MISSISSIPPI

Key Messages

Temperatures in Mississippi have risen by a miniscule 0.1°F since the beginning of the 20th century, but recent years have been very warm. The warmest consecutive 5-year interval was the most recent, 2016–2020. Mississippi is one of the few areas globally to experience little net warming. However, historically unprecedented warming is projected during this century.

Increases in the frequency and intensity of extreme precipitation events are projected. Higher temperatures will increase the rate of soil moisture loss during dry spells, which could increase the intensity of naturally occurring droughts.

Sea level rise poses an increasing threat to Mississippi's coastal communities. Potential impacts of sea level rise include higher storm surge and disappearing barrier islands.

Mississippi is located between the Gulf of Mexico and the southern end of the vast, relatively flat plains of central North America, which extend from the Arctic Circle to the Gulf of Mexico. The state is therefore exposed to diverse air masses, including the warm, moist air from the Gulf of Mexico and drier continental air masses, which are cold in the winter and warm in the summer. Clockwise circulation of air around a semipermanent high-pressure system in the North Atlantic (the Bermuda High) causes a quite persistent southerly flow of air off the Gulf during the warmer half of the year. Thus, **Mississippi's climate is characterized by relatively mild winters, hot summers, and year-round precipitation**. In addition to serving as a predominant source of moisture, the warm waters of the Gulf of Mexico help moderate temperatures along Mississippi's coast. This mild climate is an important economic driver for agricultural production and tourism. Statewide annual average (1991–2020 normals) precipitation is 55.9 inches and ranges from 50 inches in the north to about 65 inches along the coast. Extreme temperatures range from a record low of −19°F at Corinth (January 30, 1966) to a record high of 115°F at Holly Springs (July 29, 1930).

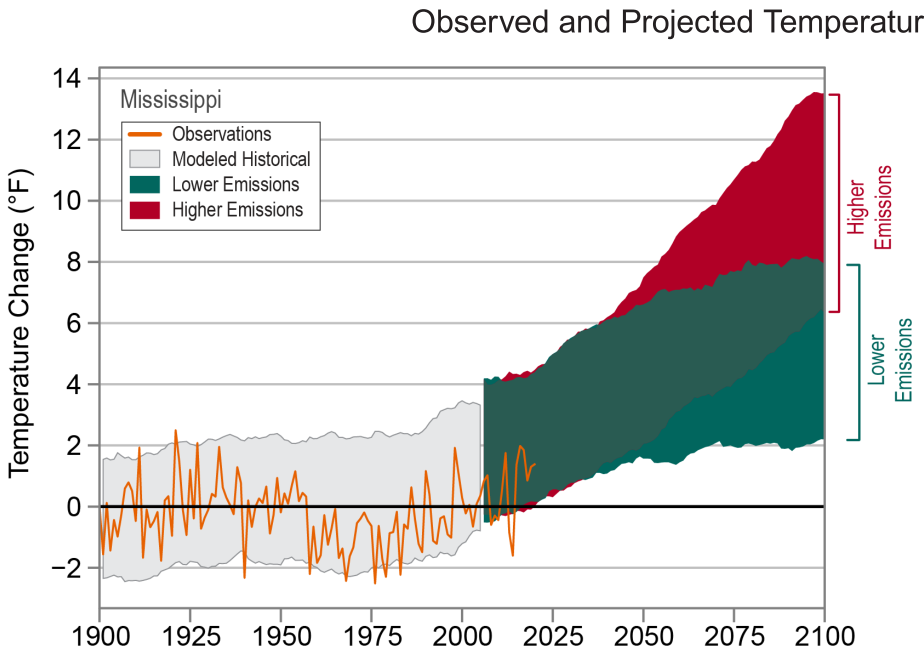

Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Mississippi. Observed data are for 1900–2020. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Mississippi (orange line) have risen by a miniscule 0.1°F since the beginning of the 20th century, but recent years have been very warm. The warmest consecutive 5-year interval was the most recent, 2016–2020. Mississippi is one of the few areas globally to experience little net warming. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within, but on the low end of, 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 projected years 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 projected years being about 11°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI.

