

Responses to reviewer #2
***Guyot et al.* under review at HESS**

<https://doi.org/10.5194/hess-2019-277>, 2019

We would like to thank the three reviewers for their very constructive comments on our manuscript. We received genuine insights, which have significantly contributed to increasing the manuscript quality and potential impact.

In order to improve the clarity in our responses we have numbered the reviewers' comments for reviewer #2 and #3 (Reviewer #1's comments are already numbered): for example, the comment 1 from reviewer 2 is listed as R1C2 and will refer to these comments as such in the following.

We have addressed all comments in point-by-point responses.

REVIEWER #2

Guyot et al. describes a new 3 year dataset for southeastern Australia collected from two different manufacturers of optical disdrometers. The authors have prepared a careful analysis of the differences for instruments from the same manufacturer and instruments from different manufacturers. Significant differences were documented due to the sampling sensitivity at different droplet sizes and velocities that results in changes to the derived DSD. The paper's treatment of the scientific objectives is robust and no significant issues could be found. Recommend accepted with technical corrections.

We would like to thank the reviewer for his/her time helping us improve the quality of the manuscript. Some of her/his comments are consistent with the comments from reviewer #1, and when that happened, we flagged these with cross-referencing (such as R1C21 for R2C14) for the response.

R2C1: Technical corrections: Page 4 Line 18: Reference needed for Darwin observations

Response: Two references have been added (Dolan et al., 2013; Thomason et al., 2018). This was also a comment from R1 (R1C5).

R2C2: Page 5 Lines 10-13 contains too many ideas - needs to be broken up into two sentences

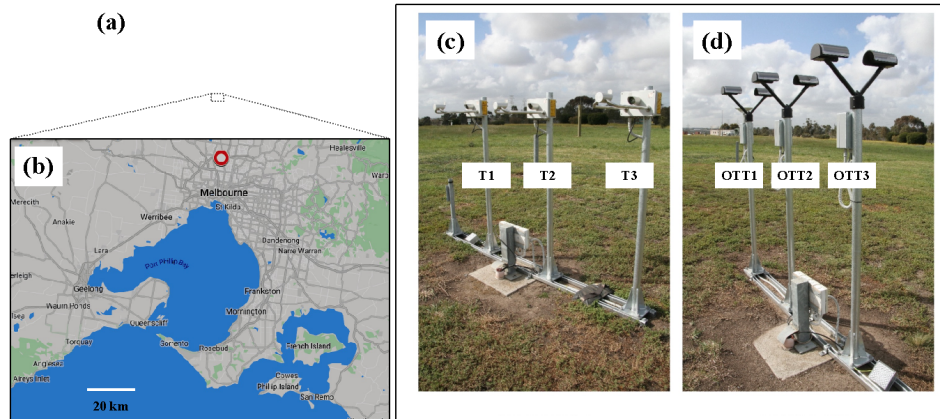
Response: Done.

R2C3: Line 12: Understanding the synoptic rainfall regimes is important for such a study. Has any previous work been done that you can reference?

Response: Thanks; we referenced this in an earlier version of the manuscript but somehow the reference got deleted in the text (but still remained in the reference list). We have now added again the same reference here (Verdon-Kidd and Kiem, 2009).

R2C4: Figure 1(b): Melbourne map is difficult to read - can you increase the contrast and maybe add a border? Figure 1 caption: Are the stands at 2m or 1.5m (as stated in the previous caption)

Response: Disdrometers were installed at 1.5 m above ground level. This has been corrected in the Figure caption. We added a border to the Melbourne map and augmented its size and contrast. Below is our new Figure 1:



R2C5: Page 10 Equation(2): Units of Zmom should be Z instead of dBZ?

Response: units are $\text{mm}^6 \text{m}^{-3}$. This has been corrected.

R2C6: Page 11 Line 6: Do you mean specific attenuation? This needs to be clarified.

Response: This has now been clarified following also the same remark from reviewer #1 (see R1C14).

R2C7: Page 7 General comment: It sounds like the optical disdrometers are using a laser beam sheet with negligible depth to sample the DSD? Maybe worth stating this explicitly for readers.

