

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

### *Focus on The Southwest*

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, drought 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 findings are of particular interest to the Southwestern United States. Excerpts from 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/>.

#### **Temperature Extremes**

“Future changes in extreme temperatures will generally follow changes in average temperature:

- 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.” (p. 81)

#### **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.” (p. 100)

#### **Precipitation**

The report predicts “a reduction of cool season precipitation across the U.S. Southwest. This is consistent with a recent 10-year shift to shorter and weaker winter rainy seasons...” (p. 105)

#### **Precipitation Shifts**

The North American Monsoon, which affects summer precipitation in the Southwest, has been delayed during the past 60 years, and the average length of the monsoon has decreased.

“Based on a linear trend, the mean start date for the monsoon has been delayed almost 10 days...over the past 63 years...Because extended periods of intense heat and desiccation typically precede the arrival of the monsoon, the trend toward later starts to the monsoon will place additional stress on the water resources and ecology of the region if continued into the future.” (P. 51)

“Based on a linear trend, the average wet spell has decreased by almost one day...from nearly four days in the early 1940s to slightly more than three days in recent years. The decrease in wet spell length indicates a more erratic monsoon is now being observed. Extended periods of consecutive days with rainfall are now becoming less common during the monsoon. These changes can have profound influences on surface soil moisture levels which affect both plant growth and runoff in the region.” (P. 51)

### **Precipitation Extremes**

One study in the report examined “frequency and intensity of prolonged no-rain episodes . . . during the warm season, when evaporation and transpiration are highest and the absence of rain may affect natural ecosystems and agriculture.” The study “found that during the past four decades the duration of prolonged dry episodes has significantly increased over the eastern and southwestern United States and adjacent areas...” (p. 45)

### **Drought**

“...the consensus of most climate-model projects is for a reduction of cool season precipitation across the U.S. Southwest. . . 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)

While the report found that across the U.S. “that droughts have, for the most part, become shorter, less frequent, and cover a smaller portion of the U.S. over the last century (p42),” the situation is different in the Southwest. “The main exception is the Southwest and parts of the interior West, where increased temperature has led to rising drought trends.” (p. 42)

“Droughts are likely to become more frequent and severe in some regions as higher air temperatures increase the potential for evaporation.” (P. 81)