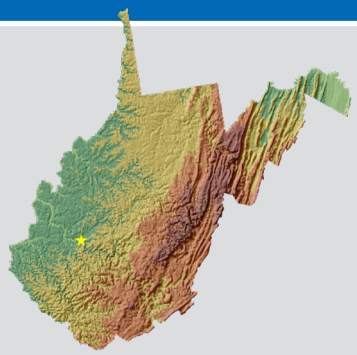
WEST VIRGINIA



Key Messages

Temperatures in West Virginia have risen 1°F since the beginning of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected during this century, with increases in heat wave intensity and decreases in cold wave intensity.

Total annual precipitation has been highly variable, with a slight increase since 1895. Winter and spring precipitation amounts are projected to increase, as well as the number and intensity of extreme precipitation events, creating an increased risk of flooding.

Naturally occurring droughts are projected to be more intense in the future due to temperature-caused increases in the rate of soil moisture loss during dry spells.

The climate of West Virginia is characterized by moderately cold winters and warm, humid summers. The jet stream, which is located near or over the Northeast region during the winter, brings frequent storm systems, which cause cloudy skies, windy conditions, and precipitation. The state is affected by a variety of extreme events, such as floods, droughts, heat and cold waves, ice storms, remnants of hurricanes, and snowstorms, including nor'easters. Due to the state's rugged topography, climate conditions vary considerably. West Virginia's elevation—the highest average elevation east of the Mississippi River—moderates summer temperatures. Summer average maximum temperatures range from around 85°F in the southwest, near the Ohio River, to less than 80°F in the east-central mountains. Winter average minimum temperatures range from the low 20s (°F) in the mountainous central and northeastern portions of the state to around 30°F in the far south. The central portion of West Virginia receives 50 or more inches of precipitation per year, while the west, along the Ohio River, receives around 40 inches. A rain shadow (an area of reduced rainfall due to sheltering hills) exists to the west of the state's Eastern Panhandle, where annual average precipitation drops to about 35 inches.

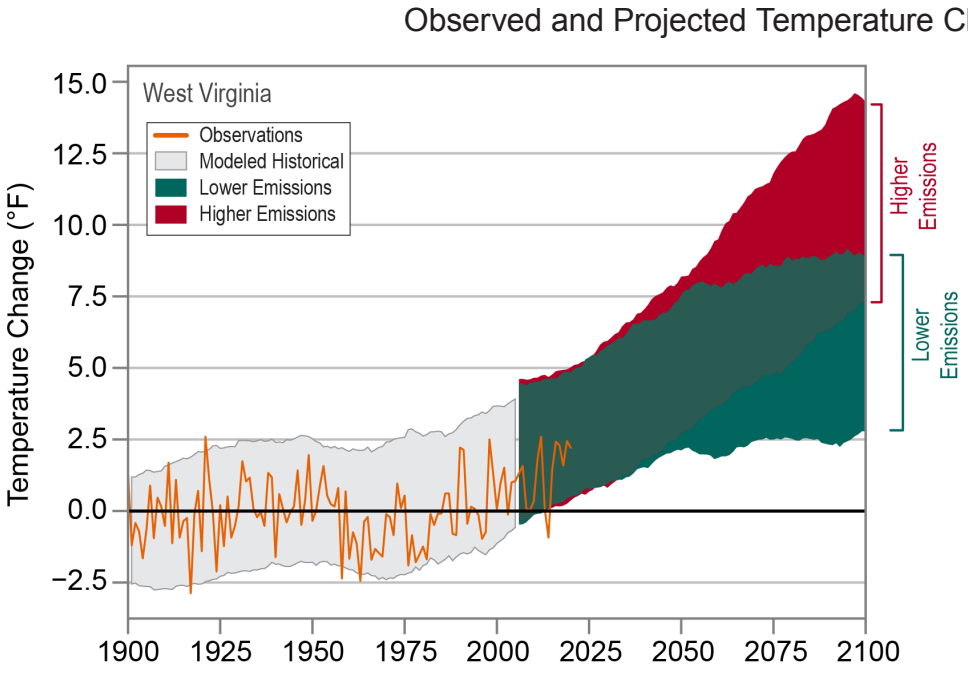


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for West Virginia. Observed data are for 1900–2020. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in West Virginia (orange line) have risen 1°F since the beginning of the 20th century. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during this century. Less warming is expected under a lower emissions future (the coldest end-of-century projections being about as warm as the hottest year in the historical record; green shading) and more warming under a higher emissions future (the hottest end-of-century projections being about 12°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI.

