

“Weather and Climate Extremes in a Changing Climate” NOAA and U.S. Climate Change Science Program

Excerpts for the Eastern United States

A consensus science report commissioned by the U.S. Climate Change Science Program and conducted by the National Oceanic and Atmospheric Administration concludes that human-induced warming has contributed to warmer average temperatures, increased “heavy precipitation events,” and more frequent heat waves. The frequency of cold days and nights is declining and the number of frost days is decreasing.

Many of the report’s findings apply broadly to regions across the continental United States, but some are of particular interest to the Eastern United States, such more frequent heat waves and more intense hurricanes. Excerpts of the report’s findings can be found below.

The full report, “Weather and Climate Extremes in a Changing Climate,” issued in June 2008, is available online at <http://www.climatechange.gov/Library/sap/sap3-3/final-report/>.

Heat Waves and Temperature Extremes

“Several recent studies have addressed explicitly possible future changes in heat waves (very high temperatures over a sustained period of days), and found that in a future climate there is an increased likelihood of more intense, longer-lasting and more frequent heat waves.” (p. 100)

“Abnormally hot days and nights and heat waves are very likely to become more frequent. Cold days and cold nights are very likely to become much less frequent. The number of days with frost is very likely to decrease. Climate models indicate that currently rare extreme events will become more commonplace. For example, for a mid-range scenario of future greenhouse gas emissions, a day so hot that it is currently experienced only once every 20 years would occur every three years by the middle of the century over much of the continental U.S. . . . By the end of the century, it would occur every other year or more.” (p. 4)

“The occurrence of temperatures below the biologically and societally important freezing threshold (0 C, 32F) is an important aspect of the cold season climatology. Studies have typically characterized this either in terms of the number of frost days (days with the minimum temperature below freezing) or the length of the frost-free season. The number of frost days decreased by four days per year in the United States during the 1948-1999 period. . . The start of the frost-free season in the northeastern United States occurred 11 days earlier in the 1990s than in the 1950s. For the U.S. as a whole, the average length of the frost-free season over the 1895-2000 period increased by almost two weeks.” (p. 40)

Hurricanes

“Taking into account limitations in data coverage from aircraft reconnaissance and other issues, we conclude that it is likely that hurricane activity, as measured by the Power Dissipation Index (PDI), has increased substantially since the 1950s and ‘60s in association with warmer Atlantic SSTs (sea surface temperatures).” (p. 57)

“In summary, we conclude that Atlantic tropical storm and hurricane destructive potential as measured by the Power Dissipation Index (which combines storm intensity, duration, and frequency) has increased. This increase is substantial since about 1970, and is likely substantial since the 1950s and ‘60s, in association with warming Atlantic sea surface temperatures.” (p. 58)

“Northern Hemisphere ETC (Extra-Tropical Cyclone) intensity has increased over the period 1959-1997 across both mid- and high latitude cyclone intensity, with the upward trend more significant for the high latitudes than for the mid-latitudes...Using reanalysis data covering the period 1949-1999, Paciorek et al. found that extreme wind speeds have increased significantly in both basins (Atlantic and Pacific).” (p. 65)

“It is likely that hurricane/typhoon wind speeds and core rainfall rates will increase in response to human-caused warming. Analyses of model simulations suggest that for each 1 degree Celsius increase in tropical sea surface temperatures, hurricane surface wind speeds will increase by 1 to 8% and core rainfall rates by 6 to 18%.” P81

Storm Surge and Wave Height

“The observed increase in the PDI (Power Dissipation Index) since the 1970s and increases in land-falling hurricane frequency since the 1970s are consistent with the measured increasing wave heights.” (p. 72).

“There are likely to be more frequent deep low-pressure systems (strong storms) outside the tropics, with stronger winds and more extreme wave heights.” (p. 82)

“Storm surge levels are likely to increase due to projected sea level rise, though the degree of projected increase has not been adequately studied.” (p. 82)

Precipitation Extremes

“One of the clearest trends in the United States observational record is an increasing frequency and intensity of heavy precipitation events. . . .One measure of this is how much of the annual precipitation at a location comes from days with precipitation exceeding 50.8 mm (2 inches). The area of the United States affected by a much above normal contribution from these heavy precipitation days increased by a statistically significant amount, from about 9% in the 1910s to about 11% in the 1980s and 1990s. Total precipitation also increased during this time, due in large part to increases in the intensity of heavy precipitation events. In fact, there has been little change or decrease in the frequency of light and average precipitation days during the last 30 years, while heavy precipitation frequencies have increased. For example, the amount of precipitation falling in the heaviest 1% of rain events increased by 20% during the 20th century, while total precipitation increased by 7%.” (pp. 46-47)

Precipitation Shifts

“Regional analyses suggest that there has been a decrease in snowstorms in the South and lower Midwest of the United States, and an increase in snowstorms in the upper Midwest and Northeast. This represents a northward shift in snowstorm occurrence, and this shift, combined with higher temperatures, is consistent with a decrease in snow cover extent over the United States.” (p. 36)