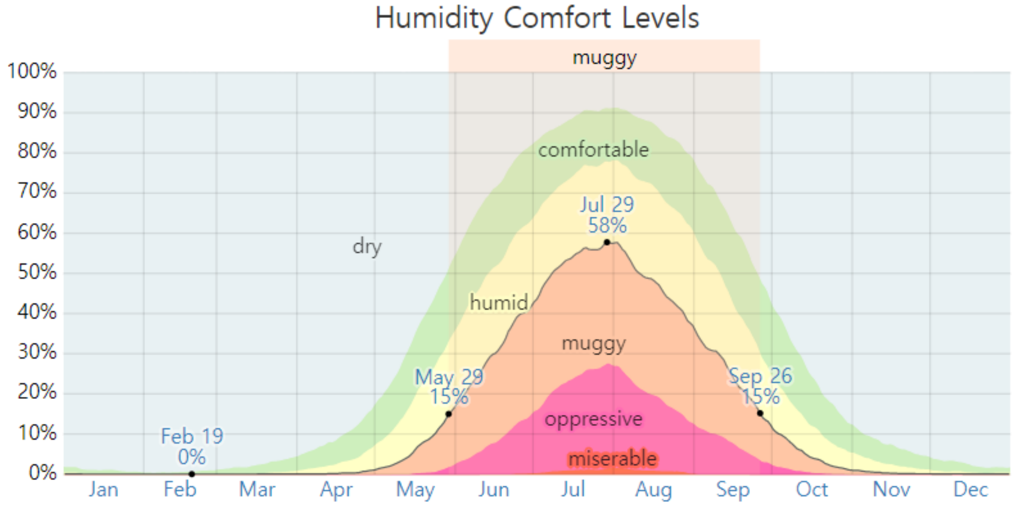
Humidity

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night.

Philadelphia experiences *extreme* seasonal variation in the perceived humidity.

The *muggier period* of the year lasts for *3.9 months*, from *May 29* to *September 26*, during which time the comfort level is *muggy*, *oppressive*, or *miserable* at least *15%* of the time. The *muggiest day* of the year is *July 29*, with muggy conditions *58%* of the time.

The *least muggy* day of the year is *February 19*, when muggy conditions are essentially unheard of.



The percentage of time spent at various humidity comfort levels, categorized by dew point: dry < 13°C < comfortable < 16°C < humid < 18°C < muggy < 21°C < oppressive < 24°C < miserable.

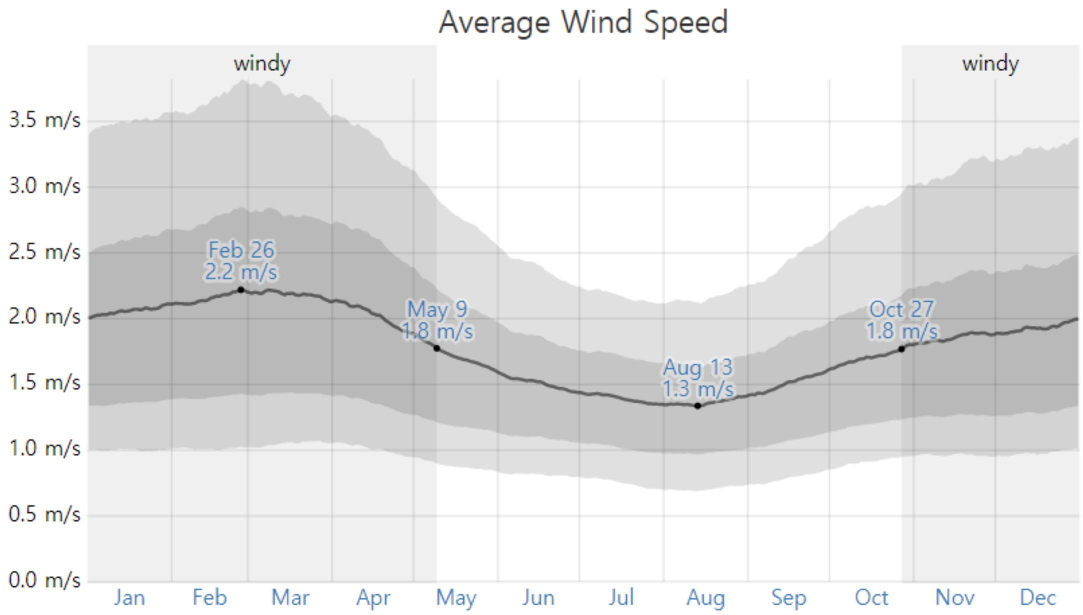
Wind

This section discusses the wide-area hourly average wind vector (speed and direction) at *10 meters* above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

The average hourly wind speed in Philadelphia experiences *mild* seasonal variation over the course of the year.