Response: A sentence has been added to reflect that technical assumption.

R2C8: Page 9 Line 5: Drizzle/Rain repeated in brackets

Response: Duplication has been deleted.

R2C9: Page 11 Line 3: How dependent is the T-Matrix calculations on the temperature? It seems a 20C temperature might bias towards warmer rainfall events?

Response: Sensitivity of the T-matrix calculation to temperature was tested following a similar approach to Louf et al. (2019), but we decided not to expand on this as it goes beyond the scope of the current work. The retrievals are not very sensitive to the temperature but more to the canting angle and choice of model. This is not critical for single polarisation but impacts more the dual pol moments. We added the following sentence to our manuscript: "Sensitivity analysis of the T-matrix to the canting angle

and temperature, as well as a consistency analysis following a similar approach as Louf et al. (2019), were tested but not presented herein as this is beyond the scope of the present study.”

R2C10: Line 23: Two rain gauges are referred two, but only one is introduced.

Response: The other rain gauge is now introduced as well. It reads:

“Another gauge located at Melbourne Airport (Bureau of Meteorology station #086282) and situated 9.0 km from the experimental site was also used for comparison.”

R2C11: Page 12 Line 11: the sentence starting with ‘The recorded...’ needs more context. maybe say ‘This erroneous data...’

Response: It is actually the non-erroneous data! We have now specified accordingly and added a reference to Table 2 to improve clarity. The new sentence reads:

“This corresponded to a total of 40,062 common quality (“quality” being defined as filtered and quality-checked data following the processing steps as described in the method section) minutes across the four instruments [...]”

R2C12: Table 2: What does ‘high quality refer to?’

Response: We have now clarified this terminology in two locations:

In the method section: “The post-processed data following these sequential steps is further described as “quality” data.”

In the results section: “This corresponded to a total of 40,062 common quality (“quality” being defined as filtered and quality-checked data following the processing steps as described in the method section) minutes across the four instruments, with cumulative rainfall ranging from 1093 to 1244 mm (depending on sensor) over the observational period.”

R2C13: Figure 2 (b)(c) caption: Are the duration/intensity analysis derived from rain gauges or disdrometers?

Response: This data is from OTT1. We have now changed the legend and it reads:

“**Figure 2:** (a) Cumulative rainfall amount for the July 2014 to July 2017 period for the 4 disdrometers and two tipping bucket rain gauges located at 5.6 km (Essendon Airport) and 9.0 km (Melbourne airport); (b) Rainfall event duration frequency distribution based on rainfall records from OTT1; (c) Rainfall cumulative amounts per event frequency distribution based on rainfall records from OTT1.”

R2C14: Figure 3: Why are there no OTT stats for the 6-7mm class?

Response: Thanks; [See also R1C21](#) who raised the same issue.

In order to process the data to plot Figure 3, we had to find overlapping bin classes for OTT and THIES instruments, which is shown in Table A1 (in appendix). We realised that there was an overlapping class category missing in the Table A1 (e.g. 0.375 to 0.500 mm

range). The corresponding pipeline python code therefore had the same error and that led to a shift in the corresponding bin class for the OTTs. Correcting this, the new Figure shows more particles counted for OTT1 and OTT3. Looking into the details, only 8 minutes for OTT1 and 3 minutes for OTT3 for the full dataset present particles falling into that bin class (6 to 7 mm). In Figure 6 the log scale magnifies the importance of that data.

R2C15: Figure 4: subplot labels are missing and description of lines in the density distribution plots

Response: [See also R1C24](#). The red and blue lines in the density plot represent respectively the mean diameter D_m for OTT1 and OTT3 (panel c) and T1 and T3 (panel d). The caption of the figure has been updated. Labels (a) to (g) have been added to the plot.

R2C16: Page 18 Line 17: It's not clear to me where T3 exhibits significantly more size/velocity samples outside the outliers in figure 6. It looks like T1 has more outliers, and the OTT's even more so.

Response: [See also R1C27](#). Figure 6 is now updated showing also the non-filtered particles (outside of the boundaries defined using Atlas et al. (1973) model of fall velocity. Our apologies for that mistake: the OTT figure were the correct version showing non-filtered and filtered particles while the Thies LPM were showing only the filtered particles. Figure 6 now supports this statement as you can see for T3 in particular.

