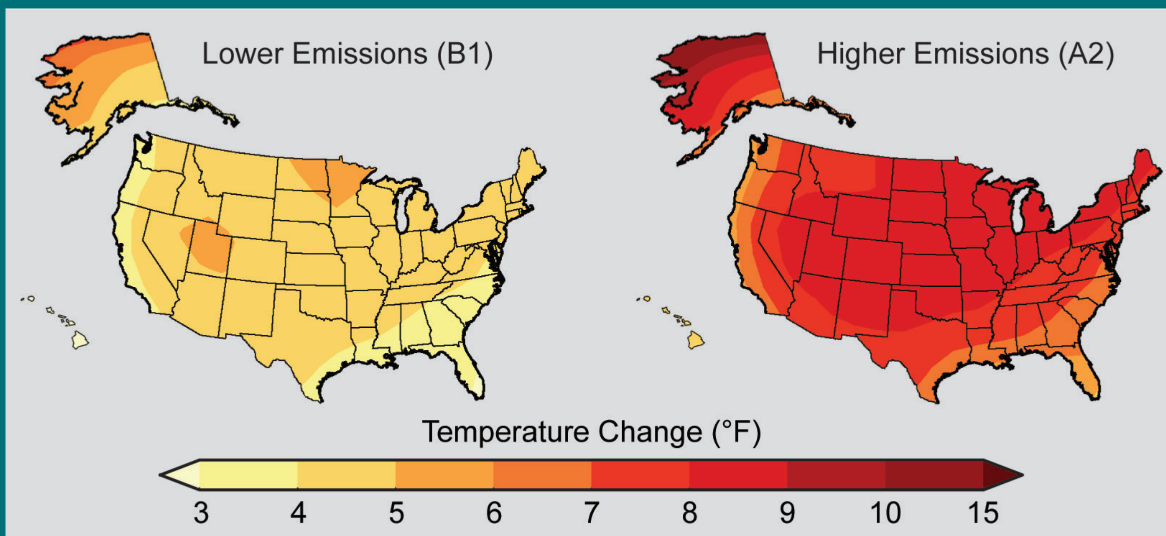
FINDING 3 FUTURE CLIMATE

Human-induced climate change is projected to continue, and it will accelerate significantly if emissions of heat-trapping gases continue to increase.

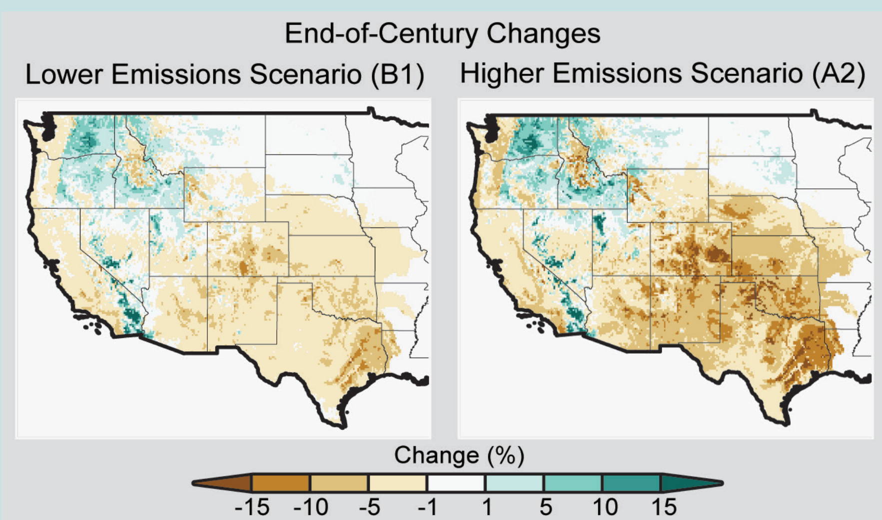
Heat-trapping gases already in the atmosphere have committed us to a hotter future with more climate-related impacts over the next few decades. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases that human activities emit globally, now and in the future.