The *windier* part of the year lasts for *6.4 months*, from *October 27* to *May 9*, with average wind speeds of more than *1.8 meters per second*. The *windiest* day of the year is *February 26*, with an average hourly wind speed of *2.2 meters per second*.

The *calmer* time of year lasts for *5.6 months*, from *May 9* to *October 27*. The *calmest* day of the year is *August 13*, with an average hourly wind speed of *1.3 meters per second*.



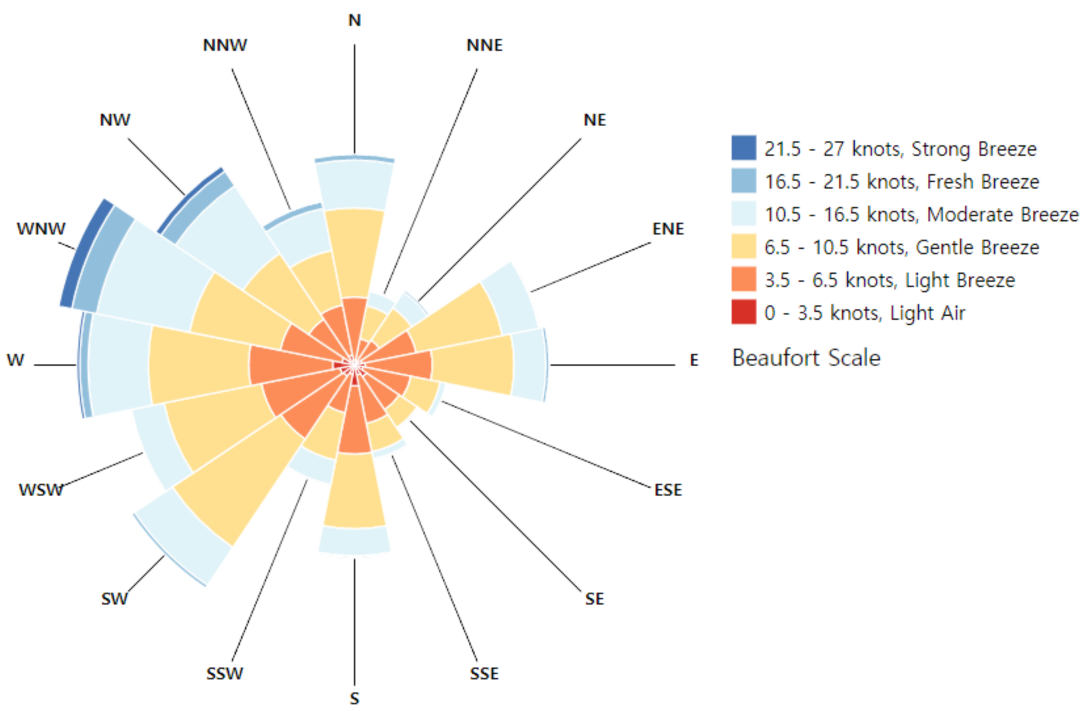
The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands.

The predominant average hourly wind direction in Philadelphia varies throughout the year.

The wind is most often from the *south* for *2.3 months*, from *July 21* to *September 29*, with a peak percentage of *37%* on *August 2*. The wind is most often from the *west* for *9.7 months*, from *September 29* to *July 21*, with a peak percentage of *45%*on *January 1*.

Wind Rose

246 of 8760 hours (2.8%) calm



Data Sources

This report illustrates the typical weather in Philadelphia, based on a statistical analysis of historical hourly weather reports and model reconstructions from January 1, 1980 to December 31, 2016.

Temperature and Dew Point

There are 4 weather stations near enough to contribute to our estimation of the temperature and dew point in Philadelphia.

For each station, the records are corrected for the elevation difference between that station and Philadelphia according to the International Standard Atmosphere, and by the relative change present in the MERRA-2 satellite-era reanalysis between the two locations.

The estimated value at Philadelphia is computed as the weighted average of the individual contributions from each station, with weights proportional to the inverse of the distance between Philadelphia and a given station.

