This manuscript presents a new record of stable water isotope measurements in water vapor from Matara, Sri Lanka. The isotope measurements are compared with meteorological measurements from a nearby station and ERA5 / NCEP reanalysis data from the surrounding region to identify the most important drivers of isotopic variability at the site. The authors find differences in isotopic signatures between the northeast and southwest monsoon seasons, which they attribute to different moisture source conditions and convective activity.

This dataset is very valuable, especially given the scarcity of isotope measurements in the region. The measurement protocol appears to be sound (but I am not an expert, I hope the other reviewer(s) can check this better), and the analysis is well done with some exceptions. My main concerns are the moisture source diagnosis (see major comment 1) and the structure, specifically in the introduction and the results (major comment 2).

Major comments:

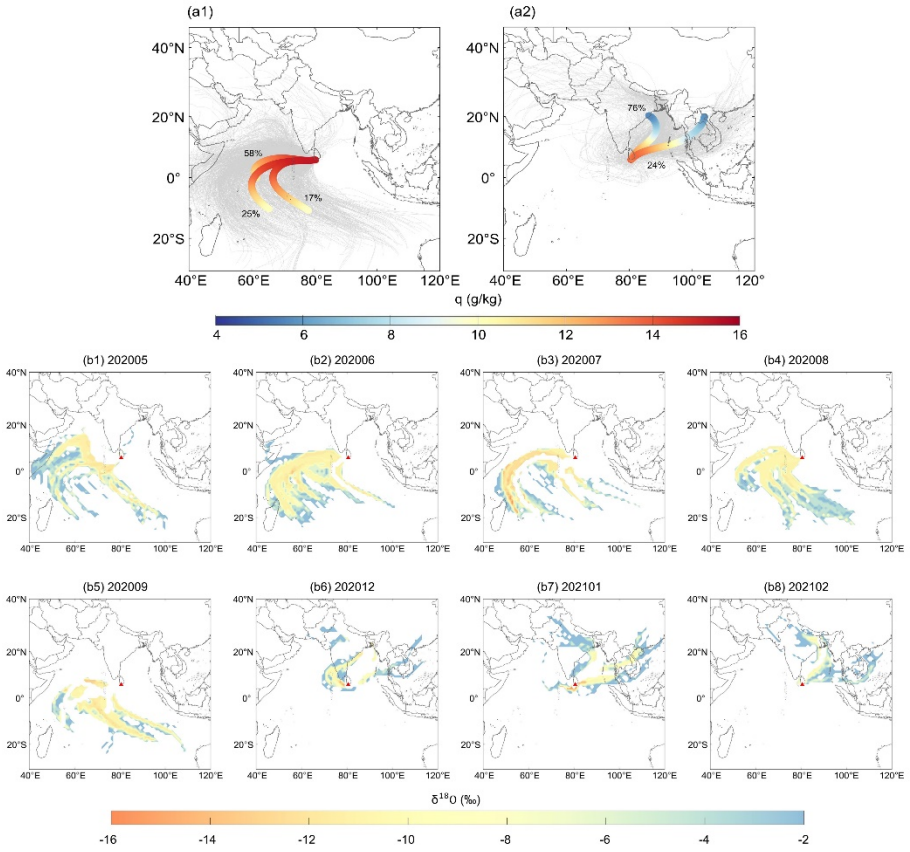
1) The trajectory analysis needs more explanation. For example, you wrote that you did a K-means clustering to calculate specific humidity along the trajectories. Why? Do you mean you did K-means clustering of the trajectories, and then calculate specific humidity along the resulting clustered trajectories?

Reply: The HYSPLIT model, using GDAS1 reanalysis datasets, generates specific humidity outputs for each trajectory along its path. Following the reviewer's comments, we have rewritten this part, providing more detailed explanations of how the backward trajectories are computed (lines 342-350).

2) Also you cannot simply assume that the end point of the trajectory is the moisture source. This is a very qualitative picture and does not provide more information than what is already known (i.e. moisture comes from the northeast during the northeast monsoon and from the southwest during the southwest monsoon). To get a more quantitative picture, you would have to look at moisture uptakes along the trajectories. For example, you could use positive changes in specific humidity, or

locations where there is evaporation from the surface. There are several moisture source diagnostics that could do this, e.g. WaterSip (Sodemann et al., 2008), HAMSTER (Keune et al., 2022), UTrack (Tuinenburg & Staal, 2020). For all of these you will also need more trajectories to get a representative picture of the air masses. One trajectory every 6h is not enough. I would recommend to start trajectories from several heights and from different horizontal locations around the measurement site.

