NOAA NATIONAL CENTERS
FOR ENVIRONMENTAL INFORMATION

STATE CLIMATE SUMMARIES 2022

FLORIDA

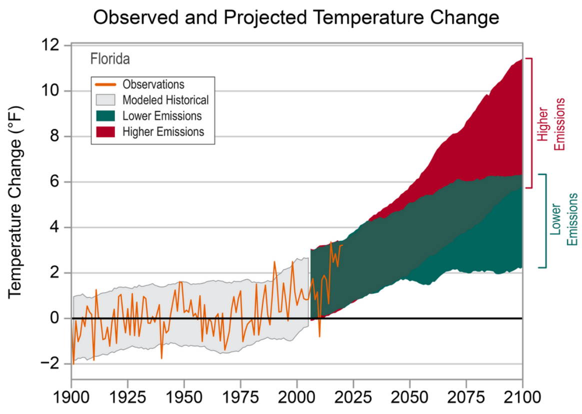
KEY MESSAGE 1

Temperatures in Florida have risen more than 2°F since the beginning of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected during this century. Increases in the rate of soil moisture loss due to rising temperatures will likely increase the intensity of naturally occurring droughts.

FLORIDA

Due to its location at subtropical latitudes and adjacent to the warm waters of the Gulf of Mexico and western Atlantic, Florida has a climate characterized by hot, humid summers and mild winters. The Bermuda High, a semipermanent high-pressure system off the Atlantic coast, plays an important role in the climate of the state, particularly in the summer. Typically, the Bermuda High draws moisture northward or westward from the Atlantic Ocean, causing warm and moist summers with frequent thunderstorms in the afternoons and evenings. Average (1991–2020 normals) temperatures in January range from the lower 50s (°F) in the northern portion of the state to the upper 60s (°F) in the south. During July, typically the hottest month of the year, average temperatures in the low 80s (°F) are prevalent throughout the state. Statewide annual average (1895–2020) precipitation is 53.7 inches, with more precipitation falling during the warmer months of June through September.

