21st century (Figure 1). Even under a lower pathway of greenhouse gas emissions, temperatures are projected to most likely exceed historical record levels by the middle of the 21st century. However, there is a large range of temperature increases under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records (Figure 1). Increases in the number of extremely hot days and decreases in the number of extremely cold days are projected to accompany the overall warming**.** According to a recent state-level analysis, by the middle of the 21st century an estimated 70% of summers in this region are anticipated to be hotter than what we now recognize as the warmest summer on record.

Winter and spring precipitation is projected to increase for the 21st century (Figure 5)**; extreme precipitation is also projected to increase**. The projections of increasing precipitation are characteristic of a large area of the Northern Hemisphere in the northern middle latitudes, as well as increases in heavy precipitation events. This may result in increased coastal and inland flooding risks throughout the state.

Over the last century, global sea level has risen by about 8 inches. Sea level has risen faster along the shores of New Jersey as compared to the global average. Observations beginning in 1911 show sea level has risen an average rate of 1.6 inches per decade over the period of record at Atlantic City, about double the global rate. Land subsidence has been one factor adding to sea level rise along the New Jersey coast. Sea level rise has caused an increase in tidal floods associated with nuisance-level impacts. Nuisance floods are events in which water levels exceed the local threshold (set by NOAA's National Weather Service) for minor impacts. These events can damage infrastructure, cause road closures, and overwhelm storm drains. As sea level has risen along the New Jersey coastline, the number of tidal flood days (the number of tidal flood days) has also increased, with the greatest number occurring in 2010 and 2012 (Figure 6). **Global sea level is projected to rise another 1 to 4 feet globally by 2100 as a result of both past and future greenhouse gas emissions from human activities** (Figure 7). Even higher rises are projected along the New Jersey coast because of land subsidence. Coastal flooding caused by sea level rise has important future cross-sector implications for public health, water resources, and coastal ecosystems.

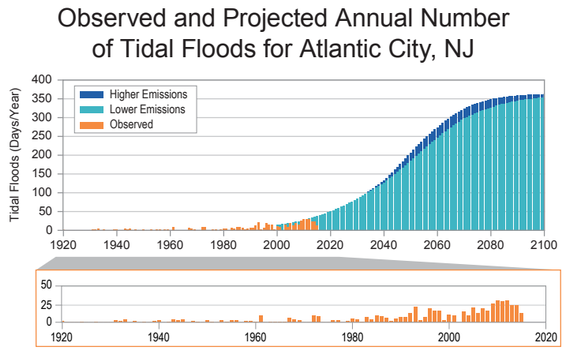

Figure 6: Number of tidal flood days per year for the observed record (orange bars) and projections for two possible futures: lower emissions (light blue) and higher emissions (dark blue) per calendar year for Atlantic City, NJ. Sea level rise has caused an increase in tidal floods associated with nuisance-level impacts. Nuisance floods are events in which water levels exceed the local threshold (set by NOAA's National Weather Service) for minor impacts, such as road closures and overwhelmed storm drains. The number of tidal flood days (the number of tidal flood days) has been high during the last 10 years with the greatest number occurring in 2010 and 2012 in Atlantic City. Projected increases are large even under a lower emissions pathway. Near the end of the century, under a higher emissions pathway, some models (not shown here) project tidal flooding nearly every day of the year. To see these and other projections under additional emissions pathways, please see the supplemental material on the State Summaries website (https://statesummaries.ncics.org/nj). Source: NOAA NOS.

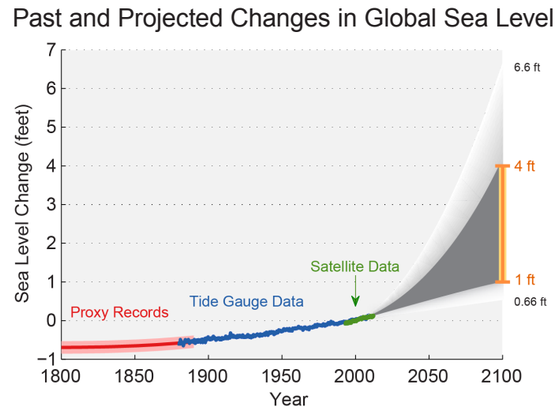

Figure 7. Estimated, observed, and possible future amounts of global sea level rise from 1800 to 2100, relative to the year 2000. The orange line at right shows the most likely range of 1 to 4 feet by 2100 based on an assessment of scientific studies, which falls within a larger possible range of 0.66 feet to 6.6 feet. Source: Melillo et al. 2014 and Parris et al. 2012.

WWW.NCEI.NOAA.GOV | HTTP://STATESUMMARIES.NCICS.ORG/NJ | LEAD AUTHORS: JENNIFER RUNKLE, KENNETH E. KUNKEL | CONTRIBUTORS: SARAH CHAMPION, REBEKAH FRANKSON, BROOKE C. STEWART, WILLIAM SWEET

NEW JERSEY

Key Messages

Average annual temperatures have increased by 3°F in New Jersey over the past century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century. Heat waves are projected to be more intense while cold waves are projected to be less intense.

