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Subject: submission of the first revised version of the paper acpd-13-30521-2013

Dear editor,

Please find attached a revised version of our paper "The isotopic composition of water vapour and precipitation in Ivittuut, Southern Greenland" for submission to ACPD .

We thank the reviewers for the helpful comments, which allowed us to improve the paper. The clarification requested were included in this new version, and new references have been included. As suggested, Figures 7 and 8 have been adapted to improve their readability using different colors and the map formats. The methodology and interpretation of the comparison between precipitation sampling and water vapour measurements have been clarified. Figure 9 has been modified to include error bars taking into account the variability of temperature into account for isotopic fractionation calculation. We also provide a detailed reply to each individual comment made by the reviewers.

We hope that this revised version will be suitable for publication,

Best regards,

Jean-Louis Bonne

Point by point responses to referees

Anonymous Referee #1

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.

We have modified the introduction and the discussion of our results especially the relationship between deuterium excess and moisture source relative humidity, including more references and a comparison of the relationships observed at other latitudes.

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?

We have compared the RH vs d-excess relationship arising from Ivittuut data with the relationships obtained from other areas (Southern Ocean, tropical Atlantic, Mediterranea area, and Bay of Bengal). We suggest that the source signal is preserved along transport to south Greenland, as shown for the Southern Ocean, and unlike what is observed in the Bay of Bengal, where the source signal may be lost due to the intense convective activity, for which other processes are at play (Risi et al, 2008). Our finding is consistent with simulations (Jouzel et al 2013) suggesting that atmospheric distillation processes can preserve a source signal at high latitudes.

The following references have been added to the introduction and discussion sections.

Jouzel, J., G. Delaygue, A. Landais, V. Masson-Delmotte, C. Risi, and F. Vimeux (2013), Water isotopes as tools to document oceanic sources of precipitation, Water Resour. Res., 49, 7469–7486, doi:10.1002/2013WR013508.

C. Risi, S. Bony and F. Vimeux, 2008 . Influence of convective processes on the isotopic composition (18O and D) of precipitation and water vapor in the tropics : 2. Physical interpretation of the amount effect, Journal of Geophysical Research, vol 35, doi :10.1029/2008GL035920

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 Lagrangian 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.

The comparison with the results from Pfahl and Wernli (2008) have been included in part 4.4.

Suggested 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

These references have been added .

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?

In fact, there was a mistake in the description of the figure, as the Flexpart backtrajectory simulation only covered the period September 2011 to December 2012, there was not 14 but 8 synoptic events represented here from the 14 synoptic events selected among the data set, and not 14. During this period, 6 events are between September and December, and only 1 event is in spring and 1 event in summer.

Concerning the seasonal dependency, we have tested to compute this average backtrajectory while removing spring and/or summer events. The corresponded figures have been attached to this response. The spring event appeared very similar to the others. The summer moisture source maps show the same type of behavior, but corresponds to the most south moisture uptake at D+0 en D+1.

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 reach ground. In this case, the solid-vapor equilibrium coefficient should be used.

Using remote sensing data from CloudSat and CALIPSO, Liu et al. (2012) have shown a predominance from low level clouds in the Arctic and over Northern Atlantic region. This is not a proof of the physical phase of the water in the clouds concerned by our measurements, and we made explicit the hypothesis that the liquid precipitation samples correspond to liquid condensates in the clouds (for the calculation of fractionation coefficients, and the interpretation of the differences between liquid and snow precipitation in winter). This is now clarified in our revised manuscript (part 2.3).

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.

A systematic comparison is limited by the timing of the precipitation and vapour measurements, which do not cover the same periods, and limit objective statistical analyses (e.g. correlation). We have added the error bar on the calculation of vapour at equilibrium with precipitation. We have re-formulated the description of the results to clarify the main findings of the comparison.

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.

There was a lack of precision in this sentence. What we meant was that our observations are based on continuous measurement technique, contrary to cold trap sampling approach or precipitation sampling for example.

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

This sentence has been moved 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?

The precipitation in the collector is not sampled immediately after each precipitation event. For this reason, it is possible that the water store in the collector in between precipitation event and sampling time undergoes evaporation. In this case, fractionation might have occured in the collector. In the case of evaporation, this is expected to alter the meteoric relationship between dD and d18O. For this reason, we have chosen to retrieve the precipitation samples presenting deltaD/delta18O ratios far from Global Meteoric Water Line. In our case, data with ratios over 9.5 were retrieved.