Figure 1

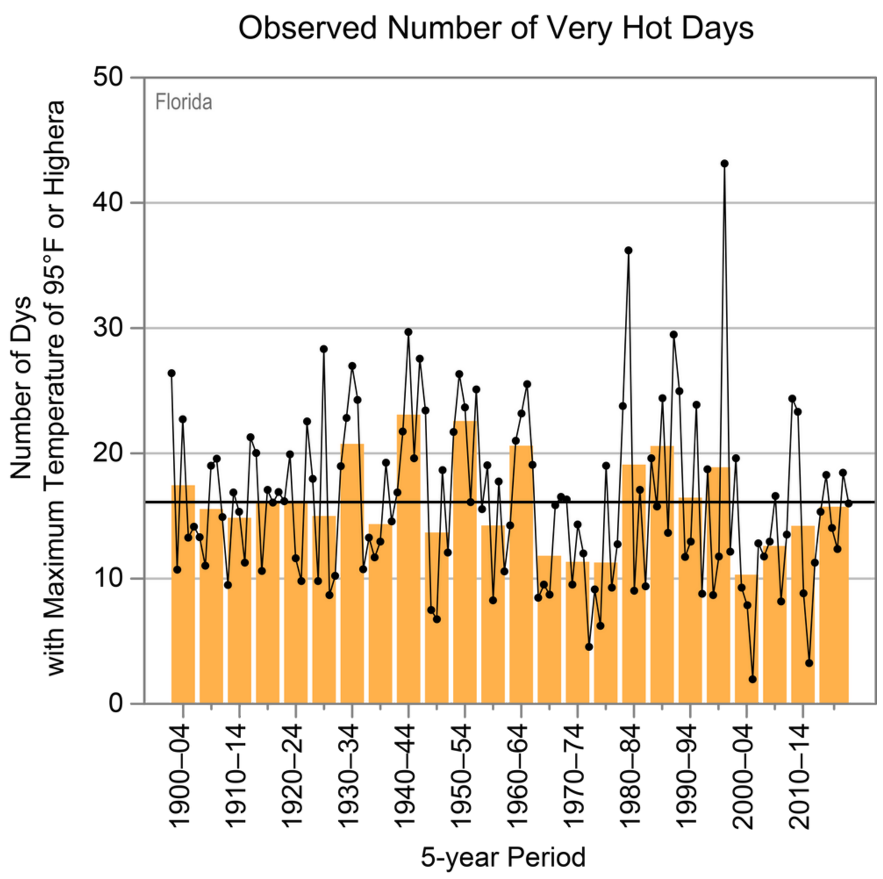


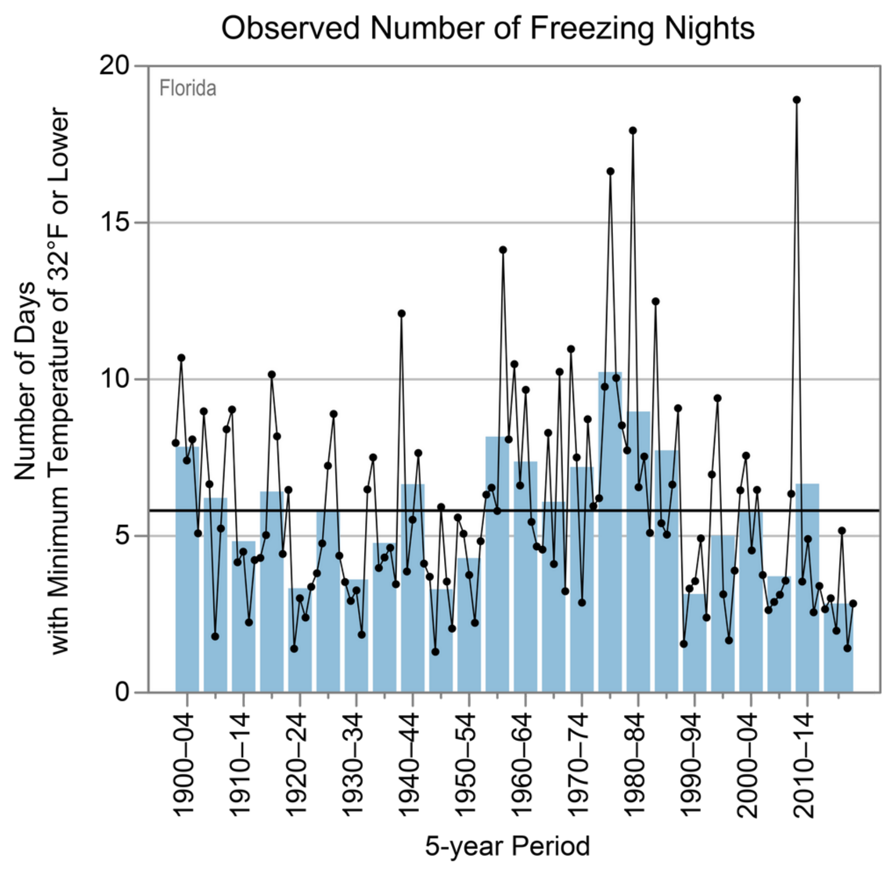
Temperatures in Florida have risen more than 2°F since the beginning of the 20th century (Figure 1). Although there has been a general lack of daytime warming (Figure 2a), nighttime warmth has increased dramatically since 1995 (Figure 3); the number of very warm nights during the 2015 to 2020 period was more than double the numbers of the mid-20th century (1930–1944). While Florida typically experiences far fewer days with temperatures exceeding 100°F than most other southern states, it is the most humid state in the Nation. Extended periods of extreme heat, especially when combined with high humidity, can result in heat-related illness among vulnerable populations and place excess stress on agricultural production, water supplies, and energy generation.

Figure 2

a)

b)





