NEW HAMPSHIRE

Key Messages

Temperatures in New Hampshire have risen more than 3°F since the beginning of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected during this century. Warming has increased more in the winter than in any other season. Future winter warming will have large effects on snowfall and snow cover.

Precipitation since 2005 has averaged 6.8 inches more than the 1895–2004 average, and the highest number of extreme precipitation events occurred during 2005–2014. Annual average precipitation and the frequency and intensity of extreme precipitation events are projected to increase, with associated increases in flooding.

Global sea level is projected to rise, with a likely range of 1–4 feet by 2100. Rising sea levels pose significant risks to coastal communities and structures, such as inundation, erosion-induced land loss, and greater flood vulnerability due to higher storm surge.

New Hampshire is located on the eastern margin of the North American continent. Its northerly latitude and geographic location expose the state to both the moderating and moistening influence of the Atlantic Ocean and the effects of hot and cold air masses from the interior of the continent. **Its climate is characterized by cold, snowy winters and mild summers.** The jet stream is often located near the state, particularly in the late fall, winter, and spring, and gives it highly variable weather patterns. Precipitation is frequent because several preferred storm tracks associated with the jet stream cross the state. The extreme northern and western portions of the state are the least influenced by the moderating effects of the Gulf of Maine and thus experience more extreme cold temperatures. The southeast, with its lower elevations and proximity to the Atlantic Ocean, is somewhat warmer. Average minimum temperatures in January are colder in the north (Lancaster: 2°F to 7°F) and at higher elevations (Mount Washington: −5°F to −1°F) than in the south (Concord: 12°F to 15°F). Coastal communities, such as the Portsmouth area, are even warmer, with average minimum temperatures ranging from 15°F to 18°F. Average maximum temperatures in July range from 75°F to 80°F in the north and from 80°F to 85°F in the south. The statewide annual average (1991–2020 normals period) precipitation is 48.8 inches, with higher amounts occurring in the south and along the eastern border of the state and lower amounts in the west and north.

Observed and Projected Temperature Change

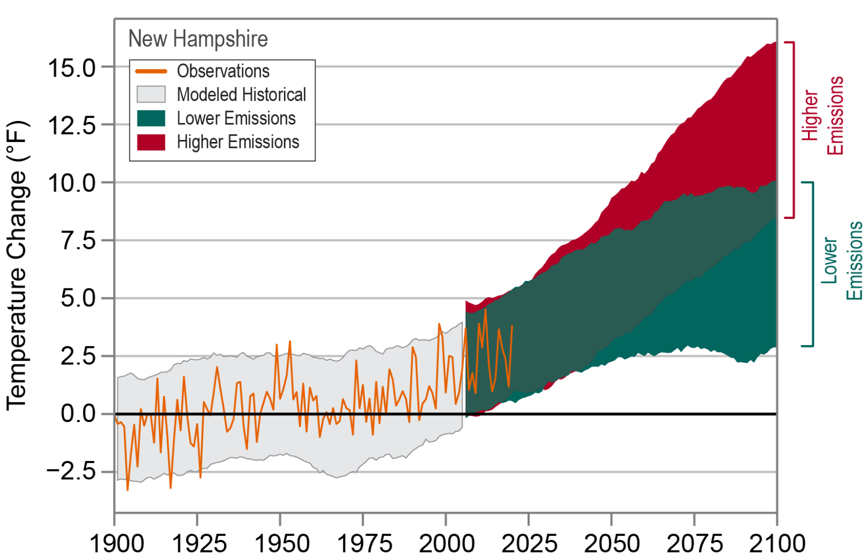

Figure 1. Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for New Hampshire. Observed data are for 1900–2020. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in New Hampshire (orange line) have risen more than 3°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-year projections being about 2°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest end-of-year projections being about 12°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI.

