Referee #2 Review of Seidl et al. "The ISLAS2020 field campaign: Studying the near-surface exchange process of stable water isotopes during the arctic wintertime" submitted to ESSD (ESSD-2024-293)

General comments:

This paper presents water isotope data collected during the ISLAS202 campaign. These stable isotope data include multiple different water phases (e.g., liquid, vapor, solid-snow, ice, etc.) from both inland and coastal settings. Overall, the study design and data collection methods are sound and the data seem of high quality, especially given the difficulties of doing this type of work (the water vapor data, in particular) in the High Arctic. The data presented by the authors is likely to be of use to various different disciplines from climate modelers to cryosphere scientists. The vertical profile data are particularly innovative and of interest. With some minor revisions, this manuscript could be acceptable for publication in Earth System Science Data.

Thank you for your recommendation. We will work to address the minor comments mentioned below.

More specific comments:

- Lines 48-50: Adding some recent (existing) work showing how different process and locations influence variability in Arctic d-excess would be beneficial. While more Arctic d-excess information (as in this paper) would certainly be helpful, recent work reveals some of this nuance that the authors state as needed and should be included. This would also help place the contributions of this work in better context.

  For example:

Wahl, S., Walter, B., Aemisegger, F., Bianchi, L., & Lehning, M. (2024). Identifying airborne snow metamorphism with stable water isotopes. *The Cryosphere*, *18*(9), 4493-4515.

  Indicates how water vapor d-excess can change with varying snow and (Arctic) atmospheric conditions (e.g., temperature, wind, etc.) in a laboratory setting.

Klein, E. S., Baltensperger, A. P., & Welker, J. M. (2024). Complexity of Arctic Ocean water isotope ($\delta18O$, $\delta2H$) spatial and temporal patterns revealed with machine learning. *Elementa: Science of the Anthropocene*, *12*(1).

Reveals nuance and new spatial patterns in Arctic d-excess values.

With this set up, the authors can then more specifically describe their new contributions to understanding d-excess variability (some of which begins at Line 59) and place them in better context. For example, the vertical profiles and quite creative and interesting.

A similar point was made by Referee#1, and the two paragraphs consisting of L.42-58 will be rewritten to include more context amongst the existing literature.

- Line 127-128: The authors state that daily samples were taken, entirely of snow. What if there was not any fresh snow? Were samples collected from the existing surface? Was this done in the same spot (after several days of collection, samples would be further down the snow pack and not near the surface)?

We will rewrite this sentence to better describe the sampling schedule observed at the site. Namely that once a day, given that a sufficient amount of fresh snow had fallen, the snow was collected and homogenized, with an aliquot taken for analysis.

- Line 132: In this context, please explain high frequency. Once a day? Twice a day?

We will include the maximum sampling frequency for this location, which was every 3 hours, mostly during IOPs, but also during more localized heavy snowfall events outside the IOP periods

- Line 188: Is the tubing flow path length the same at 4 cm as 200 cm? Due to logistics, I suspect so, but this would be good to clarify. Were the flow rates the same at all heights?

 The flow rates and tubing path lengths were the same at all heights, owing to the design of the profiling arm. We will highlight this fact.

- Line 280: Why was the plastic tubing a combination of Bev-A-Line (~4m) and PTFE tubing (~6m)? I don't think this matters for data collection and I understand the challenges of working in the field, but I was just wondering if there was a particular reason for this.

This was the composition of the tubing leading to the semi-permanent CRDS analyser already installed at the observatory. We connected to a (previously capped) tee-junction with a section of our own PTFE tubing.

- Lines 322-324: It looks like with the secondary standards used for water vapor isotope calibration, DI and GSM1, the most depleted (negative) value is -261 ‰ for δD. However, if I am interpreting this correctly, some of the values are far below this (e.g., Figure 6 from the snow tundra site has values below -340). Is there a reason a standard with a lower value was not used? Table 6 lists GLW, which has a lower value, but it appears this was not used for vapor? Is there a reason a standard with a lower value was not used for calibration and how might this impact the values (e.g., potentially greater error with more depleted values)?

This is a good point. Leading up to the campaign period, GSM1 was our most depleted laboratory standard. GLW was only just being introduced to our laboratory at around this time and was unfortunately unavailable to use during the in-field calibrations. This extrapolation to the depleted values observed during the campaign does introduce the potential for increased uncertainty in the calibration to the VSMOW-SLAP scale. However, GLW was used during the characterization of the analyzer's dependency on the isotope – mixing ratio (Sodemann et al., 2023, AMT). We will elaborate in the revised version of the text.

Sodemann, H., Dekhtyareva, A., Fernandez, A., Seidl, A., and Maccali, J.: A flexible device to produce a gas stream with a precisely controlled water vapour mixing ratio and isotope composition based on microdrop dispensing technology, Atmos. Meas. Tech., 16, 5181–5203, https://doi.org/10.5194/amt-16-5181-2023, 2023.

- Also, this is somewhat subjective, but there are many uses of passive voice, which make the paper longer and more difficult to read. For example, in the first sentence of Section 2, the word "being" can be deleted between "site" and "in".

Thank you for pointing this out; we will review our use of active and passive voice. We believe that the proper mixing of the two, as opposed to only one or the other, can lead to a more enjoyable and impartial reading experience. But it can be a difficult balance to achieve.