

## **Response to Reviewer 1 of manuscript “Continuous measurements of atmospheric water vapour isotopes in Western Siberia (Kourovka)”**

We thank Reviewer 1 for valuable remarks and suggestions, which have guided us to improve our revised manuscript. Please find below our answers to individual comments.

Page 476, line 26: This sentence should be divided clearly into surface processes and atmospheric processes. And, should choose reference more carefully. Here I describe my suggestion: As a result, fractionation takes place during each phase change such as evaporation from the sea surface (Craig and Gordon, 1965; Merlival and Jouzel, 1979), soil evaporation and plant transpiration from land surface (Farquhar et al., 2007), condensation in the clouds (Jouzel, 1986; Ciais and Jouzel, 1994) and rain re-evaporation and diffusive exchange processes between raindrop and vapor (Stewart, 1975; Field et al., 2010).

*This clarification is helpful, and we have used the suggested formulation in our revised text.*

Page 477, line 11: Dansgaard, 1964 should refer in here. (Dansgaard, 1964; Rozanski et al., 1993; Gat, 1996)...

*The reference has been added.*

Page 477, line 18: LGR instrument is based on off-axis integrated cavity output spectroscopy system (OA-ICOS) technique. Please describe more precisely.

*We have updated the text with the full description of the LGR technique.*

Page 478, line 1-4: Water vapor isotope monitoring using laser technique has also been carried out in Asia (e.g., Wen et al., 2011; Kurita et al., 2013).

*The measurements conducted in Asia have been cited in the list.*

Page 480, line 16: Please describe the range of room temperature precisely with plus and minus symbol (e.g. 18±0.5 degree C).

*The room temperature was specified in the text as 18±1 degree C.*

Page 480, line 17: “~” -> about

*Corrected*

Page 480, line 21: Please describe temperature range more precisely. Do not use “~”, but note exact temperature range.

*The tube temperature range was specified in the text as 55-60 degree C over the entire tube length.*

Page 480, line 27: I don't understand this sentence. Water vapor directly injected into the Picarro? Is the following my interpretation correct? “Each reference water is injected into heated chamber in the vaporizer which set at 140 degree C and then mixed with dried room-air pumped through a DRIERITE column.”

*The interpretation is correct. The sentence was rewritten according to the suggestion.*

Page 481, line 19 – 23: Please start with a CAPITAL letter.

*The lists had been formatted following the Chicago Style Guide. The suggested correction has been implemented.*

Page 482, line 1-15: Please start with a CAPITAL letter.

*Corrected according to the suggestion as well.*

Page 482, line 19-20: “Starting from June 2012” -> “From June 2012 to September 2012”

*Corrected*

Page 482, line 24: Does calibration module mean the SDM? And, please clearly mention what parts the authors replaced. Is the following my interpretation correct? “In September 2012, the SDM was replaced to the latest system with new glass syringe; this led to ...”

*Yes, by calibration module we meant the SDM. The module itself was not replaced, but ceramic syringes were substituted with glass ones. The sentence has been reformulated for clarity.*

Page 483, line 5: results compare -> results were compared

*Corrected*

Page 486, line 25: 3 percent is quite huge. Is this mean 3 permil?

*Thank you for pointing out this typo. It has been corrected to 3 permil.*

Page 487, line 24-25: Please describe the grounds why the authors could judge as “significant”.

*Here, we compare the slopes obtained for the full dataset comparing with the slopes calculated solely for the daytime measurements. For the spring the slope value changed from 6.9 to 7.2 and for the summer the value changed from 5.6 to 7.0. Having in mind the standard deviations, presented in the Table 2, we can judge these changes as significant (and we do not observe such significant changes for the other seasons). These particular values have been added in the text to avoid misunderstanding.*

Page 487, line 26-29: I don't understand this sentence. Do these slope values reflect the amplitude of continental recycling? If so, please explain the background process precisely.

*During summer, we observe both a loss of correlation and a change in slope, which are related to diurnal summer processes. We suggest that they are*

*driven by continental recycling processes. Indeed, earlier studies have shown the importance of transpiration on deuterium excess (e.g. Welp et al., 2012).*

Page 488, line 16: Rayleigh distillation theory is used to explain not the isotopic evolution in surface vapor, but in precipitation. Please reconsider this sentence.

*The Rayleigh distillation theory has been used to explain the variation in the precipitation isotopic composition. For this purpose, it is necessary to calculate the isotopic composition of the intermediate product (water vapor from which precipitation is formed). We therefore believe that we can refer to the Rayleigh distillation theory also for the water vapor isotopic composition.*

Page 488, line 17-21: This discussion is based on the explanation for the temperature effect observed in isotopic content in precipitation. Air mass, which forms precipitation should not be identical with surface vapor. I think it is better to read Lee et al., (2006) before revising this manuscript.

