Interactive comment on "The TRIple-frequency and Polarimetric radar Experiment for improving process observation of winter precipitation" *by* José Dias Neto et al.

Anonymous Referee #2

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Review of ESSD paper – 2018_142

This manuscript describes a dataset of two-months of observations from the JOYCE-CF instrument suite in Germany. This work focuses on three ground-based radars at frequencies of 13, 35, and 94 GHz. There is a detailed description of the data processing and filtering methods implemented in producing the triple-frequency co-located observations. These triple-frequency patterns of clouds and precipitation are examined with ancillary meteorological measurements to isolate processes. Aggregation and melting particle signatures are isolated and identified. In general, I believe

this work is unique and important, and builds well on previous triple-frequency radar precipitation studies (i.e., Kulie et al., 2014). Consequently, I think this work should be published after adequately addressing concerns I have outlined below. I would classify my review of this paper as a major amount of minor revisions – however, I want to emphasize that the writing needs to be thoroughly edited and clarified; this is especially important in Section 3, as the details of the filtering of the dataset need to be very clear.

Major Comments:

My main issue with the paper is the writing. Word usage, punctuation issues, and change of author voice (inconsistencies) throughout the manuscript make it a difficult read. The author(s) need to carefully go through the manuscript, as there are several places with incorrect or missing punctuation (i.e., lots of missing commas, semicolons are often used incorrectly). Run on sentences and long phrasing needs to be broken up in places for clarity. Please be careful with tense as well – there are statements voiced as present and past together. And try and avoid passive voice statements if possible.

Some examples of proper comma usage (with comma added):
Page 2, Line 15 . . .characteristic particle size, as well as. . .
Page 3, Line 4 . . .other two radars, which were installed. . .
Page 9, Line 14 . . .close to cloud edges, or for Ze close to. . .

Please be consistent in how the citations are presented (i.e., Löhnert et al., 2015 vs. Löhnert et al. (2015)).

The radars are referred to as X, Ka, W bands and X-band, Ka-band, W-band – please

choose one to use consistently in the manuscript.

It is confusing that throughout the paper the author uses the names of the respective radars (KiXPol, JOYRAD-35, and JOYRAD-94), but in the figures it is often the bands being referenced (ie., X, Ka, W)... it would be best to make these consistent for the reader. I suggest using the names when initially introducing the radars in Section 2, but then use X-, Ka-, and W-band radars in the text when talking about the figures, as it is easier to follow the statements. These inconsistencies are distracting.

In Section 3.2 a Parsivel is used to correct the calibration of the 35GHz radar at the lowest noise-free bin (500 m AGL). My question is how confident are the authors that the DSDs at 500 m and the ground are so comparable that they feel this is an ideal means of evaluating the radar? My experience is that the DSD can change a lot within the BL and certainly in 500 m. Additionally, if we assume growth of droplets for these cases, then the shift in the histograms shown in Fig 3 is in the correct direction for a DSD with larger droplets at the surface compared to 500 m. So, my question is how can you separate out changes in DSD as a possibility for the results you see in Fig 3 (since you have no way of truly knowing the DSD at 500 m)? In other words, how are you accounting for the ambiguity of any growth mechanisms in the lowest 500 m?

In general, Section 3 needs attention, as it could be written more clearly. The data processing and filtering methods are complicated, and I think more attention needs to be focused on cultivating a very clear description of issues presented. As it stands, Section 3 tends to go back and forth between concepts. For example, the 3-minute moving window average is introduced on Page 11, Line 4 (in reference to Figure 5), but it is not explained why it is implemented. Later on, in Section 3.6, the 3-minute moving window average is re-introduced and explained as to why it is used. This is one example of many in Section 3 that I feel muddle the message and confuse the

reader. Another issue is that discussion of the Errors and Warnings is disorganized. I think reorganizing and clarifying sections 3.4, 3.4.1, and 3.6 are needed. All of these sections feel somewhat random and the narrative thread is lost.