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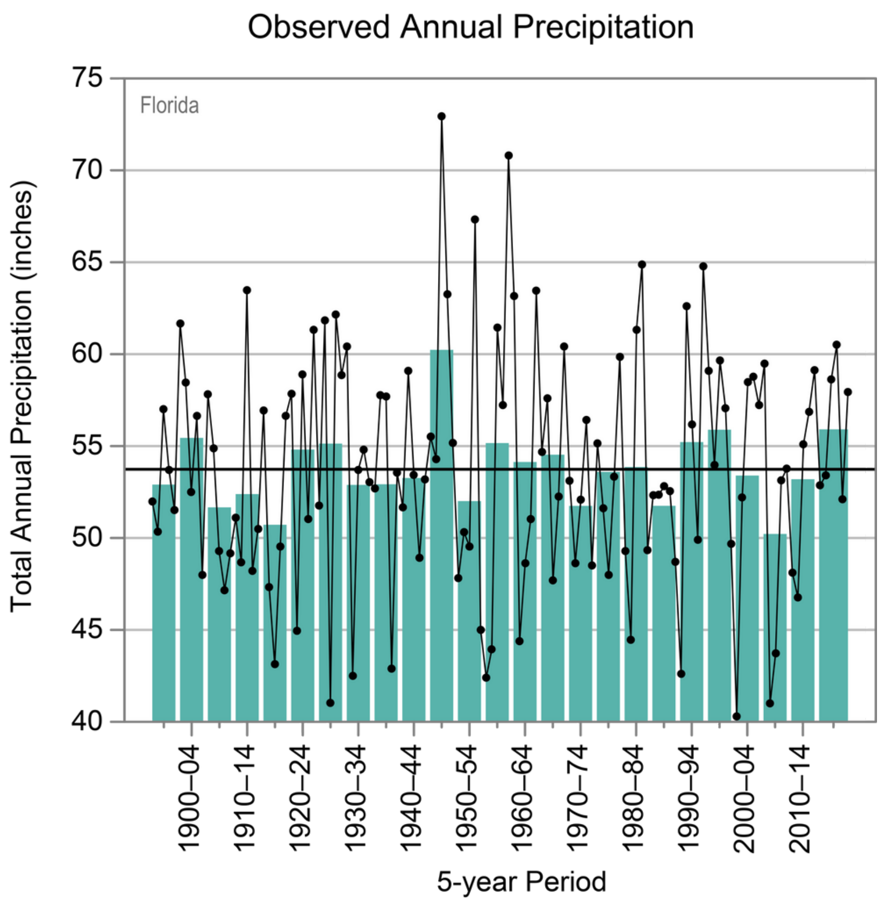

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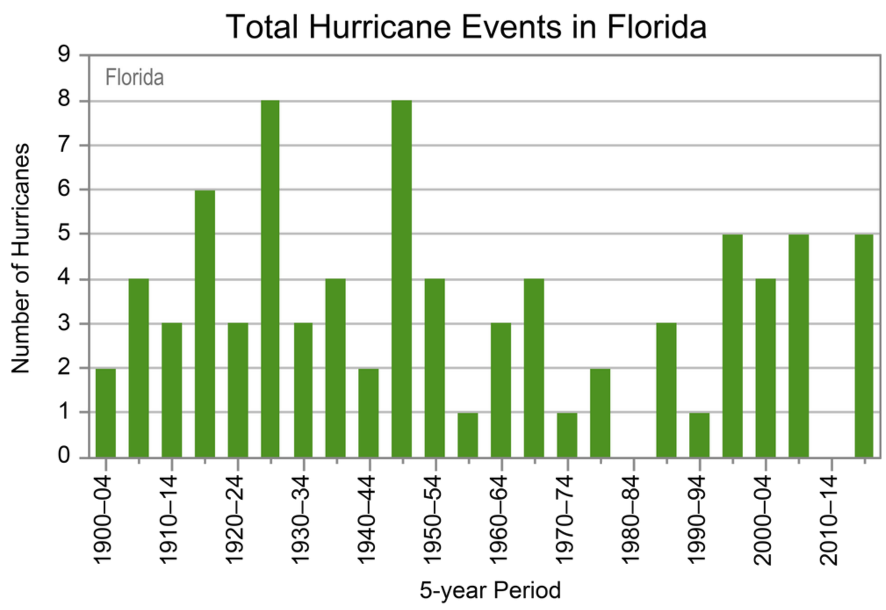