Reply: Thank you for your suggestion. Following the reviewer's comments, we conducted backward trajectory tracking from Matara station from 16 additional point: specifically, the corner points of a 0.2° × 0.2° rectangle centered on Matara and four vertical levels (50m, 500m, 1200m, and 2000m) (see lines 338-342) giving now 20 points in total. Also Figure 5 has been revised based on these new trajectories and clustering results.



3) The structure of the text could be improved, in particular the introduction and the results section.

Reply: Thank you for your suggestion. Following the reviewer's comments, we have modified the structure of the introduction and the results sections.

4) The introduction now goes back and forth between monsoon, different isotope processes, and Sri Lanka. I would suggest restructuring it as follows: Motivate why the Indian Summer Monsoon is important for the Asian climate system (same as now), without mentioning isotopes yet. Then introduce stable water isotopes and why they are useful for studying the water cycle. Try to focus only on processes that are relevant for the study. Then write that there are not many studies on isotopes in the Indian Ocean and in particular Sri Lanka. Then introduce the new dataset.

Reply: Thank you for your suggestion. Following the reviewer's comments, we have modified the structure of the introduction, moving the content on isotope research in the Indian Ocean, especially Sri Lanka, to the penultimate paragraph in lines 142-156.

5) The results section introduces many different figures and variables and it is not always clear why. I would suggest showing only figures/variables that are important for the story and lead to the conclusions. Also make sure to describe where you got variables from, if you show them.

Reply: Thank you for your suggestion. Following the reviewer's comments, we have modified the Results Section to only discuss variables with essential significance. Furthermore, we carefully examined the variables employed in the results section and included an explanation of the sources from which these variables were derived.

Minor comments

Title: "A-year continuous observations" is grammatically wrong. Change to "One-year continuous observations" or "One year of continuous observations".

Reply: Thank you for pointing this out. We have corrected the title to "One-year Continuous Observations of Near-Surface Atmospheric Water Vapor Stable Isotopes at Matara, Sri Lanka".

L27&30: This is a bit confusing, -20.4‰ to -9.1‰ does not seem more depleted than -23.9‰ to -7.5‰.

Reply: Following the reviewer's comments, we have adjusted the sentence (see lines 27-31).

L29: displayed -> characterized by

Reply: We have changed the word to "characterized by" as suggested (line 30).

L32: No comma after humidity

Reply: We have deleted the comma after humidity in line 32.

L35: The findings don' t provide a new dataset (second part of the sentence), rather the other way around.

Reply: We have adjusted the sentence (lines 37-39).

L37: "in tropical regions and provide a new dataset for enhancing..."

Reply: See above reply.

L44: There -> They

Reply: We have rephrased this to "The results" to avoid any ambiguity (line 45).

L45: Again, not really (cf. L27&30).

Reply: We have rephrased the sentence (Lines 45-47).

L46: The sea surface condition does not improve the understanding.

Reply: We have adjusted the sentence to "sea surface evaporation" in Line 47.

L178: Features -> Featuring

Reply: Changed (line 180).

L182: “Most of the precipitation…”. With 8 out of 12 months attributed to either southwest or northeast monsoon, 70% is actually not so high (only 3.3% more than the average precipitation amount).

Reply: Following the reviewer’s comments, we re-examined the original data and calculated that the rainfall recorded by the Automated Weather Station at Matara during the southwest and northeast monsoons accounted for 78% of the annual precipitation. Therefore, we have adjusted the sentence to use this percentage rather than “most” (line 188).

L186: derives -> forms/produces

Reply: Changed (line 190).

L190: Similarly -> In contrast

Reply: Changed (line 194).

L198: “Meteorological data are compared …”: I would move this sentence to the beginning of Section 2.2.

Reply: Done.

L202: Do you mean Fig. 1a&b?

Reply: We meant Fig. 1c. This has been added as a reference (line 217).

L207: an -> the

Reply: Changed (line 221).

L208: What does “averaged” mean here? I thought you only have one year.

Reply: We mean “monthly” averages. This has been added for clarity (line 221).

L213: Instead of the link, just cite NCEP? Does ERA5 not provide OLR?

Reply: Although ERA5 also provides an OLR dataset, we chose the OLR dataset from NCEP, as referenced by the link in line 226.

L214: You do not really use all of these ERA5 variables, do you? I would mention only those that are used (and relevant). Also why 2000 to 2021, why not only 2020-2021?