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?

We have modified the text to just report the consistency with results obtained for precipitation sampled in summer, at the event scale, above the Greenland ice sheet (NEEM).

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.

A paper is in preparation concerning this 2012 summer heat wave event. This paper is aiming a comparison of Ivittuut observations with NEEM water vapour isotopic observations and a study of the origin of humidity during this event using different modelling tools including water tagging. The Ivittuut isotopic observations by themselves will not be described in this paper. In our mind, the description of this specific event is important here, as it illustrates how changes in transport can affect the water vapour isotopic composition.
We have added a reference to Neff et al. (2013) who investigated the air backtrajectory showing long distance transport for the 2012 heat wave.
The reference to our work under progress has been removed from this subsection.

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?

This slope has been obtained through the analysis of the linear relationship d18O and dD in all our precipitation samples. The sentence has been modified for more clarity.
The value is representative of results from high latitude precipitation, where the meteoric slope deviates from 8 due to the impact of low temperatures on the fractionation coefficients. For example, Steen-Larsen et al. (2011) obtained summer slopes of 7.6-7.8 (for subsets of samples with high and

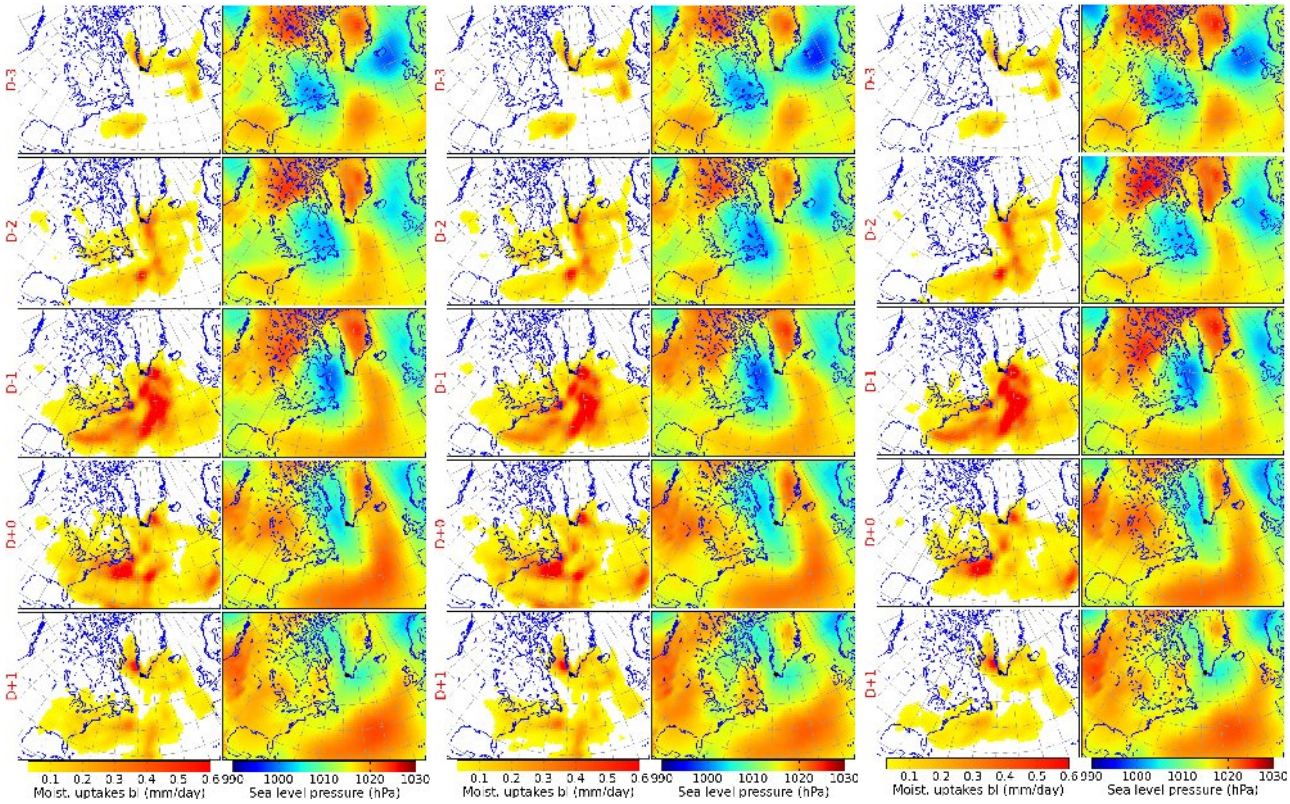
low d-excess) at NEEM, which is very close to our observations.