Precipitation has been highly variable, with wetter than average conditions over the last decade. Winter and spring precipitation and extreme precipitation events are projected to increase in the future.

Sea level along the New Jersey has risen by more than 16 inches since 1911, double the global average. Global sea level is projected to rise another one to four feet by 2100. Sea level rise poses substantial risks, including greater vulnerability to severe coastal flooding.

New Jersey's geographic position in the mid-latitudes often places it near the jet stream, particularly in the late fall, winter, and spring. This gives the state its characteristic changeable weather. Precipitation is frequent because low pressure storms associated with the jet stream commonly affect the state. In addition, New Jersey's location on the eastern coast of North America exposes it both to the cold winter and warm summer air masses of the continental interior and the moderate and moist air masses of the western Atlantic Ocean. In winter, the contrast between frigid air masses of the continental interior and the relatively warm Atlantic provides the energy for occasional intense storms known as nor'easters. As a result of these varying influences, **New Jersey's climate is characterized by moderately cold and occasionally snowy winters and warm, humid summers**. There is a west-to east contrast of temperatures with cooler temperatures in the higher elevation northwest and warmer conditions in the east near the coast. Temperature differences from northwest to southeast are most noticeable in the winter. The northern elevated highlands and valleys experience colder temperatures and more annual average precipitation compared to the rest of the state. Average minimum temperatures in January range from 15 to 20°F in the northwest to 25 to 30°F along the coast. A similar temperature gradient exists for average maximum temperatures in July, where cooler summertime temperatures (80–85°F) occur in the northwestern corner and temperatures between 85 and 90°F are representative of the rest of the state. The statewide average annual precipitation is 46 inches. There is a north-south precipitation gradient as well with the north-central portion of the state averaging 51 inches of precipitation, while the coastal region averages 40 inches.

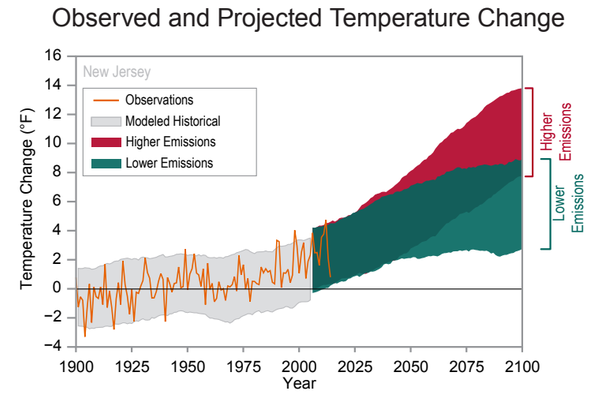

Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for New Jersey, averaged over 5-year periods. Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions)[1]. Temperatures in New Jersey (orange line) increased from 1900 to the 1950s, then declined into the 1960s and 1970s, and have risen since then by about 2°F to the warmest levels on record. 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 the 21st century. Less warming is expected under a lower emissions future (the coldest years being about as warm as the warmest years in the historical record; green shading) and more warming under a higher emissions future (the hottest years being about 10ºF warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI.

[1]Technical details on models and projections are provided in an appendix, available online at: https://statesummaries.ncics.org/nj.

Annual temperatures in New Jersey have increased approximately 3°F since the beginning of the 20th century (Figure 1). Nine of the ten hottest calendar years on record for the state have occurred since 1990, with 2012 registering as the warmest year on record, at 4.5°F above average. The number of very hot days (daytime high temperatures above 95°F) has been above average since the early 2000s (Figure 2a). The number of warm nights (nighttime low temperatures above 70°F) in New Jersey has consistently been above the 1900–2014 mean during the 21st century with the highest 5-year average number occurring during 2010–2014 (Figure 3). Declines in the number of days of extreme cold (minimum temperatures below 0°F) have occurred since the early 1990s (Figure 2b). Over the past 25 years many more unusually warm months than unusually cold months have occurred in the state, so much so that over the period 2000–2015 there were no top 5 coldest months but 32 top 5 warmest months.

Annual precipitation for New Jersey has been about 8% above average over the last 10 years (Figure 2c). The driest conditions existed in the 1960s, with wetter conditions occurring since the 1970s. The wettest 5-year period was 1971–1975 and the driest was 1962–1966. The number of extreme precipitation events has also been above average over the last 10 years. During 2010–2014, the state experienced the largest number of extreme precipitation events (days with more than 2 inches) compared to any other 5-year period, about 50% above the long-term average (Figure 4). Summer precipitation has been above the 1900–2014 mean during the 21st century, with the largest 5-year average rainfall amount occurring during 2010–2014 (Figure 2d).

Figure 2: The observed (a) number of very hot days (annual number of days with maximum temperature above 95°F); (b) number of very cold nights (annual number of days with minimum temperature below 0°F); (c) annual precipitation; and (d) summer precipitation in New Jersey, averaged over 5-year periods. The dark horizontal lines represent the long-term average. The values in Figure 2a and 2b are averages from seven long-term reporting stations. The values in Figure 2c and 2d are from NCEI's new climate division data set. Since the late 1980s the number of very hot days has been near to above the long-term average. Very cold nights have been an increasingly rare occurrence since the early 1990s and this downward trend has extended into the 21st century. Annual and summer precipitation has been above average during the most recent decade (2000–2014), with record amounts of summer precipitation occurring between 2010 and 2014. Source: CICS-NC and NOAA NCEI.

