General comment by the authors to Reviewer #4:

We thank the reviewer for the time and effort in reading the manuscript and for the constructive comments and suggestion which we in the following address point by point (our answers are marked with blue font color and the modified text are in italic blue).

Reviewer #4

General Comment: The manuscript described a multi-frequency radar reflectivity dataset collected at the Julich ObservatorY for Cloud Evolution core facility (JOYCE-CF), Germany from November 2015 to January 2016. The dataset is expected to be useful to analyze multi dual frequency ratio (DFR or DWR) for ice clouds to identify ice particle types andice growth processes. Analyses using the dataset can give unique insight into cloud microphysics and to be valuable for radar and cloud microphysics communities. The data were well calibrated and quantified. The 'Level2' data described in the manuscript are available on the ZENODO website. The manuscript well described the data processing and quality. The manuscript can be accepted after some minor revisions, but some more information about the observations about the observation and data processing are needed in the manuscript and should be added to the data.

Specific comments

Manuscript

1. Abstract: A sentence in lines 10-11 of abstract "we find very strong aggregation . . ."This should be rephrased carefully, because several previous studies suggested heavy aggregation above melting layer without using DWR (e.g., Ryzhkov et al. 1998). Please specify this is based on large DWR, as mentioned in conclusion (line 7 in p.22 DWR_{XKa} massively increases up to extreme values of 20 dB, which has not been reported so far.). The sentence in the abstract should also follow this conclusion.

A: We agree with the reviewer that previous studies suggest the presence of massive aggregation above the melting layer. For this reason, we reworded this sentence as following:

The combination of DWR with mean Doppler velocity and linear depolarization ratio enables us to distinguish signatures of rimed particles and melting snowflakes. The riming signatures in the DWR agree well with results found in previous triple-frequency studies. Close to the melting layer, however, we find very large DWR (up to 20 dB), which have not been reported before.

Section 3.1:

2) Did you use IQ signals to change average time and range-gate spacing? I think that pulse width, PRF, and the number of pulse average are important information to justify the data quality and understand error sources.

A: Unfortunately we could not store the IQ signals during the campaign, because it would exceed our storage capacity. The measurements are resampled in post-processing based on the data initially processed by the radar software. The information about pulse repetition frequency, number of spectral average and number of FFT are added to tables 1 and 2 in section 2.

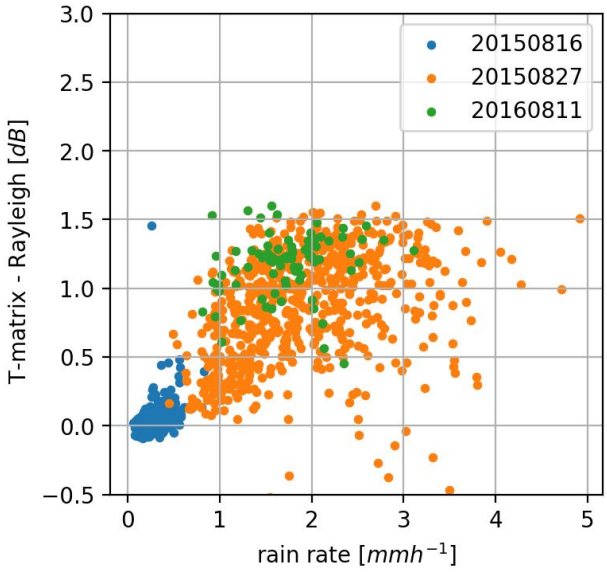
3) How many data points were used for the nearest neighbor interpolation?
A: Only one point is used, and it is the closest inside of tolerance window.

Section 3.2:

4) What are the variability of simulated attenuation and the uncertainty in scattering calculation assumptions (T-matrix)? Could you describe how much the variability/uncertainty in the scattering calculation assumptions impact the calculated attenuation?

A: The T-matrix approach is an analytic solution of the electromagnetic scattering problem and the uncertainties on that might arise only from an inappropriate selection of the drop shape model or water refractive index. Regarding this, we have adopted the state of the art assumptions as described in the manuscript. However, for the studied cases the computed reflectivity is even very close to the Rayleigh approximation (~1 dB, see the following plot). As a consequence, we

strongly believe that uncertainties in the scattering calculations can be considered negligible.



5) Does the quality vary with height? Did you consider radar data sampling volume in the quality?

A: Not sure whether we understand the reviewer's question correctly, but we did not consider the radar sampling volume directly for the calibration.

6) I suppose that attenuations by ice hydrometeors and supercooled liquid droplets were not considered. I suggest mentioning thin in the manuscript or data files.