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

To be able to study the variations occurring on a synoptic (day to day) time scale, we wanted to remove the influence of seasonal variations on our signal. For this purpose, we have used a 15-day-running-average. Indeed, our observation period is not long enough to extract an appropriate seasonal cycle. The text has been adapted to explain why we have decided to use anomalies against 15-day-running-average values.

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

Those two figures have been changed for a better readability. The color scales were changed, as well as the color of continents, parallels and meridians.



3 versions of Figure 7 taking into account or not the spring or summer events.
On the left: all 8 events.
In the middle: all events except the spring event.
On the right: all events except the summer event.

This shows that the synoptic events have very similar behaviors in terms of humidity transport, even on different seasons. The humidity sources of the summer event are located more in southward than the other events.

J. Sjolte (Referee)

Bonne et al. present new measurements of more than one year of vapour isotopes from southern Greenland. The authors provide a detailed description of the methods used to obtain the data, as well as time series analysis, theoretical considerations of processes, and interpretation of the data using models. They conclude that the local vapour could be in isotopic equilibrium with precipitation, shifting moisture source regions with seasons and individual events, and that the isotope enabled GCM they compare with generally performs well but has significant problems in capturing the levels and variability in deuterium excess.
Overall the manuscript is well organised, with the necessary tables and good figures. I find the language to have a somewhat uneven quality, especially in the first part of the manuscript. Suggestions for specific corrections are made in the detailed comments below, but the manuscript would benefit from being read through carefully for language problems.

The introduction has been adapted to improve its readability.

The novel character of the data seat warrants publication, and I think the authors have a made a good effort of providing a rich interpretation of the data, although there are still several open questions. As also listed in the detailed comments, I'm not convinced by the authors assessment of equilibrium between vapour and precipitation. At least from the data presented here. Taking this, and the other comments below, into account I think the manuscript would be suitable for publication.

General comments.
As already mentioned I found the manuscript to have some problems with language. Particularly I find that the abstract reads a bit like a list and could be rewritten more fluently.

A large part of the abstract was reformulated to improve its readability.

Of more technical character, the authors should be careful with the terminology around isotope ratios, both with respect to consistency (see comment for P30523 L2) and physical meaning (see comment for P30522 L10-11 and P30533 L8).

The terminology has been corrected.

Detailed comments :
P30522 L5-7: The sentence "This record depicts small summer diurnal variations ." seems a bit on it own, and is the equilibrium of surface vapour and precipitation also for summer? Please rewrite for clarity.
P30522 L10-11: "delta18O enrichment " the enrichment (of vapour?) is of 18O not delta18O. Similar with deuterium excess. If you want to refer to the delta18O and deuterium excess values, simply write higher or lower values, whatever the case may be.
P30522 L12: replace "is" with "has".
P30522 L13: "The strong correlation ..." it is the first time the correlation is mentioned. Give correlation first, then the Rayleigh distillation interpretation.
P30522 L19: replace "is" with "has".

The abstract has been changed and these comments have all been taken into account.

P30523 L2: "Water stable isotopologues " on this page you use three different terminologies for stable water isotopes. Examples: "Water stable isotopologues " (L2), "water stable isotopes " (L3-4) and "water isotopes" (L8). The correct terminology is "stable isotopologues of water". Traditionally , the convention of using the term "stable water isotopes", although incorrect, has been made for convenience. In more recent years some have begun using "water stable isotopes". Whatever term you chose, please be consistent throughout the manuscript.

We chose the common determination "stable water isotopes" and applied it throughout the paper.

The mention of "water stable isotopologues" is used at the first occurrence of this expression, to explain exactly what this terminology designates.

P30523 L5: replace "this" with "it". "this" refers to something in the previous sentence. Perhaps reformulate by starting the sentence with "We briefly summarize the key findings ...".