Projected Temperature Change



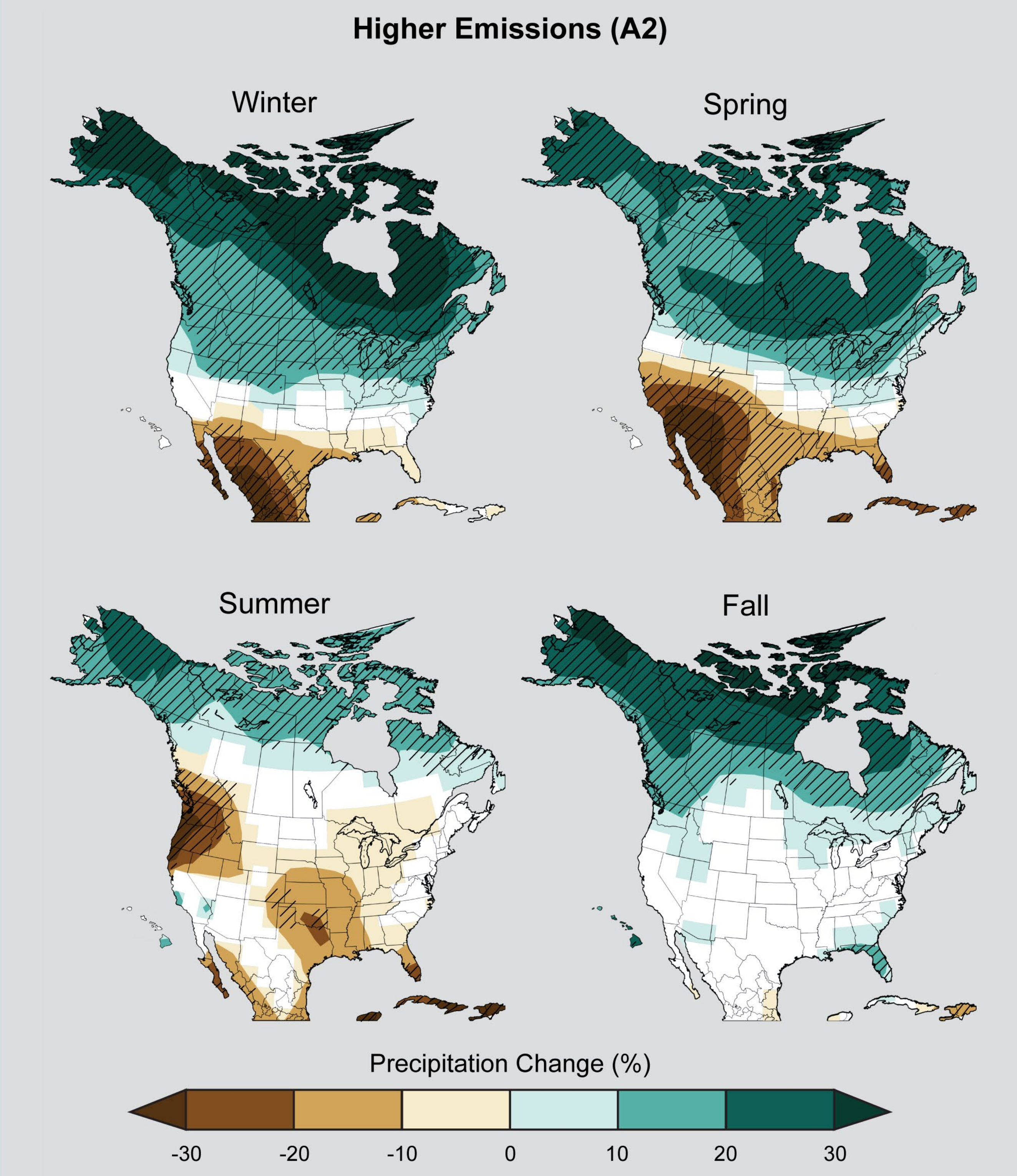
Maps show projected change in average surface air temperature in the later part of this century (2071-2099) relative to the later part of the last century (1970-1999) under a scenario that assumes substantial reductions in heat trapping gases (B1, left) and a higher emissions scenario that assumes continued increases in global emissions (A2, right). These scenarios are used throughout this report for assessing impacts under lower and higher emissions. (Figure source: NOAA NCDC / CICS-NC).