A: The reviewer is right, we do not directly correct for the attenuation by ice hydrometeors and supercooled liquid droplets because we do not have information about the vertical distribution of ice hydrometeors and liquid droplets. We are discussing this aspect in section 3.4. After the revision process, we have extended the discussion of this point in section 3.5 following also the comments of reviewer #1 point 3.

Figure:

7) Figure 4: I could not clearly see differences between Panel A and Panel D, and PanelB and Panel E. I think that zoom-up plots for 15:00-23:00 would be better.

8) Figure 5: Same as Fig. 4. I think that zoom-up plots for 13:00-15:00 would be better.

A: Thanks for the suggestion, but the paper is mainly focused on ice clouds. A zoom-up as suggested would not help us to show the impact of each flag step.

Others:

9) P. 14, line 9: Should be Z_dr.
A: Corrected

10) What is the LDR limitation value for each radar?

A: Not sure whether we understand the reviewer's question correctly, but the Ka Band radar is the only one with LDR capabilities and the minimum measured LDR is ~ -38 dB.

11) P. 20, line 9: Should be "suggests."
A: Corrected

Data

12) Each file has more than 0.5 GB in size. This is not fairly small to promote using the product. Which version of NetCDF was used? I would recommend using NetCDF4,which can save data space very well.

A: Thanks for the recommendation, but we are already using NetCDF4 to compress the data.

13) Are you willing to employ the CF-Radial format (https://ral.ucar.edu/projects/titan/docs/radial_formats/CfRadialDoc.pdf)? I understand that this format may need more variables that are not important for this observation (e.g., azimuth, elevation). But if you think to extend this triple-frequency observation and the datasets to different scan strategies (e.g., slant angle, RHI) andmore general radar communities, the CF-Radial format can offer the capability to extend to different observations.

A: Thanks for the interesting suggestions, and we will consider the CF-Radial format on the following releases of the dataset. For this release we are using SAMD Product Standard (Standardized Atmospheric Measurement Data, version 1.0), and this standard is based on CF conventions 1.6.

14) Computed attenuation amount at each range gate is also important data. I recommend including the attenuation by hydrometeors (two-way total attenuation or specific attenuation dB/km) in the data files.

A: Thanks for your suggestion, but we are not able to calculate the attenuation by hydrometeors because we do not have information of hydrometeors distribution for each profile.

15) The initial analysis in the manuscript used temperature information, which is very important additional information to identify ice particle types and particle growth processes. I think that the temperature data should be included in the data files.

A: We agree with the reviewer that the temperature provides an important additional information. We added the estimated temperature, pressure and relative humidity profiles to the data files.

16) Pulse width, actual range resolution, range gate spacing, PRF, the number of integration pulses for each radar are also important parameters. I recommend including the information should in the data files.

A: We included the pulse repetition frequency, number of FFT and number of spectral average as global attribute in the data files.

17) Have the reflectivity data in files been corrected for the systematic offsets mentioned in section 3?

A: The reflectivity variable available in the dataset is corrected using all steps described in section 3, and it also includes the systematic offsets.

18) Why the many of X-band echo regions were masked compared to Ka/W-band reflectivites?

A: KiXPOL is a mobile weather X-band scanning radar which we used as a vertically pointing radar for our measurement campaign. Because of its technical

specification, it has a lower sensitivity compared to the other radars (see figure 8 and table 6 and the discussion in the relative section).

19) I briefly took a look at the data on Nov. 23. Why did the X-band reflectivity have noisy signatures at lower altitudes? Those signatures were not found in Ka/W-bandreflectivities.

A: We describe this noise signatures in the section 4.2 of the updated version of the manuscript, and the most likely explanation for it is occurrence of chaff deployed by military airplane.

20) Why are offset values variable with time in short time periods?

A: As described in section 3.4, the remaining offset is calculated using a moving window of 15 min. As result of this technique, the remaining offset is mainly dependent of hydrometeors distribution or wet radome. A sharp frontal passage is likely to cause a sudden variation of the differential attenuation between the various radars.

21) What is a variable “nv” in the data files?

A: The "nv" variable is a dimension and it describes the number of vertices of each data point as required by the CF-conventions documentation (http://cfconventions.org/cf-conventions/v1.6.0/cf-conventions.html#cell-boundaries). In the TRIPEx dataset, each data point has 4 vertices. The figure below illustrates position of each vertice (V1, V2, V3, V4) considering a data point at time 't' and height 'h'. Note that in this convention t and h are indexes and not values.