Temperatures in Mississippi have risen by a miniscule 0.1°F since the beginning of the 20th century, but recent years have been very warm. The warmest consecutive 5-year interval was the most recent, 2016–2020. **Mississippi is one of the few areas globally to experience little net warming** (Figure 1). Temperatures in Mississippi were above average in the 1920s, 1930s, and 1950s, followed by a substantial cooling of almost 2°F throughout the 1960s and 1970s. Temperatures have risen since that cool period by more than 2°F. The contiguous United States as a whole has warmed by about 1.8°F since 1900, with only slight cooling from the 1930s into the 1960s. Hypothesized causes for this difference in warming rates include increased cloud cover and precipitation, increased small particles from coal burning, natural factors related to forest regrowth, decreased heat flux due to irrigation, and multidecadal variability in North Atlantic and tropical Pacific sea surface temperatures.

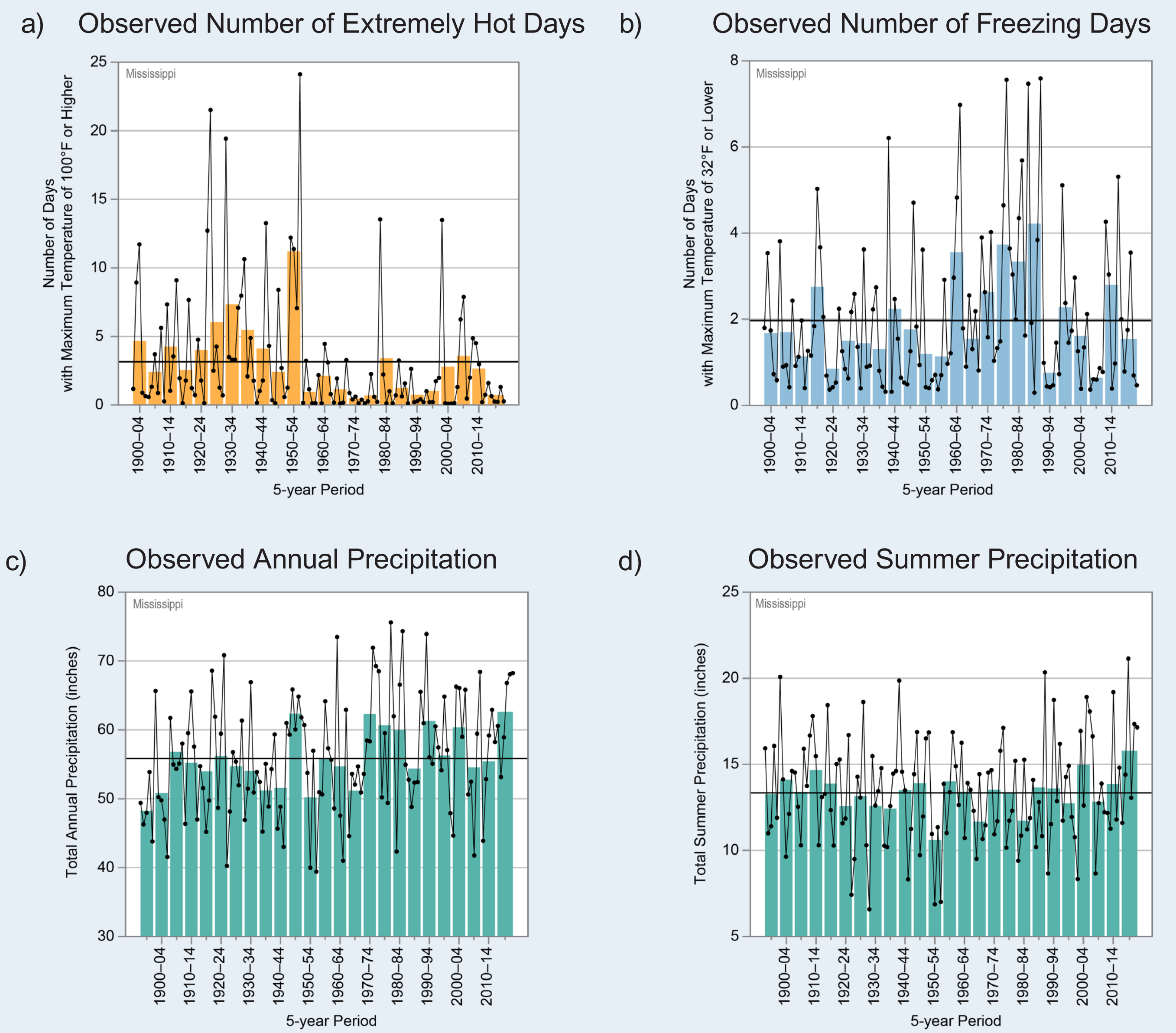

Figure 2: Observed (a) annual number of extremely hot days (maximum temperature of 100°F or higher), (b) annual number of freezing days (maximum temperature of 32°F or lower), (c) total annual precipitation, and (d) total summer (June–August) precipitation for Mississippi from (a, b) 1900 to 2020 and (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: (a) 3.2 days, (b) 2.0 days, (c) 55.9 inches, (d) 13.3 inches. Since 1955, the number of extremely hot days has generally been below average. The number of freezing days shows wide variability but has generally been below average since 1990. Annual precipitation has generally been above average since 1970, while summer precipitation shows no long-term trend. Sources: CISESS and NOAA NCEI. Data: (a, b) GHCN-Daily from 17 long-term stations; (c, d) nClimDiv.

The number of extremely hot days was generally above average in the first half of the 20th century, but since 1955, the number of these days has generally been below average (Figure 2a). During the last 11 years, the number of very warm nights has been above average, with the 2010–2014 multiyear average exceeding that of previous multiyear-year