Figure 2: Observed (a) annual number of very hot days (maximum temperature of 95ºF or higher), (b) annual number of freezing nights (minimum temperature of 32ºF or lower), (c) total annual precipitation, and (d) total number of hurricane events (wind speeds reaching hurricane strength somewhere in the state) for Florida from (a, b, d) 1900 to 2020 and (c) 1895 to 2020. In Figures 2a, 2b, and 2c, dots show annual values, bars show averages over 5-year periods (last bar is a 6-year average), and the horizontal black lines show the long-term (entire period) averages: (a) 16 days, (b) 5.8 nights, (c) 53.7 inches. In Figure 2d, bars show totals over 5-year periods (last bar is a 6-year total). Since 2000, the number of very hot days has been below average. The number of freezing nights has generally been below average since 1990. Total annual precipitation reached its lowest level during the 2005–2009 period, coinciding with an increase in drought and wildfires. Hurricane strikes occur frequently along the Florida coast, with most multiyear periods experiencing at least 3 hurricanes. Some years are more active than others. For example, following a very

active 2004 (4 events) and 2005 (5 events), there were no landfalling hurricanes in Florida from 2006 to 2015. Sources: (a, b, c) CISESS and NOAA NCEI; (d) NOAA Hurricane Research Division. Data: (a, b) GHCN-Daily from 13 long-term stations; (c) nClimDiv.

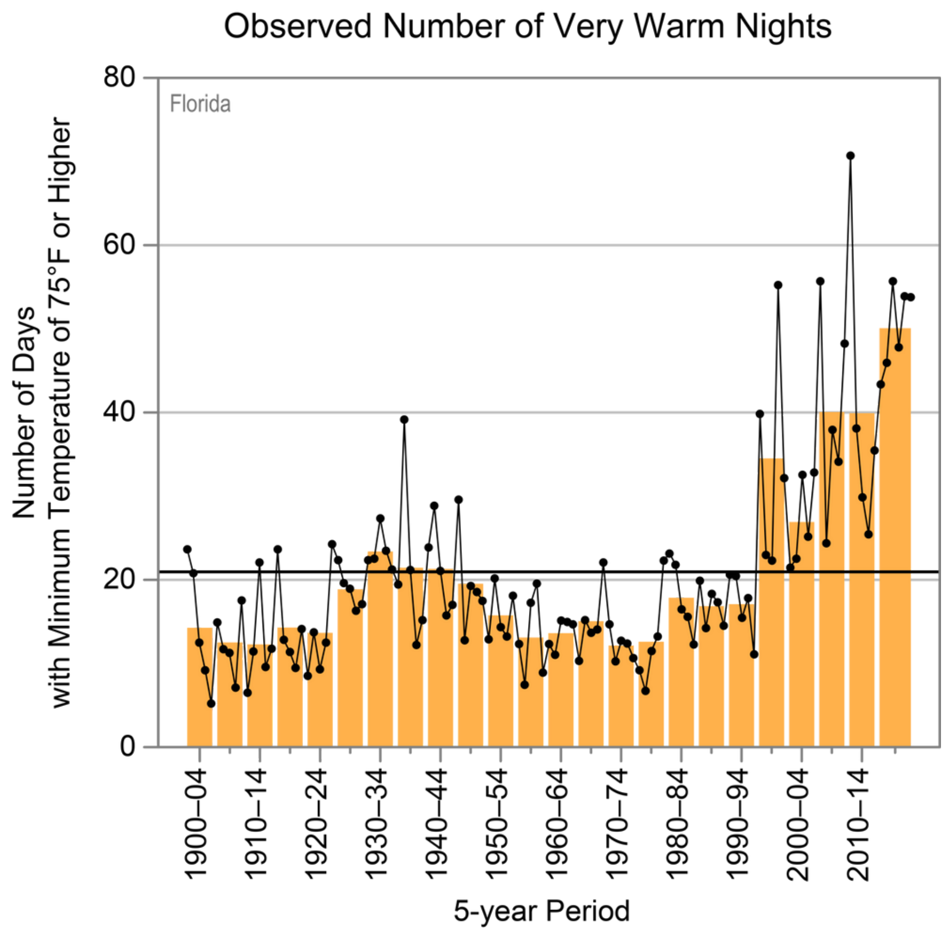

Figure 3: Observed annual number of very warm nights (minimum temperature of 75°F or higher) for Florida from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 21 nights. The number of very warm nights has risen substantially since 1995. The 2015 to 2020 multiyear average is more than double the 1930–1934 multiyear average. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 13 long-term stations.

