

Reply to Referee #1

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General comments: The manuscript represents a substantial contribution to climate change, as it addresses the reconstruction of past humidity variations. So far, this climatic parameter could only be addressed based on pollen assemblages. The manuscript outlines the conceptual framework in great detail, and the results are appropriately discussed.

→ We are very grateful to anonymous Referee #1 for her/his constructive suggestions helping to improve our manuscript. Please find our replies to the individual comments below.

I have only one major concern: It is well known, that the dD of n -alkanes reflect source water isotopic composition (meteoric water in case of vegetation). The dD of rain water is related to Air Temperature, so the dD of source and related leaf water changes with temperature. This would result in a shift of the intercept of LEL with the Meteoric Water Line towards more negative values during cold periods (Fig. 4 in the manuscript). However, the authors do not discuss the effect of this temperature dependency on the measured dD values of leaf-wax n -alkanes. At least it is not obvious from the discussion presented. In Fig. 3, it is shown that n -alkanes are depleted in D during Younger Dryas. For me, it is consistent with colder temperatures during this interval. The authors need to address this topic, outlining if, and in what manner, temperature changes will affect the reconstructed humidity values in their approach.

→ We agree with Referee #1 that temperature is known to have a strong effect on $\delta^2\text{H}/\delta^{18}\text{O}_{\text{precipitation}}$ (and thus as well on $\delta^2\text{H}_{n\text{-alkane}}/\delta^{18}\text{O}_{\text{sugar}}$). Following her/his recommendation, we will readily include the reconstructed $\delta^2\text{H}/\delta^{18}\text{O}_{\text{source-water}}$ record for the Gemündener Maar as calculated from the intersects of the LELs with the GMWL/LMWL in the revised version. As it can be expected, that record shows generally more depleted values during the Younger Dryas, albeit the variability is clearly much higher than e.g. in the Greenland ice cores. Concerning the temperature effect on reconstructed humidity (RH) values in our approach, we explain in Chapter 3.3 that temperature changes of ± 10 °C result in RH changes of just around $\pm 1\%$ by slightly

affecting the slope of the local evaporation line (LEL). We hope that this issue will become clearer during revision and shortening (as recommended by Referee #1) of our manuscript.

Specific comments: The abbreviation LEL (Page 11, line 9) should be explained earlier (LEL = local evaporation line).

→ Thanks. We will readily follow the recommendation of Referee #1 during revision.

Technical comments: The manuscript is pretty long. The clarity of several points may be improved by shortening of the text. This may also facilitate a wider distribution of the paper.

→ We agree with Referee #1. Following her/his recommendation, we will readily shorten the manuscript during revision and do our best in order to improve clarity.