We would like to thank both referees for their efforts in evaluating, commenting, and thus improving our manuscript. In the following we address their comments:

Referee 1:

1)

We will add the Rayleigh line and the mixing line of Fig. 16 (top panel) to all the panels in Figs. 12, 13, 14, and 16.

Yes, we agree that models are needed for a comprehensive scientific exploitation of the data. However, we should go step by step and paper by paper. Before robust model studies, it is on us (the remote sensing experts) to make the community (in particular the modelling community) aware of the potential, complexities, and limitations of water vapour isotopologue ratio remote sensing observations. This is the very necessary focus of our paper.

2)

- We will think about moving Figs 1+2 and part of the text of Section 2 to the Appendix: "The in-situ reference dataset"

- We will think about moving Figs 3+4 and part of the text of Section 3 to the Appendix: "Typical averaging kernels of the remote sensing products"

- We will think about putting Figs. 13 and 14 into an Appendix called: "Anomalies in coincidence: Picarro versus NDACC/FTIR"

So in total we can have four appendices and move six Figures from the main text into an Appendix. However, we will discuss this and we should avoid that by this rearrangement the red line of the paper gets lost.

3)

The correlation between ln[H2O] and delD has a linear component due to Rayleigh distillation processes. However, there is no quantitative science in this Figure 12. It is just a demonstration that in the lower/middle troposphere delD and H2O are strongly correlated. This demonstration is important because it documents that for a validation of the added value of delD it is not sufficient to compare the remotely-sensed delD to a reference delD. Instead we have to validate the delD versus H2O plots. This aspect has not been sufficiently well addressed in the past.

We can improve the text saying that R^2 is already 80% assuming linear correlation, assuming more complex relation R^2 will even increase.

Referee 2:

Title:

We will change the title to:

"Empirical validation and proof of added value of MUSICA's tropospheric delD remote sensing product: a study over the northern subtropical Atlantic"

Why we choose the site of Tenerife?

- It is world-wide the only site where in-situ water vapour isotopologue observations are made continuously in the free troposphere (the nighttime observations at Izana and Teide are representative for the free troposphere). Furthermore, these observations are made in coincidence with many other atmospheric observations. The Izana Atmospheric Research Centre is an atmospheric super site.
- Aircraft campaigns are rather expensive and very difficult to organize over populated areas (e.g., central Europe). So we made our campaign in Tenerife Island where organization is less compromised by civil aircraft traffic. We agree with the referee that more campaigns would be very desirable, but as aforementioned such campaigns are expensive enterprises. We hope that the referee can support our efforts for getting the funds for further campaigns.

Why is the observed scatter (ISOWAT versus remote sensing) larger than the theoretical random uncertainty?

A scatter of 10-25% for humidity is typically observed in such studies, even for total column amounts. This is not surprising at all. A look on the large variability as revealed in the in-situ Figs. 1+2 makes clear that middle/lower tropospheric water vapour fields are very inhomogeneous. This inhomogeneity makes measurement-to-measurement comparisons very difficult (please note that the distribution of a trace gas like CO2 is much more homogeneous and thus much easier to validate). A large part of the observed scatter is caused by the observation of different airmasses by the two instruments.

Our empirical study allows a conservative estimation of the random error (random error is at least as small as reported by the scatter). The point is here that the theoretically estimated values are within these empirically and conservatively estimated values. A more empirical constraint of the uncertainty might be achieved by an in-situ sensor flying along the line of sight of the remote sensing instruments. However, this is difficult due to the constraints given by civil flight control/security.

Bias:

We give errors in the bias as standard error of the mean in the right panels of Figs. 7+9 and we discuss it in the text. We will give in addition some numbers in the text.

In case the bias is due to spectroscopy or to something that is independent on the location of the measurement, a bias correction can be made according to A*bias, whereby A is the averaging kernel. We will discuss this in the text and relate it to the respective work made by Worden et al. and other colleagues for TES. In this context we could add new Figures with bias corrected data, but please be aware that we also want to consider the preferences of Referee 1 and eventually reduce the number of Figures.

Will the bias change for other geophysical locations:

In Wiegele et al. (2014) we extrapolate the results here to other locations (northern mid-latitudes and high latitudes). This is done by comparison of IASI versus FTIR. We think that the Wiegele et al. study strongly suggests that our results reported for Izana are reasonably valid for other geophysical locations.

A direct validation to in-situ observations we would need further aircraft campaigns, which depend on future funding.

Section 5, rather a demonstration than a proof:

For the same water vapour amount delD values are clearly different depending on the transport process. This is seen consistently by all the different measurement techniques. In water vapour alone these different transport processes cannot be distinguished. We think that it is a proof of the added value of the delD data.

Thanks for the minor comments/corrections.