During the cold season, extratropical cyclones and associated fronts are responsible for significant day-to-day variability in the weather. While the temperatures associated with cold waves are warmer than in areas to the north, they can have major impacts on those sectors adapted to the generally mild climate, such as agriculture. For example, several strong freezes since the beginning of the 19th century have gradually forced the citrus and other industries (e.g., winter vegetables and sugarcane) to migrate from North Florida into South Florida. The annual average (1991–2020) number of freezing nights varies from greater than 20 in the far northern part of the state to 0 in the south (Figure 4). Throughout 80 years of record keeping, Miami International Airport has dropped below freezing only 7 times and not once since 1989. Subfreezing air sometimes reaches as far south as Central Florida, causing major damage to citrus crops. A severe cold outbreak lasting more than a week in January 2010 resulted in more than $200 million in losses to the Florida citrus industry. There is no long-term trend in the number of freezing nights, but there has been a decrease from the high numbers of the late 1970s (Figure 2b).

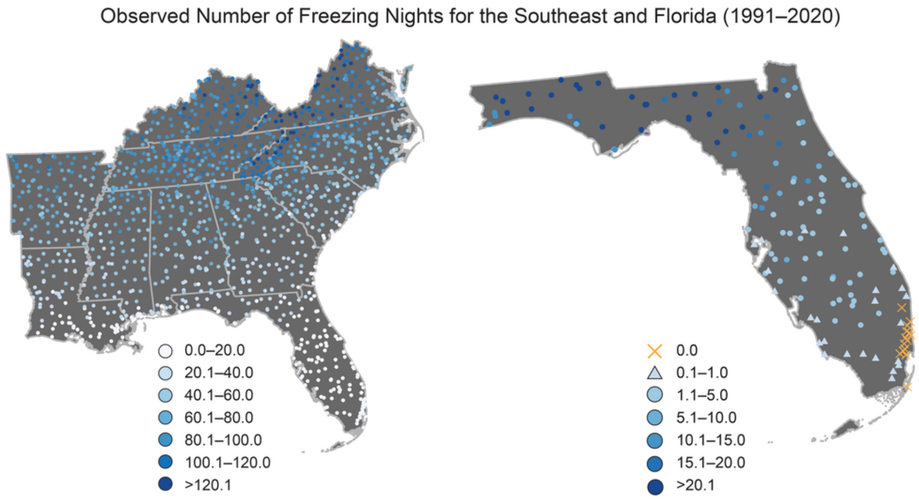

Figure 4: Observed annual average (1991–2020) number of freezing nights (minimum temperature of 32°F or lower) for the Southeast region (left) and Florida (right, with a different scale). Source: CISESS.

Total annual precipitation varies widely from year to year (Figure 2c). The driest year on record was 2000, with 40.3 inches of precipitation, and the wettest was 1947, with 72.9 inches. The driest consecutive 5-year interval was 2006–2010, with an average of 47.9 inches per year, and the wettest was 1945–1949, with an average of 60.2 inches per year. Historically, the number of 4-inch extreme precipitation events has been highly variable but has been near or above average since 1995 (Figure 5). Two notable extreme precipitation events occurred in 2014. During January 9–10, torrential rain fell in the West Palm Beach area, with more than 10 inches at Fort Pierce and more than 14 inches at Sun Valley. On April 29 in the Panhandle, more than 15 inches fell in Pensacola and about 20 inches in Milton. Drought is a persistent climate threat for Florida, resulting in water supply reductions, disruptions to agriculture, and increased risk of wildfires. In every decade since 1900, the state has been impacted by at least one severe and widespread drought.