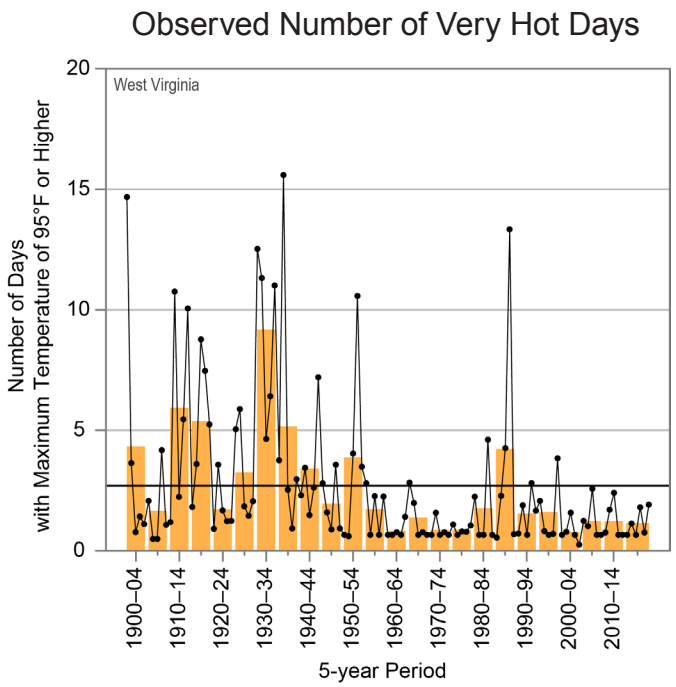


Figure 2: Observed annual number of very hot days (maximum temperature of 95°F or higher) for West Virginia from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is 6-year average). The horizontal black line shows the long-term (entire period) average of 2.7 days. The number of very hot days has been below average since the 1990s. Record-high numbers occurred during the droughts of the 1930s. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 6 long-term stations.

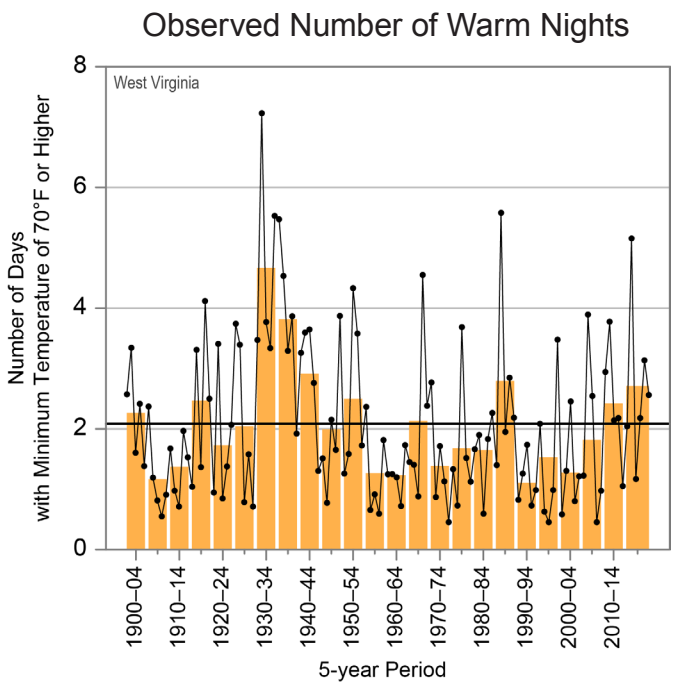


Figure 3: Observed annual number of warm nights (minimum temperature of 70°F or higher) for West Virginia from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 2.1 nights. There is no long-term trend in the number of warm nights, but the two most recent multiyear periods (2005–2009 and 2015–2020) were above average. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 6 long-term stations.

Temperatures in West Virginia have risen 1°F since the beginning of the 20th century (Figure 1). Temperatures increased during the early part of the 20th century, followed by a period of cooling. Gradual warming has occurred since the early 1980s; temperatures in this century have been above the long-term (1895–2020) average and slightly warmer than the previous warmest periods of the 1930s and early 1950s. The number of very hot days has been below average since the 1990s (Figure 2). The number of warm nights does not show any long-term trend, but above average numbers have occurred during the last 11 years (Figure 3). The number of very cold nights has generally been below average since the 1990s, although an above average number of these nights occurred recently in 2014, 2015, and 2018 (Figure 4).