periods (Figure 3). Since 2005, summer temperatures have been above average, but the highest multiyear average occurred during the 1950–1954 period (Figure 4). The number of freezing days was mostly well above average between 1960 and 1989 but has been highly variable since then (Figure 2b). While the recent trend is toward fewer extremely cold events, a historic cold wave affected the state during February 11–20, 2021. In the northwest, temperatures remained below freezing for 8 consecutive days and fell to around 0°F. Heavy snow (more than 10 inches in some locations) and severe icing caused widespread damage. Drinking water supplies in the state capital, Jackson, were not fully restored for weeks.

Total annual precipitation in Mississippi has generally been above average since 1970 (Figure 2c). The driest consecutive 5-year interval was 1895–1899, averaging 48.3 inches per year, while the wettest was 2016–2020, averaging 63.1 inches. Total summer precipitation shows no long-term trend; however, the highest multiyear average occurred during the 2015–2020 period (Figure 2d). The number of 3-inch extreme precipitation events has generally been above average since 1970 (Figure 5). Agricultural droughts (inadequate soil moisture levels to meet crop water demands) occur frequently during the summer. Since the creation of the United States Drought Monitor map in 2000, Mississippi has been completely drought-free approximately 48% of that time (2000–2020), and at least half of the state has been in drought conditions approximately 12% of that time.

Extreme weather events in Mississippi include severe thunderstorms, flooding, extreme heat, tornadoes, winter storms, and tropical cyclones (hurricanes and tropical storms). Between 2005 and 2020, the Federal Emergency Management Agency granted 29 disaster declarations to the state; 23 were for severe storms, tornadoes, and flooding events, and the other 6 were for hurricanes. The typical flood season is November through June, when the Mississippi River's flow is at its peak. Tropical cyclone flooding on smaller rivers occurs in the late summer and fall. Flooding of historic proportions occurred along the