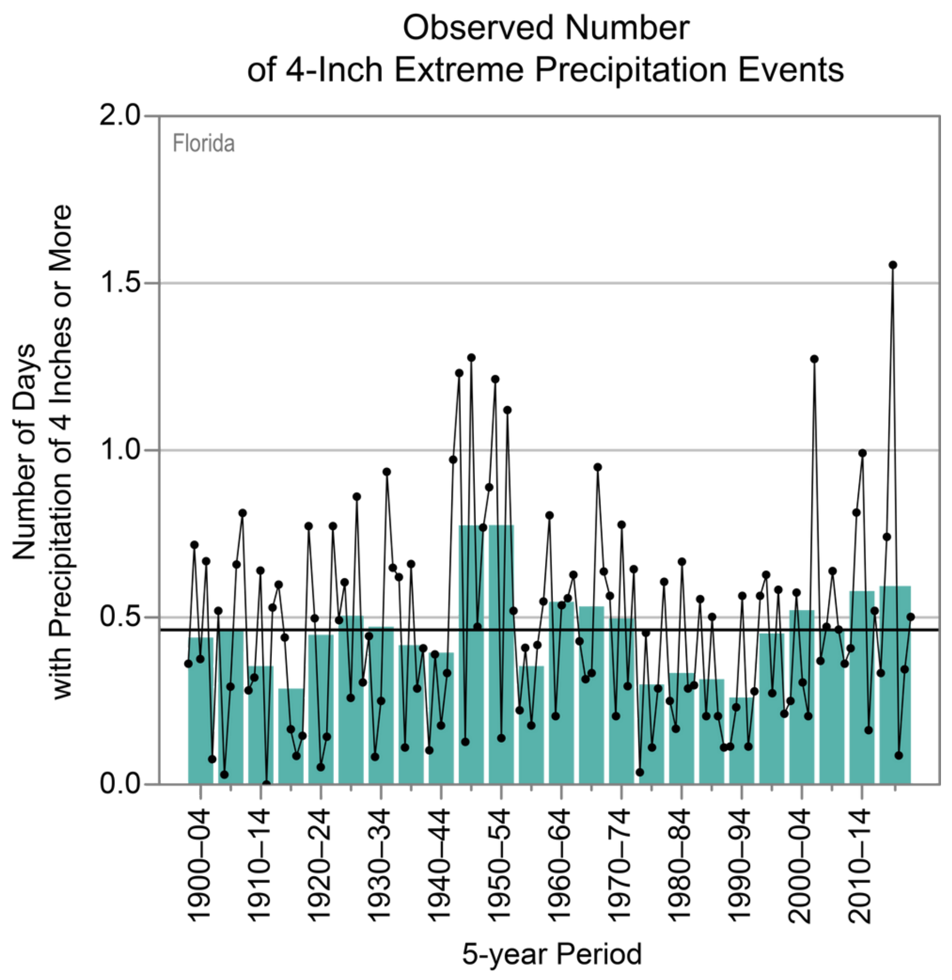

Figure 5: Observed annual number of 4-inch extreme precipitation events (days with precipitation of 4 inches or more) for Florida from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 0.5 days. A typical station experiences an event about once every 2 years. The number of 4-inch extreme precipitation events shows wide variability but has been near or above average since 1995. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 15 long-term stations.

Thunderstorms are ubiquitous during the summer. Florida experiences the highest annual number of thunderstorms in the United States. Hurricanes and intense coastal storms are the most serious weather threats. Hurricane strikes occur frequently along the Florida coast, with hurricane-force winds impacting the state an average of 3 times every 5 years (Figure 2d). In 2018, Hurricane Michael (Category 5) struck the Panhandle, nearly destroying Mexico Beach and causing extensive damage to Panama City and Tyndall Air Force Base and more than $20 billion in damages. Michael was the strongest hurricane on record to make landfall along the Florida Panhandle. In 2017, Hurricane Irma (Category 4) made landfall at Cudjoe Key, then crossed over the Gulf of Mexico and made landfall again in the Florida Panhandle. The Florida Keys were heavily impacted, and near-historic levels of storm surge caused significant coastal flooding in Jacksonville.

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 the 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. By 2050, most of the state is projected to see an increase of more than 50 days with temperatures of 95°F or higher. The summer heat index is projected to increase by 8° to 15°F, the largest escalation in the Nation.

Increases in the frequency and intensity of extreme precipitation and drought are projected. Projected changes in summer precipitation are uncertain (Figure 6); however, even if precipitation remains constant, higher temperatures will increase the rate of soil moisture loss and likely lead to more intense droughts. Decreased water availability, exacerbated by population growth and land-use change, will continue to increase competition for water and affect the region's economy and unique ecosystems. Increasing drought intensity will likely trigger more frequent wildfire events. Typically, the state exhibits a peak in wildfire activity from January to mid-June, a period when tropical moisture is reduced and occasional cold fronts usher in dry, windy conditions. In 2020, Florida experienced 2,381 wildfires, ranking fifth in the Nation for number of wildfires; a total of 99,413 acres burned. While the annual frequency of hurricanes has remained relatively stable throughout the 20th and early 21st centuries (Figure 2d), **hurricane rainfall is expected to increase for Florida as the climate continues to warm**.