Projected Changes in Soil Moisture



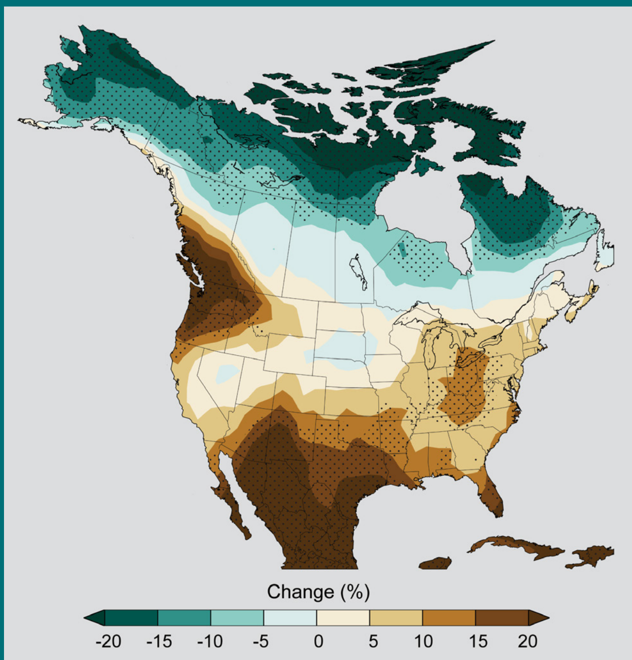
Increased temperatures and changing precipitation patterns will alter soil moisture, which is important for agriculture and ecosystems and has many societal implications. These maps show average change in soil moisture compared to 1971-2000, as projected for late this century (2071-2100) under two emissions scenarios, a lower scenario (B1) and a higher scenario (A2).[1] Eastern U.S. is not displayed because model simulations were only run for the area shown. (Figure source: NOAA NCDC / CICS-NC).

Projected Precipitation Change by Season

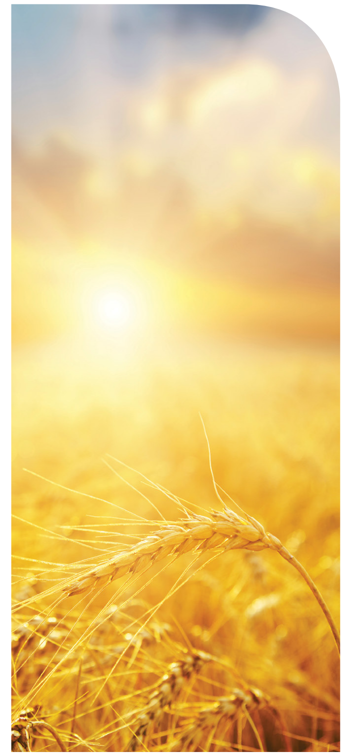


Climate change affects more than just temperature. The location, timing, and amounts of precipitation will also change as temperatures rise. Maps show projected percent change in precipitation in each season for 2071-2099 (compared to the period 1970-1999) under an emissions scenario that assumes continued increases in emissions (A2). Teal indicates precipitation increases, and brown, decreases. Hatched areas indicate that the projected changes are significant and consistent among models. White areas indicate that the changes are not projected to be larger than could be expected from natural variability. In general, the northern part of the U.S. is projected to see more winter and spring precipitation, while the southwestern U.S. is projected to experience less precipitation in the spring. Wet regions are generally projected to become wetter while dry regions become drier. Summer drying is projected for parts of the U.S., including the Northwest and southern Great Plains. (Figure source: NOAA NCDC / CICS-NC).

Change in Maximum Number of Consecutive Dry Days



Map shows change in the number of consecutive dry days (days receiving less than 0.04 inches of precipitation) at the end of this century (2070-2099) relative to the end of last century (1971-2000) under the highest scenario considered in this report, RCP 8.5. Stippling indicates areas where changes are consistent among at least 80% of the 25 models used in this analysis. (Figure source: NOAA NCDC / CICS-NC).