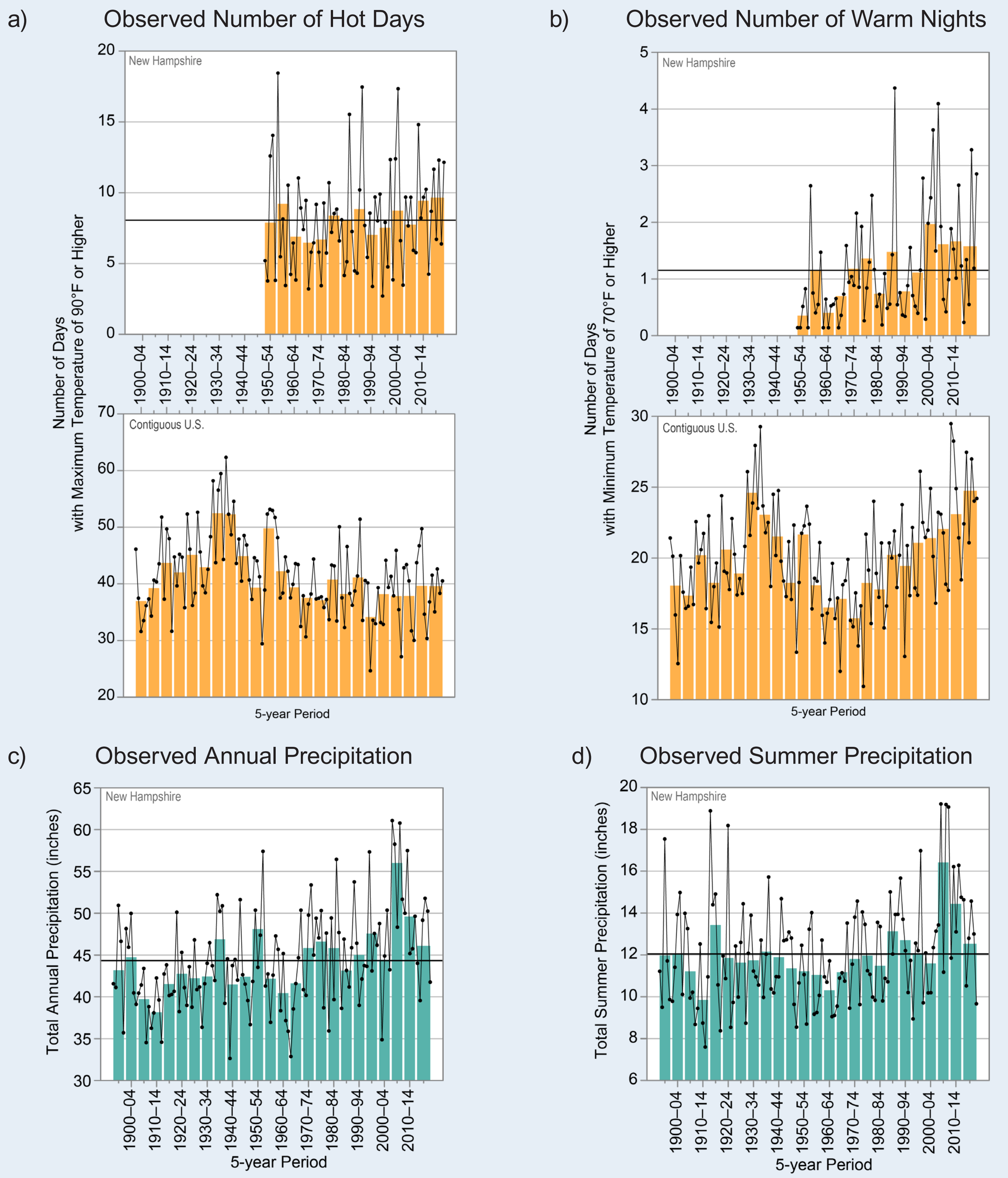

Figure 2. Observed (a) annual number of hot days (maximum temperature of 90°F or higher), (b) annual number of warm nights (minimum temperature of 70°F or higher), (c) total annual precipitation, and (d) total summer (June–August) precipitation for New Hampshire from (a, b) 1950 to 1920 and (c, d) 1895 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black lines show the long-term (entire period) averages for New Hampshire: (a) 8.1 days, (b) 1.2 nights, (c) 44.3 inches, (d) 12.1 inches. Values for the contiguous United States (CONUS) from 1900 to 2020 are included for Figures 2a and 2b to provide a longer and larger context. Long-term stations dating back to 1900 were not available for New Hampshire. There is no overall trend in the number of hot days; however, the number of warm nights has been above average since 2000. A significantly larger amount of both annual and summer precipitation occurred between 2005 and 2014 than in any previous consecutive 10-year interval. Sources: CISESS and NOAA NCEI. Data: (a, b) GHCN-Daily from 10 (NH) and 655 (CONUS) long-term stations; (c, d) nClimDiv.

Temperatures in New Hampshire have risen more than 3°F since the beginning of the 20th century (Figure 1). The number of hot days has varied across the period of record (1950–2020; Figure 2a); however, the most recent period (2015–2020) had the highest multiyear average of about 9 days. Since 2000, the number of warm nights has been above average, with the 2000–2004 period having the highest multiyear average of about 2 nights per year (Figure 2b). The greatest warming has occurred in the