

## ***Interactive comment on “Moisture origin as a driver of temporal variabilities of the water vapour isotopic composition in the Lena River Delta, Siberia” by Jean-Louis Bonne et al.***

### **Anonymous Referee #1**

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#### General comments:

This paper uses a two year record of water vapor isotopes to help understand moisture sources and cycles of waters in the Siberian Arctic. This is an interesting paper that could be useful for both understanding patterns in the modern climate, but likely also has some applicability for paleo reconstructions (especially some of the moisture source isotope patterns). The seasonal differences in fractionation between phases are particularly interesting. The methods and study structure are largely sound and the interpretations make sense; with some moderate to minor changes this revised paper could be acceptable for further publication.

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Specific comments: 74-78, 82-84: It would be helpful to have a distinct figure showing the location of the study site. I recognize the site can be seen on some of the other figures, but a location map figure would be helpful for orienting the study and the environmental variables in the region. 98: The sentence talks about “. . . parameters always measured above the snow cover”, but there apparently is not always snow cover at the site (e.g., Figure 1). I think I know what you mean, but the description is a little confusing. Could you please clarify and/or rephrase? 110-111: It is stated that the container was heated, but at approximately what temperature? Was this the 50 °C of the inlet? Additionally, a photo or figure of the instrument set up might be helpful. 112: How was the inlet constantly heated at around 50 °C? 124-128: This is a little unclear: Are the humidity calibrated values relatively unchanged until 3 g/kg, then change logarithmically until 0.3 g/kg? 150-153: Approximately what percent of the total data set was removed because it lacked the full group of meteorological data? Is it possible that this is skewing any of your findings, such as the seasonal signals? 208-209: It is stated that it is difficult to investigate the impact of the change of each local moisture source as different surface cover changes (e.g., sea ice and snow cover) overlap. However, Figure 1 appears to show that sea ice cover starts to deteriorate in 6/2016 during a two to three month period in which there is no snow cover? Is it possible to use this period of time to try and disentangle the influence of sea ice versus snow cover? 268-270: Is the  $\delta^2\text{H}$  in reference to vapor? Is the R2 correlation coefficient between  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  really 1.0? Are there no differences? Perhaps I am misunderstanding something, but if  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  in vapor are changing exactly in time (e.g., 1.0 correlation coefficient) then wouldn't there not be in substantial differences in fractionation (e.g., switch from closer to equilibrium to more kinetic)? 278-282: It is stated that the minimum  $\delta^{18}\text{O}_\text{v}$  were observed in December and not February, which is interesting as February was the coldest and driest month. While this is technically true, February is not much colder and drier than December (0.6 °C colder and 0.04 g/kg). Are these differences really likely to explain the 3 per mil  $\delta^{18}\text{O}_\text{v}$  depletion difference in December, relative to February? 343-348: Some of the assumptions used for the theoretical vapor calculations are

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stated, but it might be helpful to briefly state what model was used to make these theoretical calculations? Is there an error range associated with the theoretical values? 360: Again, a location figure would be useful to help understand the environment around the site and how seasonal changes could influence the isotope values.

361-363: It is stated that "incoming radiation might be insufficient to drive significant variations in evapotranspiration." Could these radiation variations be input into an ET model to see if this is actually true? However, in light of the next sentence which talks about this explanation being inconsistent with actual ET data from Eddy-covariance tower observations, this is likely not needed. Just an option to consider.

Technical corrections:

Equation 2: The dot between 8 and  $\delta^{18}\text{O}$  looks like a decimal place and not the multiplication symbol that it should be.

109: "(CRDS) has been installed..." This is passive, consider changing to "was installed"

116: add a space between "system(as described"

198-199: "measured snow depth indicates the permanent presence of a snow cover from"...Perhaps rephrase this as "permanent" snow cover appears to be in contrast from the September to June snow cover in this study.

Figure 1 Caption: Do liquid precipitation and snow cover depth also have 6 hour resolution?

268: Is the  $\delta^2\text{H}$  in reference to vapor? .

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