DGZ is defined as -17.5 to -12.5 C... so you could have some possible DG happening in coldest T range. Why not show what is happening even lower temps (Fig 9), why stop at -20C? Is it possible to make figure 10 with cutoffs of <-17C, between -17 and -12, and >-12C to try and to best isolate the DGZ?

Minor Comments (my suggestion and comments after the –):

Page 1, Line 1 – a two-month dataset
Page 1, Line 1 – "Doppler cloud" – the X-band does not see cloud droplets, so maybe amend the abstract to say cloud and precipitation radar observations
Page 1, Line 2 – capitalize Core Facility
Page 1, Line 19 – remove extra)
Page 2, Line 5/6 – unclear sentence "The microwave..."
Page 2, Line 18 – two months of winter
Page 3, Line 6 – capable of measuring
Page 3, Line 7 – (LDR) – when you define an acronym, put ( ) around it
Page 3, Line 15 – "interrupts" is not the correct usage here
Page 4, Line 5 – already defined LDR, no need to repeat
Page 4, Line 9/10 – Passive voice, rewrite with the clauses reversed "JOYRAD was vertically pointing most of the time, as the main..."
Page 4, Line 15 – 2nd
Page 4, Line 23 – "consequence of the use..." does not make sense
Page 5, Line 1 – "include the exclusion" does not make sense
Page 5, Line 10 – (DWRs)

Page 6, Line 5/6 – why is nearest neighbor italicized with no dash and then not below and with a dash?
Page 6, Line 6 – ensures conservation of
Page 7, Line 2 – relative to each other
Page 7, Line 4 – extra)
Page 7, Line 16 – Citation needed
Page 7, Line 28 – two-way
Page 8, Line 1 – Inter-radar
Page 9, Line 8/9 – Run on sentence. Break up and clarify
Page 9, Line 10 – inter-radar
Page 9, Line 18/19 – "upper, frozen part" of what? I assume the cloud. Also, this sentence is a run on and needs to be clarified
Page 10, Line 28 – "Apparently"?
Page 10, Line 29 – cannot
Page 10, Line 32/33 – "This…" what does This refer to here?
Page 11, Line 5 – "even more accentuates" is not clear
Page 13, Line 11/12 – "kinks in the…" Could you be more descriptive and specific about the feature you are highlighting here? Perhaps add values?
Page 13, Line 12 – "did not allow to monitor" does not make sense
Page 14, Line 5/6/7 – the "slowly descends" is indicated by MDV – so it would help to add a time/height plot of the MDV here to Figure 7. I think this will help clarify what you are trying to highlight
Page 14, Line 8 – Use of chaff with radar implies aircraft deployed material to scramble a signal. Is that the case here – was this actual chaff from an aircraft coordinated with the site? Or is it that the use of "chaff" is to highlight that there is some garbage in radar signal with high LDR and should be ignored?
Page 16, Line 21 – space (and comma) needed between dB and while
Page 16, Line 24 – estimation of
Page 16, Line 25 – "In the following…" following what?

C5

Page 16, Line 29 – dataset
Page 17, Line 10 – inter-radar
Page 17, Line 17 – "are about to decrease" there is no time information in these plots, how do you know they are about to decrease?
Page 18, Line 22 – "CloudNet product" singular or plural?
Page 20, Line 6 – Since the riming periods were so short, how confident are you in these characterizations?

Figure Comments:

The labeling for the panels in the figures is confusing. Convention is that the panel labels (A, B, C…) are in the upper-left corner and outside of the plotting area. Please adjust the labeling of the panels so that it is in line with convention and clearer for the reader. See attached figure as an example.

Figure 4 – Note the log-scale on the colorbars in C and F
Figure 5 – Note the log-scale on the colorbars in C and F and I
Figure 6 – Note the log-scale on the colorbar
Figure 7 – Add a panel for mean Doppler Velocities
Figure 9 – It would be more useful to have these two plots with same x-axis limits for comparison
Figure 10 – Note the log-scale on the colorbars in A and B and C
Figure 11 – Note the log-scale on the colorbar
Do Figure 10 and 11 have the same binning for the histograms?
Figure 12 - Note the log-scale on the colorbar in A

C6