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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**

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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 dD of precipitation is influenced by both the precipitation amount effect and temperature. The authors then construct records of past changes in terrestrial vegetation and dD 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



(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 210Pb, and downcore ages constrained by a high density of 14C dates, including characterization of a large 14C reservoir "hardwater" effect. The methodologies used for compound-specific dD analysis are sound, following best practices for H3+ factor correction, instrument drift and data normalization. The interpretation of dDwax is supported by d13Cwax data showing shifts in proportion of inputs from aquatic macrophytes versus cool/wet C3 terrestrial taxa indicating changing lake levels. The authors attempt to quantify the dDppt 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 dDppt, 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 dDwax downcore and the combined effects of colder and wetter conditions changing dDppt 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 dDwax data from modern vegetation in the watershed, in order to constrain local fractionation factors and reduce uncertainty in absolute values of reconstructed dDppt, 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 study. I strongly recommend that this paper be published in Climates of the Past.

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