Total annual precipitation in West Virginia has been variable, with a slight increase over the 126-year period of record (Figure 5). Precipitation has generally been near to above average since the early 1990s, with the last 6-year period (2015–2020) being the wettest. The driest multiyear periods were in the early 1930s and late 1960s, and the wettest were in the early 2000s and late 2010s. The driest consecutive 5-year interval

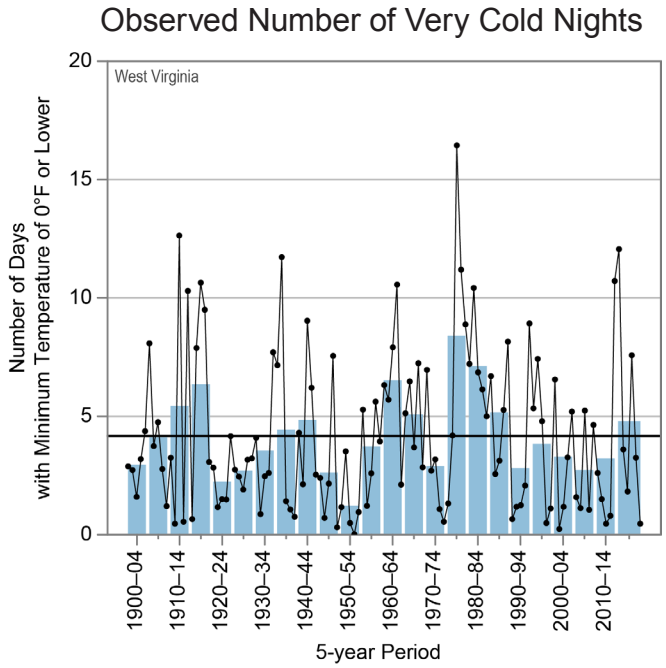


Figure 4: Observed annual number of very cold nights (minimum temperature of 0°F or lower) for West Virginia from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year period). The horizontal black line shows the long-term (entire period) average of 4.2 nights. The number of very cold nights has varied and was slightly above average during the last multiyear period (2015–2020). Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 6 long-term stations.

was 1962–1966, averaging 39.6 inches per year, and the wettest was 2016–2020, averaging 51.9 inches. The number of 2-inch extreme precipitation events was above average during the 1995–2004 interval but has been near average since then (Figure 6). The mountains of West Virginia see some of the highest snowfall totals east of the Mississippi River, with an annual average of 100 inches. A record snowfall of more than 200 inches occurred during the winter of 2009–10, with more than 100 inches falling in the month of February, when the region was impacted by three major storms.

West Virginia experiences a wide array of extreme weather, including tornadoes, thunderstorms, snowstorms, hurricane remnants, and flooding. Tornadoes occur an average of 2 to 5 times per year and are usually weak. **Flooding, caused by extreme precipitation over the rugged topography, is the costliest and most severe natural hazard for the state**. From 2010 to 2020, the state received 23 FEMA disaster declarations, 18 of which were related to severe storms and flooding events. The two most significant historical flooding events occurred in 1937 and 1985. The Great Ohio River Flood of 1937 affected numerous states, but the southwestern part of West Virginia, near Huntington, was the hardest hit. Heavy downpours occurred over a 2-week period, with rainfall averaging 6 to 12 inches throughout the region. The river level at Huntington was the highest ever recorded, cresting at 69 feet, 19 feet above flood stage. Damages to homes and buildings were in the millions of dollars. In early November 1985, an extratropical storm, influenced by the remnants of Hurricane Juan, generated up to 10 inches of rainfall across West Virginia. Extensive river flooding, mostly in the eastern portion of the state, resulted in more than $500 million in damages to 3,500 homes and 180 local businesses. A major flood event occurred in June 2016, when 8 to 10 inches of rain fell in less than 12 hours. The Elk River rose to more than 33 feet, breaking the previous high-water record set in 1888. At least 23 people were killed by flash floods.

Under a higher emissions pathway, historically unprecedented warming is projected during this century (Figure 1). Even under a lower emissions pathway, temperatures are projected to most likely exceed historical record levels by the middle of this century. However, a large range of temperature increases is projected under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records. Increased heat wave intensity and decreased cold wave intensity are projected.

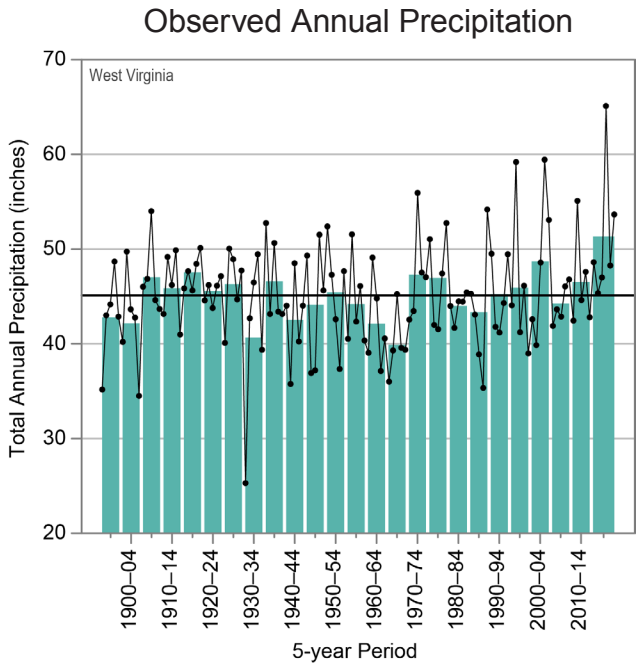


Figure 5: Observed total annual precipitation for West Virginia from 1895 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 45.1 inches. Annual precipitation has been variable, with a slight increase over the 126-year period of record. The most recent multiyear period (2015–2020) was well above average. Sources: CISESS and NOAA NCEI. Data: nClimDiv.