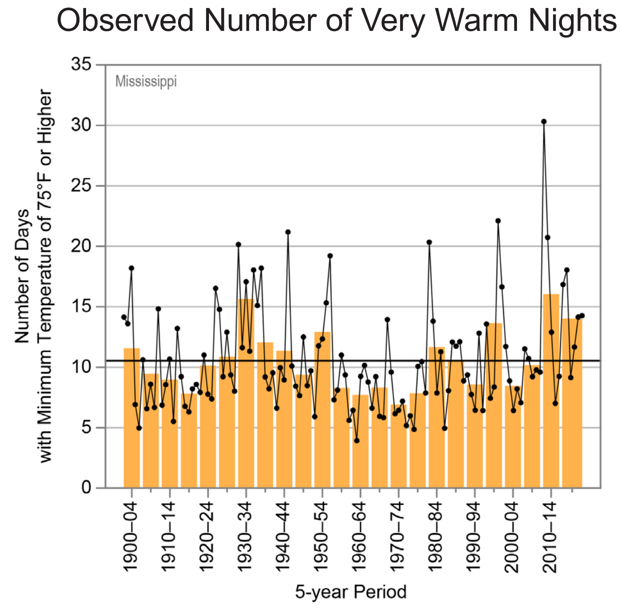

Figure 3: Observed annual number of very warm nights (minimum temperature of 75°F or higher) for Mississippi from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 11 nights. The number of very warm nights has generally been above average since 2010. The multiyear average for the 2010–2014 period exceeded that of the previous highest multiyear period (1930–1934). Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 17 long-term stations.

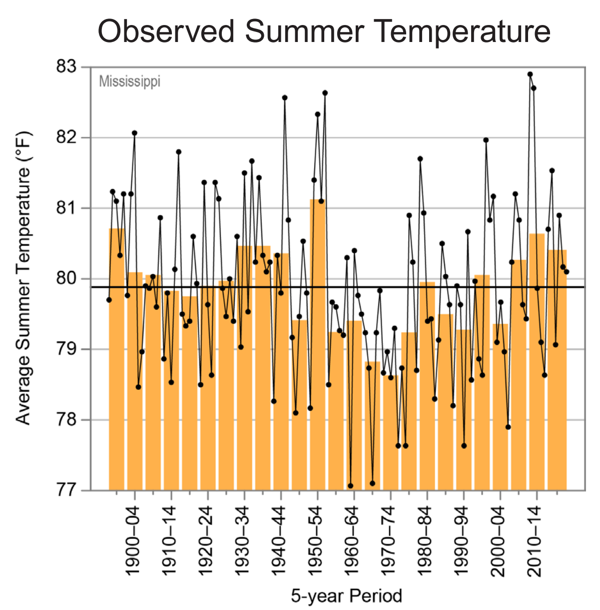

Figure 4: Observed summer (June–August) average temperature for Mississippi from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-summer average). The horizontal black line shows the long-term (entire period) average of 79.9°F. Summer temperatures have been above average since 2005, including the two warmest summers on record, 2010 and 2011. Sources: CISESS and NOAA NCEI. Data: nClimDiv

Mississippi River in the spring of 2011, following record snowmelt and unprecedented rainfall upstream of the state. Agricultural production damages exceeded $500 million in Mississippi alone.

Mississippi is at risk for catastrophic damage from hurricanes. In 1969, Hurricane Camille devastated parts of the state as either the strongest (peak wind speed) or the second strongest (minimum pressure) Category 5 storm to strike the United States in the 20th century. Mississippi alone incurred damages of more than $900 million. In 2005, Hurricane Katrina caused extensive damage along the Mississippi coast and inland, resulting in 238 fatalities and billions of dollars in damages. The storm surge at Pass Christian was 22.6 feet for Camille and 27.8 feet for Katrina. Along the Mississippi coast, surges of approximately 15 feet or greater have an average return period (estimated average time between events) of 25 years, and surges of 20 feet or greater have an average return period of 50 to 100 years (Figure 6).