R2C17: Page 20 Line 14: What does the author mean by 'first order moments'?

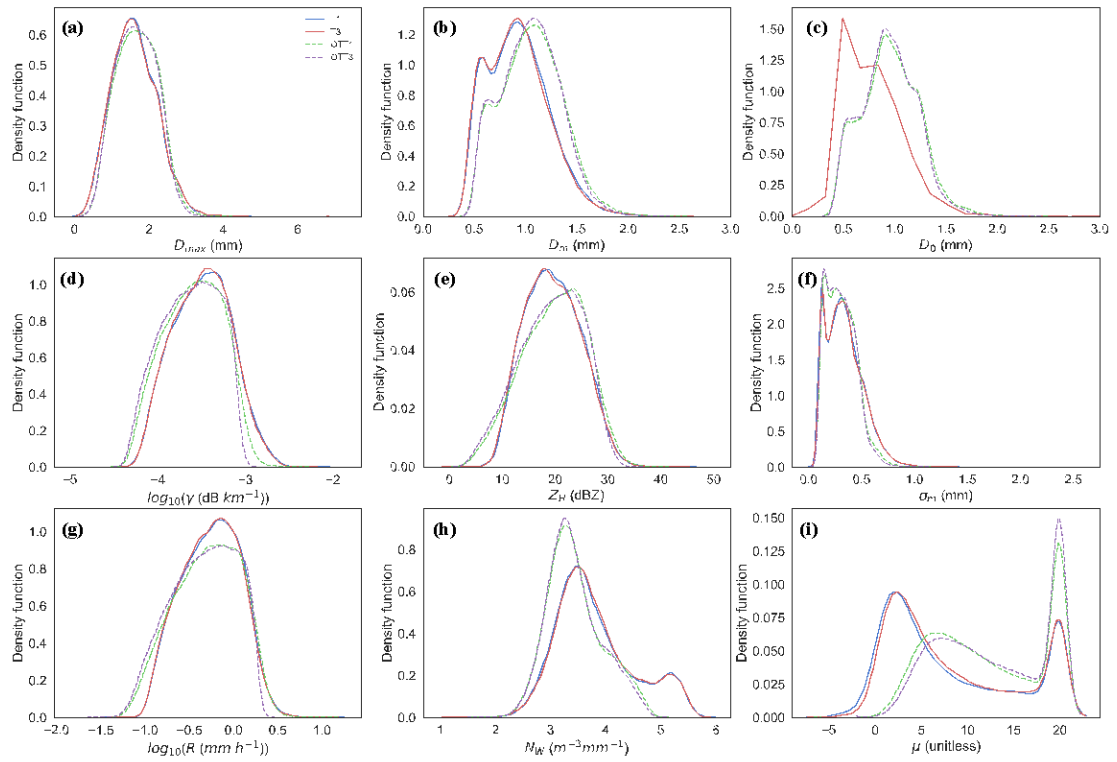
Response: This is now replaced by "All DSD parameters (Figure 8)". [See also R1C32](#).

R2C18: data availability section Page 28: the url should not include the 'www' subdomain, just <http://doi.org/10.5281/zenodo.3234218> given this paper promotes the underlying data as 'open source' or 'open access', it would be ideal to include some description of exactly what data has been hosted on zenodo (which I can't check because it's under embargo). e.g., what instruments are provided and what the file format it.