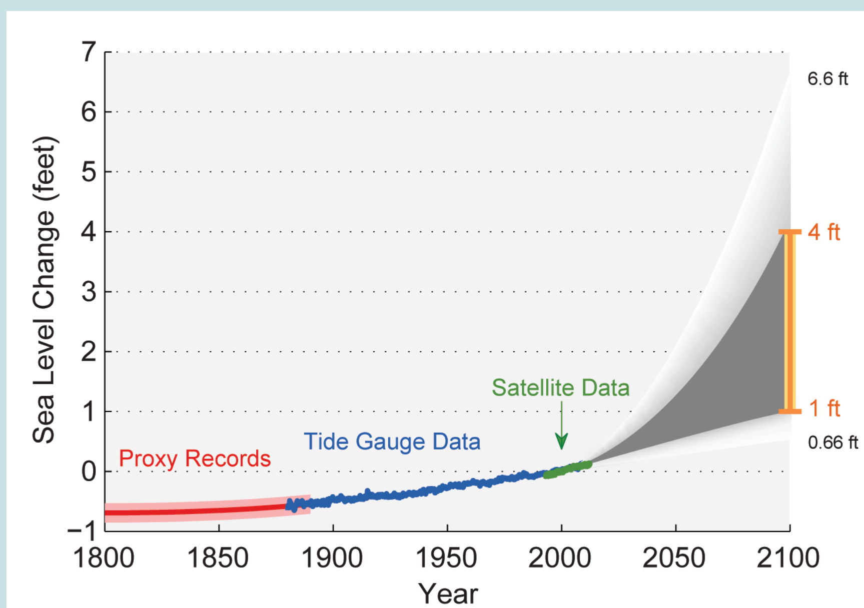


Sea level rise

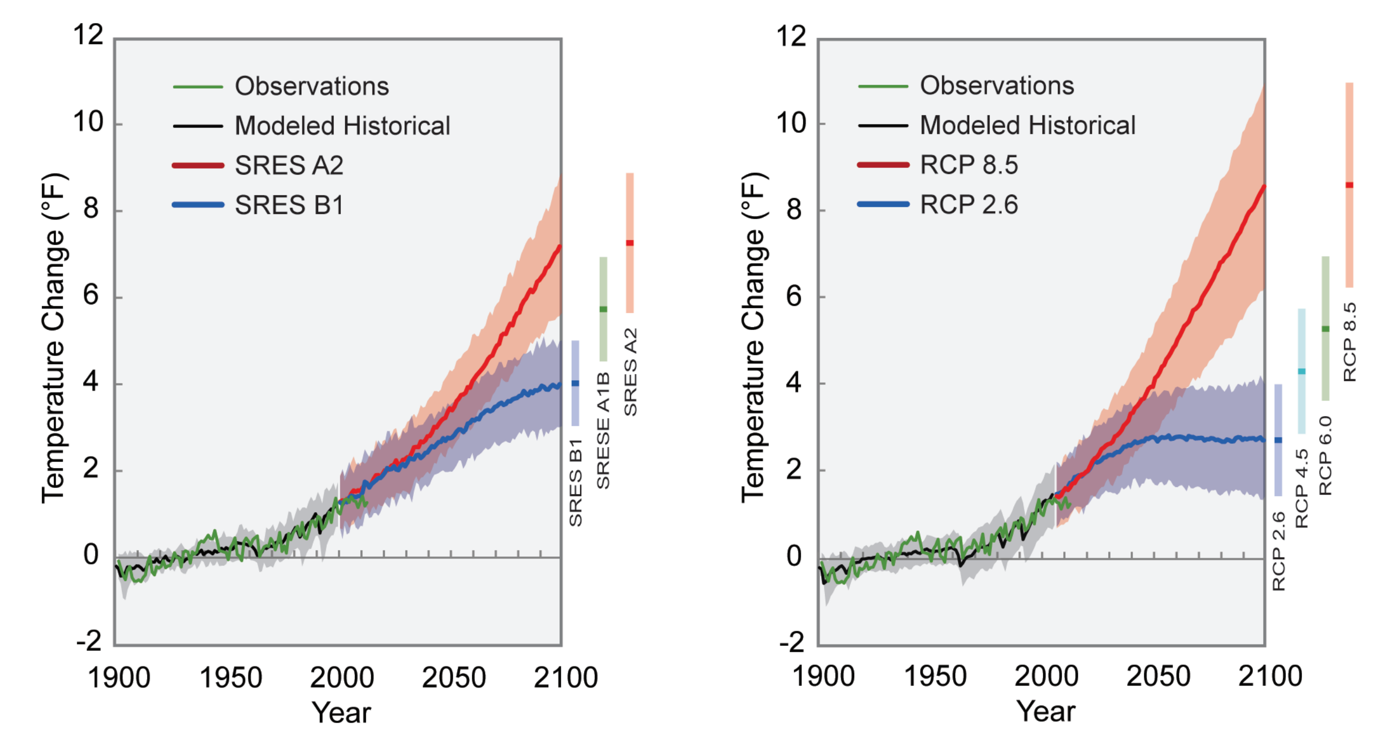
Global sea level has risen about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100. The oceans are absorbing over 90% of the increased atmospheric heat associated with emissions from human activity.[2] Like mercury in a thermometer, water expands as it warms up (this is referred to as “thermal expansion”) causing sea levels to rise. Melting of glaciers and ice sheets is also contributing to sea level rise at increasing rates.[3]

