We thank the reviewers for their comments. Below are our responses in blue.

Here is a summary of the major changes in the revised manuscript:

- In the introduction we added a discussion on previous water vapor measurements.
- We modified Figure 1 and Figure 3 to minimize the number of panels.
- Panels from Figure 4 and Figure 5 were reshuffle as requested by reviewer 2.
- The flight-by-flight descriptions of the radar reflectivities and the water vapor curtain were deleted.
- ERA5 is now compared in the model resolution.
- We added the melting layer to Figures 6,7,8,9, and 14.
- The units on the partial column results were changed from g cm^{-2} to kg m^{-2}
- We added a figure showing the Normalized histogram of the humidity retrievals during the March 8th and March 9th flights using either DAR/VIPR or DIAL/HALO to further highlight the synergy of the DAR and DIAL techniques
- As an appendix figure we added the March 4 DIAL/DAR synergy.

Response to Reviewer 1

The comments of "egusphere-2023-1807 Water Vapor Measurements inside clouds and storms using a Differential Absorption Radar" by Millán et al.

This article mainly uses the Differential absorption radar to measure the water vapor content in clouds and storms, the authors analyze the VIPR humidity measurements during two NASA field campaigns: (1) the Investigation of Microphysics and Prsecipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) campaign, with the objective of studying wintertime snowstorms focusing on East Coast cyclones; and (2) the Synergies Of Active optical and Active microwave Remote Sensing Experiment (SOA2RSE) campaign which studied the synergy between DAR (VIPR) and differential absorption lidar (DIAL, HALO) measurements. The comparison with the reanalysis data is also discussed. The results of this paper are undoubtedly of great significance for the measurement of the water vapor content in the cloud. The paper language expression is also good. Nevertheless, there are still some issues that need to be revised or clarified. Specific comments are as follows:

(1) The definition of differential absorption technology in the abstract can be considered into the introduction or section 2, because the differential absorption technology is relatively familiar to most professional readers of atmospheric measurement technology, and the quantitative research conclusions can be added in the abstract to clarify the scientific results of this work.

DAR is a relatively new technique. While it may be familiar to some readers of AMT, we believe the casual reader may not be familiar with this technique. Thus, we decided to leave the brief DAR description in the abstract.

We added to following to the abstract: Overall, in-cloud and in-storm comparisons suggest that ERA5 and VIPR agree within 20% or better against the dropsondes. The exception is during SOA2RSE (i.e., in fair weather), where ERA5 exhibits up to a 50% underestimation above 4 km.

(2) In the first paragraph of the introduction, the discussion on the progress of water vapor measurement is lacking. It is suggested to increase the new technical progress and existing problems in this aspect, and the reference of response should be added.

We added: Radiosondes provide the longest record but have limited spatial and temporal coverage, with only a few locations and launches per day (e.g., Wang et al., 2000). In-situ aircraft measurements are restricted to flight level (e.g., Zahn et al., 2014; Singer et al., 2022), while aircraft remote sensing options are limited to a few field campaigns (e.g., Johansson et al., 2018). Passive microwave or near-infrared spaceborne methods have been valuable in providing global information (e.g., Andersson et al., 2007). However, all spaceborne techniques have limitations: imagers only provide integrated column water vapor, lacking vertical distribution information, while sounders have broad weighting functions near the Earth's surface, limiting their vertical resolution. Infrared (or near-infrared) techniques are limited to clear-sky scenes, thus restricting coverage in the tropics. Radio-occultation techniques can provide high vertical resolution water vapor profiles, but their measurement geometry results in an averaging over more than 100 km horizontally. Furthermore, atmospheric ducting effects associated with the top of the boundary layer limit their accuracy in this region (e.g., Ao et al., 2012).

(3) The second paragraph of the introduction on the scientific objectives of these two projects (NASA two field campaigns) and the issues to be addressed in this paper need to be strengthened.

Section 2 of the paper "VIPR and the IMPACTS and SOAR2SE campaigns" provide these details.

(4) Table 1, The technical parameters required to increase the response such as signal to noise ratio, lowest detection line, detection distance and detection sensitivity, and suggest add a physical physical picture VIPR system and Hardware composition diagram.

We added in table 1 the noise-equivalent reflectivity at 1km range. As mentioned in section 2.2 (the Radar detection confidence flag) we only consider returns with SNR > 3.

We added after the ground based VIPR deployment explanation: (A simplified block diagram of this iteration of VIPR can be found in Cooper et al. (2021))

We added after the discussion of the two identical reflectors as separate primary apertures: A picture of VIPR mounted on the bomb-bay of the P-3 can be found at Cooper (2022).

(5) Figure 1 What is the basis of setting the flight trajectory?

In the caption we added: Flight tracks of the P-3 VIPR measurements during the 2022 IMPACTS deployment (solid lines), **flight trajectories were selected to intersect snowstorm systems**. (bottom) Flight tracks of the P-3 VIPR and HALO measurements during the SOA^{2}RSE deployment (dashed lines), **flight trajectories were aimed towards a range of clear sky and cloudy conditions over the Western Atlantic Ocean.**

(6) Figure 3. Shows the Power spectrum examples at 167.12 GHz for a clear sky and a cloudy scene, Do the other two frequencies (158.6, 174.74 GHz) have a similar conclusion and use the same data processing method? Yes, we added the following in the caption: The power spectra at 158.6 and 174.7 GHz are similar, with the former being affected by less water attenuation and the latter by more.

(7) Where the Equation 3 comes from? We added Cooper et al., 2022 in the discussion of this equation.

(8) In section 3 Retrieval methodology and datasets used for comparisons, recommended to add a flow chart.

Reviewer 2 suggested many changes to reduce the article length, hence we decided not to include a flowchart.

(9) section 4 Vapor Profile Results, personal feeling it is a bit like an experimental report, rather than a scientific research paper, it is suggested to increase the regularity of the conclusion or the discovery of the elaboration, to improve the academic nature of the paper.

To avoid sounding like an experimental report, the flight-by-flight description of the radar reflectivities was deleted. The number of sondes per flights was added to table 2.

We also deleted the flight-by-flight description of the water vapor curtains. Instead we added the following text: Overall, VIPR and ERA5 are in good qualitative agreement. Both datasets depict moisture bands (i.e., high moisture regions) associated with snow bands on the January 14, February 17, and February 25 flights; a dry layer (moisture <3 g m−3) between 40 and 100 minutes into the February 13 flight; and a strong humidity gradient at around 3-4 km throughout much of the March 8 and 9 flights. All the conclusions are discussed in the main manuscript.