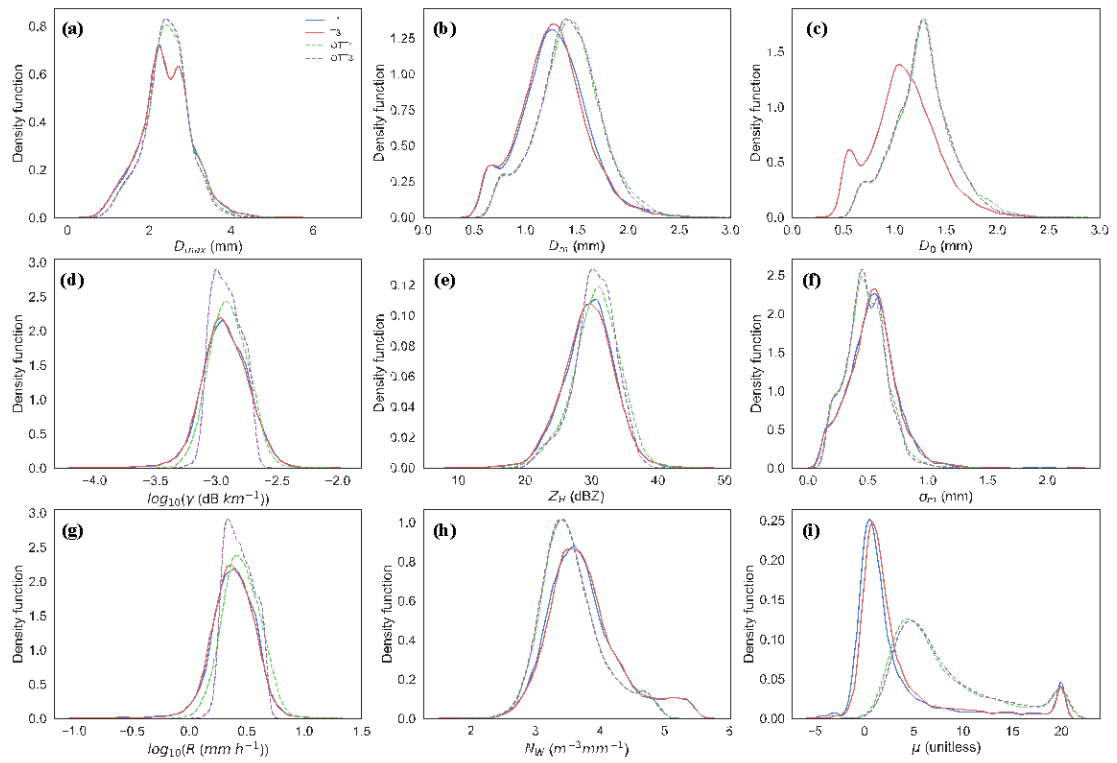
Response: We have now added information to this section and it reads:

"The dataset presented in this study are publically available at <http://doi:10.5281/zenodo.3234218>. This includes raw data for each of the four disdrometers (OTT1, OTT3, T1 and T3) recorded as daily "telegrams" by the in-built software of each instrument. Fields include the proprietary software-derived integrated variables and PSVD data."

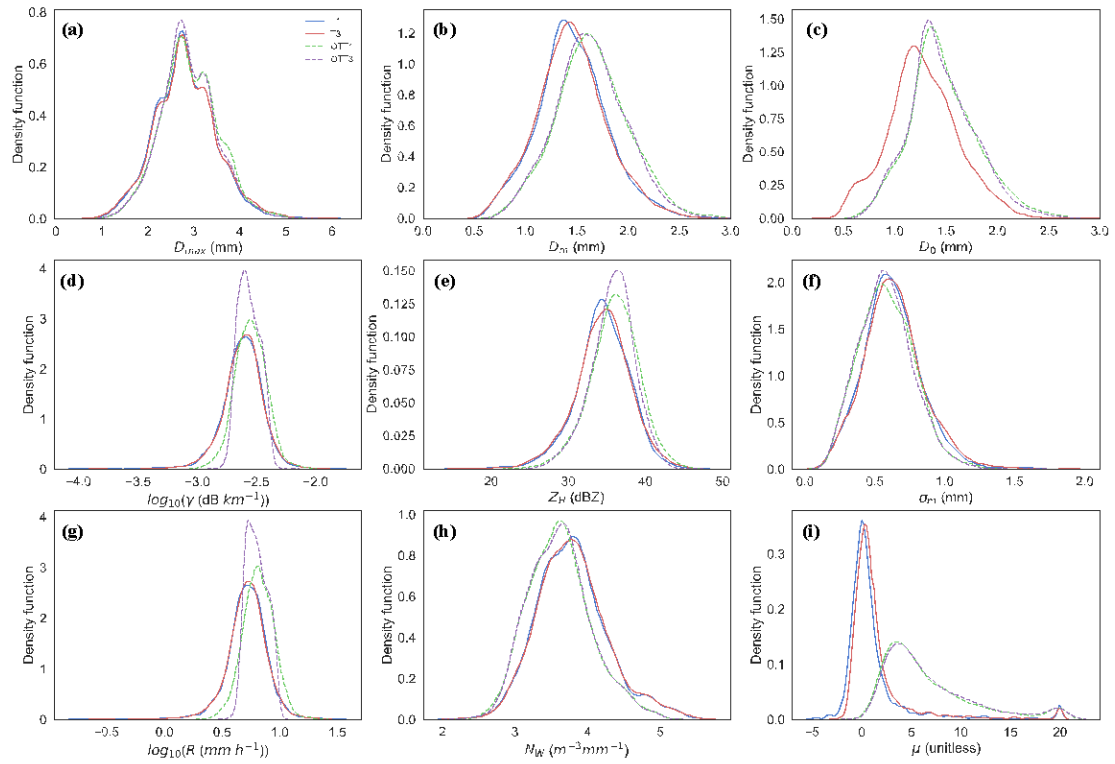
New appendix Figures as per below:



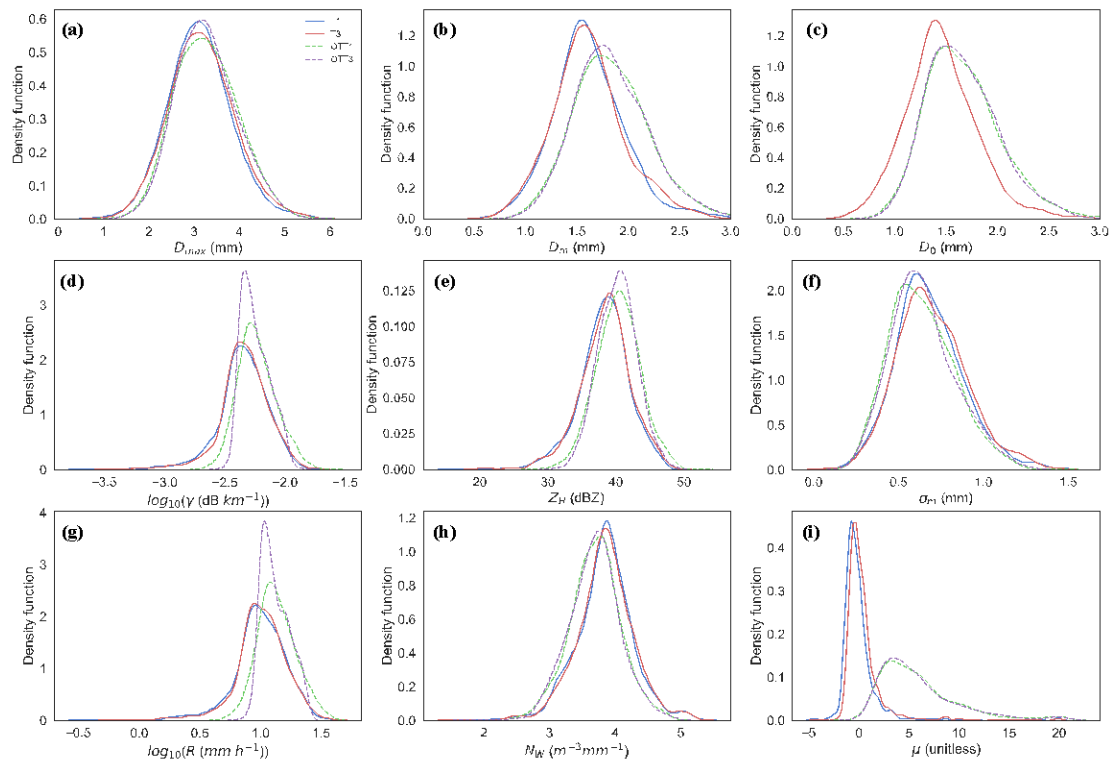
Revised Figure A1 above



Revised Figure A2 above



Revised Figure A3 above



Revised Figure A4 above