winter, with an increase of more than 4°F since 1900. This is reflected in the number of very cold nights, which has been below average since the early 1990s (Figure 3). The 2010–2014 period had the lowest multiyear average of about 18 nights per year. Warmer winters are also reflected in a trend toward earlier ice-out dates on lakes and fewer nights below freezing.

Total annual precipitation for New Hampshire has been above to well above average over the last 16 years (2005–2020; Figure 2c). The wettest multiyear periods were in the early 1950s, late 2000s, and early 2010s. The wettest consecutive 5-year interval was 2005–2009, averaging 56.0 inches per year. The driest multiyear periods were in the late 1900s, early 1910s, and 1960s. The driest consecutive 5-year interval was 1963–1967, averaging 37.2 inches per year. A state-level analysis for southern New Hampshire found that the rate of increase in annual precipitation from 1970 to 2012 was double to triple the long-term (1895–2012) average because of the high values occurring from 2005 to 2011. Similar trends in total summer precipitation have been observed over the last 16 years, with a record multiyear average of 16.4 inches during the 2005–2009 period (Figure 2d). The state experienced the highest annual number of 2-inch extreme precipitation events during the 2005–2009 period (2.4 days) and an above average number during the 2010–2014 period (1.9 days; Figure 4), although the 2015–2020 period had a below average number of such days (1.1 days). New Hampshire has also been experiencing more short-term dry periods, with extreme drought occurring in 2016 and again in 2020.

