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The isotopic compositions of leaf waxes from laucustrine sediments in the Sierra Nevada Mountains offer an opportunity to gain insight into correlations between paleoclimatological variation, biogeochemical cycles, and climate change. The annual snowpack in the Sierras vary strongly with rainfall and correlate with ENSO (El Niño – Southern Oscillation). In October 2013, a 27-meter core was recovered from Pear Lake, in Sequoia National Park, representing a 13,500 year record (the Holocene Epoch) of lake sediment. We have extracted organic material from ~1 cm intervals of the top 23 cm of this core, which represents a 208.6 ± 31.6 year record. At each depth we measured the deuterium/hydrogen ratio (expressed as δD) of sedimentary plant waxes, changes in which are interpreted to represent paleohydrological variation.

Analyses of mid- and long-chain alkanes revealed an Average Chain Length (ACL) for n-alkanes to be ~26, increasing slightly from 23 cm to the surface. Furthermore, the Carbon Preference Index (CPI) is ~6.9. δD varied by >50‰ in the top 23 cm, which represents a 208.6 ± 31.6 year record of the region. Our paleohydrological record demonstrates a strong coupling between hydrogen isotopic trends and ENSO events, but the cause of this coupling is yet to be understood. In our paleohydrological record, when an ENSO event switched from a succession of El Niño events to La Niña events or vice versa, a change in δD was observed. More negative δD values were observed during El Niño events, and more positive δD during La Niña events. These trends in δD were clear enough to predict the occurrence of ENSO events throughout the core. Refining these predictions are key to understanding hydrological cycles before the records of instrumental data to better predict their effects on future generations.