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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The isotopic composition of water vapour and precipitation in Ivittuut, Southern Greenland" *by* J.-L. Bonne et al.

Anonymous Referee #1

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General comments: This paper presented a 1.5 year water vapor and precipitation monitoring data in southern Greenland. Although the observation showed several problems (data gap for vapor and storage effect for precipitation), the authors found the arrival of low pressure systems lead to 18O enrichment and deuterium excess depletion using two simulations (A Lagransian moisture source analysis and AGCM). This 5 Tables and 13 figures paper is quite long, but, in general, the text is well organized.The vapor data is new and comparisons with the modles are interesting because they identify the limitation of the AGCM. There are, however, several important issues (see following specific comments) regarding discussion and interpretation of the data. I recommend accepting the paper after the authors address all points I raise below.

Specific comments: 1. In general the main scientific contribution of this manuscript is

the new observation data of vapor isotope ratio. In fact, the authors described technical aspects in detail. Thus, the manuscript should have emphasized the importance of the original contribution of the new data. In this point, several important studies, including a recent publication written by the same co-authors, have been published (see reference suggested below). In introduction, you should review these studies and examine technical aspects of the similar observation studies. Then, the results first compared with the observation. For example, Midhun et al. (2013) showed the RH vs d-excess correlation is less prominent over the Bay of Bengal. This suggests that the RH vs d-excess correlation at marine vapor (Uemura et al., 2008) would be modified through precipitation along the moisture transport. This is not the case in your data (fig 13). Does it mean that the precipitation amount from moisture source to the Greenland is small?

Basically, the result of data vs model comparison (e.g., fig 13 of this manuscript) is very similar to that of Pfahl and Wernli (2008). But this paper was not cited. If the Lagransian models are essentially the same, the new contribution of your data is that the RH vs d-excess relation were confirmed in a new location.

References Benneti, M., Reverdin, G., Pierre, C., Merlivat, L., Risi, C., Steen-Larsen, H. C., and Vimeux, F., Deuterium excess in marine water vapor: dependency on relative humidity and surface wind speed during evaporation, Journal of Geophysical Research: Atmospheres, DOI: 10.1002/2013JD020535, 2014

Pfahl, S. and H. Wernli, Air parcel trajectory analysis of stable isotopes in water vapor in the eastern Mediterranean, Journal of Geophysical Research, VOL. 113, D20104, doi:10.1029/2008JD009839, 2008.

Uemura, R., Yohei Matsui, Kei Yoshimura, Hideaki Motoyama, and Naohiro Yoshida Evidence of deuterium excess in water vapor as an indicator of ocean surface conditions, Journal of Geophysical Research, VOL. 113, D19114, doi:10.1029/2008JD010209, 2008

Midhun, M., P. R. Lekshmy, and R. Ramesh, Hydrogen and oxygen isotopic compositions of water vapor over the Bay of Bengal during monsoon, Geophysical Research Letters, Volume 40, Issue 23, pages 6324–6328, DOI: 10.1002/2013GL058181, 2013

2. Analysis of the synoptic timescale variability (Section 3.2) is interesting. But the events were selected from 4 seasons, and then the averaged data was used for discussion. This is somewhat inconsistent with the following analysis of seasonal variability (Section 3.4) because seasonal moisture-source shift also influences vapor isotope signal. Could you check the logical consistency and clarify your point?

3. P30540, L5-7, "... snow precipitation samples show generally higher dp than liquid precipitation, reflecting the different equilibrium fractionation coefficients for solid or for liquid phases ...." This statement is not true because liquid precipitation at the ground is often solid precipitation in the clouds (e.g., Bergeron process). Snowflakes melt until they reache ground. In this case, the solid-vapor equilibrium coefficient should be used.

4. P30540, L8-25, "...18OV and 18Ov time series.....and the Northern Atlantic region ...." I don't agree with this analyses. First, the observation and equilibrium vapor values are NOT "very consistent". The vapor observation data contains many data gaps due to technical difficulties of automated operation. The system failed to obtain about 50% of the data. This makes it difficult to compare observation and equilibrium calculated values. Second, the data appear to be scattered. Correlation coefficient with significant test and its slope (should be near 1) should be shown.

Technical corrections: Abstract, ".....the first continuous record.... " The data set contains many data gaps due to technical difficulties of automated operation. Thus, this is not the continuous record.

P30527, L16-18, "Thanks to partnerships established with local authorities.....both sides." Move this sentence to Acknowledgement.

P30529, L7, "After discarding samples affected by storage effects". What is the storage effect? Do you mean the evaporation in the collector? If so, how did you set a criteria of 'bad' sample?

P30535, L25-27, "Hourly averaged measurement.....compared to the 6.5 value reported by Steen-Larsen et al. (2013)". So, what do you want to say by this comparison? Is the difference statistically significant? If so, what does it mean?

P30538, L4-14, "....These events will be investigate more in detail in a forthcoming paper..." This section (3.2.) should be deleted because it is an incomplete paragraph without supporting data. This topic should be discussed in a forthcoming paper as the author described.

P30539, L17-18, "For precipitation .....by a slope of 7.5 .....". What do you want to say by the slope of 7.5? What does it mean?

P30541, L28, ".....detrending to remove seasonal effect ". Why did you remove seasonality? Why did you use 15day running mean to remove it?

Fig 7 & Fig 8; It is nearly impossible to see gray and white lines of map.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 30521, 2013.