REPLY TO REVIEWER #2:

We appreciate the helpful comments and suggestions of Reviewer #2. The provided comments mainly concern aspects, which were also criticised by Reviewer #1. We will follow these suggestions in the revised version of the manuscript as we have realised that this helps to highlight key messages concerning the application of ^{17}O-excess of phytoliths for paleo-RH reconstruction. Please, find below in black the comments of the reviewer, in blue our responses to the comments and how these comments will be addressed in the revised manuscript.

The manuscript submitted to Biogeosciences presents results of a grass growth study that occurs in a natural setting and compared the results to controlled growth studies that occurred in plant growth chambers. The study monitored many environmental conditions that fluctuated during the day. The triple oxygen isotope compositions and δD were measured from the irrigation water, soil water, water vapor, leaf water, and the siliceous phytoliths (no δD values for the silica). This was compared to modelled water from the Craig and Gordon model modified for plant growth. Overall, this is a very comprehensive dataset that does an excellent job of describing how water vapor triple oxygen and δD compositions change during the day vs. night. A lot of the study focuses on changes in the water vapor without really connecting the impact on the water vapor and leaf water to the grass phytoliths.

Major/minor comments:

Title: The title may want to be edited to better reflect the manuscript which really addresses changes in humidity and stable isotope compositions of leaf water between daytime and nighttime.

This was also suggested by Reviewer #1. We will change the title to better reflect the content of the revised manuscript.

Lines 418-421: Which differences are different by 1.7‰ and 10 per meg? In Fig. 5, the solid red and green lines have different differences even though they both represent a λ of 0.522. Also, how is 'agreement' defined. As written, this seems qualitative as someone could define agreement in a way such that neither λ 522 or 0.524 are agreement with the predicted water from the Craig and Gordon model.

We here refer to the difference between the average isotope composition of leaf water for the regrowth predicted by the C-G steady state model and the formation water reconstructed from phytoliths when using $\lambda_{phyto\text{-}H2O}$ of 0.522 and $^{18}\alpha_{phyto\text{-}H2O}$ from Dodd and Sharp (2010). The solid red and green lines differ as different colors represent reconstructed FW using different $^{18}\alpha_{phyto\text{-}H2O}$. We agree that "agreement" is not an appropriate term here. We will revise figure 5 and the corresponding results section to clarify the key message.

Figure 5: This graph is a little confusing on what is measured vs. modeled. The predicted leaf water is from the C-G model? If so, please add 'gray circle' to the figure to help the reader understand the figure better Is the formation water calculated from the measured grass leaf phytoliths? If so, why are they connected with a line? Passey and Ji (2019) modelled how water would change in different humidity scenarios. Would modelling how the irrigation/precipitation waters change with evaporation in different humidities be more useful than comparing to equilibrium precipitation of silica?

This was also pointed out by Reviewer #1. Precipitation, irrigation and grass leaf phytoliths represent measured data. The leaf water is predicted by the C-G steady state model for average climate and plant physiological conditions over each of the three regrowth periods. The phytolith formation water (FW) is reconstructed from the measured phytolith isotope composition using different definitions of $^{18}\alpha_{phyto\text{-}H2O}$ (different colors), and different $\lambda_{phyto\text{-}H2O}$ of 0.522 and 0.524 (dashed vs solid lines). The figure shows the consistency of fractionation coefficients relating the triple oxygen isotope composition of phytoliths and leaf water with previous studies. Closest "agreement" between FW and predicted leaf water is achieved for $\lambda_{phyto\text{-}H2O}$ of 0.522 and $^{18}\alpha_{phyto\text{-}H2O}$ from Dodd and Sharp (2010). The remaining deviations can be related to slight variations in the distribution of phytoliths and leaf water along the leaf blade, variable mixing proportions of short cell (unevaporated) vs long cell (evaporated) phytoliths. We will discuss this further in the revised manuscript.

Conclusions: Although it may have been missed, there is no conclusion that clearly defines how the phytoliths could be used to predict relative humidity. As the title reflects that phytoliths record daytime humidity, how far off was the humidity as recorded in the phytoliths vs measured? Perhaps adding a term that compares the difference between the $\Delta'^{17}O$ value (or humidity) and the predicted $\Delta'^{17}O$ value (or humidity) would better show to the reader the usefulness of this proxy.

Thank you for pointing this out. In the revised manuscript we will add a discussion section on future perspectives on the use of ^{17}O-excess of phytoliths for paleo-RH reconstruction.

Overall, the content of this study is of broad importance and fitting for Biogeosciences after minor revisions to better connect the triple oxygen isotope compositions of the phytoliths to relative humidity and the leaf water.

Passey B. H. and Ji H. (2019) Triple oxygen isotope signatures of evaporation in lake waters and carbonates: A case study from the western United States. Earth and Planetary Science Letters. **518**, 1-12.