https://doi.org/10.5194/egusphere-2024-745-RC3

The review of manuscript “Identifying airborne snow metamorphism with stable water isotopes” by Dr. Sonja Wahl and colleagues.

The manuscript presents and discusses the results of laboratory experiments that simulate blowing snow events. The authors show that the blowing snow particles are modified as a result of “airborne snow metamorphism”. The isotopic composition of the snow particles and of the surrounding water vapor is changing as well (due to sublimation and re-sublimation fluxes), although the sign and value of the isotopic transformations differ from one experiment to another.

This study shows that the snow drift before the newly precipitated snow is finally deposited onto the snow surface, is an important part of “post-depositional” processes that alter the initial isotopic content of the precipitation. Thus, this work is an important step towards a deeper understanding the whole complexity of the post-depositional snow evolution, which is crucial for the interpretation of the deep ice core isotopic signal.

We thank the reviewer for this very positive review and have noted our replies to the comments below (answers in green). In addition to edits based on the reviewers’ comments, we updated a few inconsistencies in the text and figures, such as the color code in Fig. 3 to be consistent throughout the manuscript. In summary the changes made are related to:
1) New Fig. 5 to describe the co-evolution of d18O and dD during and after snow introduction in more detail and an adjustment of the vapour isotope change results section 3.2.2
2) the statistics of observed isotope changes in vapour and snow. We included a table (Table 2) to group the information and declutter the corresponding text.
3) A short paragraph in the introduction to define temperature-gradient and isothermal snow metamorphism

I have only minor correction to the manuscript:

Lines 658-659 (“Thus, it could be possible to use the snow isotopic composition to differentiate between wind-blown snow and precipitated snow”) – firstly, I am not sure why one could need to make such differentiation. Secondly, freshly precipitated snow stays “fresh” not for long time, it is involved to the post-depositional processes immediately after deposition, so its isotopic signature would be modified quickly. Thirdly, in precipitation there is a huge variability of d18O and dxs, as seen from the observation (see data from Concordia station, as an example).

The usefulness for such a distinction tool might not be relevant in the paleoclimate context but rather interesting for deposition patterns in highly-complex terrain in

relation to avalanche formation for example. Furthermore, it supports previous studies emphasizing that the attribution of the variability in isotope signals in ice cores to source conditions is not straightforward. However, we agree with the reviewer that our experiments do not reveal a unique isotopic fingerprint that can be used to identify wind-blown snow unambiguously. Thus it might only be useful in conjunction with physical properties parameters as an additional indication for wind-blown snow. We have changed the sentence to: L. 690: *"However, the results suggest that a strong d-excess decrease can be linked to airborne metamorphism. This should be kept in mind when observations of snow d-excess values are used as hydrological tracers."*

Line 215 – ml min^{-1} (put a space between ml and min). The same in line 223.
We added the space in both locations.

Figure 3 – does the grey background in the upper row have any particular meaning? If not, it's better to delete it.
We adapted the figure as suggested by the reviewer and removed the grey background.

Line 481 – do you need the word "explained" here? Suggest to delete it.
As suggested we deleted the additional (explained) from the Section caption.