Weather Clim. Dynam. Discuss.,
https://doi.org/10.5194/wcd-2020-46-RC2, 2020

WCDD

Interactive comment

Interactive comment on "The role of air–sea fluxes for the water vapour isotope signals in the cold and warm sectors of extratropical cyclones over the Southern Ocean" *by* Iris Thurnherr et al.

Anonymous Referee #2

Received and published: 4 November 2020

This paper analyses the impacts of air-sea fluxes on the water isotopic signal during warm and cold advection within extra-tropical cyclones. Is it based on the stable water vapour isotopic observations conducted during a ship campaign around Antarctica in the Southern Ocean sector, nicely combined with model simulations.

This article presents an excellent analysis of the dataset obtains during the ship campaign and adequately uses the numerical modeling tools to interpret these data. It is very well written. Appropriate methods are employed and the findings are largely supported by appropriate figures. The main findings reveals that different atmospheric processes occur during warm and cold advection, explaining the various stable water

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vapour isotopic composition signals observed above the ocean surface.

The article is rather long and contains a lot of analyses and information. It could be lightened by removing sections about the climatology of cold, warm and zonal advection regimes, which are not absolutely necessary for the understanding of the analysis of stable water vapour isotopic composition during atmospheric transport.

The end of the stable water isotopes analysis is focusing on the interpretation of the model simulations, which is totally justified as it helps understanding the processes happening during atmospheric transport before the measurement point. However, more comparisons with the observations performed during the campaign should be provided, as these simulations originally aim at interpreting the observations.

Major comments:

L. 221: Since the identification of the moisture uptake plays an important role in the analysis, more details should be provided here about the method to identify the moisture source. What should be explained in particular is the method to calculate the transport time from the moisture source to the measurement point. Since many back-trajectories are calculated by the Lagrangian model for each ending point, this time to the moisture source but be an averaged value for all trajectories. Furthermore, each trajectory might be filled in water at different stages of the atmospheric transport, so how is the moisture source estimated for each trajectory? Is it also an average time of all the stages at which the air mass is filled in moisture?

L. 291-292: Maybe add in a few words what is exactly meant by the “occurrence frequency” and “associated air-sea moisture fluxes”. Is it the frequency for each grid cell of each type of advection regime, and is the associated moisture fluxes would the mean values associated to each regime?

Section 4,3 and Fig. 12 and 13: You are often discussing variations of the median values for trajectories experiencing no surface precipitation upon arrival and for those

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with surface precipitation upon arrival. On the figures, many of the differences you discuss appear to be rather small for some parameters. Contrary to the values for all trajectories, where the [25,75] percentiles are shown, these values are not presented for these two subsets. Would it be possible to include such parameters on Fig. 12 and 13? I believe this is missing when you want to legitimate the validity of the comparison of the medians when differences are very small.

Minor comments: L. 196: “realistic”

L. 246 and 254: “around 60°E” and “the cyclone at 60°E”: I believe the description of the localization of the described cyclone is too vague, which makes it difficult to compare with Fig.3. Based on the Figure, I wouldn’t say that the cyclone is located at 60°E but rather between 60 and 90°E. Maybe you should mark the cyclone on Fig. 3 with a different color.

L. 250: Similar remark for the 40°W cyclone, which extends over a large range of longitudes. Furthermore, it would be easier to identify it if the 40°W meridian was shown on Fig. 3. As for the previous comment, a color indicator or an arrow/letter on Fig. 3 would help identifying this specific cyclone you are describing.

L. 275: “compare orange trajectories in Fig. 4 and black dots in Fig.5” > I don’t understand what should be compared here. I think you are actually refering to Fig. 7 instead of 5.

L. 361: “Fig. 10d”. Check the order in which Figures are referred to and placed in the manuscript.

Fig. 11: I think it would be more readable if the xlabels where not centered on the ticks, but right-aligned, as they are rotated and they would finish at the tick.

L. 505-507: Maybe you could make a similar introduction for part c) at the end of part a). It would also be possible to modify the order of the paragraphs into a), c), b), d), in order to stay focused on the same type of events.

L. 519: “influenced”

In section 4.3: I find this section extremely interesting and this shows the capacity of the Lagrangian backtrajectory simulations and the regional modeling of water isotopic composition in explaining the processes affecting the water vapour within air masses during atmospheric transport. However, I think what is missing in this section is a comparison with the measurements performed on the ship. Would it be possible to include on the graphics of Fig 12 and 13 the distribution of all isotopic and meteorological values for the selected periods at the end point of the trajectories or at the surface, to see if it compares well with the COMOiso simulation and discuss such comparison in the manuscript?

Fig. 13: A legend similar to Fig. 12,h should be added to this figure.

L. 577-578: “This is indicated by the vertical d profile of non-precipitation trajectorie”: I am not sure this sentence is necessary here, since it is followed by a discussion on the trajectories and the discussion on vertical profiles comes afterwards.

L. 591-593: Maybe rather place this paragraph in the discussion-conclusion, as this is not only a conclusion for 4.3.d but for the complete 4.3 section.

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