

Interactive comment on “Meridional and vertical variations of the water vapour isotopic composition in the marine boundary layer over the Atlantic and Southern Ocean” by Iris Thurnherr et al.

Anonymous Referee #3

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Review of ACP-2019-782

SUMMARY This paper by Thurnherr et al. is a detailed survey of exploration of water vapor isotopic composition in the marine boundary layer (MBL) in the Atlantic Ocean and Southern Ocean over a wide range of latitudes. The Antarctica Circumnavigation Expedition (ACE), which occurred from Nov 2016 through April 2017, took a five-month continuous time series of stable water isotope (SWI) measurements and analyzed the causes of SWI variations. Specifically, this paper explores in detail the SWI variations in the MBL with latitude, the relation between large-scale circulation and measured SWI

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at different latitudes, and the effects of near-surface wind speed and ocean surface state on SWI variations with altitude.

SIGNIFICANCE: Stable water isotopes (SWI) are unique tracers of the atmospheric water cycle, and this is a pioneering survey of SWI in the Atlantic and Southern Ocean, both the first measurements and detailed moisture source analysis. The measurements are of high quality, as demonstrated by extensive calibration. I highly recommend publication after minor technical corrections, in particular minor changes to the figures.

TECHNICAL CORRECTIONS:

1. Page 2, line 24: Unless you think that this is obvious, I recommend the authors add that $R(\text{VSMOW2})$ is multiplied by 2 for the two possible positions of the isotope within the water molecule.
2. Page 2, line 26: Equilibrium fractionation is not the only type of isotopic fractionation. Non-equilibrium fractionation by diffusion is also isotopic fractionation. I recommend the authors modify as follows: ‘The difference in saturation vapor pressure between heavy and light isotopologues causes one type of isotopic fractionation ...’
3. Page 9, line 14: The authors state that horizontal differences between SWI-8-sb and SWI-8-ps sensors are smaller than vertical differences, but Figure 5 seems to indicate that d has large horizontal differences comparable to vertical differences in d .
4. Page 13, line 23 incorrect figure citation, should be: ‘The meridional distribution of d (Fig. 6c) ...’
5. Page 14, line 17 incorrect figure citation, should be: Fig. 6 a,b,c.
6. Page 15, line 25 incorrect figure citation, should be: Fig. 6f.
7. Figure 1, page 26: I suggest that the authors add latitude labels on Figure 1, it would help with interpretation.

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SPELLING/TYPOS:

1. Page 6, line 12 (also lines 19, 20, 33): Is apostrophe 12'000 standard Swiss notation for 12 000? I recommend no apostrophe to avoid confusion.
 2. Page 13, line 6: change 'warmer T' to 'higher T'.
 3. Page 13, line 12: spelling typo, should be 'meridional'.
 4. Page 13, line 33: spelling typo, should be 'Agulhas'.
- Figure 4, page 29: add abscissa (x-axis) label: "Date (dd-mm)".
3. Figure 5, page 30: add abscissa (x-axis) label: "Date (dd-mm)".
 4. Figure 6, page 31: the letters 6a, 6b, etc. in the text do not appear to match the order of figures in Figures 6. Please recheck.
 5. Figure 6 caption, page 31, and Page 18, line 32: I recommend changing 'site' to 'location' because site implies a fixed location whereas you are measuring at many latitudes along the ship track.
 6. Figure 10 caption, page 35: in the next-to-last sentence change 'Less points' to 'Fewer points...'

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