Reply: Following the reviewer's comments, we rechecked the variables we used from the ERA5 reanalysis data. We use 2m air temperature, 2m dew temperature, and air pressure to calculate specific humidity. For the wind vector plots (Fig. 1a, b), we used wind speed and wind direction at 850 hPa. Precipitation data was used as the background for Fig. 1(a, b) to illustrate the distribution of tropical precipitation. We used SST for comparisons with the temperature at Matara and to assess sea surface evaporation conditions. Additionally, we performed an analysis about the effect on water vapor stable isotopic composition using the atmospheric boundary layer height. The only unused variable was "evaporation", which has been deleted (line 200).

We selected the period from 2000 to 2020 to gain an understanding of the climatological averages at the study site. A one-year period would have been too short to be representative of local climatic conditions.

L218: hourly -> one hour

Reply: Changed (line 231).

Equation 3: This equation is not very clear. It looks like q_s is a function of sea surface salinity of 35 PSU, but what you mean (I assume) is that it is q_sat(SST) at a salinity of 0 PSU, while the left hand side is q_sat(SST) at a salinity of 35 PSU.

Reply: We have also added "sea surface salinity of 35 PSU" after "q_{sat} (SST)" in Equation 3 and line 240.

L231: I think here it would make more sense to take the atmospheric pressure (same as for q_sat(T_air)), because it is probably not constant, and the difference in pressure

between 2m and the sea surface is negligible. Assuming a constant sea surface pressure might introduce artificial variations in RHsst.

Reply: Following the reviewer's comments, we have changed the pressure to atmospheric pressure.

L237: in conjunction with

Reply: Following the reviewer's comments, we have added the word "with" after "in conjunction" in Line 251.

L250: How far away from the AWS is the water isotope analyzer?

Reply: The distance is about 5 m. We have added this to the main text (line 249).

L250: is situated, is positioned, and consists

Reply: Has been corrected (Lines 264-265).

L251: Could you add the numbers describing the different components to Figure 1d?

Reply: Following the reviewer's comments, we have added the numbers describing the different components to Fig. 1d.

L257: What is XX?

Reply: This was a placeholder that was left in the text by mistake. We have replaced it with the corresponding text (lines 263-265) as follows:

"The calibration unit generates a constant water vapor flow with known isotopic composition at different humidity levels. "

Thank you for pointing this out.

L264: Remove "are defined"

Reply: Removed (line 279).

Equations 6 & 7: Actually, the R values are the ratios of the isotopes rather than the

isotopologues (Coplen, 1994), i.e. R_18O = 18O / 16O and R_D = D / H

Reply: We have corrected Equations 9 & 10 accordingly. Thank you for pointing this out.

L270: Add “respectively” at the end.

Reply: Done (line 285).

L291: This sentence does not make sense (grammatically).

Reply: We have rephrased the sentence (lines 305-307).

Section 2.4: For all of these models, please write somewhere which values are used for the different variables.

Reply: Following the reviewer’s comments, we have added the values used for the different variables.

Equations 9&11: Please use a consistent notation for the equilibrium fractionation factor.

Reply: We have changed the notation to “α_v^l” in Equation 16 and in lines 319 and 321.

Equation 10: This is specific to HDO. I would either add a second equation for H218O, or make the first equation more general.

Reply: We have added the (new) Equation 15 to represent $[H_2{}^{18}O]$.

Equation 11: I would cite Craig & Gordon (1965).

Reply: Done (line 330).

L351: For the water isotopes the seasonal cycle is not very obvious from Figure 2. The hourly or daily variability is much larger than the seasonality.

Reply: Following the reviewer’s comment, we have rechecked the data. From Fig. S3,

there are seasonal variations in relative humidity, specific humidity, lifting condensation level, monthly precipitation, and water vapor isotopic composition ($\delta^{18}O$, δD, and d-excess).

L352: How did you get the LCL? And why is it relevant?

Reply: We have added the calculation steps for LCL in Section 2.1 (lines 204-209) and as new Equations 1-5. To some extent, LCL can reflect precipitation conditions. Therefore, we chose to use LCL for the analysis.

L357: The maximum temperature is much higher, isn't it?

Reply: Yes, it is. Thank you for pointing this out. We have corrected the value for maximum temperature to "33.5 ℃" in line 389.

Figure 2: I don't think it is necessary to show both humidity and specific humidity.

