We thank the reviewers for her/his comments. Below are our responses in blue.

The paper investigates the value of DAR for retrieving integrated water vapour (IWV). The paper is concise, well written and generally clear. The topic is very important and timely given the recent technology advance for G-band radars. I have few major points that I would like to be addressed.

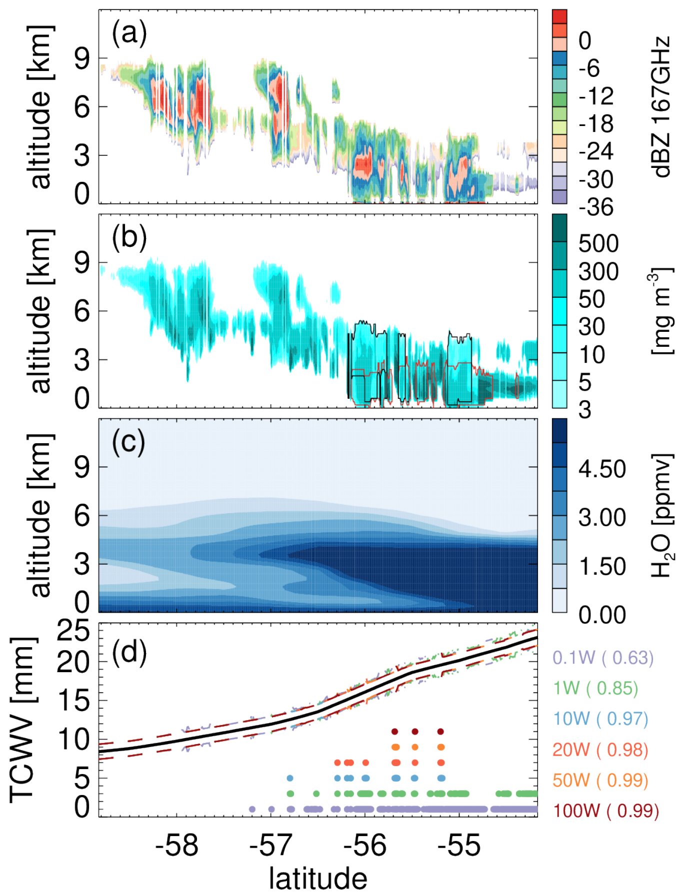
Major comments:

1) The paper provides a good idea about the performance of the proposed DAR system globally. However the strength/novelty of the methodology to me is to provide IWV in cloudy conditions (in clear sky conditions we can probably be satisfied with current observations), where also I expect to see larger IWV spatial gradients (and so where the fine resolution of the method could be really useful). So it would be great to see the performances conditioned to cloudy conditions (maybe defined by some LWP thresholds). Also it would be interesting to see a scene (maybe a Stratocumulus or a convective scene from LES) with strong IWV gradients where the retrieval performances can be shown in detail.

Our simulations include many cloudy and precipitating scenes. To make this clearer in page 6 line 16 after, "In these maps there are around 80,000 simulations (we only used every 50 CloudSat measurements)." we will add: These simulations include, according to the CloudSat classification algorithm [Sassen and Wang, 2008] more than 10,000 clouds identified as cirrus and stratocumulus, around 500 identified as Cumulus, 7000 as nimbostratus, and 800 as deep convection. Further, these simulations include around 400 precipitating scenes with rain rates of up to 4.5 mm hr^{-1} according to the rain profile product [L'Ecuyer and Stephens, 2002].

The impacts of clouds can clearly be scene in Figure 7 which shows how the yield is affected under clear sky conditions versus all sky conditions. In page 9 line 4, We will add the following: The yield, however, improves substantially. For example, in the tropics, for 20W of transmit power, the yield becomes better than 0.85 (as opposed to better than 0.7) and for 50W become better than 0.95 (as opposed to better than 0.8). *This yield improvement under clear sky cases is due to the lack of the attenuation burden impose by hydrometeors.*

At this point we will add the following figure:



With the accompanying text: To further highlight that this technique will work under cloudy and precipitating conditions, Figure 8 shows a cross section of CloudSat-driven simulations over the Southern Ocean. This cross section consists of 500 CloudSat profiles encompassing ice clouds, liquid clouds, rain, and snow. Yields in this cross section are similar to those shown in Figure 7 at around 55S for the all scenes zonal average yield.

This new figure will have the following caption: Cross section exemplifying the CloudSat-driven simulations (data from 1 January 2007 over the Southern Ocean). (a) Simulated CloudSat-driven radar reflectivity at 167 GHz. (b) CloudSat retrieved total (IWC+LWC+rain+snow) hydrometeor water content. Black and red lines delimit areas where snow and rain were detected. (c) ECMWF-aux water vapor. (d) Total column water vapor (black solid line) as well as the retrieval precision (dashed lines) for different transmit powers and locations where at least one of the radar pulses was attenuated beneath the noise floor. Yield values for each simulated transmit powers are given by the numbers in brackets.