Past and Projected Changes in Global Sea Level

Figure shows estimated, observed, and possible amounts of global sea level rise from 1800 to 2100, relative to the year 2000. Estimates from proxy data[4] (for example, based on sediment records) are shown in red (1800-1890, pink band shows uncertainty), tide gauge data in blue for 1880-2009,[5] and satellite observations are shown in green from 1993 to 2012.[6] The future scenarios range from 0.66 feet to 6.6 feet in 2100.[7] These scenarios are not based on climate model simulations, but rather reflect the range of possible scenarios based on other kinds of scientific studies. The orange line at right shows the currently projected range of sea level rise of 1 to 4 feet by 2100, which falls within the larger risk-based scenario range. The large projected range reflects uncertainty about how glaciers and ice sheets will react to the warming ocean, the warming atmosphere, and changing winds and currents. As seen in the observations, there are year-to-year variations in the trend. (Figure source: Adapted from Parris et al. 2012,[7] with contributions from NASA Jet Propulsion Laboratory).



Emission Levels Determine Temperature Rises



Different amounts of heat-trapping gases released into the atmosphere by human activities produce different projected increases in Earth's temperature. In the figure, each line represents a central estimate of global average temperature rise for a specific emissions pathway (relative to the 1901-1960 average). Shading indicates the range (5th to 95th percentile) of results from a suite of climate models. Projections in 2099 for additional emissions pathways are indicated by the bars to the right of each panel. In all cases, temperatures are expected to rise, although the difference between lower and higher emissions pathways is substantial.

The left panel shows the two main scenarios (SRES) used in this report: A2 assumes continued increases in emissions throughout this century, and B1 assumes significant emissions reductions beginning around 2050, though not due explicitly to climate change policies. The right panel shows newer analyses, which are results from the most recent generation of climate models (CMIP5) using the most recent emissions pathways (RCPs). Some of these new projections explicitly consider climate policies that would result in emissions reductions, which the SRES set did not.[8] The newest set includes both lower and higher pathways than did the previous set. The lowest emissions pathway shown here, RCP 2.6, assumes immediate and rapid reductions in emissions and would result in about 2.5°F of warming in this century. The highest pathway, RCP 8.5, roughly similar to a continuation of the current path of global emissions increases, is projected to lead to more than 8°F warming by 2100, with a high-end possibility of more than 11°F. (Data from CMIP3, CMIP5, and NOAA NCDC).

Where we are heading

Both voluntary activities and a variety of policies and measures that lower emissions are currently in place at federal, state, and local levels in the U.S., even though there is no comprehensive national climate legislation. Over the remainder of this century, aggressive and sustained greenhouse gas emission reductions by the U.S. and by other nations would be needed to reduce global emissions to a level consistent with the lower scenario (B1) analyzed in this assessment.