The sentence has been inverted.

P30523 L9: replace "variation " by "deviation".

This has been replaced.

P30524 L2-3: "with a mean slope of 8 resulting from equilibrium fractionation" equilibrium fractionation will not give a slope of 8. See Figure 4 in Jouzel and Merlivat (1984).

You are right that this slope does not only comes from equilibrium fractionation, but is the common average slope observed for meteoric waters. This sentence has been corrected.

P30524 L5: "140 000 yr" the oldest part of the NEEM core with any kind of age control (fitting to Antarctic time scales) is 128.5 kyr.

We will use this value.

P30524 L11: the papers (Dansgaard, 1964; Sjolte et al., 2011) produce a spatial isotope-temperature slope. Is it not relevant also to cite a paper (e.g. Johnsen et al. 1992) that uses a spatial relation for temperature reconstruction?

This citation has been added.

P30524 L17: "... and in moisture origin ." As cited later, Sime et al. 2013 investigates influences of moisture sources on the Greenland isotope-temperature slope for warm climates.

This citation has been added to this assertion.

P30525 L15-16: "The data have shown that the surface water vapour is in isotopic equilibrium with the snowfall and the surface snow." based on what is actually concluded in the previous publications I think the authors should soften up this statement.

There is evidence of possible isotopic equilibrium between water vapour and surface snow in NEEM. In Steen-Larsen et al. 2011: "The surface atmospheric water vapor appears in isotopic equilibrium with the snow surface indicating a large water exchange between the atmosphere and snowpack". In Steen-Larsen et al. 2014: " Our observations are consistent with calculations assuming isotopic equilibrium between surface snow and water vapor." We have therefore reformulated our sentence.

P30526 L24: replace "confronts " with "compares"?
P30526 L26: replace "the acquisition of " with "obtaining"?
P30527 L5-6: "In Sect. 2.5 are summarized the instrument set-up difficulties and improvements, and the data quality. " please rewrite.

All these corrections have been done.

P30529 L13-14: "For all precipitation sample isotopic ratio Rp , we obtain vapour isotopic ratio Rv = Rp /. " rewrite for readability. Perhaps something like "For all precipitation samples, with isotopic ratios denoted Rp , we obtain a theoretical isotopic ratio of vapour, Rv = Rp /. "

This sentence has been adapted.

P30529 L17-20: Did you test how much the uncertainty in the temperature during the precipitation will affect the estimated vapour composition? You could add this as a range bar in Fig. 9.

See comment P30540 L20-25.

P30531 L17: replace "Unstabilities" with "Instabilities".

Done

P30533 L8: "... depleted d measurements ..." again, measurements cannot be depleted in d, only in either 18O or D. Do you mean that the low d values are artefacts?

Thanks. We have reformulated the sentence and clarified that these very low d values might be linked to an artifact of the corrections applied.

P30533 L9: replace "the repeatability " with "repetition"? If this does not work, rewrite sentence more clearly.

This sentence has been adapted.

P30536 L6-7: "the seasonal cycle " should it be "the mean seasonal cycle"?

Yes. It has been changed for more clarity.

P30538 L6: "positive snow albedo and liquid cloud feedbacks " to avoid misunderstandings maybe reformulate to "positive feedbacks from changes in snow albedo and liquid cloud content".

This new formulation has been adopted.

P30540 L20-25: "We conclude from this comparison that surface water vapour may be at equilibrium ." This conclusion might have some truth to and it is of course not strongly formulated. However, as suggested above, I think that you could estimate the range of uncertainty in the calculated condensate by looking at the temperature range during the time where you think the precipitation fell. There is quite some scatter in the values and I am not convinced by the plot in Fig. 9.

Standard deviations have been included for the isotopic composition of vapour calculated from theoretical equilibrium with precipitation. The uncertainty calculation takes into account the precision on isotope measurements, and the variability of surface air temperature during the sampling period. An explanation on the calculation of errors has been included in Part 2.3.

P30542 L25: replace ”confronted” with ”compared”.

Done

P30543 L6-7: What is the approximate elevation of the first model level? Do you compare to any near-surface variables in the model like 2m temperature, or is it only data from the first model level? What are the possible implications of any discrepancies in definition between the measured and modelled parameter (e.g. measured surface air temperature against first model level temperature)?.