We did not use LWP because it breaks down under rainy condition where the CWC-RO algorithm fails. But we believe panel (b) shows clearly the hydrometeor burden.

Further, to emphasize that the *clear sky* systematic uncertainty (section 5.2) is really talking about cloudy and precipitating scenes we will change its name to “Clouds and precipitation errors” and the figure legend to “Cloud and Precip”.

To emphasis that the method will work in cloud and precipitation regions, the explanation of the systematic errors will be expanded to (page 10 line 7): As shown in Figure 8, most of the potential systematic uncertainties are lower than 0.5 mm, *including those uncertainties accounting for the extra attenuation impose by clouds and precipitation (as long as they do not attenuate completely the radar pulses)*. The exception are the errors associated with H_2O 183 GHz line width which could be as big as 1.4 mm…

Sassen, K., and Z. Wang, (2008) Classifying clouds around the globe with the CloudSat radar: 1-year of results, Geophys. Res. Lett., 35, L04805, doi:10.1029/2007GL032591

L’Ecuyer, T. S., and G. L. Stephens, 2002: An estimation-based precipitation retrieval algorithm for attenuating radars., J. Appl. Meteor., 41, 272-285.

2) Just to give an idea to the reader it would be good to know the single-pulse sensitivity for the radar specs tabulated in Tab.1. I expect 30 dB difference between the different powers? Is that correct? Is there any issue with the dynamic range of the surface reflectivity measurements?

We will add to table 1 the minimum detectable dB(s_0T^2) for each of the transmit power, the new line will say:

Minimum detectable[b] dB(s_0T^2) -18, -28, -38, -41, -45, -48.
[b]for each of the transmit powers considered, respectively.

We do not really know what the reviewer means by dynamic range of the surface reflectivity, it is precisely that range, the difference between 167 and 174.8 return the signal that we are exploiting to retrieve total column water vapor.

3) For Multiple scattering you state: “In all scenarios simulated here, the surface return dwarfed the multiple-scattered component of clouds and rain.” Well I am sure this is true everywhere but in deep convection. CloudSat surface return sometime is indeed dwarfed by multiple scattering in deep convection (several examples are provided in literature, e.g. Battaglia and Simmer, IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING,VOL. 46, NO. 6, JUNE 2008) I am sure that, when increasing the frequency, such instances will be more. It would be good this is quantified (maybe having a scene like suggested at 1) could help). Also what do the authors mean with “coarse” resolution of Cloudsat hydrometeors ? (I am still confused why the authors need to under-sample Cloudsat (computational time?)

The multiple scattering discussion on page 10 line 11 will be change to: In all scenarios *simulated here*, the surface return dwarfed the multiple-scattered component of clouds and rain. That is, the systematic uncertainty induced by ignoring multiple scattering effects was negligible, because the screening of the precipitating scenes (disregarding profiles which had any negative values) screened out those scenarios where multiple scattering was present. However, we do not anticipate that multiple scattering will be a problem, because according to Battaglia et al 2008, 80% of the rainy profiles can be accurately modeled assuming a single scattering approximation, and, further, in the order 20% of the cases, the strong hydrometeor burden will hinder the surface return.

We do under-sample CloudSat to save computational time, this will be stated clearer. In page 5 line 14, after the sentence “Note that, to decrease the number of calculations we subsample these fields, we only used one out of 50 CloudSat measurement.”, we will add: In other words, we under-sample CloudSat to save computational time.

Battaglia et al (2008), Identifying multiple-scattering-affected profiles in CloudSat observations over the oceans, doi: 10.1029/2008JD009960

Minor comments:

1) In the abstract I do not think that the authors actually mean “pulses will reach the surface” (for radar the pulses must also go back to the receiver to be detected!)

The reviewer is absolutely correct, we will change to: …both pulses will be detected with a signal to noise ratio > 1 at least 70% …

In page 8 line 25 where we define yield, the sentence will also be changed to: number of times surface reflections at both frequencies are detected with an SNR > 1 divided by the total number of simulations.

2) Sect.3: not clear what scattering model has been used for ice.

As mention in line 5 of page 5 (first paragraph of that section), “we use Mie scattering theory assuming spherical solid hydrometeors”, that is, we evaluate ice, liquid cloud particles, rain and snow using Mie theory. If the reviewer is asking for the particle size distribution that is given in table 2. Currently (at the end of that paragraph) it just states, More details can be found in Table 2. To make it clearer, this last sentence will be changed to: More details, *such as the dielectric constants and the particle size distributions used*, can be found in Table 2.

3) Sect.3: “we only used every 50 CloudSat measurement” (you mean one out of 50?)

Yes, we mean one out of 50, the sentence will be changed to: Note that, to decrease the number of calculations (save computational time) we subsample these fields, we only used one out of 50 CloudSat measurement.