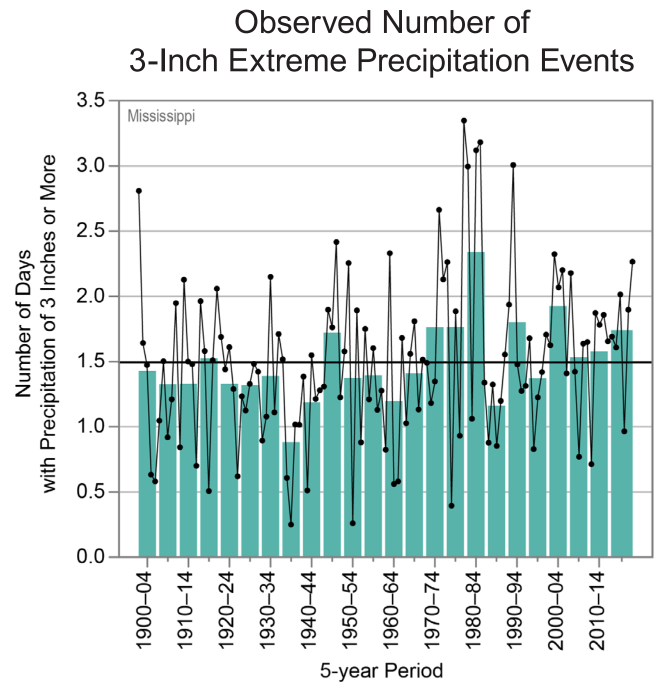

Figure 5: Observed annual number of 3-inch extreme precipitation events (days with precipitation of 3 inches or more) for Mississippi from 1900 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 1.5 days. A typical station experiences 1 to 2 events per year. The number of 3-inch extreme precipitation events has generally been above average since 1970, with the highest number occurring during the 1980–1984 period. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 20 long-term stations.

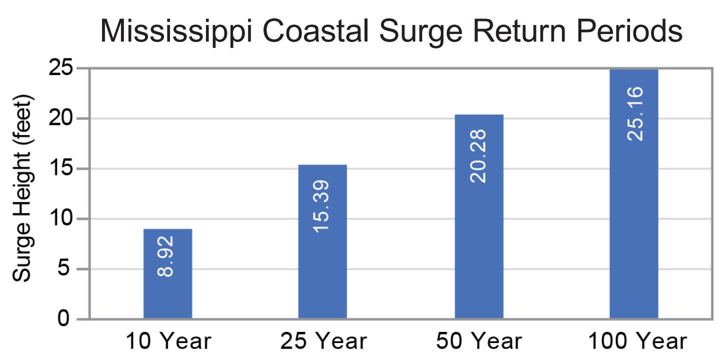

Figure 6: Storm surge heights occurring at selected average return intervals (10, 25, 50, and 100 years) along the Mississippi Gulf Coast. Storm surges of 22.6 feet (recorded for Camille) and 27.8 feet (recorded for Katrina) are expected to occur less than once every 50 years and 100 years, respectively. Sources: CISESS and NOAA NCEI. Data: Needham et al. 2012.

Tornadoes are another important weather hazard for Mississippi. **Between 1985 and 2019, Mississippi averaged 46 tornadoes annually, with 4 fatalities per year**. The state ranks twelfth nationally for the total number of reported tornadoes but first for the number of tornado deaths per million people. Since 2005, the state has experienced its four highest annual number of tornadoes: 2005 (105 tornadoes), 2008 (109 tornadoes), 2011 (94 tornadoes), and 2019 (113 tornadoes). Tornadoes occur year-round, but there is a distinct tornado season with a high peak of events in April and a second, smaller peak in November.

Historically unprecedented warming is projected during this century (Figure 1). Even under a lower emissions pathway, annual average temperatures are projected to exceed historical record levels in most years by the middle of this century. Since the 1970s, Mississippi temperatures have generally been within the range, but on the low end, of model-simulated temperatures. The projected rate of warming over the next several decades is similar to the observed warming rate since the 1970s.

