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Interactive comment on "Rainfall retrieval with commercial microwave links in São Paulo, Brazil" *by* Manuel F. Rios Gaona et al.

Anonymous Referee #3

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General comments:

The manuscript Rainfall retrieval with commercial microwave links in Sao Paulo Brazil aims to evaluate potential of commercial microwave links (CMLs) as rainfall sensors in the subtropical climate. The authors collect data from several microwave links, process them using RAINLINK R package and compare them to rain gauges operated by CAMADEN. Moreover, disdrometer observations are used to estimate parameters of attenuation-rainfall power-law model and these parameters are compared to those from ITU recommendations and from Dutch case studies.

Although the topic of CML rainfall retrieval in subtropical climate is relevant and the presented dataset is valuable the study has several major drawbacks: i) the authors select for evaluation only well performing CMLs. This is a reasonable approach if the

selection procedure is independent of a reference rainfall data. However, this is not the case, as one of the selection criteria is correlation of CMLs to the reference rain gauges ii) the results are presented and discussed very briefly without sufficient attempt to investigate the causes of good/bad performance of particular CMLs. The influence of drop size distribution to the attenuation-rainfall model is analyzed in more detail, however, this effect can explain only small fraction of total errors. Especially spatial representativeness of reference rain gauge data should be more properly analyzed to avoid interpreting discrepancy between path-integrated CML rainfall observation and point RG rainfall observation as an inaccuracy of a CML iii) The conclusions are not sufficiently supported by the data. The authors claim that CMLs are very promising source of rainfall data only based one very good and two relatively well performing CMLs. Also the suitability of RIANLINK package for CML processing in subtropical regions is not proofed. The data rather indicate that constant WAA correction used in the RAINLINK package is inappropriate for CMLs.

Given the above mentioned shortcomings the reviewer does not recommend the manuscript for a publication, however, encourage the authors to improve the data analysis, rewrite especially the results, discussion and conclusion sections and resubmit the manuscript. Some suggestions for revisions are given in the specific comments bellow.

Specific comments:

The reviewer suggests changing the structure of the manuscript: i) moving the descriptions of the evaluation procedure (event definition) from the Results and Discussion section to the Data and Methods section, ii) considering moving the results of DSD analysis from the Rainfall retrieval algorithm section.

P4L26: Is the threshold value r2 $\geq$ 0.7 chosen arbitrary? Why not 0.5 or 0.9? In any case, the selection of CMLs for evaluation based on reference data does not enable to evaluate potential of CMLs without having reference rainfall. This is one of the ma-

jor drawbacks of the whole analysis. Moreover, it might be valuable keeping the bad performing CMLs in the analysis and identify the causes of the bad performance.

P5L5: Given the CML paths lengths from several hundreds of meters up to several km the criterion of 1 km distance from link path seems to be too strict and not always reasonable. E.g. for CML 14 it might be more representative to use average of two RGs even though the second RG is several km far away. In any case, the reviewer suggests presenting at least some basic analysis of RG correlation and set the criterion based on this analysis. Such analysis would also support the results and enable to distinguish between discrepancy of path and point measured rainfall and between errors due to inaccuracy of CMLs.

P6L21: The section describes rather in detail generally well known performance metrics, however does not provide complete information about evaluation procedure. E.g. it should be explained here how the event based evaluation is performed (metrics are calculated for each event and then averaged as presented in Tab 2?).

P7L15: why -90 dB and not some other value?

P7L17: Both overall evaluation and event based evaluation is presented here. This is very good idea, as one could learn e.g. during which types of events CMLs perform well. However, at the end the event based results are presented in overall statistics (Tab. 2) except results presented in the Fig. 5. It might be very interesting to see how stable the CML performance is (e.g. in terms of variance of the metrics). This could be presented as boxplots or scatter plots of metrics, similarly as on Fig. 5. This would also enable more proper discussion of the results with potentially answering to questions like these: Do CMLs perform better during strong rainfalls than light rainfalls? Do they better reproduce rainfall temporal dynamics (r2) during light or heavy rainfalls?

P8L6-L11: The event definition might be rather in the method section

P8L14-18: It seems that shorter CMLs are substantially more biased than longer

CMLs. This indicates that the bias arises from wet antenna attenuation. Thus, RAIN-LINK's representation of baseline (constant) seems not working very well.

P8LL35 – P9L2: The performance was clearly very good only for one CML whereas the other experience relatively high bias. This is not really proving the good performance of RAINLINK in subtropical regions.

P9L18-20 and P10L4-6: Only three CMLs out of 17 resp. 11 were identified (based on reference rainfall) as well performing. The suitability of RAINLINK for processing such data should be, therefore, discussed more critically. Similarly, the authors claim that the potential of CMLs would be great if the data and metadata are properly stored. This is unfortunately not happening in the reality as demonstrated by the presented results. Thus, use of CMLs for subtropical regions is still rather big challenge. The dataset presented in this paper might, however, contribute to coping with this challenge. Thus, the reviewer highly encourages the authors to invest more work into its analysis and resubmit the improved manuscript.

Fig.1: CMLs selected for the analysis are really tiny in the figure. Maybe cropping and resizing the figure would help (long CMLs aiming to the north-west could be cropped as they are not used for the analysis).

Tab. 2: It seems to be there is no distinctive difference in the effect of DSD when evaluated over the whole dataset (tab. 1) and event based. It might be, therefore, reasonable to present here only results for fitted DSD (i.e. best performing a, b parameters) and instead one value (Mean of a metric?) present e.g. mean and standard deviation of a metric.