Arizona's Changing Climate

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Arizona's climate is changing. It's becoming warmer and drier. Prescott average daily temperatures have increased by seven degrees since 1910. Observed increases in carbon dioxide in the atmosphere caused by the burning of fossil fuels and deforestation, imply global, and northern Arizona, temperatures will continue to increase through the first half of our new century due to the Greenhouse Effect and its associated global warming.

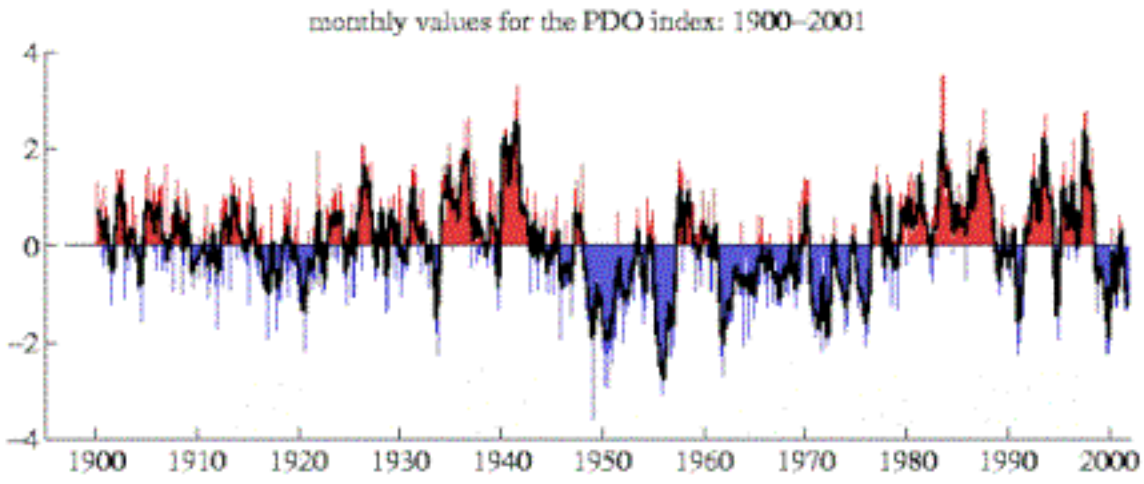
In Prescott the average winter snowfall has decreased by nineteen inches since the beginning of the 20th century. The decrease at Crown King is forty-four inches. This suggests snowfall in northern Arizona's mountains— which is the most effective means of recharging northern Arizona's groundwater -- is decreasing even faster. Arizona's precipitation comes from two sources. Winter storms traveling in westerly winds from the Pacific Ocean contribute 65%. Summer monsoon thunderstorms account for the remaining 35% of our annual precipitation. Because of rapid runoff and evaporation, monsoon rains are less effective in recharging northern Arizona aquifers at higher elevations.

Long term precipitation trends in Arizona are controlled by sea surface temperatures in the eastern and northern Pacific Ocean. El Nino events bring warmer than normal sea surface temperatures and weak trade winds to the eastern equatorial Pacific Ocean along the west coast of California. The warmer sea surface temperatures strengthen winter storms and displace the winter storm track southward across the southern United States, bringing wetter than normal weather to the Desert Southwest. Dry La Nina events are associated with below normal sea surface temperatures and strong trade winds in the eastern Pacific Ocean. La Nina events move the winter storm track northward into the Pacific Northwest and bring drier than normal conditions to Arizona.

The twenty six years between 1950 and 1976 were characterized by strong La Nina and weak El Nino events and associated dry weather in Arizona. The period between 1976 and 1998 was dominated by strong El Nino and weak La Nina events, which resulted in wetter than normal weather in Arizona. El Nino and La Nina events are part of larger, longer-lasting (20 to 30 year) trends in northern Pacific Ocean sea surface temperatures — known as the Pacific Decadal Oscillation. Research by scientists at NASA's Jet Propulsion Laboratory indicates

we have entered a 'cool' phase of the PDO, with cool sea-surface temperatures in the eastern equatorial Pacific Ocean, more La Nina events, and more dry weather in the southwestern United States (see Figures 1 and 2 below).

Figure 1.



Positive values of the PDO Index are related to El Nino events and wet weather in Arizona. Negative values are associated with La Nina events and dry weather in Arizona

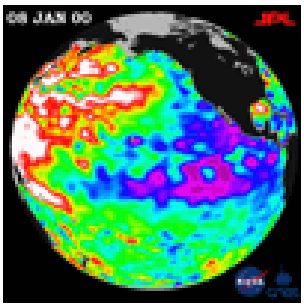


Figure 2.

Satellite image shows warm water in the western Pacific Ocean (red and white), and cool (blue and purple) water in the eastern Pacific Ocean. The images are derived from satellite and conventional sea surface temperature data. The observations lead scientists to believe we have entered a cool phase of the PDO, that will sustain the drought in Arizona.

CONCLUSIONS:

Long-term (1910 to present) observations suggest northern Arizona precipitation is decreasing. Observed local, and projected global warming trends (due to the Greenhouse Effect and the associated global warming), indicate winter snow accumulations will continue to decrease in Northern Arizona. Trends in sea surface temperatures in the northern Pacific Ocean indicate there will be fewer wet El Nino events, more dry La Nina events, and continued warm and dry weather in northern Arizona for the foreseeable future, suggesting northern Arizona is in the early stages of an extended drought.

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