



# Future Regional Climate Change in The Ten Hydrologic Regions of California: A Climate Modeling Investigation

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A regional climate model suggests that California's water reserves will be strongly impacted as atmospheric CO<sub>2</sub> emissions double pre-industrial levels within the next five decades. The model indicates annual mean temperatures increasing by at least 2° C, and both total precipitation and precipitation stored as snowpack decreasing. These effects will vary in amplitude across the ten hydrologic regions of California. For example, the greatest temperature increase will occur in the Sacramento River region, and the greatest decrease in precipitation will occur in the southernmost regions. Adapting to these changes will require significant changes in current water management practices, which will need to be specific to the changes occurring at the regional scale.

This study focuses on two questions: (1) how will anthropogenically driven climate change affect California's resources, especially the hydrologic resources, in the coming decades; and (2) what water resources will be available in the future, and at what times during the year (e.g., seasonality and amounts of rain and snow)?

To answer these questions, we apply a regional climate model (RCM) to a domain centered upon California. We specify atmospheric greenhouse gas concentrations as predicted by the Intergovernmental Panel on Climate Change (IPCC) for the next several decades, and calculate the climate that would likely occur under these conditions, as compared to modeled scenarios of present day climate.

Key findings include that a doubling of atmospheric CO<sub>2</sub> concentrations above pre-industrial values will lead to increased temperatures, decreased precipitation, and decreased snow accumulation across California. Model predictions show that for all ten of California's hydrologic regions, the median annual temperature increases from 2 to 4 °C in the future, with the greatest temperature increase occurring in the Sacramento River region. Median annual precipitation in the future will be reduced for the six southernmost regions of the state by up to 17%. Future annual snow accumulation decreases for all hydrologic regions. Decreases in snow accumulation, by volume, are greatest in the Sacramento River, the North Coast, and the San Joaquin River regions.

Our model results suggest that California will be strongly impacted by climate change. Increased temperatures may affect agricultural production, energy consumption, water consumption, human health, and ecosystems. Changes in precipitation and decreased snow accumulation may affect water storage and delivery, causing greater stress on a system already under significant pressure. Adaptation to these changes will likely necessitate significant changes in current water management practices.

## **Publications**

Snyder, M.A., L.C. Sloan, and J.L. Bell, 2004. Journal American Water Resources Association, 40(3):591-601.

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