Summer precipitation is projected to decrease in Mississippi, although the projected decreases are smaller than natural variations (Figure 7). Little change is projected for spring precipitation. Increases are projected for fall and winter, but the increases are smaller than natural variations. Increases in evaporation rates due to rising temperatures may increase the rate of soil moisture loss and the intensity of naturally occurring droughts. During such droughts, decreased water availability will likely have important implications for the region's and the state's agricultural economy.

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 8). Sea level rise along the Mississippi coast may be even higher. The closest tide gauge with long-term data (at Alabama's Dauphin Island) reports a rise of more than 11 inches over the past century. 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. Nuisance flooding has increased in all U.S. coastal areas, with more rapid increases along the East and Gulf Coasts. Nuisance flooding events in Mississippi are likely to occur more frequently as global and local sea levels continue to rise.

Sea level rise has the potential to significantly damage critical transportation assets and negatively impact coastal resort communities along the Gulf Coast of Mississippi. Increasing erosion of the barrier islands may exacerbate the potential impacts of sea level rise, as these islands can shield the densely populated coastal areas, such as Gulfport and Biloxi, from storm surge. Horn Island, for example, is losing sediment faster than it can be replenished.

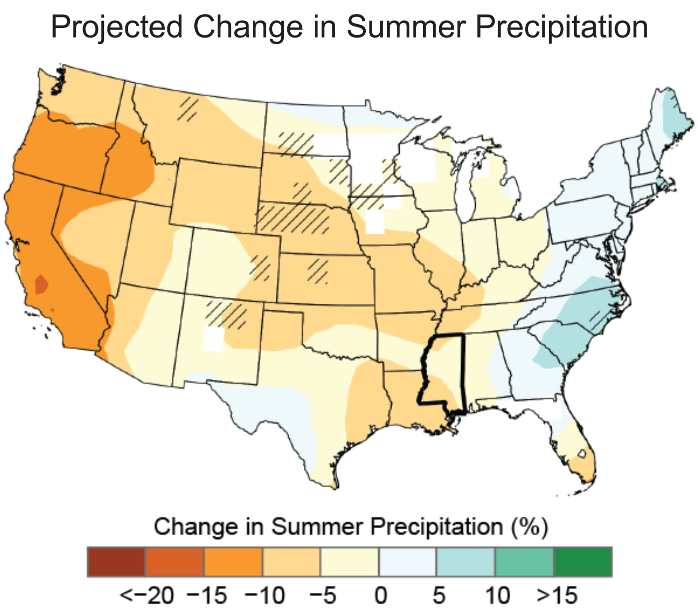

Figure 7: Projected changes in total summer (June–August) precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Whited-out areas indicate that the climate models are uncertain about the direction of change. Hatching represents areas where the majority of climate models indicate a statistically significant change. While the map indicates slight decreases for Mississippi, these changes are minimal compared to natural variations and are not statistically significant. Mississippi is part of a large area of the Southeast where projected summer precipitation changes are small compared to natural variations. Sources: CISESS and NEMAC. Data: CMIP5.

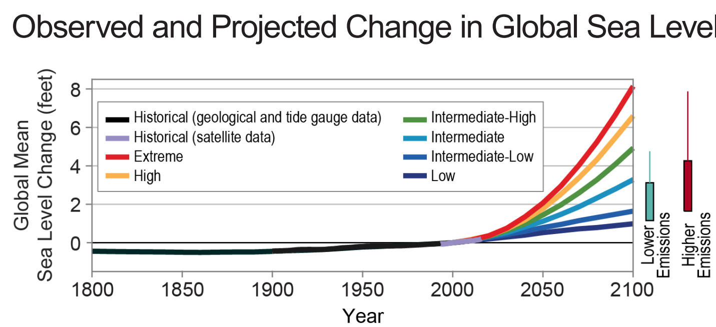

Figure 8: Global mean sea level (GMSL) change from 1800 to 2100. Projections include the six U.S. Interagency Sea Level Rise Task Force GMSL scenarios (Low, navy blue; Intermediate-Low, royal blue; Intermediate, cyan; Intermediate-High, green; High, orange; and Extreme, red curves) relative to historical 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.