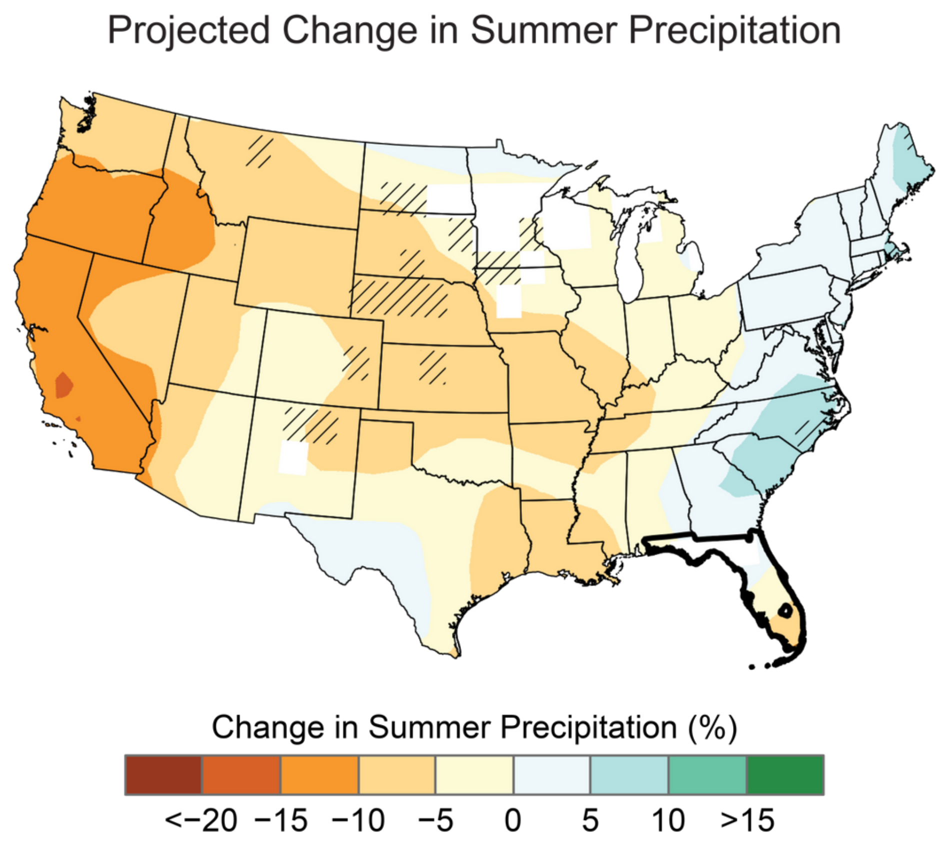

Figure 6: Projected changes in total summer (June–August) precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Whited-out areas indicate that the climate models are uncertain about the direction of change. Hatching represents areas where the majority of climate models indicate a statistically significant change. Summer precipitation projections are uncertain for Florida, as well as for a larger part of the Southeast. Sources: CISESS and NEMAC. Data: CMIP5.

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 7). 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. Tidal flood days (all days exceeding the nuisance-level threshold) remain rare at Key West, but as global sea level rises, they are projected to become a common occurrence (Figure 8). Increased inland flooding during heavy precipitation events in low-lying coastal areas is a threat, because mere inches of sea level rise have the potential to impair the capacity of stormwater drainage systems to empty into the ocean. Sea level rise presents major challenges to South Florida's existing coastal water management system due to a combination of increasingly urbanized areas, aging flood control facilities, flat topography, and permeable limestone aquifers. Increases in nuisance-level coastal flooding and saltwater contamination of coastal groundwater reservoirs are likely consequences of sea level rise.