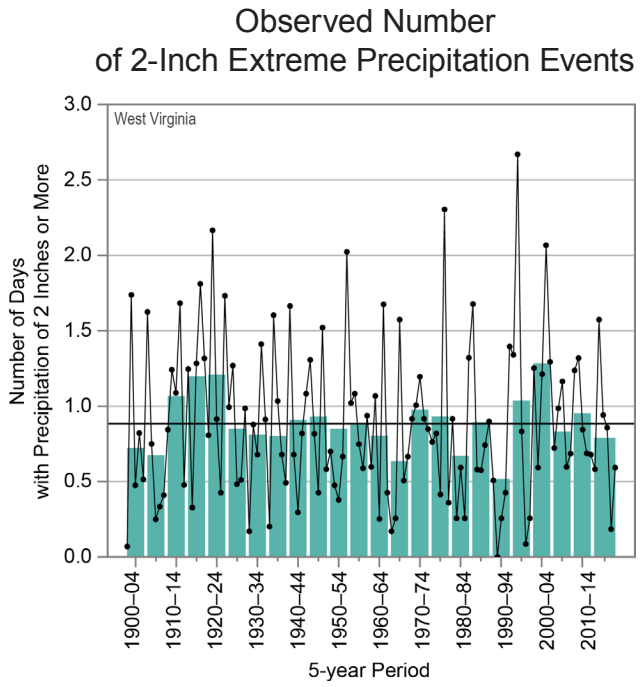


Figure 6: Observed annual number of 2-inch extreme precipitation events (days with precipitation of 2 inches or more) for West Virginia from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 0.9 days. A typical station experiences an event about once per year. There is no long-term trend in the number of 2-inch extreme precipitation events. The 2000–2004 period had the highest multiyear average. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 8 long-term stations.

Annual precipitation is projected to increase for West Virginia over this century (Figure 7), **with the largest increases occurring during winter and spring**. The number and intensity of extreme precipitation events are also projected to increase. These events will likely lead to greater flood risk. Drought is a periodically occurring natural phenomenon in the state. Higher temperatures are projected to increase the rate of soil moisture loss during dry spells, resulting in more intense naturally occurring droughts in the future.

Much of West Virginia's land cover is forested. These forests provide unique habitats for an abundance of plants and animals, some of which are endangered. For example, the state's red spruce habitat occupies the largest high-elevation area in the northeastern United States. Upland red spruce communities are highly vulnerable to climate change due to their topographic location on the highest mountaintops, low elevation barriers to dispersal, and fairly narrow temperature and precipitation tolerances. In the future, climate change may significantly alter red spruce forests.

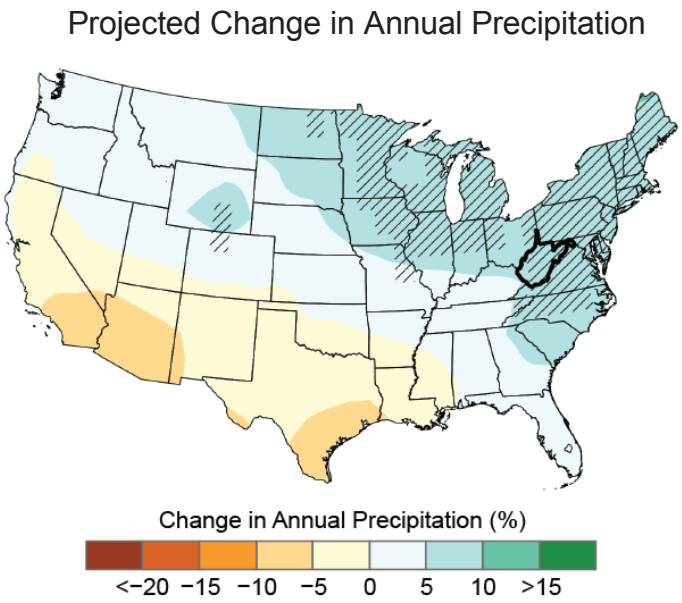


Figure 7: Projected changes in total annual precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. West Virginia is part of a large area of projected increases in the Northeast. Sources: CISESS and NEMAC. Data: CMIP5.

Technical details on observations and projections are available online at https://statesummaries.ncics.org/technicaldetails.