The stations contributing to this reconstruction are: Philadelphia International Airport (48%, 11 kilometers, southwest); Wings Field (19%, 19 kilometers, northwest); North Philadelphia Airport (20%, 19 kilometers, northeast); and South Jersey Regional Airport (12%, 27 kilometers, east).

Other Data

All data relating to the Sun's position (e.g., sunrise and sunset) are computed using astronomical formulas from the book, Astronomical Tables of the Sun, Moon and Planets, by Jean Meeus.

All other weather data, including cloud cover, precipitation, wind speed and direction, and solar flux, come from NASA's MERRA-2 Modern-Era Retrospective Analysis. This reanalysis combines a variety of wide-area measurements in a state-of-the-art global meteorological model to reconstruct the hourly history of weather throughout the world on a 50-kilometer grid.

Land Use data comes from the Global Land Cover SHARE database, published by the Food and Agriculture Organization of the United Nations.

Elevation data comes from the Shuttle Radar Topography Mission (SRTM), published by NASA's Jet Propulsion Laboratory.

Names, locations, and time zones of places and some airports come from the GeoNames Geographical Database.

Time zones for aiports and weather stations are provided by AskGeo.com.

Passive Design Strategies

Passive Heating

Passive heating uses the energy of the sun to keep occupants comfortable without the use of mechanical systems. These concepts will help you design for passive heating.

Direct Solar Gain

Direct gain is the heat from the sun being collected and contained in an occupied space. Direct solar gain is important for any site that needs heating, because it is the simplest and least costly way of passively heating a building with the sun. Avoiding direct solar gain is also important in hot sunny climates.

Massing & Orientation for Heating

Massing and orientation are important design factors to consider for passive heating. Consider these factors early in the design so that the surface areas exposed to sun at different times of day, building dimensions, and building orientation can all be optimized for passive comfort.

Thermal Mass

Thermal mass is a material's resistance to change in temperature. Objects with high thermal mass absorb and retain heat. Thermal mass is crucial to good passive solar heating design, especially in locations that have large swings of temperature from day to night.

Trombe Wall and Attached Sunspace

A Trombe wall is a system for indirect solar heat gain that is a good example of thermal mass, solar gain, and glazing properties used together to achieve human comfort goals passively. It consists of a dark colored wall of high thermal mass facing the sun, with glazing spaced in front to leave a small air space.

Apertures for Heating

Windows and other apertures bring in heat from sunshine, but can also lose heat by radiant cooling and by conducting heat better than most wall or roof constructions. Apertures and shading must be intelligently placed to take advantage of the sun's heat in cold locations and seasons, while not overheating in hot seasons.

Shading for Solar Heat Gain

Shades can keep the heat and glare of direct sun from coming through windows. They can also keep direct sunlight off of walls or roofs, to reduce cooling loads.

Passive Cooling

Just like passive heating, cooling your building using passive strategies is important for reducing energy usage in your building. Specifically, utilizing passive cooling strategies like natural ventilation, air cooling, and shades can reduce your demand for mechanical cooling while maintaining thermal comfort.

Natural Ventilation

Natural ventilation, also called passive ventilation, uses natural outside air movement and pressure differences to both passively cool and ventilate a building. It can include design strategies like wind ventilation, the stack effect, and night purge ventilation.

Air Cooling

Natural ventilation can still be an option even in hot climates, particularly in hot dry climates. Two techniques can be used to cool incoming air: Evaporative cooling and geothermal cooling.

Massing & Orientation for Cooling

Massing and orientation are important design factors to consider for passive cooling. Consider these factors early in the design so that the building layout and building orientation can all be optimized for passive comfort.

Apertures for Cooling

The simple act of opening a window can often provide immediate cooling effects. But how do the size and placement of that window impact the effect you feel? Window design and ventilation louver design greatly affects passive cooling potential, specifically natural ventilation.

Daylighting

Getting smart about lighting is an important step to designing energy efficient buildings. Learn how to use daylighting, efficient lights, and good controls to both reduce energy demands and make people happier and more productive.

The sun is predictable and daylight can be a very reliable source of light. Sunlight, views, and daylight are different though, and need to be carefully managed.

Daylighting, or using sunlight to illuminate your building, is an effective way to both decrease your building's energy use and make the interior environment more comfortable for people.

In commercial buildings, electric lighting accounts for 35 - 50% of total electrical energy consumption. Strategic use of daylight can reduce this energy demand. Daylight also improves people's comfort and productivity.

Even when you can't use daylighting, good lighting design can reduce energy use significantly. Both are important in Net Zero Energy Buildings.

Sources

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