

Reconstructing San Diego, CA, USA's hydrologic history since the Last Glacial Maximum using models, speleothems, and groundwater geochemistry

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Here we have estimated a record of reconstructed precipitation for the San Diego region, from the close of the Last Glacial Maximum (LGM; 20,000 years ago) to present, using published geochemical proxies and climate models. We use cave speleothem $\delta^{18}\text{O}$ records to estimate high-resolution relative precipitation variability over time, combined with discrete model output of absolute precipitation for selected periods, to generate the continuous precipitation reconstruction. We selected the two speleothems closest to our study area from the Cave of the Bells near Tucson, AZ, and Leviathan Cave near Las Vegas, NV, both within 650 km of the study area, from regions that have been shown to have similar climatological conditions in the modern era and the LGM. Results from multiple model experiments provide absolute precipitation estimates at four discrete time periods. The model results are scaled proportionally to match historical average San Diego precipitation values from 1850-2005 of 500 mm/yr. The model output for the other time periods are scaled to estimated average precipitation rates of 510 mm/yr (850-1850 CE), 460 mm/yr (6,000 BP), and 1120 mm/yr (21,000 BP). The speleothem $\delta^{18}\text{O}$ records are then scaled to best fit these modeled precipitation estimates, generating a high-resolution precipitation record from the close of the LGM to present. Stable isotope and noble gas data from deep groundwater wells throughout San Diego are used to further constrain the paleo-reconstruction. Compared to modern observations, preliminary results confirm that both precipitation and precipitation altitude were higher during the LGM, and average surface temperatures were 5°C cooler during the LGM.