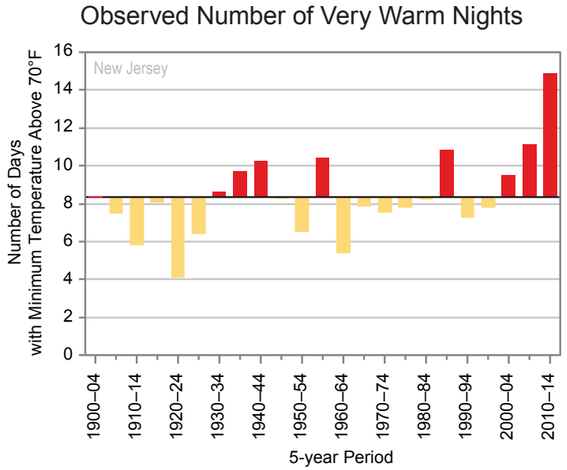

Figure 3: The observed number of warm nights (annual number of days with minimum temperature above 70°F) for 1900–2014, averaged over 5-year periods; these values are averages from seven long-term reporting stations. The number of warm nights in New Jersey has been above average since 2000 with the highest 5-year average number occurring during 2010–2014. The dark horizontal line is the long-term average (1900–2014) of slightly more than 8 days per year. Source: CICS-NC and NOAA NCEI.

Extreme weather events typically experienced in the state include coastal nor'easters, snow storms, spring and summer thunderstorms, flooding rains, heat and cold waves, tropical storms, and on rare occasion hurricanes. The state's coastline is highly vulnerable to damage from coastal storms, which include nor'easters, tropical storms, and hurricanes. Damaging nor'easters are most common during the months between October and April. Nor'easters tracking over or near the coast can bring strong winds and heavy precipitation. **Annually, the state experiences at least one coastal storm, but some years have seen upwards of 5 to 10 storm events.** The most extreme and destructive event to affect New Jersey in recent years was Superstorm Sandy in 2012. The powerful storm surge, the most destructive element of Sandy, reached 9-10 feet above normal in some areas along the coast. This was produced by strong winds and an unusual west-northwestward track. New Jersey experienced extensive damage from severe winds and coastal flooding with an estimated $29.4 billion in repair, response, and restoration costs.

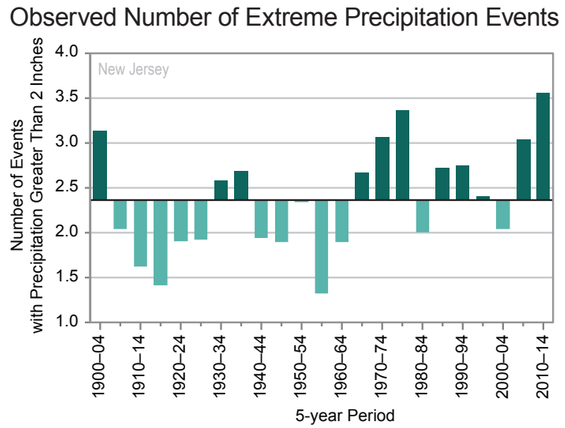

Figure 4: The observed number of extreme precipitation events (annual number of events with greater than 2 inches) for 1900–2014, averaged over 5-year periods; these values are averages from six long-term reporting stations. The number of extreme precipitation events has been the highest during the last decade. The dark horizontal line is the long-term average (1900–2014) of 2.4 days per year. Source: CICS-NC and NOAA NCEI.

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the

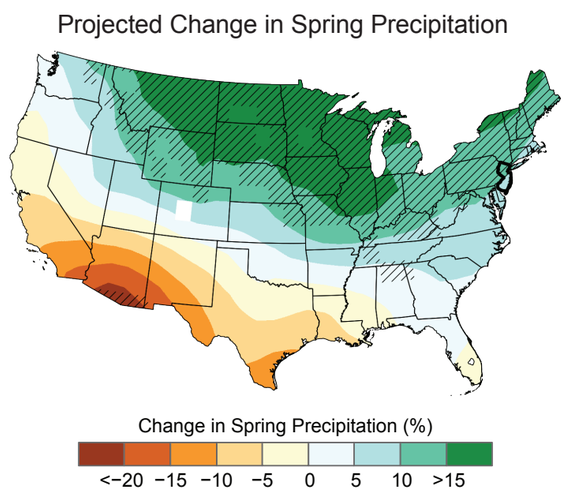

Figure 5: Projected changes (%) in spring precipitation for the middle of the 21st century (2041-2070) compared to the late 20th century (1971-2000) under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. New Jersey is part of a large area of projected increases in spring precipitation in the northeastern and central United States. Source: CICS-NC and NOAA NCEI.