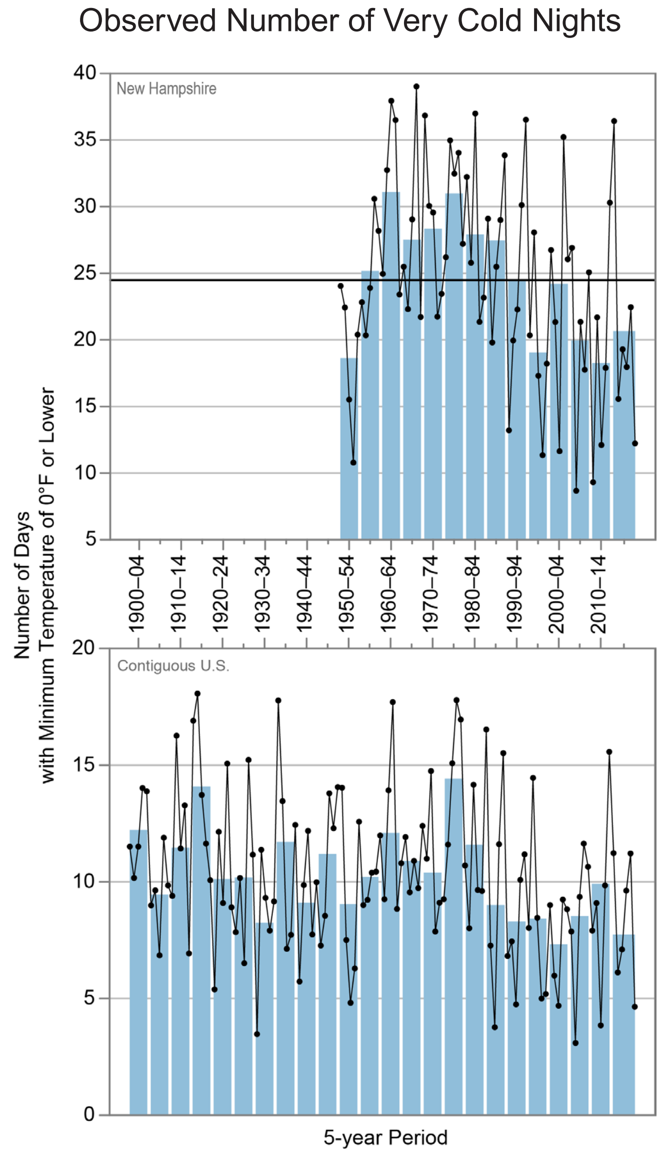

Figure 3. Observed annual number of very cold nights (minimum temperature of 0°F or lower) for New Hampshire from 1950 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average for New Hampshire of 25 nights. Values for the contiguous United States (CONUS) from 1900 to 2020 are included to provide a longer and larger context. Long-term stations dating back to 1900 were not available for New Hampshire. Since the mid-1990s, the number of very cold nights has been below average. The 2010–2014 period had the lowest multiyear average. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 10 (NH) and 655 (CONUS) long-term stations.

Extreme weather events common to New Hampshire include severe coastal storms, winter storms, cold waves, thunderstorms, floods, and tropical cyclones. The Federal Emergency Management Agency made 15 major disaster declarations for New Hampshire over the last 10 years (2011–2020); almost half (7) were related to severe storms and flooding. **The state's coastline is highly vulnerable to damage from winter coastal storms (known as nor'easters) and tropical cyclone events (hurricanes and tropical storms)**. These cyclonic storms often result in wide-scale flooding, property damage, and coastal erosion. Superstorm Sandy, in 2012, was the most extreme and destructive event to affect the northeastern United States in 45 years and the fourth costliest in the Nation's history. The most destructive element of Sandy was storm surge, with heights reaching 3.2 feet above normal tide levels in New Hampshire. The state suffered more than $75 million in economic losses.

Winter storms are an important feature of New Hampshire's climate. In most years, several storms depositing 5 or more inches of snow will affect the state. Seasonal snowfall totals for 2014–15 were well above the long-term average of about 60 inches across southern portions of the state; for example, Concord received more than 90 inches. Concord also received more than 85 inches during 2016–17 and 2017–18. However, the 2007–08 season holds the record for the highest seasonal snowfall in Concord (118 inches). **Although these recent winters were snowy, overall snowfall has been declining at a majority of stations. During the 2015–16 season, Concord received about half of its normal snowfall**. The number of snow-covered days is also decreasing throughout the state.

Under a higher emissions pathway, historically unprecedented warming is projected during this century (Figure 1). Even under a lower emissions pathway, annual average 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. Heat waves are projected to increase in intensity, while cold waves are projected to become less intense. In response to cold season warming, the state can expect more precipitation falling as rain rather than snow, earlier lake ice-out dates, and a decline in days with snow cover. This has implications for winter tourism. By midcentury (under a higher emissions pathway), the annual number of days above 90°F is projected to increase by up to 30 days in southern New Hampshire and up to 10 days in the north.

