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

Excerpts on the Western United States and Pacific Northwest

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 resulted in 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 in the West and Pacific Northwest. A sampling of the relevant excerpts is included in this fact sheet.

The report, "Weather and Climate Extremes in a Changing Climate" issued in June 2008, is available online at http://www.climatescience.gov/Library/sap/sap3-3/final-report/.

Temperature Extremes

"Since the record hot year of 1998, six of the past ten years (1998-2007) have had annual average temperatures that fall in the hottest 10 percent of all years on record for the U.S." (p. 37)

"Since 1950, the annual percent of days exceeding the 90th, 95^{th,} and 97.5 percentile thresholds for both maximum (hottest daytime highs) and minimum (warmest nighttime lows) temperature have increased when averaged over all of North America. . .The changes are greatest in the 90th percentile . . . the largest increases in the 90th percentile threshold temperature occur in the western part of the continent from northern Mexico through the western United States and Canada and across Alaska . . ." (p. 37-38)

"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 day (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, with the largest decreases, as many as 13 days per year, occurring in the western United States…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)

Heat Waves

"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…[One study showed] the more intense and frequent summertime heat waves over the southeast and western U.S. were related in part to base state circulation changes due to the increases in greenhouse gases (GHGs). An additional factor for extreme heat is drier soils in a future warmer climate." (p. 100)

Drought
". . .the consensus of most climate-model projects is for a reduction of cool season precipitation across the U.S. Southwest and northwest Mexico. . .This is consistent with a recent 10-year shift to shorter and weaker winter rainy seasons and an observed northward shift in northwest Pacific winter storm tracks. Reduced cool season precipitation promotes drier summer conditions by reducing the amount of soil water available for evapotranspiration in summer." (p. 105)

Fire
"...the fire danger has increased in the southwest, in California in the spring season . . . large wildfire activity in the western United States increased suddenly and markedly in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons. The greatest increases occurred in mid-elevation Northern Rockies forests, where land-use histories have relatively little effect on fire risks, and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt." (p. 43)

Wave Height Extremes - Pacific Storm Track
"Increases in extreme wave height characteristics have been observed along the Pacific Coast of North America during recent decades based on three decades of buoy data. These increases have been greatest in the Pacific Northwest, and are likely a reflection of changes in storm tracks." (p. 36)