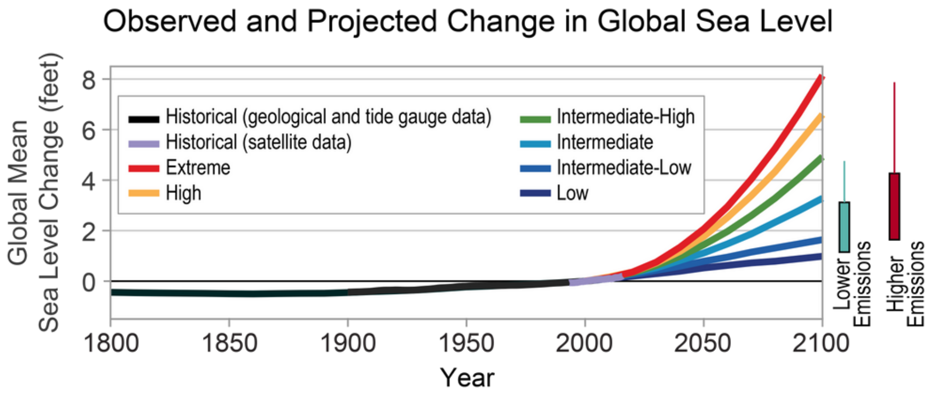

Figure 7: Global mean sea level (GMSL) change from 1800 to 2100. Projections include the six U.S. Interagency Sea Level Rise Task Force GMSL scenarios (Low, navy blue; Intermediate-Low, royal blue; Intermediate, cyan; Intermediate-High, green; High, orange; and Extreme, red curves) relative to historical 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.

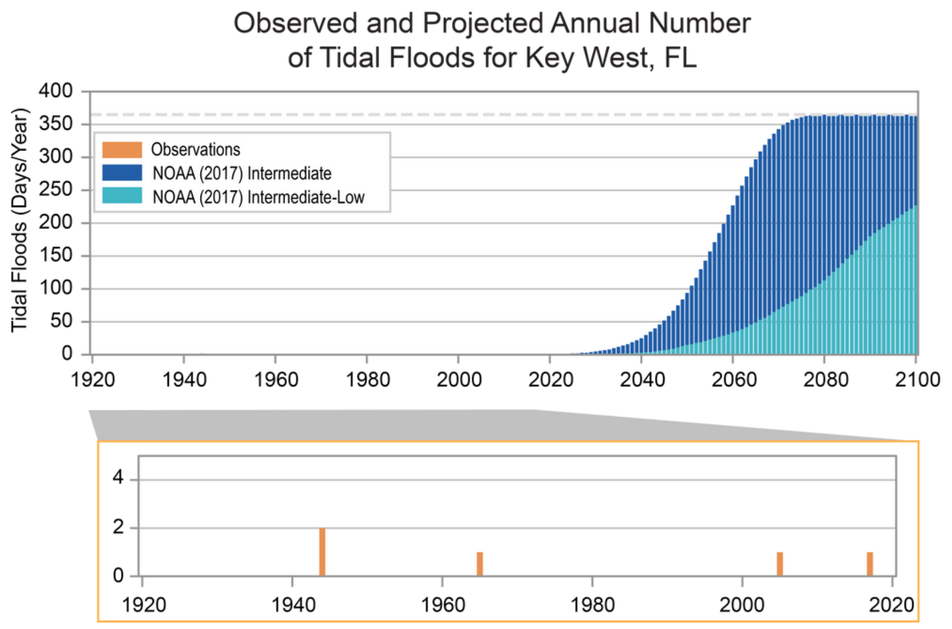

Figure 8: Number of tidal flood days per year at Key West, Florida, for the observed record (1920–2020; orange bars) and projections for two NOAA (2017) sea level rise scenarios (2021–2100): Intermediate (dark blue bars) and Intermediate-Low (light blue bars). The NOAA (2017) scenarios are based on local projections of the GMSL scenarios shown in Figure 7. Sea level rise has caused a gradual increase in tidal floods associated with nuisance-level impacts. The greatest number of tidal flood days (all days exceeding the nuisance-level threshold) occurred in 1944 at Key West. Projected increases are large even under the Intermediate-Low scenario. Under the Intermediate scenario, tidal flooding is projected to occur every day of the year by the end of the century. Additional information on tidal flooding observations and scenarios is available online at https://statesummaries.ncics.org/technicaldetails. Sources: CISESS and NOAA NOS.

Details on observations and projections are available on the Technical Details and Additional Information page.

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