Reply: We have added an explanation for why we show both humidity and specific humidity (line 231-237). We plotted both in Fig. 2 because, due to weather conditions and instrument trouble, the humidity measured by the LGR instrument is missing data for March to April. Additionally, the meteorological variables measured by the AWS are missing data for September to October, leading to some missing specific humidity values calculated from meteorological parameters. This is why we chose to present both variables as they complement each other, providing a clearer picture of humidity changes at Matara.

L414: emerged -> show

Reply: Changed (line 436).

L442: Why do you compare your values to those from Greenland? It is a very distant site.

Reply: Indeed. Following the reviewer's comment, we have changed this to a comparison with Bangalore station, located in southwest India. Bangalore is also a

coastal city near the Arabian Sea. The revised content can be found in lines 461-468.

L466: What do you mean by precipitation leaching?

Reply: Rainfall exerts a certain leaching effect on moisture and influences the mixing process of water vapor, which is why the observed moisture falls between the Rayleigh fractionation line and the isotope mixing line.

L472: "were" missing

Reply: We have modified the sentence to "The measurements substantially deviate from the Rayleigh curve and show a higher depletion than predicted by the Rayleigh model, likely due to the influence of convective processes." (line 507).

L485: "and led…" does not fit here

Reply: Following the reviewer's comments, we have modified the words "and led" to "due to" in line 501.

L497: What do you mean by reversed? The diurnal variations go in the same direction, only the magnitudes are different.

Reply: Following the reviewer's comments, we have changed the sentence in lines 512-514.

L626: It is averaged in space, isn't it?

Reply: Yes, we calculated the average over a 5°×5° spatial area.

L662: Maybe write here that this is now for the simultaneous values.

Reply: Following the reviewer's comments, we have rephrased this in line 678.

L692: The highest? (Fluctuations)

Reply: Thank you for your comment. Yes, it refers to the maximum value in line 789.

Supplement

L21: directedly -> directly

Reply: Corrected (line 21).

L23: of what?

Reply: Following the reviewer's comments, we have added the word "what" after the "of" in line 23.

L30: led -> lead

Reply: Changed (line 30).

Figure S3: Could you also mark the northeast and southeast monsoon months like in

Reply: Changed as requested

Figure 2?

Reply: Thank you for your comment. I am sorry but I did not quite understand what you mean here. In the *Supporting Information*, there is no Fig. 2.

Figure S4: Maybe add titles to the subfigures to make it clear which is which.

Reply: Following the reviewer's comment, we have added titles.

Figure S5: I don't see the yellow solid line. The figure resolution is not good.

Reply: Following the reviewer's comment, we have rechecked the figure. As a result, we found that the yellow solid line is a misuse and is not included in the image. Therefore, we have removed the "yellow solid line" section (lines 137-139 in *Supporting information*). Meanwhile, we have redrawn the image and increased its resolution.

Figure S7: Again, titles would help to know which subfigure corresponds to which

season.

Reply: Done as requested.

What is the difference between Figures S7 and S9?

Reply: The difference between Fig. S7 and Fig. S9 lies in the time periods. Fig. S7 represents the southwest and northeast monsoon periods, while Fig. S9 represents the whole year.

Figure S10: Why do you show only the northeast monsoon?

Reply: The northeast monsoon is discussed separately because the changes during this period are more distinct and representative.

Table S1: Since VSMOW is there, add SLAP?

Reply: Following the reviewer's suggestion, we have added "VSMOW-SLAP" and "Vienna Standard Mean Ocean Water- Standard Light Antarctic Precipitation" in Table S1.

References

Coplen, T. B. (1994). Reporting of stable hydrogen, carbon, and oxygen isotopic abundances (technical report). Pure and applied chemistry, 66(2), 273-276.

Craig, H., & Gordon, L. I. (1965). Deuterium and oxygen 18 variations in the ocean and the marine atmosphere. In Stable isotopes in oceanographic studies and paleo-temperatures (pp. 9–130). Lab. Geol. Nucl.

Keune, J., Schumacher, D. L., & Miralles, D. G. (2022). A unified framework to estimate the origins of atmospheric moisture and heat using Lagrangian models. Geoscientific Model Development, 15(5), 1875-1898.

Sodemann, H., Schwierz, C., & Wernli, H. (2008). Interannual variability of Greenland winter precipitation sources: Lagrangian moisture diagnostic and North Atlantic Oscillation influence. Journal of Geophysical Research: Atmospheres, 113(D3).

Tuinenburg, O. A., & Staal, A. (2020). Tracking the global flows of atmospheric

moisture and associated uncertainties. Hydrology and Earth System Sciences, 24(5), 2419-2435.