What is compared here are surface observations with first model level outputs. No surface output of LMDZ are available in our data set. The first level altitude of LMDZ is coded in pressure levels. Over Greenland, the top of this first layer is at about 15hPa above the ground level.

P30543 L15-16: So it is the model orography causing the cold and dry bias, because of too high surface elevation in the model?

What is important here is the altitude of the grid, but also the land/sea mask. From one grid cell to another, the station might be considered to be on the ice sheet or over the ocean. These suppositions have been included in the text.

P30546 L26: missing parenthesis around the citations?

Yes. This has been changed.

List of changes

Changes in text

P30522 L5: “the first continuous record”: this expression was ambiguous and has been replaced.

P30522 L8-25: A large part of the abstract has been modified in order to be more fluent and not look like a list. The different comments concerning the abstract have been taken into account.

P30523 L2: “Water stable isotopologues” replaced by “Stable water isotopes”.

P30523 L4: “Water stable isotopes” replaced by “Stable water isotopes”.

P30523 L5: Sentence inverted

P30523 L8: “water isotopes” replaced by “stable water isotopes”.

P30523 L9: “variation ” replaced by “deviation”.

P30523 L16: “water stable isotopologues” replaced by “stable water isotopes”.

P30524 L2-3: “with a mean slope of 8 resulting from equilibrium fractionation”. This sentence has been corrected because this slope does not originates from equilibrium fractionation.

P30524 L5: “140 000 yr” replaced by 128.5 kyr. The sentence has been reformulated.

P30524 L9: “water stable isotope” replaced by “water stable isotopes”

P30524 L10: The sentence was cut in two.

P30524 L11: The citation Johnsen et al. 1992 has been added.

P30524 L17: Citation of Sime et al. 2013 added to “... and in moisture origin”.

P30524 L17-21: This sentence has been reformulated.

P30524 L26: “water stable isotopes” replaced by “water stable isotopes”

P30525 L6: “water stable isotope composition” replaced by “water isotopic composition”,

P30525 L11-24: These explanations were moved to the next paragraphe.

P30525 L15-16: The affirmation has been soften regarding what is seen in the bibliography.

P30525 L17: “also” was removed.

P30526 L5: Insertion of a new paragraph presenting the studies of influence of oceanic moisture sources on d-excess in different locations.

P30526 L9-10: NEEM observations description was simplified, as these observations are mentioned above.

P30526 L11: “a water vapour stable isotope analyzer” replaced by “an~in situ continuous analyzer of water vapour isotopic composition”

P30526 L14-19: Those sentences are integrated in the next paragraphe (in the outline description).

P30526 L24: “confronts ” replaced by“compares”?

P30526 L26: “the methods used for the acquisition” replaced by “the methodologies implemented for obtaining”

P30526 L27: “used in the next sections” removed..

P30526 L27: Sentence modified for better readability.

P30527 L5-6: “In Sect. 2.5 are summarized the instrument set-up difficulties and improvements, and the data quality. ” please rewrite.

P30527 L8: “the” added before “FLEXPART” and “LMDZiso”

P30527 L9: “equiped with”, instead of “with”

P30527 L8: “water isotopes” replaced by “stable water isotopes”.

P30527, L16-18, “Thanks to partnerships established with local authorities ... both sides.” This sentence was moved to Acknowledgments.

P30528, L10: “Young sensor (model 05603B)” replaced by “Young 05603B sensor”

P30528, L16: A description on the method for calculation of the precision of theoretical water vapour isotopic composition at equilibrium has been included in this subsection.

P30528, L17: “stable water isotopes” instead of “water stable isotope”

P30529 L11-12: The sentence has been rewritten.

P30529 L13-14: The sentence has been rewritten.

P30529 L14: Details on the reason to chose either snow/vapour or liquid/vapour fractionation coefficients have been added.

P30529 L17-20: The sentence was split in two, and an explanation of the use of surface temperatures has been included.

P30531 L9: “where” replaced by “were”.

P30531 L17: “Unstabilities” replaced by “Instabilities”.

P30532 L2: “measurements” replaced by “measurement”.

P30532 L17: “water isotope monitoring” replaced by “water vapour isotopic monitoring”.

