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Interactive comment on “High resolution leaf wax carbon and hydrogen isotopic record of late Holocene paleoclimate in arid Central Asia” by B. Aichner et al.

Anonymous Referee #1

Received and published: 17 January 2015

The authors present a detailed and thorough study of controls on hydrogen isotopes in precipitation and leaf waxes in lake sediments from the western Tibetan Plateau. They use instrumental and isotope-enabled model data to demonstrate that δD of precipitation is influenced by both the precipitation amount effect and temperature. The authors then construct records of past changes in terrestrial vegetation and δD of precipitation using isotopic analysis of terrestrial leaf waxes. The paleoclimate records show distinct periods of colder/wetter conditions at 3.5–2.5, 1.9–1.5 and .6–.1 cal kyr BP, the last coinciding with the Little Ice Age. The strength and position of the Westerlies are invoked to explain shifts between warm/dry and cold/wet climates in Central Asia, due to changes in moisture transport into the continental interior and the seasonality of precipitation

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(i.e., spring/summer rain versus winter snow).

The methods used in the study are very robust, resulting in high-quality paleoclimate time series and supporting data for the interpretations. The age-depth model for the lake sediment core is well constructed, with surface ages constrained by ^{210}Pb , and downcore ages constrained by a high density of ^{14}C dates, including characterization of a large ^{14}C reservoir “hardwater” effect. The methodologies used for compound-specific δD analysis are sound, following best practices for H_3+ factor correction, instrument drift and data normalization. The interpretation of $\delta\text{D}_{\text{wax}}$ is supported by $\delta^{13}\text{C}_{\text{wax}}$ data showing shifts in proportion of inputs from aquatic macrophytes versus cool/wet C_3 terrestrial taxa indicating changing lake levels. The authors attempt to quantify the $\delta\text{D}_{\text{ppt}}$ signal by applying leaf wax fractionation factors developed from nearby sites in the Central Tibetan Plateau, in general agreement with factors from other arid regions of the globe. However, it is difficult to assess absolute values for past $\delta\text{D}_{\text{ppt}}$, for example to quantify the proportion of spring/summer rainfall versus melting of winter snow feeding the lake and groundwater, without better knowledge of the fractionation factors for local vegetation within the watershed. The authors overcome this obstacle by focusing on the relative differences in $\delta\text{D}_{\text{wax}}$ downcore and the combined effects of colder and wetter conditions changing $\delta\text{D}_{\text{ppt}}$ in the same direction. The discussion of past controls on isotopes in precipitation is exhaustive, with comparison to other studies in the region showing that the spatial patterns of past climate changes support shifts in the position of the Westerlies as the dynamic forcing mechanism.

Overall, the study is well designed and executed. It would have been valuable to have $\delta\text{D}_{\text{wax}}$ data from modern vegetation in the watershed, in order to constrain local fractionation factors and reduce uncertainty in absolute values of reconstructed $\delta\text{D}_{\text{ppt}}$, although this lack does little to diminish the significance of the study. One minor concern is that the lower half of Figure 4b lacks scale bars and labels for the monthly mean climate variables. Other than this, the paper is well-written and clear in its structure and language. The figures are effective and informative, and support the conclusions of the

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study. I strongly recommend that this paper be published in *Climates of the Past*.

Interactive comment on *Clim. Past Discuss.*, 10, 4385, 2014.

CPD

10, C2197–C2199, 2015

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