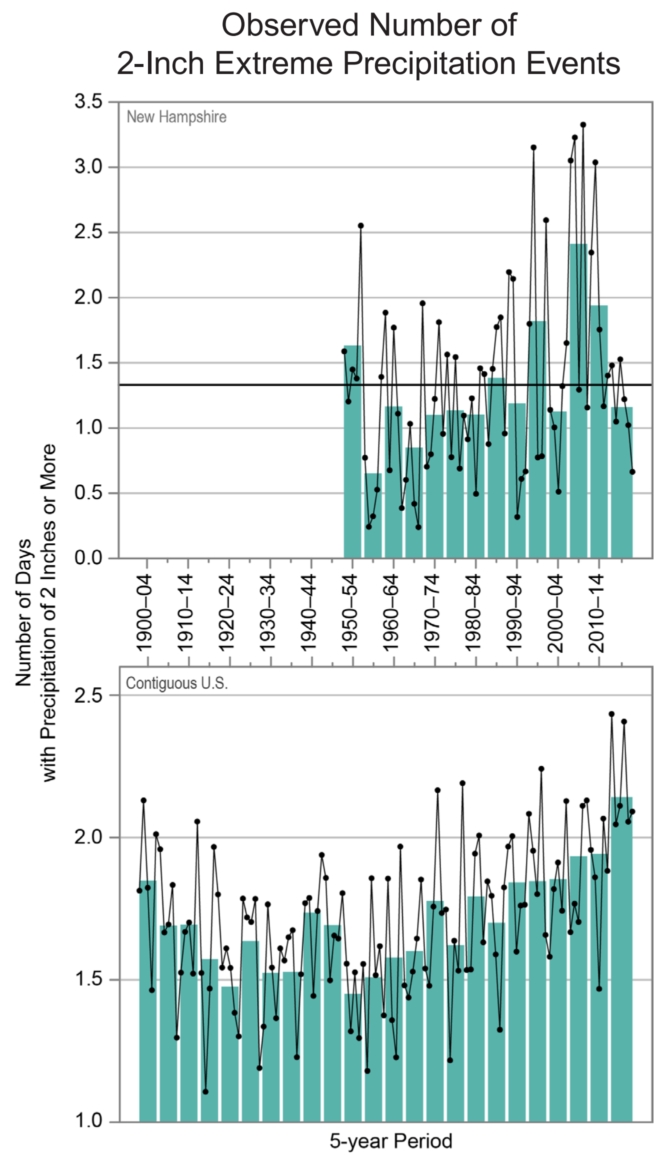

Figure 4. Observed annual number of 2-inch extreme precipitation events (days with precipitation of 2 inches or more) for New Hampshire from 1950 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average for New Hampshire of 1.3 days. A typical reporting station experiences 1 to 2 events per year. Values for the contiguous United States (CONUS) from 1900 to 2020 are included to provide a longer and larger context. Long-term stations dating back to 1900 were not available for New Hampshire. The highest number of 2-inch extreme precipitation events occurred during the 2005 to 2014 interval. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 13 (NH) and 832 (CONUS) long-term stations.

Annual average precipitation is projected to continue to increase for New Hampshire over this century, particularly during the winter (Figure 5). This trend is characteristic of a large area of the Northern Hemisphere in the higher mid-latitudes that is projected to see increases in precipitation totals. The frequency of extreme precipitation events is also expected to more than double in the region by the end of this century under a higher emissions pathway. These precipitation projections may also result in increased flooding risks. The intensity of naturally occurring droughts is also projected to increase because of an increased rate of soil moisture depletion from higher temperatures during dry spells.

Since 1900, global average sea level has risen by about 7–8 inches. It is projected to rise another 1–8 feet, with a likely range of 1–4 feet, by 2100 as a result of both past and future emissions from human activities (Figure 6). Coastal communities in Portsmouth are particularly vulnerable to sea level rise and coastal storm surge. From 1926 to 2019, tidal-gauge records showed that sea level in Portsmouth Harbor had risen more than half a foot (8.04 inches), nearly the same as the global average. Sea level rise contributes to increases in coastal erosion and saltwater intrusion and has also 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. Nuisance flooding has increased in all U.S. coastal areas, with more rapid increases along the East and Gulf Coasts. Nuisance flooding events in New Hampshire are likely to occur more frequently as global and local sea levels continue to rise.