P30533 L8: “... depleted d measurements ...” replaced by “... low d values ...”. Sentence reformulated to clarify than there might be artifacts on the d measurements on this period.

P30533 L9: The sentence has been adapted.

P30535 L23: Precision on the altitude of the first model layer has been included.

P30535 L24: “water isotopes” replaced by “stable water isotopes”.

P30535 L26: “comparable” replaced by “close to” for more precision.

P30536 L6-7: “the seasonal cycle ” replaced by “the mean seasonal cycle”?

P30537 L18: The description of Figure 7 has been changed for more clarity.
P30537 L19: One sentence added to explain that the figure represents the average moisture uptake on 8 synoptic events before 31 December 2012.

P30538, L9: Added reference to Neff backtrajectory simulations to explain our conclusions on transport without presenting our transport simulations here.

P30538, L6: “due to”, replaced by “accentuated by”

P30538, L6: “positive snow albedo and liquid cloud feedbacks ” replaced by “positive feedbacks from changes in snow albedo and liquid cloud content” to avoid misunderstandings.

P30538, L7-8: “are also encountered”, replaced by “are observed in our record”, to differenciate what is seen from our observations of what is found in litterature.

P30538, L8: “flat”, replaced by “small compared to usual synoptic variations”.

P30538, L10-11: Precision that when the air mass passes over the Atlantic, there is a strong moisture uptake. Otherwise, it was not clear were the uptake was.

P30538, L13-14: The reference to the forthcoming paper has been removed.

P30539 L17-18: The sentence has been reformulated. A comparison with observations in NEEM (Steen-Larsen et al. 2011) has been added.

P30539 L22: “results” replaced by “measurements”

P30540 L6: We add conditions of validity and hypothesis to soften the impact of the conclusions and add a reference to support our hypothesis.

P30540 L10-13: The sentence was reformulated.

P30540 L23-25: We remind here the hypothesis used for this comparison, in order to soften the impact of the conclusions.

P30541 L26-27: “water isotopes” replaced by “water vapour isotopic composition”

P30541 L26-27: The sentence has been reformulated for better clarity, and to explain the interest of working with anomalies compared to 15 days running average.

P30542 L19: Comparison with Pfahl and Wernli 2008 included.

P30542 L26: “to: test” replaced by “to test”; “provide” replaced by “to provide”; “estimate” replaced by “to estimate”;

P30543 L15-16: Added some hypothesis on the origin of cold and dry bias.

P30543 L21: ”LMDZiso bottom layer” replaced by ”LMDZiso lowest layer”, as “bottom” generally designates ground models.

P30545 L23: ”in applied” replaced by ”is applied”.

P30545 L23: ”in applied” replaced by ”is applied”.

P30546 L26: Parenthesis added around the citations.

P30549,L1, One sentence from P30527, L16-18 was moved here, and the first sentence was adapted.

Changes in figures

Fig 7 and 8 have been changed for better readability. However, the content is still the same.

Fig 7 caption: “14” synoptic events replaced by “8” synoptic events as a correction of an error in the description of this figure.

Fig 9: Error bars have been included on equilibrium water vapour measurements, and the legend has been changed.

Concerning bibliography

- The citation Steen-Larsen 2013b has been replaced by the published version Steen-Larsen 2014.
- Dahl-Jensen et al. 2013 : the format of this citation has been changed : the very long list of authors has been replaced by « NEEM community members ».

Some citations were added to the new version of the manuscript:

- 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

- Johnsen, S. J., Clausen, H. B., Dansgaard, W., Fuhrer, K., Gundestrup, N., Hammer, C. U., ... & Steffensen, J. P. (1992): Irregular glacial interstadials recorded in a new Greenland ice core. Nature, 359(6393), 311-313.

- Jouzel, J., G. Delaygue, A. Landais, V. Masson-Delmotte, C. Risi, and F. Vimeux (2013): Water isotopes as tools to document oceanic sources of precipitation, Water Resour. Res., 49, 7469–7486, doi:10.1002/2013WR013508.

- 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

- 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.

- C. Risi, S. Bony and F. Vimeux, 2008: Influence of convective processes on the isotopic composition (18O and D) of precipitation and water vapor in the tropics : 2. Physical interpretation of the amount effect, Journal of Geophysical Research, vol 35, doi :10.1029/2008GL035920

- 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