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Interactive comment on "Continuous monitoring of surface water vapour isotopic compositions at Neumayer Station III, East Antarctica" *by* Saeid Bagheri Dastgerdi et al.

Anonymous Referee #3

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Review for the Cryosphere of

Continuous monitoring of surface water vapour isotopic compositions at Neumayer Station III, East Antarctica

by Saeid Bagheri Dastgerdi and others

General In my opinion, the superb quality of the isotope dataset (with some question marks, see discussion on humidity below) deserves a more in-depth analysis of the atmospheric conditions explaining the isotopic variations in the water vapor. For instance, with reliable ground observations and high resolution (space and time) ERA5 it is now possible to use higher-level temperatures (e.g. 850 hPa) to characterize air

masses in the analysis, see below.

Major Fig. 1 is too empty: use it to indicate summer/winter surface pressure distribution, sea ice edges, surface topography, and grounding line.

Fig. 2: It would be interesting to plot RH separately in this figure as well. How do the moisture measurements of the Picarro instrument compare to those of the meteorological field? Ah, I now see this is reported later (l. 195). Please mention this earlier.

Table 1 can be moved to an appendix.

Fig. 4: In Fig. 3 you show a large difference between q measured at the Picarro inlet and the meteorological field (from T and RH measured at 2 m), and suggest this may be caused by strong near-surface inversions in moisture. Yet, here you continue to directly compare isotope values with temperatures from that same field. Please elaborate somewhat on why you think that does not pose a problem during variable inversion conditions.

l. 195-200: The correlation is high, but a) there is still considerable scatter and b) the slope is off by 50%. These are important differences. These differences can be discussed in somewhat more detail, e.g. are these high values at all possible given the outside temperatures measured at $\sim$20 m above the surface, or would this imply oversaturation? You could also select non-inversion conditions (cloudy, strong winds) to check your assumptions on the inversions.

Section 3.2.1: Melting and the resulting cutoff of surface temperature at 0 C is probably less relevant to explain the limited day-to-day variability in 2 m temperature during summer, because melting at Neumayer is mostly a daytime feature, i.e. seldomly lasts a full day, and therefore has less impact on daily mean temperature. A more probable explanation is that because of the absorption of solar radiation the surface radiation deficit becomes small or absent in summer, preventing the formation of strong near-surface temperature inversions in the daily mean. It is the regular formation (clear skies, weak winds) and destruction (cloudy skies, strong winds) of these inversions that explain the large interdiurnal temperature variability in the non-summer seasons.

Fig. 5 and Section 3.2.2: In an environment with unlimited evaporation/sublimation potential such as Neumayer, with near-continuous surface cooling outside of summer, the near-surface air will always be close to saturation (this is what you show in Fig. 9). Repeating the correlation of water isotopes with humidity, as you did in Fig. 4 with temperature, is therefore not so useful.

Section 3.2.3: have you tried correlations with relative humidity?

Fig. 6: please include the sea ice edge. The difference in latitudinal fetch and absolute uptake appears to be a combination of sea ice extent (sea ice preventing evaporation) and the semi-annual oscillation, the twice-annual expansion/contraction of the circumpolar pressure trough which determines the latitudinal fetch. The absolute temperature also plays an important role, with evaporation/sublimation being reduced at low temperatures (winter).

Fig. 8: This figure shows surface pressure reduced to sea level, and is therefore inaccurate over topography. Values over the continent should be masked.

Section 4.1.1: Temperature at Neumayer is mainly controlled by season (determining the free atmosphere, or 'background' temperature) and surface cooling (determining the negative departure of the near-surface temperature from this background temperature). Eliminating the latter by e.g. selecting the 850 hPa temperature over Neumayer from balloon soundings/ERA5 could facilitate the interpretation of water isotope values in terms of airmasses and large-scale circulation.

Minor/textual l.100: "−16.10âŮęC (±1.05âŮę C)". What does the uncertainty indicate here? Given measurement uncertainty, suggest removing one digit, i.e. -16.1 C

l.108: One standard deviation appears rather inclusive. Why was this value selected?

l.115: "For the largest time of the year" -> "For most of the year"

l.124: "Cover the whole range..." but the numbers provided fall outside of that range?

l.138: Relative humidity (RH) is commonly expressed as %, not ppm. Moreover, the latter concentration suggests that you are talking about specific humidity (q). Later on you use 'absolute humidity'. Please clarify and provide these numbers (RH and q) for the presented ppm thresholds as well.

l.182: "Humidity": absolute or specific humidity? l.189: "humidity amount..."Check throughout, please.

l.222: Only the summer slope differs significantly.

l.262: Check the value of the standard deviation, that appears too large.

l. 302: 10.56 -> 10.6, see also l. 305.

l.309: warm/cold temperature -> high/low temperature

l.324: neither -> either

Section 4.4: suggest changing the title into: Comparison to other sites

l.366: 'opposite' please rephrase

Section 4.4.1: Mention that an extensive ice shelf is absent in the case of DDU, and that the station is situated on an island several km away from the coast.

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