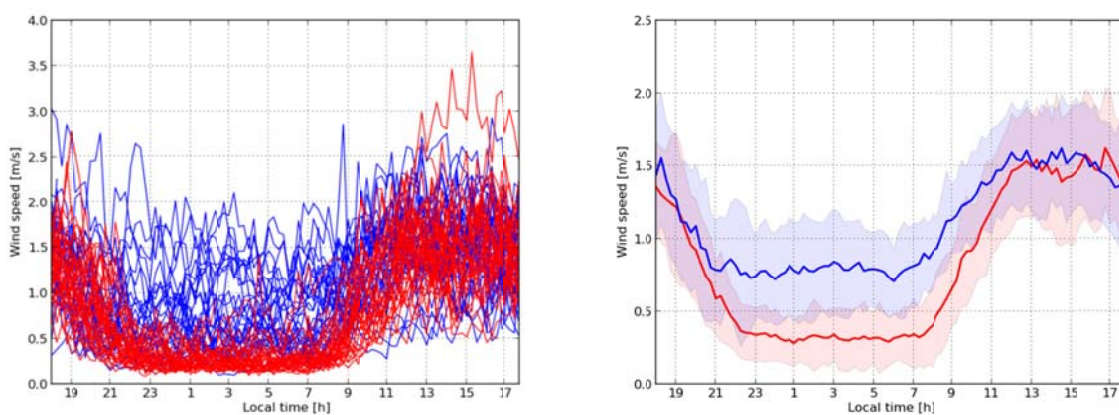
*Our initial formulation implied a control of distillation on surface vapour. We are fully aware that surface vapour is not the same as vapour at cloud height, where condensation occurs. However, our data reveal synoptic weather control on surface vapour. This implies fast exchanges between advected moisture (affected by distillation) and surface moisture. We therefore propose this new formulation: “The data indicate that while local temperature is a key driver of autumn-winter seasonal variations of delta-D, which is consistent with temperature-driven distillation effects, this is not the case for spring-summer.”*

Page 488, line 23: The word “probably” is too strong to use here. I think “maybe” is much better in this case.

*Corrected*

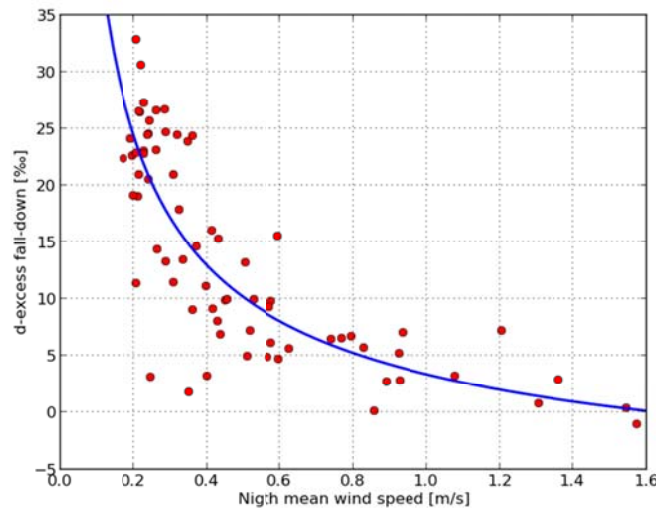
Page 489, line 21-25: This explanation is not clear. I can't understand why the difference in vegetation types on the surface lead to different pattern of the diurnal d-excess cycle. Generally, diurnal cycle is linked to the regional or local circulation, so that diurnal cycle dominates over the region when large-scale circulation is weak. I guess that Cluster 1 and Cluster 2 can be characterized by each particular large-scale atmospheric pattern. How do you think?

*The difference between our observations and that of Berkelhammer et al. is explained by different site configurations. Our measurements have been performed in a clearing inside a forest, where micrometeorological effects such as wind mixing could alter d-excess gradients. Such effects could be more limited in the case study of Berkelhammer et al., where the sampling has been performed inside a forest with damping of surface winds. Here (Figure S1), we show the wind speed daily cycles in our study area (left panel). Daily cycles shown in red are related to the Cluster 1 (that shows strong d-excess fall-down during the night) and in blue – to the Cluster 2 (with weak d-excess fall-down). We observe much more turbulence during the night for Cluster 2. Resulting clusters for the wind (right panel) clearly show the difference of the wind speed during the night that lead to the difference in d-excess cycle patterns.*



*Supplementary Figure S1. Left: wind speed diurnal cycles (red for Cluster 1, blue for Cluster 2), right: wind speed dominant clusters.*

Within all the diurnal cycles, we observe a relationship (see Figure S2) between the night mean wind speed (between 23:00 LT and 07:00 LT) and the amplitude of d-excess fall-down (difference between d-excess mean value for the interval from 15:00 LT to 18:00 LT and mean value for the interval from 07:00 LT to 08:00 LT).



*Supplementary Figure S2. Deuterium excess fall-down vs. night mean wind speed.*

*These observations support our statement that the different site configurations might have an influence on the respective diurnal cycles.*

*In our revised manuscript, in the lines 21-25 (page 489), we therefore propose the following sentence: “In our case, the measurements are conducted in a clearing and not within the forest. We suggest that this allows turbulent night mixing to strongly reduce or even mask the diurnal cycle of d-excess caused by transpiration.”*

*If the Reviewer agrees, we will add these new figures in the text.*

Page 490, line 4: “is observed” -> “was observed”

*Corrected*