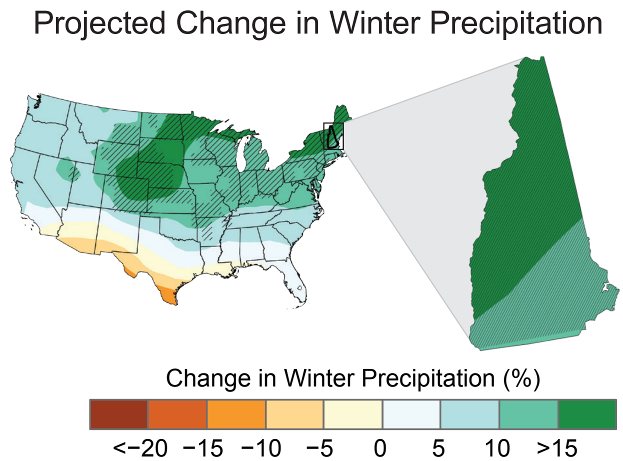

Figure 5. Projected changes in total winter (December–February) precipitation (%) for the middle of the 21st century relative to the late 20th century under a higher emissions future. Hatching represents areas where the majority of climate models indicate a statistically significant change. Winter precipitation is projected to increase in New Hampshire. Sources: CISESS and NEMAC. Data: CMIP5.

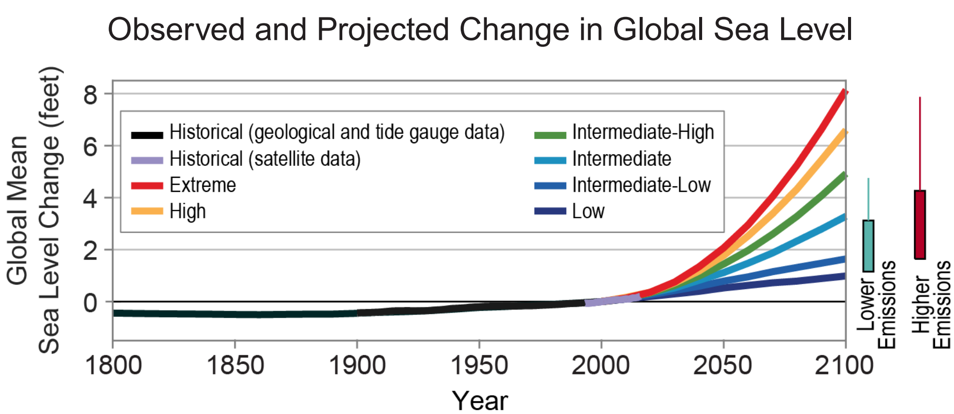

Figure 6. Global mean sea level (GMSL) change from 1800 to 2100. Projections include the six U.S. Interagency Sea Level Rise Task Force GMSL scenarios (Low, navy blue; Intermediate-Low, royal blue; Intermediate, cyan; Intermediate-High, green; High, orange; and Extreme, red curves) relative to historical geological, tide gauge, and satellite altimeter GMSL reconstructions from 1800–2015 (black and magenta lines) and the very likely ranges in 2100 under both lower and higher emissions futures (teal and dark red boxes). Global sea level rise projections range from 1 to 8 feet by 2100, with a likely range of 1 to 4 feet. Source: adapted from Sweet et al. 2017.

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

WWW.NCEI.NOAA.GOV | HTTPS://STATESUMMARIES.NCICS.ORG/CHAPTER/NH/ | LEAD AUTHORS: JENNIFER RUNKLE, KENNETH E. KUNKEL
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